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Reengineering Elite Universities: Massive Open Online Courses and the Rise of Applied Science in American Higher Education

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Reengineering Elite Universities:
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By

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Committee in charge:

Professor Neil Fligstein, Chair
Professor Jennifer Johnson-Hanks
Professor Jenna Burrell

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Abstract

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In the early 2000s a small handful of computer science and artificial intelligence researchers stitched together a platform to teach undergraduate computer science courses to tens of thousands of students simultaneously. These course, which became known as MOOCs (Massive Open Online Courses) instigated a wave of debate about the future of higher education, as well as a series of reforms at campuses across the country. This dissertation analyzes why this moment materialized in 2012, and how three elite universities at its center crafted organizational strategies in response. Using field theory and literature on academic capitalism, this dissertation will argue that MOOCs were a recent flashpoint in the increasing competition over leadership in academic computer science that is collapsing historical distinctions between arts and science universities and applied science schools. Part I analyzes the origins of the MOOC movement and charts changes in frames within the field using LDA topic modeling to show that online higher education moved from the periphery of the field of higher education to its center in the early 2010s. Part II leverages 45 primary interviews with leaders of three campuses most closely associated with the MOOC movement: Stanford, MIT, and Harvard. The analysis shows that Stanford administrators responded to unanticipated and provocative actions from entrepreneurial faculty members with the creation of a for-profit MOOC spin-off. While these actions conformed to theories of academic capitalism, the ultimate diffusion of MOOCs across the country led universities in Cambridge to reject profit as a central consideration in their strategic response, demonstrating that academic capitalism is not necessarily contagious. This dissertation argues that the tools of field theory provide insight into competition over the future of higher education which is contested along multiple simultaneous dimensions. Rather than competition over revenue, MOOCs represented intensification of overlap in the field of higher education between tradition arts and science based incumbents, and newly ascendant universities more closely associated with applied science and engineering.

Dedication

For my family; those who are with me only in memory, those who sustain me every day, and those who's light is just beginning to shine.

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If you are reading this, a project many years in the making has come to fruition. As with any endeavor of this size, I am deeply indebted to many others for the essential support, encouragement, and insight they provided along the way.

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I may not have had the opportunity to embark on this project if it were not for the wisdom and understanding of Victoria Bonnell, who saw in me, and in this work, potential to make a contribution to sociology at a time when I myself was deeply apprehensive about that prospect. Jennifer Johnson-Hanks was essential in helping me further advance the reinvention of my intellectual agenda and in providing me the space and encouragement to pursue this project.

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1. Introduction

What might the world look like if education beyond high school was freely available to any person around the world who had an internet connected device? What would the future of the faculty in a given discipline, say sociology, look like if teaching and learning were treated as a technical system to be engineered, optimized, and scaled? How might our great universities reimagine themselves so as to persist and remain essential as new content delivery and data gathering systems replace the lecture hall? After 400 years of relatively stable institutional order and service to the American project, why did leaders of the most prestigious and wealthy universities on earth treat these questions with earnestness and urgency in the early 2010's given the plethora of other challenges they faced? In the following chapters, this dissertation will address this issue and argue that the rise of computational engineering, and the experts who practice its techniques, are reorganizing American higher education in previously unfathomable ways.

In 2012 America's most prestigious universities found themselves engaged in a reform conversation on somewhat unnatural terrain. Following decades of pressure to increase completion rates, control costs, and provide broad access to America's traditional colleges and universities, a small handful of heterodox faculty decided to sidestep traditional university bureaucracy and to take their pitch directly to learners. Realizing the intense demand for the courses they taught in some of the in demand sub-fields of computer science – artificial intelligence and machine learning – a few professors at Stanford used their skills, and the norms of iterative experimentation familiar to their discipline, to stitch together a makeshift platform to project their course onto the open internet. The flurry of activity which followed led to expenditure of hundreds of millions of dollars, the reorientation of hundreds of academic careers, an especially ubiquitous and awkward acronym ("MOOC" for Massive Open Online Course), and a new chapter in the history of online higher education.

This dissertation seeks to understand how faculty and administrators at the helm of three of the richest and most prestigious universities in America – Stanford, MIT, and Harvard – initiated and responded to the these dynamic new experiments in course delivery. Social movement scholars would described these rapidly changing circumstances as unsettled times. These periods are exemplified by increasing pressure for action, doubt about appropriateness of previously taken for granted routines and behavioral responses, and uncertainty about actions elsewhere in the field. Exploring organizational decision making within the context of uncertainty provides unparalleled insight into self-understandings and self-perceptions of actors.

This is certainly not the first project dedicated to the role internet technologies in general, and MOOCs in particular, might play in higher education reform. Globally, only 2% of the $5 trillion spent on education annually goes to technology, and EdTechXGlobal predict that by 2020 the education technology market will grow to be worth more than a quarter of a trillion dollars (EdTechXGlobal 2016). While venture capital firms have long identified the opportunity to capitalize on this fact, higher education has remained particularly immune from the disruptive technological revolutions that have upended other stable fields. The contribution this dissertation sets out to make comes from centering the three most important university actors in the MOOC movement and placing their individual strategies in the contest of the competitive field of higher education. Understanding their perception of threat, their individual priorities in the face of uncertainty, and their assessment of their intimate peers, this dissertation will provide primary

evidence about how our oldest organizations in America are managed toward persistence. As such, it does not take for granted the utility or inevitability of MOOCs and their related technologies. Rather, it poses the question: given the ambiguity and uncertainty surrounding these new technologies, what strategies did each university pursue, and why? Using this orientation this dissertation leverages the tools of organizational sociology to provide a logic of action that is more persuasive than previous accounts of the MOOC movement.

There is a puzzle about persistence at the heart of this project for students of organizational behavior that, while rarely highlighted, sits in plain sight. It has to do with the frequently taken for granted assumption that Harvard is America's preeminent university; a belief that predates the very existence of an independent American state. In a country enamored with its own relation with modernity, owning a relatively short history and penchant for creative destruction, and categorized by the dynamism of civil society and associational life, how has the incumbent in such a large and dynamic field persisted for so long? And what are the conditions under which such a stable order may be upended?

MOOCs: A New Frontier

The advent of the internet has introduced new possibilities for the delivery of higher education into a sector that is highly competitive and facing serious questions of cost and legitimacy. Proponents of these new technologies, including policy-makers, see the potential to bend the cost curve of higher education while reaching the contemporary college students. These modern students are said to be more likely than ever to be non-traditional (older and employed), and more demanding of instruction degree programs that are practical and can be tailored to individual learners. In these ways, online higher education looks very similar to the long histories of past experiments with distance education that have remained marginal in the US context[1]. Indeed, active experimentation with online course delivery has produced a number of large scale experiments since the mid 1990s. Most of these experiments failed spectacularly; those that succeeded were largely relegated to the periphery of the field of higher education.

What made MOOCs different is the highly technical nature of the feedback systems and the specific experts who built and maintained them. When higher education goes digital, the potential for the proliferation of data is enormous. Not only can you increase and refine the quantification of traditional metrics like learning outcomes and teaching strategies more effectively at the beginning and end of a semester, you can do so at more steps, and with more specificity, than previously imagined; and these well-known metrics (like learning outcomes) are only the beginning.

Computer-mediated technologies make possible the collection of data on every click (or non-click) a learner makes, thereby enabling experts to find out such things as whether a student works at night or during the day, whether a student studies within hours of the final exam or days in advance, how long a student spends on a particular page of reading, and how many or what kinds of students do the readings or watch lectures before they attempt to complete learning evaluations. The more students using these systems, the more data generated, and the more refined the algorithms that underlie tailored learning approaches become. This so called *big data*, its proponents argue, is the cutting edge of efficiency and productivity processes that have

[1] The Open University in the UK has had a very different trajectory, and has been successful at enrolling and teaching large numbers of previously unreached students while maintaining its public profile and growing to be well respected and ranked.

disrupted industries from retailing to medicine and can now be used to drive better learning outcomes for more people in the US and around the globe.

These arguments and technologies do not proliferate on their own; they are created by individuals with specialized training who advocate for their chosen solutions in particular ways. These individuals (computational engineers) carry with them assumptions about data, discourse, argument, and truth. They work in organizations with particular histories, and established routines of practice, situated within particular fields. In the case of contemporary online higher education, these claims are interpreted by similarly situated actors (university professors and administrators from arts and science disciplines), who are experts in their own right, and whose expertise is based in communities of practice that depend on varied norms around the objectives of scholarly life.

Later chapters will show that the major initial MOOC initiatives took place without a clear consensus about the efficacy or cost savings offered by these systems. In spite of this, faculty and administrators at elite universities invested substantial financial and symbolic capital in well publicized new projects to integrate these technologies into university teaching. This process began in the Stanford Computer Science Department, where Sebastian Thrun pursued an experiment to test two propositions; the first was that demand for high quality training in machine learning was massive, global, and unmet; the second was that learners outside the Stanford community could meet or exceed the evaluation criteria of the local undergraduate population. This unplanned experiment destabilized traditional assumptions about elite universities and set in motion a multi-year strategic response from administrators at Stanford, MIT, Harvard, and across the field of higher education.

This dissertation focuses on how academic experts and administrators charged with leading Stanford, MIT, and Harvard through these unsettled times thought about, struggled over, and integrated (or excluded) these new actors and technologies into the symbolic system and organizational field of elite higher education in the US. In particular it focuses on how the increasing centrality of computational methods, and the experts who wield them, is putting pressure on traditionally accepted hierarchies within and between elite universities. Toward that end, it will focus on Stanford, MIT, and Harvard, three of the most important sites of the MOOC movement, academic computer science, and elite higher education. As an embodied processes, I will evaluate how organizational leaders and academics at each of these sites worked to capitalize, or contain, the flurry of activity put into motion during the MOOC movement given the individual histories and contemporary organizational realities that shape and constrain them.

The remainder of this chapter provides an argument about why the MOOC movement should matter to sociologists and students of organizations, and proposes an approach to studying it. It begins by laying out the critical sociological questions called forward by the MOOC phenomenon and reviewing relevant literature on organizations, technology, and the university that might be brought to bear to study answer them. It goes on to review the method, case selection, and data on which the argument of the remainder of this dissertation is based.

Theory

This project finds itself at the intersection of two distinct fields and draws substantially on literature from each. The first builds on scholarship in sociology concerned with organizational evolution and shifting inter- and intra-organizational hierarchies. The latter draws on debates in modern higher education literature focusing on the political economy of the American university. This study makes clear that the field of higher education is valuable terrain

for the application and expansion of organizational theories focused on prestige and interorganizational status structure. While the preponderance of research on status in higher education focuses on the level of the student, a new round of organizationally oriented literature on higher education is flourishing (Armstrong & Hamilton 2013; Stevens 2007; Stevens et al. 2008; Stevens & Gebre-Medhin 2016). This literature, strengthened by this project, will further this new frontier of scholarship by building on intersections between theories of organizations which prioritize agency and contingency, exemplified by field theory, and the literature on contemporary university change.

Organizational Fields and Stability

Analyzing the actions of elite universities during the MOOC movement implies coming to terms with strategies of action pursued by organizational leaders to steer their organizations through unsettled times. When judged by their ability to ensure that their organizations persist and maintain status positions, generations of leaders of elite universities in America have been remarkably skilled actors. The intellectual tools to analyze this long term success are concentrated within the sociological literature on organizations. Among the most commonly cited strand within this field is loosely configured under the title "new institutionalism". This group of scholars offers a number of outstanding empirical approaches to analyzing contestation and culture within historically situated organizational fields. This section will review a few of these relevant approaches, and the shortcomings they pose, which focus on how actors interpret structural openings and draw on available symbolic frames to construct and legitimate new fields or transform existing ones. In bringing many of the tools of culturally oriented historical sociology to the analysis of relatively short term processes of change, they offer rich and detailed accounts of the mid-level processes associated with the rise of the organizational forms and institutional arrangements of modern society over the most recent century (although some of this work deals with much older historical cases (Johnson 2007)). While each empirical case identifies different processes of interaction and causation, there are general similarities across all these approaches.

The strength of new institutionalism is that many of these approaches account for the agency of individuals and groups in analyzing organizations and institutions within some limits set within the field. Furthermore, they do not assume a universal causal process linking individuals to cultures, professions, organizations, or institutions, but rather develop causal stories of these processes with specific attention to historical cases.

DiMaggio's (1991) analysis of the birth of an organizational field (art museums in the first half of the 20th century) shows how patrons (charitable foundations in this case) and organizational entrepreneurs construct a unified understanding of a new organizational form, essentially inventing the art museum as it is understood today. While legitimizing this new organizational form is centrally important, this process is anchored in practical occupational categories and communities fostered through symbolic and mental work. To make the art museum, these actors had to also make the art historians and curators, which they did through developing curriculum and endowing educational programs at elite universities.

While not explicitly associated with the new institutionalist tradition, Abbott's (1988) work on professions echoes some of the same themes while shifting the focus of analysis. For Abbott, culture, agency, the practice of professional labor, and organizational context are all central to the animation of his framework. Professions are conceived of as successful in so far as they are able to identify an object of intervention, articulate abstracted knowledge about that

object, and defend the boundaries around that object in the terrain of ideas as well as in organizations and work sites. The material location of an occupational group within the context of the division of labor, individual organizations, and industries is seen to be loosely coupled with the ideological efforts of professionals. At that level professions are responsible for curating and defending the abstracted knowledge systems experts depend on to legitimate monopolies over parts of social space. Over the course of the 20th century, the university has come to serve as the organizational home for the branches of these professions charged with curating and defending these abstract knowledge systems, as well as a key institutional source of legitimation.[2]

Fligstein (1987) bridges many of the gaps between field theory and professional contestation in his study of how professions fighting local battles in organizations can come to restructure ideas about the fundamental meaning of those same institutions. In his analysis, the rise of finance capitalism can be traced to professional communities of finance experts who seize on structural opportunities to develop more central roles in major American corporations. Once established they use their professional knowledge to reshape what it means to be an American corporation.[3] In the education literature, Brint and Karabel's (1989) depiction of the community college within the field of American higher education is seen in similar terms. They highlight the claims of aspirant professional communities within high schools who successfully defined new social and organizational space around applied career training. This new organizational terrain between the traditional secondary and post-secondary sector ultimately became community colleges and the secondary school administrators who helped define it went on to monopolize it.

However, many of these approaches focus on empirically rare events: emergence and transformation. The preponderance of social action within fields, alternatively, is in the service of minting stability and relative position vis-à-vis peers. Other organizational sociologists have offered mechanisms to explain the persistence of incumbents, and the maintenance of organizational differentiation, over time in changing fields. For these scholars, the social space inhabited by organizations is imagined to be structured based on theoretical foundations which privilege networks, cognitive understandings, and formal structures. Among the largest challenge faced by these theoretical approaches is how to explain stability in the context of an ongoing process of jockeying, contestation, and contingency in settled fields. The version of field theory presented by Fligstein and McAdam (2012) addresses many of these challenges. Under structural conditions that enable robust action (Padgett & Ansell 1993), or through the work of skilled social actors (Fligstein 2013), openings provide opportunities for restructuring hierarchies or institutions. Where DiMaggio and Powell (1983) use the concept of isomorphism as one key set of mechanisms that describe why organizations often evolve to be quite similar in structure and form, even under varied circumstances, field theory offers tools to understand how contingency

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[2] It is important to note that while applied professions that have established themselves in universities must build bridges between organizations where jobs exist and academic communities (say hospitals/clinics and university medical schools) academic life is organized differently. Elite universities who train the majority of PhDs and academic professionals, can be seen as the sites of the maintenance and production of knowledge, while less prestigious universities, where the majority of academic jobs are, become work sites. Understanding the nature of the relationship between these two sites is crucial to understanding how development of academic disciplines unfold and evolve.

[3] Morrill (1991)provides another somewhat related view of this field level analysis with an ethnography of the norms of behaviors of managers as the rise of hostile takeovers swept corporate America.

offers multiple possibilities for the direction of a field as it evolves, even under relatively stable orders.

Among other insights, scholars working from this perspective have highlighted the tendencies of firms to avoid direct competition with similarly situated peers by specializing rather than competing, and agreeing to co-exist rather than fighting to the death (Fligstein & McAdam 2012). These tendencies, which run counter to assumptions of modern economics regarding efficiency, explain the remarkable durability and stability of many organizational fields over long time periods. The assent or success of individual professional communities can also drive de facto institutional transformation within and beyond individual fields. Many of these insights are drawn from the field of social movements. By appreciating the individual organizations as a field of potential struggle where social actors can leverage identity claims, symbols, varying epistemologies, ontologies, and resources to pursue collective projects of reform or self-preservation, the mechanisms driving a wide variety of field level transformations become clearer (Fligstein 1993).

Higher Education

The field of higher education is rich with opportunities to advance and expand these theories of organizational persistence and the reproduction of hierarchy within fields. Higher education is one of the first, and oldest, national organizational fields in America. Cambridge is the site of two of the most iconic universities in the world, each of which define their respective sectors of domestic higher education. The third case of this dissertation, Stanford, is a rare case of an ascendant newcomer. The age and stability of this field of American post-secondary education does not imply stagnation. Contrary to the critical perspectives often mobilized against universities, the institution and field have evolved dramatically. Profound historical changes in the role, mission, and practice of the American university have been documented, and are ongoing, since its origin. One such change has been the increased centrality and significance of technology schools. These organizations deviate from the broad based liberal arts structure which defines places like Harvard by focusing on applied sciences and engineering.

In a review of recent historically oriented organizational sociology on the university, Stevens and Gebre-Medhin (2016) identify at least three major historical epochs of the American university, each a contingent accomplishment knit together by university leaders, government agencies, families, and students. At the turn of the 20th century, the *associational* period, American universities were working to connect themselves in a cohesive national web through regional associations and shared national standards. During the *service* epoch, as America mobilized for war, universities were key conduits through which the expanding Federal Government increased its role in the lives of citizens, historically wary of central control, to support the war effort and later to demobilize returning soldiers following WWII. As the impetus for robust federal investment in higher education waned through decades of peace, institutional entrepreneurs looked to build relationships with private industry and to recast the role of the university as engines of economic growth in what they call the *market* epoch. Seen as such, one may ask how, in the face of such dramatic change, incumbent organizations in American higher education have been able to persist for as long as they have; and point toward evaluations of the strategies of reproduction and persistence in the face of broader social change. The subsequent sections of this chapter outline a number of strands of literature that exist within the fractured scholarship on the university.

There is no shortage of scholarly reflections on the state of the American university. However, this body of work is often atheoretical and far from cohesive, and nothing like a unified social science of higher education can be said to exist.[4] This section provides a brief literature review of relevant scholarly attempts to analyze the role of the university in society, the organizational and professional fields in which universities exist, and its impact on the social practice of science and technology.

The first perspective considered here highlights the role of the university in human capital production and national development. Another approach focuses on material and training function of the university but rather its symbolic systems, sees the university as a core institution of modern collective consciousness. While the turn toward focusing on the symbolic dimension of the research university is a positive step, this tradition has the tendency to obscure historically situated contestation and flatten the agentic process of struggles over meaning making.

A second major group of scholars addresses these deficits by focusing on the erosion of university autonomy. These scholars introduce the sociological concepts of state and society, and frameworks of contestation. Earlier work focused on the loss of autonomy vis-à-vis the state, while later work highlighted the encroachment of market forces as the state deprioritized financial support for universities. This strand of literature (the market university), while essential to understanding the 21st century university, often laments the loss of the utopian city on the hill as university resource flows are reorganized, while failing to integrate critical and reflexive perspectives on the privilege of faculty and the often pernicious role that university science has played in society.

Yet another set of literature on the university considers meso-level phenomenon by balancing culture, agency, and structure within specific historical contexts. These approaches seek to identify social mechanisms of action which cajole and compel universities to change in a common direction. A related but separate group of scholarship shifts the unit of analysis from individual organizations to faculty and professional communities as they pursue strategies of action in the broader context outlined above. This subset of literature focuses on the development of professions, and professional claims to authority, through historical accounts of the localized cultures guiding the practices of these groups.

Finally, I touch briefly on scholarship that has highlighted the deficits in investment and prioritization of an essential element of the modern university: undergraduate education. While undergraduate outcomes are not the focus of this work, the proponents of the MOOC movement would likely not have had the success they enjoyed had it not been for the structural opportunity which followed from the neglect of undergraduate teaching and learning across the sector as a whole. The objective of this review is to highlight the need for a theoretical framework that deals simultaneously with the process of structural context and change while maintaining a sensitivity to symbolic systems and ideas. Such a theory must take seriously the contingent micro-processes and struggles that agents and organized groups undergo to reorder the social world. This need will guide the remainder of the dissertation.

Functionalist Views of American Higher Education

Functionalist views of the university prioritize labor market outcomes and technological development as the main purpose of these organizations. Among the most recent and significant contributions to this tradition comes from Goldin and Katz (2008). They argue that America is

[4] See Stevens et al's (2008) review of the multiple perspectives in the social science of higher education.

falling behind its European comparison group in the rate of university degrees and the number of college educated students being produced. The main purpose of the university from this theoretical perspective is to promote the interests of national economic development by generating human capital through training labor power for a highly technical and increasingly knowledge driven economy.

John Meyer exemplifies this alternate tradition by foregrounding the centrality of symbolic systems in analyzing the role of universities in modern society (Schofer & Meyer 2005). Meyer's work, as well as that of scholars working in his tradition (Frank & Gabler 2006 etc.), masterfully tracks the institutionalization of the university as a core element in modern global society. By expanding the frame of their analysis to the level of the global, they are able to show that higher education is growing at a similarly rapid rate in countries in the global south where markets for advanced technical skills are far less developed than they are in industrial economies. To reconcile this puzzle, these scholars conceptualize the university as the central institution of modern/post-modern society. As such, it is responsible for articulating and inculcating scientific rationality into the cosmology of the global institutional system and the ontology of all who exist within it. They argue that humans who once roamed the earth in fear of God dependent on religion to make sense of the world now move about the planet empowered by their scientific understanding, an understanding anchored in universities, to advance knowledge about the world around them.

While the attempt to refocus scholarship on the symbolic and ideological dimensions of the university is a welcome departure from functional accounts linked to labor markets and cognition, the scholarship in Meyer's tradition has serious limitations. When the institutionalization of culture becomes a single outcome variable studied over tens or hundreds of years, meaning and context are obfuscated and the nature and dynamics by which people collectively shape history are lost. Much like Durkheimian theories of the division of labor, these studies tend to collapse agency and historical contingency into monolithic and inevitably unfolding processes.

University Autonomy: Between State and Market

Another strand of analysis highlights and criticizes the erosion of the autonomy of the university vis-à-vis other social institutions. Most of this work builds on dichotomies of state and market. Far from a novel turn, university watchers and scholars have long feared the erosion of the idyllic space, set apart from the dynamics and demands of worldly social structures. Many observers of the modern-university turn to the classic work of Merton who identified four key norms of scholarly life based in modern university: universalism, communism, disinterestedness, and organized skepticism (Merton 1973). In his early observations about the American academy, Merton was most concerned with the creeping encroachment of the state into scholarly affairs, and the impact of those intrusions' on the development of science. Before Merton, Flexner raised concerns that the pure research mission of the university was falling victim to a plethora of non-essential demands made of it by adjacent fields including but not limited to the state ([1930] 1994).

A great deal of scholarship has also been dedicated to the contemporary migration of universities away from direct state patronage toward closer relationships with markets, and accompanying practices more closely associated with for-profit firms. While the broader historical analysis implies that a shift away from state patronage is not entirely anomalous for American higher education (Stevens & Gebre-Medhin 2016), this work highlights a critical

feature of the shifting political economy of domestic post-secondary education. This more recent variant on the erosion of autonomy perspective highlights the market as the core threat to university life, as exemplified by former Harvard President Derek Bok (2004) and, from a different perspective, Pierre Bourdieu.[5] Managerial reforms were introduced that looked to rationalize university budgets by introducing cost center accounting to university governance. This slow market creep which began in the 1970's has grown exponentially since the 1980s (Marginson & Considine 2000) with the introduction of the Bayh-Dole act and the rise of neoliberalism (Berman 2008). Slaughter and her many collaborators have astutely observed these trends, arguing that capitalists have worked through an expanding managerial stratum on campus to capture once independent academic organizations (Cantwell & Kauppinen 2014; Slaughter & Leslie 1997; Slaughter & Rhoades 2009). The main thesis of this work is that the university has gone from a public good/knowledge regime to a private good/technoscience regime (Slaughter & Rhoades 2009). They highlight the victory of science in universities around the turn of the 20th century as making way for the golden age of faculty autonomy which, while supporting capitalism, was generally a friend to social progress. Against this backdrop, the advent of neoliberalism is seen to be overwhelming the university and turning scientific faculty into entrepreneurs, discoveries into patents, administrators into market oriented managers, boards of regents into corporate networking forums, and students into consumers of education as well as the mass produced goods and services aggressively marketed to them while they are on campus.

From a more institutionalist perspective, Berman analyzed the advent of the framing of universities as economic engines by university administrators, state and federal policy makers, and industry (Berman 2008). Together, these approaches guide a great deal of contemporary inquiry into the dynamics of the university and the lives and careers of contemporary academics (Stuart & Ding 2006). In the process of responding to shifting resource flows, faculty and administrators found new ways of operating and describing their traditional activities. This involved the replacement of state and federal money with private philanthropy, corporate patronage, and industry partnership. However, the extent to which these mechanisms have superseded the proximate mechanism of status and prestige competition which guide university strategy has a tendency to be overstated.

Although many of the observations of scholarly projects organized around loss of university autonomy are insightful, they suffer substantial deficits. First, they tend to overemphasize state/market dichotomies, and at times treat each as an autonomous, bounded entity. Second, they have a tendency to uncritically celebrate the role of the university. With autonomy as a starting point, this work has trouble seriously addressing critical questions such as: what good is a university? In whose interest and for whose benefit do universities operate? Are universities an instrument of class control and legitimation of domination, or engines of mobility and critical voices for justice?[6] By focusing on the transformation of academic and scholarly practice and social organization, another branch of scholarship has more robustly given context and content to the process of market oriented university transformation.

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[5] In a rare political digression, and a peculiar move given the place education plays in class reproduction in his theoretical apparatus, Pierre Bourdieu published a postscript to the *Rules of Art* decrying the loss of autonomy the academic field was suffering at the hands of the market under neoliberalism (Bourdieu 1996).

[6] For Marx university science was likely to be the justificatory apparatus for class domination, and for Bourdieu a key site of the mystification and source of the symbolic legitimacy of the dominant class. Additionally, scholars of the early 20th century university have pointed out the inextricable link between social science, colonialism, and imperialism.

Mechanisms for Movement

Markets are not the only story in the contemporary literature on organizational change in higher education. Scholars in the field have done innovative work to analyze the impact of rapidly proliferating ranking systems which purport to summarize the dizzying diversity of American higher education into discrete numeric valuations which can be represented in ordered league tables. In particular, the work of Espeland and Sauder (2016) has paved new ground in understanding the vulnerability of organizational hierarchies to external pressure in fields heavily dependent on hard-to-measure symbolic outputs. Building on the work of Porter (1996), which highlights the rise of social measurement, Espeland and Sauder evaluate the concepts of reactivity (the tendencies of subjects being observed to change their behavior in response to said observation) (Espeland & Sauder 2007) and discipline (the internalized normative structures which persist beyond observation) (Sauder & Espeland 2009) in shaping university behavior in an age of rankings (Espeland & Sauder 2007).

Bastedo and Bowman (2010) add another layer of complexity to the rankings literature in higher education. They chart the impact of changes in rankings on resource flows and find that while rankings are often produced by those outside of the field for the purpose of external consumption, rankings have the most substantive impact on actors at the core of the field. These central actors make much of the minor machinations in final standings that go unnoticed by those at the periphery. In all, this work demonstrates how, exactly, isomorphic pressure toward conformity drives actors toward what are often arbitrary and illegitimate priorities of ranking organizations which are often controlled by actors outside the core of the field of higher education.

Higher education scholars have built loosely on this field of research to identify the patterns employed by university administrators who seek to improve their standing in league tables, a behavior often called "striving" (O'Meara 2007). This branch of scholarship has focused on the behavior of broad access, teaching oriented schools that desire to ascend the status hierarchy. To accomplish this, schools often increase their focus on research, transforming the student body through changes in admissions expectations and procedures, and restructuring administrative functions to accommodate increased focus on competing for external research funds (Morphew & Baker 2004). By and large, these organizational striving strategies have been crafted by those most sensitive to the reputational impacts of rankings: university administrators. Scholars have extended their frame to evaluate the impact of striving strategies on faculty life and careers. While resistance to these pressures is common, it is not universal, as some faculty (especially those with deep familiarity with higher education status structures, including young PhD's recently trained at R1's) embrace the reform efforts (Gonzales 2014; O'Meara & Bloomgarden 2011).

Finally, Brint and Karabel's (1989) work on the incorporation of the community college into the field of higher education provides another example of the mechanisms at work intensifying the proliferation of a common model and institutional structure for higher education. As policymakers and state planners began to contemplate mass higher education in the early 20th century, the role and meaning of the two year institution was undefined. Citing the lack of interest of business managers in manpower trained at community colleges, student resistance to vocationalization, and ambiguity among traditional faculty and administrators to the new organizations, it took the work of organizational entrepreneurs to construct and define this new space. In particular, high school administrators and teachers saw that the articulation of a new organizational space would enable them to reap some of the symbolic benefits and status claims

of higher education by becoming professors and chancellors and presidents of these new colleges. At the same time they avoided competing directly with elite universities symbolically (by calling themselves junior colleges) or materially (by inventing the associates degree and leaving intact the monopoly over the BA held by four year universities).[7]

Market Scientists and Programming Culture

As highlighted by Brint and Karabel (1989), organizational sociologists do well to focus on professional dynamics as mechanisms of action within the field of higher education. Another set of literature which takes academic professions seriously is interested in entrepreneurship among faculty as the role of professor becomes more deeply articulated with the market university. Much of this tradition builds on Berger and Luckmann (1967) and network theory to highlight the micro-processes of culturally contextualized meaning making on the individual and organizational level. These scholars focus on the reordering of social roles that underlies the process of market encroachment into the academy described previously. Stuart and Ding (2006) highlight network variables to interpret their data. They find that the presence of high status entrepreneurs within an academic scientist's network, or having multiple entrepreneurial colleagues in the graduate department in which they were trained or in the department where they work, had positive impacts on the likelihood of academic scientists engaging with entrepreneurial activities (Stuart & Ding 2006).

Scholars working in this tradition do well to highlight the social roles underpinning organizational and institutional arrangements. Without intimate knowledge of how actors reorganize these roles, and maintain or create legitimacy, macro historical transformation loses its meaning. However, finding a way to contextualize these roles in social structures that account for more than norms, and which take agency and contingency seriously is critical to bridging the gap between micro and macro processes.

Of particular interest for this project is the process by which organizational and institutional contexts shape the cultural and political practices of computational engineers. Computer programmers may not be prototypical examples of a profession because, as Abbott (1988) argues, the rapidly changing pace of software languages makes it difficult to articulate a fixed body of abstract knowledge. However, the rise of modern high tech companies built on these technologies (Google, Facebook, etc), and the hegemony of the experts in those companies, allow for the solidification and articulation of group culture and ideologies, and may signal the establishment of a new stable role and professional community[8]. Furthermore, training and socialization of top computer scientists is still concentrated in a small handful of elite educational institutions.[9]

Within these communities and among the networks of researchers working in top companies and academic laboratories, the cultural and political contestation of computer programmers is organized around political lines established in the early part of the 1980's. In *Coding Freedom* Coleman (2012) highlights the struggle over "free" and "open source" software that grew out of a contradiction between practices of academics in their labs and the interests of the high tech companies that were working to profit from new developments in computer

[7] See also Dougherty (1994) for further analysis of these trends.
[8] See Kunda (1992).
[9] In 2018 US news and world reports advertise a four way tie for first place in rankings for graduate schools in computer science between MIT, Stanford, UC Berkeley, and Carnegie Mellon (US News & World Report 2018).

science. As microprocessors became a common tool used by high tech researchers in universities, electrical engineers and scientists were forced to write computer code to harness the power of these new machines for their own specific research tasks. The software they wrote was freely distributed, openly available, and allowed all participants in a community to repurpose and alter it at will. As high tech companies began to commercially exploit these technologies in integrated hardware/software machines, they wrote licenses that made it a crime to alter or rewrite code (ie the software on an iPhone), practices which later developed into the licensing and sale of stand-alone software (ie Microsoft Word).

Quite contrary to the picture of entrepreneurial, market driven, technical experts as rationalizing depoliticizers, many early computer scientists organized into what later became two movements to resist the limitations of unfree closed platforms. Recasting liberal and libertarian ideas of freedom, these experts launched the Free Software Foundation under the leadership of Richard Stallman (a Harvard graduate and MIT researcher at the time) and legendary computer science professor Hal Abelson (Coleman 2012).[10] Freedom is conceived of by these American experts not as the right to access code underlying computer applications, but freedom from the closure of the virtual commons by intrusive and illegitimate corporations and governments. This became a rallying cry for the digital era. Other scholars have looked at the free and open software movement in alternate political contexts. For instance in Brazil the Workers Party mandated the use of open source software across its bureaucracy after coming to power. There, this movement has come to fit into socialist ideas of freedom from US corporate hegemony in the software industry rather than personal freedom (Shaw 2011; Takhteyev 2012). Each of these examples reinforces the importance of focusing on how groups of scientists define their roles in relation to the market and politics within specific historically and locally situated institutional contexts.

Limited learning

The markets, rankings, and striving literatures portend deleterious unintended consequences on teaching and learning. Within the context of broadly declining state support, the shifting of already limited resources away from the classroom intensified the long standing movement of university faculty out of teaching careers toward research (Jencks & Riesman 1968), and contributes to the abdication of one of higher education's core products (education). These trends are confirmed by Arum and Roksa (2010) who document the precipitous slide in cognitive assessments of contemporary university students (see also Bok (2006)). Arum and Roksa (2010) use modern psychometric tests to show how little cognitive development takes place in American universities. Even among those skeptical of psychometric testing, their findings are striking: most college students make close to no progress in higher order cognitive development, and in some cases are found to be worse off at the end of college then they were at the beginning (Arum & Roksa 2010). Similarly, Rosenbaum's *Beyond College for All* (2001) argues for an abandonment of the ideology of universal college access. In its place he proposes a system where teachers are empowered to more aggressively track low achieving students into vocational career training programs which would be linked more strongly to local employers.

[10] Abelson taught the mandatory and legendary introduction to computer science course at MIT in the 1980s and shaped the thinking of the first few generations of computer scientists who when on to populate industry and the academy.

In this context, and with the availability of new internet based communication technologies, the 2000's were a period of proliferation and expansion of experiments in higher education that focused exclusively on the education function of universities. While some of these experiments were pioneered by traditional universities (eg. Western Governors University[11]) many were incorporated as for-profits. By and large, all of these new models looked for ways to deliver more, higher quality education, with lower fixed costs. They were also, by and large, relegated to the broad access segments of the field, and received little explicit public attention from elite universities (for a review of selective universities' early experiments with online course delivery see Walsh (2011)).

Data and Method

To advance our understanding of strategies of incumbents to maintain position vis-à-vis organizational entrepreneurs, this dissertation studies three of the most important sites within the field of higher education as they worked to understand, and respond to, a wave of new initiatives. Specifically, it focuses on the technical experts involved in promoting and legitimating new forms of tertiary education under the umbrella of MOOCs, and how Stanford, MIT, and Harvard leveraged symbolic and material resources to advance or defend their position. By combining an analysis of the specific cultural practices of the epistemic communities in which these experts operate—and out of which many of these new models have emerged—with an inquiry into the organizational, regional, and institutional conditions of the fields in which each university exists, additional insight can be shed on how incumbents attempt to protect their status. This dissertation attempts to execute such a research agenda.

It does so by analyzing sources of primary of data—semi-structured interviews, university reports/documents, and field notes from observations at MOOC related gatherings—alongside thousands of periodicals and secondary sources. At the core of this data are hundreds of hours of observation and more than 45 interviews with key actors at each of the cases charged with responding to the rapid developments of the MOOC movement. By observing and speaking directly with elite administrators, department representatives with oversight responsibility, and critical staffers and researchers assigned to these projects, this dissertation provides insights into the scripts and frames used by actors as they attempted to respond to novel phenomenon. When combined with extensive observational data and published accounts this dissertation provides unparalleled and compelling evidence relating to organizational strategy during this unsettled period.

Case Selection

To analyze how elite universities compete and collaborate to protect their position in the hierarchy of American higher education, this dissertation makes two strategic choices in case selection. First, the choice was made to explore these dynamics through one particular

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[11] Western Governors University is an accredited online university founded by a consortium of Governors from the western United States in 1997. The school was set up to offer convenient low cost access to higher education with a specific focus on individuals who had not some college level credits but had not completed a degree. WGU also became well known for its commitment to "competency based credentialing", through which they offered substantial credit for career and life experience to accelerate degree completion. This controversial practice, in combination with other tactics used by the school, led to a highly critical report from auditors at the U.S. Department of Education (Fain 2017)

contemporary phenomenon: the inception of the MOOC movement. The selection of a particular historic event enables the interrogation of real, verifiable, strategic decisions which can be itemized for evaluation. Within the context of the MOOC movement, a second level of geographic selection was utilized to focus on the primary sites of policy formation and action during the early MOOC movement into the field of higher education. As will be outlined below, the MOOC movement reverberated across the higher education landscape as trustees, administrators, and faculties attempted to sort out the local implications of these new experiments. Most of those efforts, however, were in response to the flurry of activity, and essential choices, made by individuals associated with just three schools. [12]

Founded	1891	1861	1636
Endowment	#5 ($21.4b)	#6 ($12.4b)	#1 ($35.9b)
Undergraduate Rank	#4	#7	#2
Shanghai (global)	#2	#3	#1
R & D Spending	#9 ($.959b)	#12 ($.908b)	#11 ($.934b)
Yield (undergrad)	#1 (81%)	#3 (72%)	#2 (80%)
Accept (undergrad)	#1 (4.7%)	#7 (7.8%)	#2 (5.2%)
CS Rank (AI)	#1 CS (#1 AI)	#1 CS (#3 AI)	#18 CS (#NR AI)

Figure 1.1[13]*:*

Beyond the sections on historical background, this dissertation focuses mainly on the actions of three universities at the center of this endeavor: Stanford, MIT, and Harvard. The spark that lit the MOOC movement transpired in Silicon Valley at the Stanford Computer Science department. When the faculty members responsible for these experiments went beyond the campus to engage

[12] The proliferation of organizational activities and functions adopted by elite universities in the field of higher education have been observed, though isomorphic pressures toward striving, to be a powerful force. It should be noted that this dissertation maintains that while these experiments in online course delivery were, and are, largely unproven, their impacts are absolutely tangible.

[13] This table draws on a number of sources. Endowment figures are from 2014 *(Wikipedia 2018a)*, Undergraduate rank is from 2014 *(U.S. News & World Report 2014)*, Global Rankings are from 2014 (Shanghai Rankings 2014), R&D spending from 2014 (NSF 2014), yield from 2015 (Wikipedia 2015), Acceptance Rates from 2016 (Wikipedia 2015), and CS Rank from 2014 (US News & World Report 2015).

allies and seek partners, the first stop they made was in Cambridge, and the two universities who were represented were MIT and Harvard.

An important dynamic is reflected in the three university cases selected for analysis. That dynamic has to do with the role of computational engineering in the internal hierarchy of individual universities, and the role of universities most closely aligned with computational engineering in hierarchies of the field of higher education. Stanford and MIT are among a tiny handful of universities responsible for training the vast majority of computer scientists employed at the top ranked departments across the country.[14] Stanford and MIT also feature two of the strongest concentrations of experts in machine learning and artificial intelligence, two of the most in demand subfields within computer science. In spite of the more than 3,000 miles which separate the two universities, the density of shared networks of publishing and professional service imply that the practical space between the two departments is minuscule.

They are, however, situated in infamously different institutional environments. The case is made most effectively by AnnaLee Saxenian in *Regional Advantage* (1996), which asks why the high tech economy came to be dominated by firms in Silicon Valley rather than the greater Boston area given their relatively equal starting positions. Her analysis shows how business and elite culture in Boston reinforced rigidly hierarchical and closed firm structures, protected by robust non-compete clauses and other protections that tied workers strongly to large employers. Silicon Valley on the other hand was unencumbered by traditional elites with an interest in large bureaucratic firms, and therefore featured flexible labor laws that enabled workers to cooperate with or move between firms and start-ups quickly and often (Saxenian 1996).

In *Cities of Knowledge*, O'Mara (2005) evaluates the geography of the postindustrial city and ask how and why some regions have been successful stimulating high skilled, technically advanced, and R & D focused economies while others have not. Stanford serves as her central case, often emulated but rarely successfully (if ever) copied. Capitalizing on a unique set of circumstances – a large endowment, a plethora of undeveloped land surrounding the campus (much of it university owned), a favorable climate, and regional linkages – Stanford was able supercharge the transformation of Silicon Valley during the 1950's into an engine for high tech growth envied the world over. But of equal significance to the physical and geographical endowments Stanford began with, were the social features it lacked. While Saxenian highlights the lack of an already established business terrain which enabled a more freewheeling and less conservative climate for collaboration, O'Mara points out the absence of the social problems inherited by administrators at Stanford which were real issues in Cambridge. The proximity to these social issues put pressures on the university which have deep roots in the outreach and extension strategies pursued by each university (see Chapter 2).

Unlike the two cases discussed above, Harvard is not consistently ranked as a central actor in the field of elite computer science or artificial intelligence. In fact, historical actions have systematically disenfranchised academic research and undergraduate training in applied sciences, engineering, and computer science at Harvard. Harvard was already nearly 250 years old when state and federal governments began to ask universities to train a new generation of engineers and applied scientists at the end of the 20th century. Rather than incorporate that project, and the new class of students who would be drafted into the ranks of applied professionals, Harvard decided to support the creation of an entirely separate, but functionally co-present, organizational entity, MIT. This decision was in large part due to the perceived status

[14] Carnegie Mellon, and to a lesser extent Cal Tech and Georgia Tech, round out these training universities.

incompatibility between the elite students and families Harvard recruited and the working and middle class families who were likely to supply the applied professionals required by an industrializing American State.

However, the central involvement of Harvard in the MOOC movement is one among many indications that a fundamental shift in the status of computational engineers is undergoing a profound shift. Including Harvard among the three cases of this dissertation allows for an analysis of how the disciplinary core of higher education, institutionalized by the start of the 20th century, is coming to occupy overlapping terrain as the once marginal subfield of applied science. As the historical incumbent in the field of higher education, evaluating Harvard's strategic response to this period of broad change provides powerful insight into how traditional actors in education work to protect and defend their status.

Data/Method

To evaluate the questions laid out above, a number of sources of data were compiled over a 5 year period. Part I of this dissertation builds mostly on secondary sources from historical publications and periodicals. The relevant specific techniques used to aggregate and evaluate that data will be covered in Chapter 3. Part II of this dissertation features a substantial amount of primary data collected for the purposes of this dissertation and not published elsewhere. This data takes the form of observations and interviews that were collected on location at each of the three field sites or entities closely associated with them. While some data was collected at the organizational spin-offs that were essential to the MOOC movement, Udacity, Coursera, and edX, the focus of this dissertation is on the actions of traditional universities.

Primary observational data collection began during the summer of 2012. While in residence at Berkeley weekly, and sometimes twice weekly, research trips were undertaken to Stanford to participate in open meetings, research groups, and public lectures associated with the MOOC movement. This practice continued until research moved to Cambridge, MA during the 2013-2014 academic year, and commenced upon returning to the Bay Area in the summer of 2014. During these more than 200 observational visits to Stanford, MIT, and Berkeley diligent field notes were recorded. These visits were used to identify and recruit individual interview targets, and to understand the tone and tenor of the public face of ongoing efforts in this space. In addition to the yearlong residence in Cambridge, four additional research related trips from Berkeley to Cambridge to conduct follow-up research and maintain relationships with informants and research subjects.

Over the course of the research period 45 semi-structured interviews were conducted. These discussions were with actors personally familiar with, and often charged with shaping, online higher education strategy during the inception and early period of the MOOC movement at the three university sites identified above. Interview data was supplemented with observational data previously referenced. Following established practice in the field of organizational analysis, these strategic interviews with key actors in the field were corroborated with other documents, public statements, and background information to ensure reliability of the results. While this dissertation does not claim to present a representative sample of any discernible category, it does provide unparalleled access into the strategies of individual and collective action that shaped organizational decision making processes.

Interviews were tape recorded[15] and transcribed. In conformity to the local IRB protocols the names and identifying characteristics of individual respondents have been removed or altered to protect the confidentiality of the subjects. The data presented below does, however, link the interview data to named affiliated institutions which is also a feature of the approved IRB protocol. The interview protocol, which consisted of 3 major sections and 75 orienting questions, provided a foundation for each semi-structured interview. Interviews ranged from 45 minutes to multiple hours depending on the prerogative of the subject. Interviews, once collected, were transcribed in part or in full by the researcher. They were subsequently coded by hand for statements related to central events and decisions related to themes of interest. These coded responses were then aggregated and are presented in whole or in part as the core empirical foundation for Chapters 4-6.

Due to this project's focus on the organizational decision-making process behind the development of online higher education strategy, a particular array of actors were targeted. Inclusion in the study was restricted to individuals who had intimate first-hand knowledge of the formation, implementation, or impact of organizational decision-making strategy about online higher education during the earliest phase of the inception of the MOOC movement. This included elite academic administrators, faculty with positions on representative bodies, teaching faculty who utilized these platforms, as well as the staff and technical experts charged with building the digital infrastructure associated with these initiatives. Due to the diversity of these interview subjects, the interview protocol was adapted and altered to highlight only relevant information available to each actor. For each case at least one interview was conducted with a subject currently or formerly at the level of Provost, President, or Trustee.

It is important to note the distinction between this method of data collection and other interview based studies in the social sciences. Interviews are often used to assess mechanisms of decision- and meaning-making among subjects. Often, these subjects are treated as representatives of a categorical variable such as race, class, profession, or job. The objective of such researcher is to sample from the population of interest when possible (or define a subset by another feature) and conduct enough interviews such that dominant patterns are not likely to be altered by the collection and analysis of additional interviews. Interviews which seek to understand organizational decision making, especially surrounding a specific named event or phenomenon, often pursue a different sampling strategy. In this case the universe of potentially relevant actors is finite and the individuals with access to first-hand knowledge represent different positions and professional communities within the organization, so representative sampling is particularly challenging if not impossible. For this dissertation, a list of potential interview targets was composed using organizational charts and publicly available statements and documents. Efforts to devise optimal avenues of approach, leveraging personal and professional networks, were supplemented with substantial investments of time and energy in participating in relevant community activities. Saturation was achieved when additional interviews ceased to alter the key actors, logics, or events of the timeline that had developed in prior interviews and which were corroborated via additional sources.

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[15] In a few rare cases, tape recording and transcription were not possible. On one occasion a recording was lost due to technical difficulties with the recorder. In another small subset of interviews, respondents declined the use of an audio recorder so diligent notes were taken during the interview which were edited and filled in immediately following the discussion.

Chapter Overview

This study is divided into two substantive parts comprised of five chapters total. Broadly, Part I seeks to provide context for the rapidly evolving activities that transpired in 2012 which took the field by storm. It does so by combining secondary sources for a historical background with novel methods of computational text analysis of trade publications to evaluate framing of online course delivery during the internet era. Part II is composed of case studies of Stanford, MIT, and Harvard. Each case builds on a foundation of primary interviews and observations to document the specific actions and reactions which transpired on each campus during the MOOC movement from the perspective of organizational leadership.

Part I: Reframing Online Higher Education

Part I provides context for the contemporary MOOC movement which reinvigorated attempts to use digital technologies and new delivery systems to transform higher education. Chapter 2 provides a brief history of the MOOC movement in an effort to demystify the concept of the MOOC and provides a foundation for engagement for the uninitiated reader. Chapter 3 analyzes secondary data using computational text analysis to understand what, if anything, makes the framing of the MOOC movement stand apart from prior historical efforts to use the internet to deliver higher education content.

Prior to 2012 it would have been very difficult to imagine that faculty strongly associated with computational engineering departments with a strong applied tradition would be likely candidates to take the lead in reforming higher education. Since its inception, the US academy has been dominated by academics associated with traditional pure research disciplines and those associated with the liberal professions. How then, did this group of traditional outsiders come to play a central role in contemporary efforts to transform the university? Addressing this question is the task of this section.

These two chapters will advance a number of frames used to explain the actions of the modern university. Prior to 2012, debate about the challenges and shortcomings of the university focused on a crisis of affordability. Many analysts, therefore, understood the MOOC movement to be a response, and potential solution, to those well publicized issues. They predicted the success of the MOOC because these technologies were expected to bring down prices. They were also expected to provide flexibility for modern college students who are more likely than ever to be older, hold a full time job, and to have already completed some tertiary education credits. From this perspective, the affordances of MOOCs were perfectly suited to the scheduling and training needs of the contemporary learner in higher education. From a third perspective, early proponents and analysts of MOOCs believed that these technologies could drive profound new discoveries in the learning sciences.

Chapter 2 will use secondary sources and a review of the historical literature to contextualize these three concepts. Based on a preliminary review of the evidence, the chapter argues that these priorities grew out of a round of experimentation with online higher education in the late 1990s, but that internet technologies have not yet been shown, in practice, to accomplish these objectives. Currently, none of the internet era models of higher education reform has been shown to dramatically lower cost for students across the field. Well-known examples of student resistance, combined with very little evidence that student demand for these delivery vehicles has increased dramatically, imply only limited support for this explanations of the MOOC movement.

Chapter 3 will use quantitative coding of industry documents relating to online higher education reform efforts during the internet era. In so doing it will demonstrate a discursive shift in frames away from content, delivery, and cost reduction, and toward frames associated with internet ideology such as openness, big data, machine learning, networked and socially distributed systems. Many of the conclusions advanced in Chapter 2 are reflected in this analysis. It not only reflects the shift in framing associated with cost and delivery, it reflects a shifting association away from lower status universities to high status universities, and toward frames associated with quantification, measurement, and the importance of digital platforms.

Part II: Reengineering Elite Universities

Using three case studies Part II analyzes how MOOCs became the foundation for a national reform movement among elite universities in an unproven method of higher education course delivery. In each case study this dissertation address the local conditions and field relations that drew Stanford, MIT, and Harvard into a flurry of activity that seemed to call into question the fundamental business model underpinning the success of each institution: high cost selective residential undergraduate education. Chapter 4 deals with a series of local events within the Stanford computer science department that lead to the creation of Coursera with help from elite administrators and lit the spark for the MOOC movement. Chapter 5 analyzes how word of these new academic startups traveled across the country through networks of academic computer scientists and administrators and was received at MIT. The section culminates in Chapter 6 which deals with the challenges faced by Harvard administrators and their collective response to the unfolding events at Stanford and MIT.

The dissertation concludes with a set of reflections on the relevance of this dynamic chapter for the contemporary university. It argues that the MOOC movement was most clearly understood and analyzed as a struggle over the future model of the American University in the context of the ascent of computational engineers within professional hierarchies in the American University and beyond. The rise of professional computer science on the heels of the success of the high tech firms in Silicon Valley may be the most salient feature of the reorientation of higher education reform efforts. This argument highlights not the technical superiority of these systems, but rather the capacity of computers scientists to monopolize and defend parts of social space. As the political economy and resource arrangements that defined the post WWII university rapidly descend into historical memory, the chapter considers how shifting inter- and intra-mural hierarchies in academic disciplines portend for future resource flows and meaning structures in post-secondary education.

PART I: Reframing Online Higher Education

2. A Brief History of Online Higher Education through the MOOC Movement

Universities have historically been defined by their physical campus where scholars and students congregated to advance knowledge. While co-presence has many benefits it is very expensive. Efforts to liberate higher education instruction from the requirement that students, faculty, and administrators be in the same place at appointed times have long historical roots beyond the advent of the internet. Building on that fact, the following section gives some historical context and establishes some relevant historical facts about the current movement toward online higher education, of which MOOCs are the most recent variant. It begins by briefly touching on the long history of distance education at the tertiary level, and discusses how Stanford, MIT, and Harvard engaged with those trends and the leveraged the affordances of different technologies. The second section provides an overview of how these general distance educational practices were translated onto the internet as that technology became broadly accessible during the 1990s, and how each of the three universities interacted with those trends. Finally the chapter outlines the explosive expansion of the MOOC movement by highlighting the major public events and announcements that captivated the field and drew attention to this new form of distance education. Overall, the historical antecedents to the MOOC movement clearly show that distance education in both its traditional and online variants has historically been a marginal practice in the field of higher education at within elite universities in particular. Experiments and production scale implementations of these techniques have been engaged with most often and most intensely by low status schools or by marginal entities affiliated with elite campuses.

Distance Education Prior to the Internet

Experiments with distance education are not novel for American colleges and universities. A clear historical parallel exists between the rise of online higher education and turn of the century correspondence courses conducted through the US mail. The height of this earlier movement was marked by a Carnegie Commission report in 1926 which noted that since their earliest iterations in the 1880s, over 300 such organizations offering correspondence courses had come into existence and were estimated to be generating over $70 million annually, an amount more than the entire "traditional sector" combined (Noble 2003 p6). Largely in response to these developments, elite universities in the US began to experiment with distance education during the same period. Among the best documented examples of these programs are those at the University of Chicago and the University of Wisconsin, which explicitly justified their programs in response to the perceived proliferation of vocationally oriented correspondence education offering new degrees for a fee (Watkins 1991).

In spite of decades of persistence, however, none of these projects was successful in unsettling the core of the American system of higher education. While the Open University in the UK did establish itself as a responsible, respected, and successful provider of correspondence courses across the Atlantic, distance education in American higher education has largely been dominated by lightly regulated for-profit entities at the periphery of the field of higher education. In spite of more than a century of experimentation with this medium, these methods have not had a profound impact on the business model of elite residential universities in America and

purveyors of correspondence programs remained stigmatized into the 2000s (Ezell & Bear 2012; Noble 2003).

Harvard: University Extension and Community Relations

Harvard is unique among elite universities in America in a number of ways. One way that is often overlooked is that it has featured a broad access outlet for local students since 1910. Known as the University Extension, and later Harvard Extension, this unit has created a space for a wide array of pedagogical and organizational experiments in a relatively safe "sandbox" not directly associated with the main Harvard brand. As a contemporary administrator of the contemporary Extension School described, "It's still very much the experimental arm of the Faculty of Arts and Sciences [FAS], because if something fails here, it's not that important frankly" (Interview 2014a). It was in keeping with this fact that over the first 100 years of its existence Harvard Extension was the bureaucratic mechanism through which Harvard conducted many activities, including defusing simmering town gown relations, pioneering early efforts to use radio and television for the delivery of course content, and embarking on lesser known international university partnerships (Shinagel 2009).

The Extension was originally conceived of, and repeatedly pressed into service, to offer a bridge between the rarified air surrounded by the brick walls of Harvard yard and the surrounding residents of Cambridge and Boston. Intended at its inception as a public lecture series offered though a consortium of local universities, Harvard took control of the project in 1910. Their move into credit bearing courses came as they began offering advanced liberal arts courses to local high school instructors to strengthen their academic bona fides. Over time these offerings came to be a central mechanism though which the university connected with local populations who would not have otherwise been considered for admissions to Harvard. Reflecting in 1930 on his experience at the University Extension, retired Dean Reginald H. Phelps explained:

> I found Extension the most rewarding. Partly, this was, no doubt, because I could run a rising program with practically no interference; partly it was the feeling that a second chance in education for people passed by in the normal run of school and college is one of the finest aspects of American Education; and partially it was the chance to establish and maintain friendly relations though our program with black people in Boston, who would otherwise not have had any contact with Harvard. (Shinagel 2009 p. 67)

By the middle of the 20th century, the University Extension had expanded substantially. Unlike many of the other extension programs which had grown up at selective American universities, Harvard was able to maintain a liberal arts focus for almost its entire range of courses. These courses were taught almost exclusively by main line faculty who were able to substantially increase their income by teaching the same course they taught to Harvard students during the day to extension students at night. Given these circumstance, as the social unrest of the 1960's came into contact with the university through local urban communities demanding economic opportunity and adult educational programs, Harvard leaned more heavily on the extension to render service to the local populations. A report commissioned in 1969 on these increasing tensions, and potential mechanisms for outreach, made the following argument:

> The Extension program is clearly one of the most important community-serving activities undertaken by Harvard. Almost all the courses, however, are offered in or near the Harvard Yard, and relatively few are addressed to current "urban" issues. We would urge the Director of University Extension to review the structure, offerings, and location of his programs to see what opportunities may exist for broadening the scope of the courses and improving the access of more distant parts of the community to those courses. Large segments of the Boston-Cambridge community may be unaware of Extension offerings, or may feel slightly intimidated by the prospect of entering the Yard to enroll. (Shinagel 2009 p. 100)

As the quote above makes clear, in addition to depending on the Extension to ameliorate tensions between the university and local communities Extension became a critical vehicle to experiment with new delivery technologies such as radio and television. Over the second half of the 20th century, Harvard Extension developed a robust partnership with WGBH that began over the radio waves and evolved onto television, featuring some of the first full courses ever broadcast live and in real time over the airwaves (Shinagel 2009 Ch. 6). Experiments did not stop at the boarders. In 1989, riding a wave of international expansion by American universities, Harvard responded to a request from a Boston based businessman to explore the possibility of a Harvard venture in India that focused on computer technology. By 1990 a formal relationship had been agreed upon and the Division of Continuing Education of the Harvard Extension School had a sister campus in Bangalore called the *Indian Computer Academy* which was inaugurated in 1992. Despite the inaugural fanfare, by October 1993, the scale of the challenge of starting a new university from scratch thousands of miles from Cambridge came into focus, and with money running out and standards well below the expectations of even the Extension brand, the relationship was terminated (Shinagel 2009, Chapter 7).

While rarely publicized beyond the Greater Boston area, Harvard Extension has been a valuable experimental arm of the university which has simultaneously offered outreach and community relations to local populations who would have otherwise been excluded, all while contributing to the budget of FAS and supplementing the income of individual faculty. Given the relatively limited impact this entity had on the central activities of the university, its fidelity to a traditional arts and science core, and the multifaceted utility it offered campus faculty and administrators, Harvard Extension persists in positive and harmonious relation to the central campus from the margins of Harvard's diverse portfolio.

Stanford: Industrial Origins

Much like the enterprising administrators that found multiple uses of the University Extension in Cambridge, Stanford had its own set of ambitious educational entrepreneurs (Collins 1979). The contexts in which these actors attempted to make space for their new initiatives, and the constituencies and priorities that they needed to serve, were substantially and consequentially different. In addition to differences in the nature of secrecy and protectionism practiced by the business community in Cambridge and Stanford, major differences in social context enabled and constrained the actions of each University in pursuing their strategies and set each on a different path. In particular, the suburban nature of Stanford, and its distant removal from the patterns of migration and industrial decline which stimulated unrest across much of the country, meant efforts to expand the reach of the university could be concentrated elsewhere. As explained above, O'Mara (2005) points out the absence of social problems inherited by

administrators at Stanford. While Harvard repeatedly looked to its Extension program to ameliorate racial and economic unrest between campus and community in post-industrial Boston, Stanford had no such challenges. This allowed Stanford to pursue a more constrained set of priorities that focused on intensifying the density of networks with local high tech industry rather than dealing with social, educational, or economic inequalities of the local community.

In addition to their relatively beneficial endowments (and lack of preexisting challenges), Stanford was strongly shaped by the strategic choices made by its leadership in response to the great depression. Then President of Stanford Ray Lyman Wilbur, and former President of the US Herbert Hoover, himself a Stanford Trustee, believed that the future financial stability and success of the university was tied to its ability to build financial and programmatic relationships with private industry. As the American University became more essential to the national political economy during WWII and the Cold War, Stanford prioritized its role as an incubator and research engine at the heart of a new postindustrial regional economy. As high technology engineering firms sprung up around campus stimulated by government funding, Stanford began considering ways it could be of service to their continued prosperity (Lowen 1997 Introduction).

A legendary figure in Engineering at Stanford, in Silicon Valley, and around the world, Frederick Terman was also instrumental in channeling Stanford's education efforts beyond the Farm (as campus is often referred to) (Gillmor 2004). For Terman believed that investment in and dissemination of Stanford research in high technology fields was the foundation for regional growth in Silicon Valley, and that dense links between campus and local industry was the way to operationalize these investments. By 1954 he had supported the creation of the Honors Cooperative Program (HCP) in the School Engineering to advance these objectives, the first education extension experiment initiated by Stanford (Kindel 2014).[16] HCP established a few novel features of Stanford's approach that persisted until the MOOC movement and set it apart from Harvard's extension efforts. First, rather than appealing to individual learners, Stanford entered into formal relationships with local companies (Hewlett and Packard, General Electric, etc.) who selected employees for admission and who paid the cost of attendance. While curriculum was tailored to the research needs of their respective companies, students were formally admitted to Stanford and completion of their programs yielded Stanford credentials identical to traditional students in engineering (Kindel 2014).

As broadcast television came into maturity by the late 1960's, aided by technical discoveries by members of the local engineering community, Stanford began exploring new ways of integrating it into their extension efforts. The chosen vehicle for this new project was the Stanford Instructional Television Network (SITN) (Kindel 2014). Rather than broadcast educational content to the broader Bay Area as a public service, Stanford built closed-circuit video links which beamed on campus instructors into the campuses of their industrial affiliates who were already paying for access to advanced training. The construction and maintenance of such a network was costly, and even with the local expertise at Stanford and among the HCP partners, someone would have to find a way to pay the ongoing expenses. These costs were absorbed largely without complaints from existing corporate partners who appreciated the fact that their technical experts could spend less time commuting to Stanford and more time at work

[16] This section on the historical roots of Stanford's educational outreach efforts owe a great debt to Alex Kindel. As participant in the Future of Learning Lab at Stanford Kindel pursued a deep dive into the archival records surrounding these experiments and came up with a comprehensive story that is well told, and it's publication would be as service to the field.

at their desks. The practice of high touch parallel programs for local technical experts, mediated by private sector employers, proved hugely lucrative for Stanford and they were emulated by other smaller units on campus. For the next quarter of a century, these basic patterns were extended using new mediums of video tape recording, local cable distribution, and later satellite distribution by 1990 (Kindel 2014).

MIT: The Pursuit of Practical Tradition

Much less has been made of MIT's educational efforts beyond traditional, matriculated, students. Unlike Harvard, MIT does not feature formal parallel residential program for undergraduate course delivery. In fact, in spite of the nearly identical geographic location, MIT has not often been called to account to leverage its resources to respond directly to the social demands of local communities. MIT's pre-internet university extension programs followed many of the patterns of Stanford's but on a much smaller and less lucrative scale.

The distinction between distance education at Harvard and MIT has its historical origins in the fundamental relationship each university plays to applied fields and industry. From its inception, MIT was designed to focus on the practical arts of applied sciences that were not entirely welcome in the academic community down Charles River. However, MIT has featured a supplemental curriculum that was offered locally shortly after its founding. Originally designed to provide incoming students with remedial or supplemental material between formal sessions, these offerings expanded to incorporate custom curriculum that met the needs of local industry. In particular, programs were launched in textiles, spectroscopy, and petroleum engineering. By the mid-2000s these residential summer programs serve more than 1,500 students a year in a wide array of courses (MIT Professional Education 2015).

In 1956, MIT launched a *School for Advanced Study* "to give formal recognition to the importance of postdoctoral studies in advancing science and technology". The objective of the new institute was to provide a pathway for advanced career professionals at the frontier of their discipline to engage with MIT experts in closely related fields (MIT Professional Education 2015). While each of these programs has persisted for decades, they involve very few learners and don't generate much revenue ensuring their marginal position on campus. In spite of its practical focus, MIT has not historically pursued a path of broad outreach or engagement with the local community or industry on the educational content side of its organization.

Early Experiments with the Internet: Content Delivery

Having played a role in designing the protocols and building the physical network that was to become the Internet, many elite universities had a front row seat to the potential of this new medium of communication and connection. Researchers in government labs affiliated with universities had already begun to experiment extensively to uncover how these new tools might supplement and amplify their practice as scholars, researchers, and educators. The earliest recognized affordances of these new technologies allowed for rapid communication across vast distances, and these features were used to launch vibrant discussion boards (and later email lists) that shrunk the distance between experts across the country and facilitated near real time written correspondence (Hafner & Lyon 1996). As with many new technologies, those who built them and pioneered their use had strong beliefs about the norms and principals that should govern their future expansion. For early internet pioneers these values were infused with a unique amalgamation of communitarianism, libertarianism, and anti-capitalist openness inspired by academic standards. However, it was not long before the expanding base of internet users saw

competing possibilities for these new practices to transform industries as well as educational business models.

The second half of the 1990s witnessed a remarkable stampede by established businesses and upstart entrepreneurs to discover fame and fortune on the new digital frontier. While business models were nascent and highly speculative, there was a sense that there were vast sums to be made with some hard work, a little cleverness, and a lot of luck; the perfect makings for a modern day virtual gold rush. Higher education was not immune to these trends, and by the late 1990's a number of high profile experiments were being planned by universities to get in on the action. By and large, the initiatives that received national prominence and funding were built on the prior experience in distance education which many colleges and universities had been experimenting with for years. The section below briefly outlines some of the major experiments in online higher education launched during the early internet era before reviewing how MIT, Stanford, and Harvard interacted with these trends.

By the mid 1990s a handful of enterprising presidents of elite universities initiated contracts to use new internet technologies to deliver some version of the college experience to the wider public over the web. Among the most widely cited early initiatives were those from UCLA (*THEN*), Columbia (*Fathom*), and a consortium of Oxford, Princeton, Stanford, and Yale (*AllLearn*). All three of these early ventures were guided by a common set of expectations about the importance of content and its value to students and the world. Columbia's experiment was launched in 2000 with a $25 million investment from an internal fund and was set up as a for-profit. By 2003, with no prospect of making money, Columbia shut down fathom.com (Walsh 2011). UCLA also pursued a for-profit path, signing a highly controversial contract in the late 1990's with THEN, which was run by an LA entertainment executive. The arrangement signed by leaders of THEN and UCLA administrators called for faculty to turn over all of the rights to their classroom content for royalties which would be channeled to the university. While THEN never succeeded in launching a product, they did provoke a massive faculty backlash against the unilateral commodification and expropriation of their course content (Noble 2003 p. 61).

While none of the early profit seeking experiments succeeded in monetizing their offerings, others launched non-profit ventures with different objectives. The AllLearn collaborative was designed to target alumni communities of the four organizations to stimulate lifelong engagement with their alma matter and, presumably, to increase the related activity of lifelong giving. The small group of elite schools, chosen through personal relationships between elite administrators on each campus, hope a consortium structure would enable the pooling of resources would enable each institution to learn more quickly how best to operate in the new digital terrain. This market was not as eager to pay even the modest course fees advertised, and within six years of its launch in 2000 the partnership was terminated. The four institutions shared the losses estimated to be in the range of $15 million. In the end both Fathom and AllLearn found it difficult to link elite arts and science course content produced on their campuses with demand, which was for professional training that yielded certificates and credentials with labor market value (Walsh 2011 Ch. 2).

While elite universities were struggling to find customers for their informal education offerings, new startups at the other end of the prestige hierarchy were beginning to grow substantially. For-profit universities, with the help of government subsidies, led the way in

identifying the possibilities of a market for credential bearing online higher education.[17] The rise of for-profit universities built around internet delivery predated the distributed learning systems that are now being pioneered. They were innovative in choosing the most lucrative subjects and in eliminating overhead costs of libraries, tenured faculty, research, and facilities. In spite of contradictory numbers on cost effectiveness and broader critiques of their recruiting practices and dependence on government loans, these new entrants have had great success in building a strong domestic policy lobby, gaining accreditation, and garnering the support of state actors.

The advance of these new technologies in higher education has been by no means smooth. Their expansion has been met with resistance at every step of their historical development, and at multiple levels in the field of higher education. The terrain of these struggles has involved individual faculty, students, staff, as well as policy-makers and academic administrators. These early historical examples of online higher education through the early 2000's involved furious efforts to sign contracts clearly outlining ownership of content in such a way as to disenfranchise faculty and assert university ownership and control. This provoked a number of well-publicized battles between organized groups of faculty and academic administrators. The American Association of University Professors, the leading national faculty professional organization, took up the issue directly and organized a number of conferences and focused campaigns on the topic (Schneider 1999). These activities reached their apex in the early 2000's, and many of the association's documents outlining the organization's approach have not been updated since. After the failure of a number of the most aggressive pilot programs to wrestle ownership of course content away from faculty, and the failure of universities and their private partners to assert control over it, the terrain of contestation has shifted. Today, core issues of ownership of course content have mostly receded and have been replaced by the power of platforms, quantified measures of learning efficacy, and cost savings.

Since the 2000s the struggle has tended toward quantitative measures of learning outcomes. New debates intensified as learning systems have been built and disseminated across larger populations. Where once these flashpoints focused on professional control over products of the classroom and academic work, contestation came to be focused on the language of openness and technical superiority measured by learning outcomes. The shift away from content and content ownership was cemented by 2010 when the US Department of Education released what was hailed as a definitive data-based endorsement of online higher education. The study, commissioned by the US Department of Education and carried out by the independent research firm SRI International, involved a meta-analysis of prior research done on learning outcomes for experimental online courses that were documented in the published and peer reviewed literature. They reached, and widely disseminated, the conclusion that online higher education had slightly better learning outcomes when compared to traditional methodologies of instruction and dramatically higher benefits when combined with traditional instruction (Means et al. 2010). These findings were met with skepticism by many in the research community, most notably Teachers College at Columbia University, which undertook a critique and reanalysis of the Dept. of Ed study and rejected the government's original findings (Jaggars & Bailey 2010).[18]

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[17] An important distinction in this section must be made that for-profits were offering credit while early experiments from selective universities were not, and do not.

[18] Within some segments of the academic community, online higher education, which brings the possibility for extensive "a-b testing", is seen as a publishing goldmine. Recent studies have been published in this area using data

The US Department of Education was not alone, however, in their endorsement of these technologies. William Bowen, one of the most highly regarded tertiary education administrators and scholars of the field, entered the fray. Bowen, the former president of Princeton University (1972-1988) and the Andrew W. Mellon Foundation (1988-2006), has recently become a full-throated supporter of further experiments and greater investments in these new technologies. An economist by training, he coauthored an often cited paper with William J. Baumol in which they argued that higher education suffered from what has become known as Baumol's cost disease.[19] After analyzing a series of new empirical inquires organized by the Ithaka Foundation, Bowen concluded that online higher education "does no harm" and does so at a dramatically reduced cost that he predicted to go down as economies of scale are developed. One good course, developed by one good faculty member and a handful of technical experts, could teach all undergraduates around the world introductory statistics for a tiny marginal cost.[20]

That vision, of a single outstanding statistics course delivering personalized curriculum to millions of students at their own pace, was not purely a fantasy by the late 2000's. It was, in fact, the foundation of another notable development in online higher education prior to the MOOC movement called the Open Learning Initiative (OLI) out of Carnegie Mellon and under the guidance of Candace Thille. The OLI, which remains officially affiliated with Carnegie Mellon (CM), grew out of the intersection between CM and the Hewlett Foundation.[21] It drew on Carnegie Mellon's unique strengths and depended on equal contributions from departments of cognitive science, education, and computer science. To spearhead this new endeavor the administration selected an outsider. Administrators looked for a candidate with a track record of management consulting experience rather than experience with education, artificial intelligence, or scholarly research. They found and recruited Thille, a dogged and skilled business consultant, away from lucrative private practice to grow the endeavor.

Where other approaches focused on content ownership and delivery, the OLI focused instead on learning and cognitive development. Partnering with scholars of education and cognitive scientists, Thille set to work building a system that could be rigorously quantitatively evaluated at more points than almost any other education platform in the world. As a foundation, the OLI was to leverage CM's past experience developing educational technologies that resulted in a for-profit spinoff called Carnegie Learning Inc, a program that built "electronic tutoring" software designed at CM that serves the secondary education market (Walsh 2011). In the early days the OLI was equal parts teaching platform and research vehicle. The first assessment efforts focused on multiple preliminary quizzes built into each course which enabled the system to serve individually tailored content to students based on their demonstrated areas of need. As the platform expanded, and costs associated with data storage was reduced, it enabled the collection

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that have scientifically established the efficacy of such things as due dates, the importance of time bound courses (like trimesters), and social and group engagement in learning.

[19] The theory argues that while technology has driven the efficiency of labor up in almost all industries, a few job task have remained unchanged by technological advances. The wages for many of these jobs continued to keep pace with inflation, but the cost to purchasers these services is now much higher than it once was. While the paper used the example of a string quartet, Bowen applied the same argument to university faculty (Baumol & Bowen 1965).

[20] Bowen recently published a review of the field that was slightly less sanguine, but still called for increased reforms based on these technologies (Bowen 2013).

[21] The Hewlett Foundations support for the OLI followed their major investment in OpenCourseWare at MIT which will be covered below.

of a plethora of additional metrics, and the technical ability for intricate adjustments through A B testing became possible[22].

Two early peer reviewed studies of the platform were conducted that yielded positive results. First, a Lovett et al (2008) study showed that there were no statistically significant differences in final test scores between students who used the OLI platform and those who participated in a traditionally delivered course. A follow up study found that OLI students could learn the same amount of material significantly faster than traditional classroom groups (Schunn & Patchan 2009). Encouraged by these results, and in the hopes of generating more data and a revenue stream to prepare for sustainability after the foundation grants expired, the OLI began signing contracts with individual schools to license their best developed courses, most notably introductory statistics (Kamenetz 2010). While no public list exists of organizations that license OLI courses, their two main markets were small liberal arts schools and community colleges.[23] Part of what made the OLI so successful was its primary commitment to cognition, built on academic research in education and psychology, and the quantification of learning processes through a purpose designed and built platforms. These two priorities were pursued in a focused way while profit and cost reduction to a secondary concern in the early stages. Furthermore, the OLI initiative at Carnegie Mellon University has its roots in early experiments with artificial intelligence and machine learning. For over a decade, researchers in the computer science department have been working on a computer tutor designed to overcome some of the pedagogical shortcomings of human instructors (a machine can teach the same concept endlessly without growing frustrated) while simultaneously increasing the rate of cognitive development and reducing cost. The OLI gained notoriety after documenting outstanding results using their platform to teach college statistics, and has since branched out to dozens of other courses.

These successes built on CM's long tradition of local education innovation around software tutors which synthesized knowledge from cognitive and computer science. Following nearly a decade of work the OLI featured heavily in the public proclamations of Secretary of Education Arne Duncan, and other top officials in the Federal Government, as a key part of the strategy to accomplish President Obama's 2020 college graduate targets announced in 2010 (Duncan 2010). In many ways, the OLI was the forerunner to the movement to use artificial intelligence to transform higher education (Walsh 2011).

MIT: The Politics of Freedom and OpenCourseWare

The OLI is connected to MIT's early efforts in internet education through the Hewlett Foundation. Throughout the 2000's Hewlett shaped the future of higher education through the OLI, discussed above, and OpenCourseWare (OCW), an innovative response to the move toward content control and commodification that was ongoing in the field. Launched in 2001, OCW built on the longstanding political commitment of many of the original members of the Computer Science and Electrical Engineering community who helped pioneer the internet. Rather than assert control over content and how it was to be delivered, the administration decided to try

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[22] A B testing is a term used by internet companies to describe experiments done on their users. If a process is conducted over the internet, large and small changes in the interface or back end can be delivered to a small treatment. Statistical comparisons can then be made against the general population of users to determine the efficacy of each iteration. Most of the time, users are not explicitly aware of these changes, or the ongoing experiments in which they are taking part.

[23] This information comes from informal conversations with members of the OLI staff.

something radical: get every faculty member to publish their course materials – syllabi, reading lists, PowerPoints slides, lab instructions, and lecture notes – on the open internet free for anyone in the world. It was a radical proposal, and the idea that such a university wide commitment could even be considered was a testament to the cohesiveness of the MIT faculty, its capacity for corporate action, and a powerful campus wide consensus over what the internet should be and how scholars should engage with it.

While typically ranked a few slots below its neighbor two stops away on the Red Line in undergraduate education, MIT has been the perennial leader in academic research and graduate training in computer science in Cambridge, and for long periods, in the world. This expertise grew out of the high technology research and training featured at MIT and supported by the federal government's defense industry. Through its officially government affiliated research center, Lincoln Labs, and other local area defense contractors informally affiliated with MIT (most notably Raytheon), much of the cutting edge research and technological development that takes place in Cambridge happens within the institutional umbrella of MIT. These alliances with federal research projects, as well as other historical developments, has yielded an organizational culture dominated by engineering, technology, and math that symbolically overwhelms the humanities. All of these efforts perfectly positioned MIT to lead the early wave of computational research and development, and simultaneously gave academic computer science a particular brand of politics.

Built on liberal foundation and broad conception of free speech, the free software movement offered a salient critique of the property rights regime that permeates digital space (Coleman 2004; Kelty 2008). With a commitment to code as speech, and the hacker ethos to build, edit and combine, software segments and tools to forge new ground, longstanding members of the MIT computer science department fostered a community of political activism in relation to intellectual property and the internet.[24] Richard Stallman, founder and current president of the Free Software Foundation, became a central figure in the movement when he announced his plans to build an entirely open source operating system in 1983. Since then he has remained connected to the MIT CS community, and has maintained an office and deep interlocking networks with many longstanding faculty.

Infused with these politics, OCW was also the beneficiary of remarkable timing and foresight. When Charles Vest, MIT's President from 1990-2004, began discussions with the Hewlett Foundation in 1999 the internet gold rush was in full swing. Measured against the other online experiments of elite universities, OCW seemed an odd choice. Why forgo a potentially huge opportunity to capitalize on such a well-known brand at such a heady time? But MIT's path was no accident.

Following the advice of the Strategy group of the MIT Council on Educational Technology, a team from the consulting firm McKinsey, and later Booze Allen Hamilton, was retained to help chart a course for MIT. To their credit, the team highlighted many of the core commitments of the MIT faculty – the importance of residential education, the dual research-teaching mission, the unwillingness of MIT faculty to compromise academic standards for any

[24] The contradictions implied in these frames were partially animated by the case of Aaron Swartz. A free software activist and well respected hacker in the Cambridge and MIT community, he was arrested for using the MIT wireless network (itself a model of openness), to the full database of Jstor Articles. Facing zealous prosecutorial tactics that threatened him with 50 year of prison time, Swartz committed suicide. This saga galvanized the Free Software Community, and reinvigorated debates about openness and the internet (Franceschi-Bicchierai 2013).

"students" – made MIT an odd fit with the sorts of online experiments that other elite universities were engaging with. The McKinsey team did float the idea of a "Venture-tech" experiment to test the market for revenue possibilities, but that proposal was met with the most direct hostility, and Chancellor Lawrence Bacow was reported to have stated "MIT is not a profit-making institution" (Abelson 2007 p. 4). As the consultants were preparing their final, heavily researched reports with financial projections of a number of potential courses of action, some members of the committee wondered aloud what might happen if they just gave their courseware away for free. Reluctantly, the consultants added that possibility with the following scenario plan, explaining OpenCourseWare could lead to:

> …the enhancement of MIT's leadership and reputation, the possible contribution to other Educational Technology Council initiatives, the benefits to on-campus intellectual life…the recognition that "MIT is really about the dissemination of knowledge"…[and] that the existence of the free material could give MIT a comparative advantage [in other ventures]. (Abelson 2007 p. 6)

These recommendations caught the eye of those who reviewed the report, and the more detailed financial analysis of competing approaches fell by the wayside.

In a series of meetings between President Vest, William Bowen, President of the Mellon Foundation, and Paul Brest, President of the Hewlett Foundation, the scheme was developed. On the MIT side, there was strong localized support for OCW, as some believed it would "be a way for MIT to take the moral high road and exert leadership" in the digital education space (Abelson 2007 p. 9). One faculty member who attended early meetings on the OCW plans was clear about the position MIT should advertise:

> [You] need to sharpen the message of what this is all about. You were the one who mentioned the word "grandeur": a grand project deserves a grand idea. The grand idea here is that MIT is reminding everyone of the democratic and civilizing possibilities inherent in the information age, and our desire to fulfill those possibilities by making our information public and free. We should be quite up front about the way we are bucking the trend towards privatizing information for personal or corporate gain. (Abelson 2007 p. 9)

But the plan was not without its detractors, some of whom feared negative ramifications for the MIT brand resulting from publishing incomplete and unpolished course materials, and others who worried that the free release of the materials would devalue the products of academic scholarship.

By Fall 2006, nearly 80% of MIT faculty were participating in the initiative, and materials from 1600 courses were published online for a cost of approximately $25 million (through year three), much of that covered by the foundation partners. By 2006, MIT was serving 7.2 million visits to OCW annually, with a significant portion coming from on campus where the materials were used by faculty and students alike to evaluate the perspectives and pedagogical priorities of other members of the community (Abelson 2007). These goals, while the product of careful forethought, were also the product of extensive efforts to socialize this new experiment. These efforts were spearheaded by some of the most influential members of the CS and Electrical Engineering community at MIT(Abelson 2007).

Stanford: Proving the Market and Boosting the Bottom Line

Stanford, having identified a sound business model and clientele for its (impressively lucrative) distance education efforts, found ways to innovate and continue to incorporate new delivery technologies into their HCP program. These new efforts continued along the path set out by Wilbur and Hoover to use extension efforts to deepen ties to local private industry though training and research dissemination. Gerhard Casper served as president though the early internet era (1992-2000). During his tenure he demonstrated renewed commitment to find ways to expand Stanford's technical and financial reach deeper into the Valley, and Kindel summarized it well:

> Casper wrote that educational technology had the potential to "forge new partnerships with industry, the government, and other educational institutions that will foster research and scholarship…enhance income opportunities for the university…[and improve] Stanford's Academic leadership position and reputation world-wide". (Kindel 2014 p. 8)

In addition to enhancing and expanding the income generating activities pioneered at HCP through a new organizational entity called the Stanford Center for Professional Development (SCPD), Stanford pursued other mass market, often under open access, distribution channels for its content. Having a front row seat to the explosive growth of the internet in a number of fields was an impetus to participate in some of the early coalitions designed to experiment with broad distribution of elite higher course education content to a broader and as of yet unproven market of learners. In particular, Stanford's partnership with AllLearn under Casper's presidency was an effort to "really understand [open online instruction] and to provider their faculty members with the opportunity to explore the use of digital technologies, both in the classroom for internal audiences and in the outward-facing projects" (Walsh 2011 p. 42). However, the early optimism from the partners turned to doubt as the company failed to find robust enough revenue streams to support its ongoing activities. Reflecting on Princeton's engagement with AllLearn, then Provost Ostriker explained:

> They were heady times. People thought: the world has changed, everything's going to be different, there [are] billions to be made with our franchise, don't get left behind…I was excited about it. I thought and think that there is great potential for this. But I found the actual form that it was taking extremely frustrating, because we entered into a business organization, which had goals, that were very different [from the university's]…this was dot-com madness as far as I was concerned. (Walsh 2011 p. 50)

By March 2006 the experiment was shuttered and the website removed from the internet.

Having failed to monetize their course content through AllLearn, Stanford was not done experimenting. Immediately preceding the shuttering of the platform, Stanford embraced a new distribution platform that did not focus on monetization: iTunes U. In 2005, Stanford began offering a handful of downloadable courses from across the disciplines on Apple's platform for free. They quickly learned that there was indeed a global market for at least some of this material, as by 2011 Stanford course content had been downloaded over 40 million times (McClure 2011). They were also surprised to find that much of this market was in middle income developing countries (Acosta 2008).

In addition to trying out new externally controlled delivery channels, faculty continued to experiment with their own, especially those connected to SCPD and/or in the Computer Science Department. Sequoia Capital, a well-known Sand Hill Road venture capital firm, offered seed funding in 2008 to help Stanford faculty produce a small handful of computer science courses for free distribution on the web. This experiment, branded Stanford Engineering Everywhere (SEE) (Stober 2008), went beyond the iTunes U style free video lectures by actively facilitating discussion groups and participant engagement on platforms like Facebook. On another track, CS faculty were actively trying to solve local challenges with integrating technology into on campus courses. After a decade of unfulfilled hopes for a learning management system that could fulfill the objectives of a faculty that was increasingly tinkering with teaching and learning technology on campus, John Mitchell, Mary and Gordon Crary Family Professor in Computer Science and Electrical Engineering, cobbled together a small amount of grant money to hire six undergraduates and a few graduate students to supervise them. After a summer of work in 2009, they had succeeded in building Stanford CourseWare*,* a flexible platform with the potential for customization desired by local faculty.

Harvard: Extension Expanded

Harvard's experimentation with internet course delivery grew out of the vibrant community and settled financial model of Harvard Extension. Having proven the existence of a profitable local market for undergraduate arts and science courses, and having negotiated and socialized a method of compensation for faculty who taught in the program, the technical affordance of the internet lowered the barrier to participation; rather than teach the same lecture to traditional undergraduates during the day and repeat the same lecture in the evening for Extension students, faculty were able teach only one section if they allowed video capture during the day.

Again, Extension found itself a prime location to try novel practices which would have otherwise been too risky to be associated with Harvard University's main brand. This made perfect sense for faculty who expressed more enthusiasm about the opportunities and benefits than they did about any potential downside. This was the result of careful consideration and well-designed incentives by administrators who hoped to ensure that all ladder-ranked faculty have an opportunity, and an incentive, to offer courses through the Extension. To achieve this, faculty were directly compensated in addition to their regular faculty salary. Long serving current faculty describe the extension as providing "put your child through college money" (Interview 2013a), allowing a wide array of faculty to earn extra income teaching a parallel version of their regular daytime Harvard University course to open enrollment students in the evening.

These structures and incentives were broadly successful. In fact, many of the early faculty and administrators associated with HarvardX (which is covered in more detail below) first taught online through the Extension School. As a long serving administrator of Extension pointed out "...the vast majority of HarvardX faculty were faculty who already had experience teaching online through the Extension; they were already comfortable with the idea of putting themselves out there to the world, maybe not to the open internet, but at least to enrolled students around the world" (Interview 2014a). Again, these activities had been organized in the extension because a clear business model had been worked out, compensation was standard, and there were no conflicts with rules governing faculty outside activities such as those that plagued contract teaching at other online ventures (a source of substantial conflict in the past) (Walsh 2011).

In addition to the marginal financial benefit for individual professors, the Extension generated a significant amount of revenue for the FAS. Since the early 2000's much of that revenue has been associated with distance courses delivered via the internet (Shinagel 2009). But the existence of the Extension as a peripheral petri dish began to change as Extension started expanding its online course offerings. With a proven model and the potential for new revenue streams came greater visibility for Extension. A long serving staff member at the Extension School noted that "...for nearly a century the Extension School operated under the cloak of darkness. There were courses in the evening, and we were left alone and nobody noticed. That changed when [we] started getting Harvard faculty to offer their regular daytime courses through Extension Online. Suddenly you had senior faculty taking notice" (Interview 2014a).The accelerated appeal of the Extension School during the internet era can be explained by two main features. First, offering courses online through the Extension was substantially less work, requiring only one lecture to traditional students. In addition, the compensation faculty received for this service, which was similar for video capture or evening courses, did not conflict with the university's regulations regarding outside activities (Interview 2014a).

While there is evidence of additional experimentation with online course delivery across multiple schools at Harvard, the centrality of the Extension in incubating online higher education remains paramount. The best contemporary history of the Harvard Extension, authored by its prior dean, Michael Shinagel, concludes with an ambitious and upbeat assessment of the future of the Extension School. Leveraging the proven potential of the internet to generate revenue from fee paying students, and the generally positive opinion held by faculty toward teaching these sorts of courses for compensation, plans were in the works for a new expanded campus for the Extension School, closer to the traditional core of activities in Harvard Square (Shinagel 2009). This bright possibility for a historically marginal entity was, however, not destined to be realized. Within a few short years, based on public statements about the online future of the extension in 2009 and the MOOC movement of 2012, Harvard Corporation had changed directions substantially. The plan to house further online course delivery at the Extension was shelved.

The Birth of the MOOC Movement

By the 2010's, the future of online higher education was not at all clear. While professionals and organizations at the forefront of computational engineering continued to disrupt new sectors of the economy, and infiltrate more deeply into social life than previously thought possible, developments in the period at the federal level had sent mixed messages about where online courses were to fit in. One strand of this activity was led by Senator Tom Harkin, who launched an oversite initiative to deal with online for-profit schools (Lewin 2010). These schools, which had increased in size dramatically during the Bush Administration, were known to have high dropout rates and unproven returns for the degrees that they did confer. Those facts combined to saddle the federal government, and the most vulnerable individual college goers, with dangerously high default rates on the federal loans which funded most of their operations.

The Senator from Iowa released two reports in 2010 documenting the state of for-profit higher education. His inquiry found that in 2008 for-profit degree-granting higher education organizations enrolled 1.8 million college students, a number more than twice as large as enrollments in the sector 10 years prior. The report estimates that the US Government directly invests over $32 billion, not counting the huge indirect subsidies including those related to student loans, in a sector where the top 16 universities made a profit of $2.6 billion in 2009

(Harkin 2010a).[25] While these organizations have been consistently outstanding at delivering high profits (comprised mostly of state subsidies), they have had a rather dismal record of student retention and post-departure student employment (Deming et al. 2011). In spite of (or because of) the profits generated, these organizational experiments have suffered from a lack of legitimacy among traditional elite's in the field of higher education, negative perceptions in the popular press, and declining student demand. Following a new round of regulation and slowing demand as the economy recovered from the Great Recession, decline in market value, and the collapse of many of the largest providers during the 2010's, they have also proven to be extremely sensitive to state subsidies and regulation (Korn 2012).

From another perspective, the Federal Government seemed to be increasingly enthusiastic about using the internet to reduce cost in higher education. As noted above, a number of high profile higher education leaders, and representatives from the Federal Department of Education, began to release research and campaign publicly for a greater emphasis on online course delivery to "bend the cost curve" of higher education. The widely publicized conclusion of the Department of Education's meta-analysis, that online courses do no harm, seemed to offer hope that with sufficient scale these new courses could address the rapid rate of cost escalation in higher education. By this time, one thing was clear: more students were being exposed to some version of online coursework across higher education at large.

Measures for the scale and scope of online higher education in the field at large can be difficult to come by given the speed with which this sector is moving, but there are some benchmarks to document the rising significance of internet technology in course delivery in the early 2010's. Much of the early experimentation was concentrated among low prestige for-profit universities, but the delivery technologies have made their way into many areas of the field. A Sloan Foundation Consortium survey of CAO's (chief academic officers) of tertiary higher education institutions in 2011 found that 6.1 million college students were enrolled in at least one online course in 2010, and that 87% of CAOs at public schools and 69% of CAOs at private schools believed online education was critical to their long-term strategy (The Sloan Consortium 2011). Not surprisingly, they also report that there is a very wide variation by school type and status in CAO's perceived faculty acceptance of online courses (The Sloan Consortium 2011 p. 5). A key area of growth in online courses had come from for-profits, a sector which has since seen a precipitous decline. While it's important to note that very few for-profits were exclusively online, there is a broad dependence on virtual delivery across the largest, fastest growing, and most significant degree-granting for-profit institutions (Deming et al. 2011).[26]

In this context, which combined the increasing acceptance of online courses by students with profound uncertainty about the organizations which depended on these technologies most heavily, the advent of the MOOC movement initiated a sequence of dramatic events that took many observers in the field by surprise. To anchor Part II of this dissertation, the remainder of this chapter provides a general timeline of the events which transpired in 2011-2012 that consumed the conversation about higher education reform. While ultimate outcomes, intended

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[25] While there is wide variation, these schools cost on average 6 times as much as community colleges and nearly twice as much as 4-year state colleges and universities. One in 4 students default on their mainly government-subsidized loans within 3 years of leaving these schools. This means that while only 10% of US college students are enrolled in their institutions, the sector accounts for 50% of all student debt (Harkin 2010b).

[26] Hybrid models are becoming increasingly common as online universities build physical campuses or take over struggling non-profit schools and invest in symbols of higher education such as grass-filled quads, football teams, dining halls, etc.

and unintended, of efforts to integrate computer technologies in tertiary education pedagogy are very much unknown, the MOOC movement compelled reactions in the administrative offices of traditional campuses across the country. While clear action was taken at Stanford, MIT and Harvard, few research universities were spared the effort of crafting a narrative, or tangible plans of action, in response to these unproven technologies. One widely publicized conflict over organizational approaches to these new technologies between boards of directors, administrators, and faculty was the ousting and subsequent reinstatement of University of Virginia President Teresa Sullivan. A PhD in Sociology from Chicago and a labor market expert, Sullivan's firing was reportedly based on the board's perception that she was not moving quickly enough to establish UVA's presence online in the wake of the MOOC movement (Rice 2012). During the spring of 2013, widely publicized faculty resistance to expanded online learning partnerships at Amherst, Duke, and San Jose State scuttled the expansion plans of online higher education organizations (Cassidy 2013). The rapidly expanding consortiums of universities, the growing number of contracts signed by course providers, and the administrative prioritization of these efforts (often in the face of resistance) all strongly signal the increasing efforts to establish a new social space associated with online higher education.

Stanford: Entrepreneurs Beyond the Academy

Few figures epitomize the explosion of academic research in computer science out of the rarified confines of ivy walled centers of learning more than Sebastian Thrun. The effervescent German began his career at Carnegie Mellon and later gained widespread public accolades as "the father of the self driving car". At 37 he was recruited to Stanford to lead SAIL, The Stanford Artificial Intelligence Lab, where he helmed a team of Stanford researchers who won the hugely prestigious US Military funded DARPA Grand Challenge in his second year on campus (Orenstein 2005). It was his actions a few years later, in the fall of 2011, that supercharged a national movement to reimagine how computers and the internet could transform higher education.

Following the daunting success of Thrun's early years at Stanford, he was recruited away to head Google X, the companies experimental "moonshot" laboratory in April of 2011 (Miller & Bilton 2011). In spite of his formal resignation from the Stanford Faculty, he decided to continue teaching the introductory course on Artificial Intelligence at Stanford which was to be offered next in Fall 2011. Along with his co-instructor, former NASA and current Google computer scientist, Peter Norvig, Thrun decided to attempt a provocative experiment. Rather than limit enrollment in his class to the 100 or so matriculated undergraduate students who could fit in the assigned lecture hall, he decided to allow anyone with a computer and an internet connection to enroll. What's more, he promised to give all those who enrolled free access to the same evaluations, graded with the same rubrics, and entered onto the same curve as traditional Stanford students (Ackerman 2011).

Thrun, no longer a formal faculty member in Computer Science at Stanford, capitalized on the flexibility to go well beyond the passive participation that other online courses were offering. By advertising complete equity with regularly admitted students, and validating that with a certificate of completion, he was challenging the central privilege of the university: a monopoly on credentials. Andrew Ng, another member of the Stanford Computer Science Department, offered a course on machine learning, and a third course on databases was offered by Department Chair Jennifer Widom in the fall of 2011 through SCPD (Beckett 2011). While

all three courses were open, only Thrun promised evaluation parity with matriculated Stanford students.

Over the summer, without notifying the upper echelon administration at Stanford of his plan, he began advertising his new experiment to the broader global community of computational engineers. In an interview he gave to the IEEE Spectrum, a news magazine for computer scientists, he promised that even with thousands of students, the proliferation of freely available technical tools would allow he and his co-teacher to be active participants in discussion forums: "We will use something akin to Google Moderator to make sure Peter and I answer the most pressing questions. Our hypothesis is that even in a class of 10,000, there will only be a fixed number of really interesting questions (like 15 per week). There exist tools to find them" (Ackerman 2011). Two weeks after the course went live in October of 2011 more than 50,000 students had registered for the class from dozens of countries around the world. By the time the course was complete, over 160,000 students had enrolled to learn about Artificial Intelligence from someone who was thought to have enabled a car to drive itself. Of those, 23,000 finished the course, including students from every country in the world except North Korea. This number represented more students than the sum total who had ever taken an artificial intelligence class (Kessler 2012).[27]

Thrun had proven a market existed for at least some forms of undergraduate courseware, and the splash it made across the field of higher education set off a race to capitalize on it. Within months of the release of final grades for Thrun and Norvig's *CS221: Introduction to Artificial Intelligence*, two new Stanford seeded startups had taken up residence in Silicon Valley. In February of 2012 Thrun launched Udacity. Coursera, headed by Stanford CS faculty members Daphne Koller and Andrew Ng, went live less than 10 weeks later (Beckett 2011).

Unlike Udacity, which promised to focus on technical courses exclusively, Coursera promised to widen its scope beyond the teaching/training in computer programing.[28] Its offerings currently include courses from across the disciplines, from constitutional law and Roman Architecture to software defined networking and computational molecular evolution. Coursera launched with $22 million in venture capital funding from Kleiner, Perkins, Caufield and Byers and The New Enterprise Associates. Coursera's founders have made public statements that before approaching venture capital for funding for their startup, they solicited funding from Stanford but were denied.[29] Since its founding, Coursera pursued a strategy of university partnership which yielded 83 partner organizations by July 2013 (Lewin 2013). Coursera set about trying to convince university administrators, nervous about falling behind in the race to the web, to post content and design new learning experiences using the university faculty's expertise. Coursera and its funders worked quickly to increase courses and users to drive data into their nascent platform (Young 2012). Daphne Koller, Stanford computer science professor and co-founder/CEO of Coursera has repeatedly made claims that course content in higher education is ubiquitous and will soon be essentially free. The real value, she predicts, will be in the technical platforms and pipes that guide student learning.

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[27] Interestingly, 410 students from the online group scored higher than the top Stanford student on the culminating exam.

[28] Udacity concentrates heavily in only this one single area of instruction and training.

[29] Stanford committed less than $200,000 in the first round of requests, a figure which has not increased substantially since. Less public information is available about the investments made by partner campuses, or the terms of those deals, many of which may involve direct cash investments.

The president of Stanford, John Hennessy, had taken a keen interest and was highlighting the potential transformative possibilities for these technologies far and wide. In an often cited, and now infamous, interview with the New Yorker in April 2012, Hennessy warned the rest of the field of higher education that they were not immune to the disruption that had hit other fields in the years prior, stating simply: "There's a tsunami coming" (Auletta 2012). With both Udacity and Coursera organized as venture backed for-profits, Stanford had to craft its own formal organizational response. To that end, Provost John Etchemendy appointed CS Professor John Mitchell as the new Vice Provost for Online Learning (VPTL) on August 8, 2012. VP Mitchell and the staff of his new office were given control of newly renovated space at the heart of campus in the old college bookstore and tasked with providing seed funding to faculty who wanted to release a course on the internet and aggregating the vast array of offerings Stanford produced. This was formalized in September of 2012 with the public release of a website called "Stanford Online" which highlighted all the freely available online courses produced by Stanford Faculty (Staff 2012).

MIT: Corporate Competition

It is safe to assume that people at MIT read the IEEE Spectrum, and had they missed the article advertising Sebastian Thrun's bold experiment, by December 2011 word of the overwhelming number of registrants for Stanford's first three MOOC courses (more than 350,000 total) had made its way to Cambridge. Rafael Reif, then Provost, was often quoted in relation to what, if any, MIT's response might be. His response was MITx. In announcing the plans to launch MITx Reif advertised three main elements: 1) MITx was promised to improve on-campus learning by integrating new online tools: 2) the platform would be open source, so others could edit and add to it; and 3) it would be a research outlet to collect massive amounts of data on, and ultimately improve, teaching and learning (Solomon 2011). This signaled a new rhetorical turn for the MOOC; while the world would get access to elite higher education content, Reif justified his project based on the learning enhancements that would be made in residential MIT classrooms. What's more, in an issue of the MIT Faculty Newsletter, Reif hailed the direct line between OCW and edX:

> **On December 19, 2011,** approximately 10 years after announcing OpenCourseWare, MIT announced its next step in opening our educational doors to the world. *MITx* is a new learning initiative that will publish online interactive courses, and offer learners the opportunity to earn certificates of completion. MIT OpenCourseWare was the genesis of today's worldwide movement of Open Educational Resources, and *MITx* will follow in that tradition. *(Reif 2012)*

Reif, himself a veteran Electrical Engineer Department chose Anant Agarwal, the leader of one of MIT's most prestigious labs, CSAIL (Computer Science and Artificial Intelligence Laboratory), to head the development process of this new platform and to spearhead the institute's online initiative (Reif 2012). With a number of standing committees designed to guide OCW into the future, a robust teaching and learning infrastructure in place on the campus, and a number of faculty who had been lauded for their on-campus pedagogical innovations, the choice of Agarwal made a statement: The ability to manage software development, and to build a platform on the fly, were at the heart of skillsets needed for this new chapter in higher education.

MIT's first MOOC was launched on March 5th, three months after the announcement of MITx. *6.002x: Circuits and Electronics.* The course was taught by Anant Agarwal and Jeffrey H. Lang (Setty 2012). Within ten days of opening registration, 120,000 people had signed up (Solomon 2012), proving to members of the MIT community that their brand could command the same level of interest as Stanford's, even on the less red-hot hardware side of the CS-EE divide. The success of 6.002x, and the rapidly expanding demands placed on the MITx team to release a fully featured open source platform and to meet the ambitious goals set out by Reif in "internet time" caused Agarwal to shift roles. In March he vacated his position atop one of the most prestigious positions in academic computer science (directing MIT's CSAIL) to run a nascent education startup. He explained his decision to the MIT community, stating in part:

> "I think MITx is very, very important for MIT," says Agarwal. "It's critical that we get out there and do it fast."… Agarwal plans to run MITx like a nonprofit startup, inspired by the small - team energy that has come to typify Internet startups from Silicon Valley to Kendall Square. The MITx team, in fact, is looking for office space in Kendall Square, either in an MIT building or not. (Solomon 2012)

Within months of Agarwal's decision, another major personnel choice was made official by MIT: Rafael Reif, one of the most enthusiastic backers of MITx, was named President following the end of Susan Hockfield's eight year tenure. In the article announcing the election of MIT's 17th president in the school newspaper, the first and most notable accomplishment used to described the 32 year veteran of the MIT faculty was his role in launching MITx and forging a partnership with Harvard for online learning (which will be discussed below) (Pourian & Solomon 2012).

Having organized a new entity to house the platform development efforts, MIT administrators turned to shaping the internal bureaucratic entities that would be tasked with managing on campus activities in the age of digital higher education. For this role, another well regarded veteran faculty member of the engineering department was selected. On November 20, 2012 Reif announced that Sanjay Sarma, Fred Fort Flowers and Daniel Fort Flowers Professor of Mechanical Engineering, would become the director of digital learning (later made Dean of Digital Learning), a new position and division created as part of the MOOC response. The new division, under Sarma's leadership was tasked with overseeing efforts to enhance education with online tools including OpenCourseWare and MITx (Lin 2012). Sarma served in that capacity until the unit was further expanded under a new unit (MIT Open Learning) and a new title (Vice President for Open Learning) (Srivastava 2016).

Harvard: A New Frontier

As the terrestrial frontier of the MOOC movement came to Cambridge, MIT was not the only school which took notice. Harvard, having recently elevated Stanford professor Alan Garber as its own Provost (Merrigan & Weinberg 2011), was watching developments closely. Within five months of MIT's announcement of its MOOC initiative, MITx, a press conference was arranged featuring a joint announcement from Drew Faust and Susan Hockfield, Presidents of Harvard and MIT respectively. With substantial fanfare, and multiple references to platforms, innovation, and disruption, a new joint venture of the two Cambridge institutions was announced on May 2nd. Called edX, the non-profit entity would launch with $60 million of committed startup funds from Harvard and MIT ($30 million from each) (Harvard Magazine 2012a; MIT

2012). Agarwal was to become the director of this new venture, and a joint government body composed equally of representatives from Harvard and MIT was to be established. This joint announcement went further than MITx in its prioritization of the research potential of the proposed platform:

> Both institutions said that they plan to use the project—called edX in homage to MITx, the online learning portal that MIT launched this year—as a laboratory for their researchers to study how virtual learners interact with the system..."This is about experimentation; it's about research; it's about rethinking education," said Harvard Provost Alan M. Garber '76. (Rouse & Worland 2012)

This prioritization of platform-centric focus on learning research came in the context of larger, unrelated, initiatives in this space.

In early 2012 Harvard was dealing with a common problem: how to spend a lavish gift – $40 million to be exact – that was earmarked for a specific purpose: improving teaching and learning. The new funding from the Hauser's, which predated the MOOC movement, was earmarked to find innovative ways to strengthen one of the core missions of the university. This gift came in the context of national criticism that the incentives of the modern academy had elevated research to the detriment of teaching and learning, stimulated in part by the work of Arum and Roksa (2010). The new push was organized under the title *Harvard Initiative for Learning and Teaching (HILT)*. The initiative was often described in partnership with a renewal of the Bok Center for Teaching and Learning. The center, which was integrated into Harvard as a service unit in the late 1970's to video tape faculty and graduate students to improve their teaching and presentation skills, got its first faculty director in February of 2013 (Fandos & Mohamed 2013).

Robert Lue, a Harvard graduate and well respected director of life science education and professor of the practice of cellular biology, was instrumental in the first year of Harvard's MOOC push. Prior to taking the helm of the Bok Center, Leu had served as faculty director of HarvardX where he oversaw the construction of local physical and academic infrastructure for course creation (Harvard Magazine 2012b). During his close to one year tenure at HarvardX, Lue oversaw the creation and execution of six full course offerings on the new edX platform, with the first two courses – *Health in Numbers* and *Introduction to Computer Science* – launching less than two months after the public announcement of edX (Ho et al. 2014). David Malan, who was the instructor for the computer science course, had made waves by building the second largest class by enrolments (691 in fall 2012) at Harvard prior to joining the edX platform (Harvard Magazine 2012c).

This early success lead Harvard to prioritize their involvement in HarvardX as they ramped up their ambitious fundraising campaign in 2013 which targeted $6.5 billion dollars in new donations across all schools (Kansra & Weinstock 2013a).[30] Unlike Stanford and MIT, this push was concentrated within the Arts and Science division FAS, Harvard's largest and most powerful faculty constituency:

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[30] The target of $6.5 billion was set to break the record for a capital campaign, recently set by Stanford who raised $6.2 billion a few years earlier. By April 2018, Harvard had raised $9.1 billion through the campaign (Halper & Wang 2018).

> With an emphasis on innovation and technology, the Faculty of Arts and Sciences, home of Harvard College, is funneling $150 million toward a priority titled "Leading in Learning." If brought to fruition, the school's vision could transform not only the way members of the Harvard community teach and learn, but also the physical spaces they inhabit…The "Leading in Learning" priority represents 6 percent of the FAS's total $2.5 billion campaign goal. While the school's other priorities will bolster and expand existing faculty programs, financial aid, and renewal of the undergraduate houses, the "Leading in Learning" initiative, as reflected in its title, is one of Harvard's most direct attempts to respond to new challenges to its traditional model of education. (Bernhard & Watros 2014)

While the Harvard FAS stood to gain from philanthropic appeals based on these new technologies and any long term windfall that might result for these new experiments, there was noisy and significant concern from faculty on campus.

In May 2013, 58 Harvard faculty published an open letter admonishing the university to reconsider the strategy and pace of experiments in this new direction.

> We appreciate the meetings, town halls, and other arenas in which faculty have been able to discuss HarvardX. But we believe that many critical questions about the relationship of the FAS to HarvardX, and to edX, have not yet been addressed. These questions (which fall outside the remit of the two existing HarvardX faculty committees, most of whose members are not from FAS) range from faculty oversight of HarvardX to the impact online courses will have on the higher education system as a whole…Given the rapid pace of development of HarvardX, we believe it is essential to have a formal, sustained, and structured faculty discussion on these issues as soon as possible. We write to request that you appoint a committee of FAS ladder faculty to draft a set of ethical and educational principles that will govern FAS involvement in HarvardX, to be brought before the FAS for a vote in the coming academic year. (Fandos 2013)

This concern was not without context. Earlier that month faculty from the San Jose State Philosophy Department criticized an arrangement which had been made by local administrators and edX to offer San Jose State students the opportunity to take Michael Sandel's edX MOOC "Justice" for credit at San Jose State. Concerned about the implications of the world's richest universities producing courseware which could be delivered to broad access universities in replacement of their traditional faculty designed and led classes, San Jose State faculty accused edX of "social injustice" (Hashmi 2013).

In spite of these concerns, Harvard's involvement with edX persisted (as did the capital campaign in which it was featured) through 2013. The same month as the letter, edX announced that it had doubled its member campuses with the addition of eight new schools (Hashmi & Shih 2013). By June edX had reached over a million registrations across all of its course offerings (Conway 2013a). The expanding audience came with expanding platform and production teams which had grown to almost 100 employees, and in August edX announced they would move into a new 15,000 square foot office space in Kendal Square (Conway 2013b).

The expansion of infrastructure under the joint venture with MIT was matched with continued internal reorganization which prioritized the increasing significance of new technologies in teaching and learning, and on Harvard's campus. One was that was manifest was the creation of a new vice provost position which was announced in the Harvard Crimson in September 2013:

> Chinese history professor Peter K. Bol will assume the newly created position of Vice Provost for Advances in Learning [VPAL]…As Vice Provost, Bol will lead and coordinate two of Harvard's prominent academic endeavors: the Harvard Initiative for Learning and Teaching, a presidential initiative launched in October 2011, and HarvardX, the University's branch of the online educational venture edX, which offered its first classes last year. (Kansra & Weinstock 2013b)

Another strong symbolic move to raise the profile of new ways of teaching and new ways of expanding the audience of Harvard course content took shape in Widener Library. Located in Harvard Yard, Widener is Harvard's oldest and largest library collection featuring 3.5 million volumes stored on 57 miles of shelves, making it one of the world's largest repositories of books, larger than any other held by a university. In an announcement in October 2013, library administrators heralded the creation of the new Rita E. and Gustave M. Hauser Digital Teaching and Learning Studio to supplement innovations in teaching technology enhancements campus wide. FAS Dean Michael Smith stated: "Widener, Harvard's icon for the dissemination of knowledge, is a fitting location for a new resource that will encourage innovation at the heart of our teaching mission" (Fandos & Hashmi 2013). The article announcing the new studio went on:

> Come October, the books and carrels of traditional scholars at Widener Library will be joined by a more contemporary educational tool.
> A state-of-the-art video production studio to be managed jointly by the Faculty of Arts and Sciences and HarvardX, Harvard's subset of the larger edX online learning initiative, will open…on the concourse level of Widener Library. The new space will aim to provide faculty with an opportunity to create digital material for Harvard courses online and on campus. (Fandos & Hashmi 2013)

From the May 2, 2012 announcement that Harvard would create an internal entity for the creation of MOOCs (HarvardX) and join forces with MIT to fund and oversee edX, to the September 2013 elevation Peter Bol as the first VPAL, Harvard – like Stanford and MIT – had dramatically overhauled its online strategy less than 16 months.

3. Reframing Marginal Practices: Topic modeling to chart a new online higher education movement

When the *New York Times* declared 2012 the year of the MOOC (Pappano 2012) it drew attention to a groundswell of discourse about transforming higher education in America which was partially document in the prior chapter. Critics and observers had been arguing that after centuries of relatively stable institutional arrangements within the university – the lecture, the academic diploma, the university campus, and the existence of an autonomous community of scholars dedicated to research and teaching – time had come for profound transformative change. One central area identified for intervention focused on the method of delivering the basic building blocks of the university degree: the college course. While the problems identified by these critics were often financial and structural, the nature of the proposed solutions has frequently been technical.

As discussed above, and contrary to many of these narratives, the field of higher education in the US has a long history of experimenting with new technologies to expand the delivery of coursework for institutional and financial gain. Since the advent of the postal service, educators and entrepreneurs have attempted to broaden the reach of tertiary education beyond the geographical limitations of the campus. Rapid long distance two-way communication (through the telegraph and later the telephone) and subsequent developments enabling broadcast (radio and television) have consistently ushered in new groups of educational reformers and technological experts seeking to use new tools to reshape the field. It is, therefore, no surprise that the advent of the internet has engendered such vociferous calls for reform and the birth of a number of new purpose-built organizations designed to harness these technologies to further their interests. A closer look at efforts to integrate online technologies into course delivery in higher education since the mid 1990's reveals at least two periods of intense activity and experimentation.

The first peak in activity occurred in the late 1990's. Organizational experimenters during this period included some of the most selective and well-endowed universities, as well as budget-strapped community colleges, new for-profit universities, and a wide array of social and economic internet entrepreneurs hoping to leverage the power of the internet to advance their agendas in the field of higher education. In spite of the rather grandiose claims of many of these early protagonists, and the rapid dissipation of interest in these projects, the integration of internet technologies into teaching at the university level remained largely peripheral to the field of higher education throughout the 2000s. To the dismay of many of the most ardent advocates of these new technologies, the academy did not follow the recording industry, or bookstores, into dramatic upheaval and transformation.

In general, past historical attempts to transform the field of higher education and the institution of the university through technology have yielded limited results, and these experiments have largely been kept at the margins of the field or incorporated into the institution resulting in limited change in practices of hierarchies. Given this history of marginalization, was there anything novel about the resurgence of discourses and organizational activity surrounding the "MOOC madness" of the early 2000's? How does this round of interest in technical reform differ from past experiments? Finally, what constituencies have been associated with these periods of interest in online course delivery? This chapter addresses these questions. It will do so

by analyzing trade publications and select news sources over most of the internet era (September 1997 and November 2013). The analysis included in this chapter uses Topic Modeling, a newly available computer-assisted method that enables the evaluation of large text data sets using machine learning algorithms.

This chapter will show data that strongly suggests the early history of online higher education built on concepts and frames associated with pre-internet distance education practices. These involved packaging higher education courses into content modules and delivering them efficiently and cost effectively to increasingly busy and mobile students. Rather than mailing audio-tapes, DVDs, or course packets through the mail, similarly packaged items could be delivered via the web. The content was assumed to have value by virtue of the status and official credentialing power of institutions of higher education, and faculty were to be the experts that created it. Data will also be presented showing that the constituencies most closely associated with these frames were large state university systems (Walsh 2011).

Next, the chapter shows that in the MOOC era, the frames shifted. The language of distance education gave way to a discourse based on high technology. The value of these offerings became concentrated in the platforms themselves, rather than in the course content. Furthermore, the closely associated constituencies seemed to be elite departments of computer science and the individual researchers that inhabit them, assumed to be best able to leverage the increasingly central (and mediating) discourse of testing, measurement, and evaluation central to recent American education reform at all levels (No Child Left Behind is a prominent example).

This chapter argues that the first step in understanding the renewed and intensified interest in technical reforms to the institution of higher education is to assess how it was framed, and to explore the relationship to institutional reorganization at the level of popular narration. In addition to shedding light on the structures of meaning making, evaluating frames can guide future research to uncover identities, social groups, and actors that are likely to be associated with these new efforts. While the methods utilized in this chapter cannot uncover the intent of the actors involved in crafting a strategy of action, it does advance an understanding that discursive shifts is an important step toward evaluating the contours of the struggle over the structure and direction of the field.

MOOCs: Reframing and Relocating

The vast breath and diversity of the field of American higher education makes it difficult to provide comprehensive assessments of the exact size and shape of ongoing technological experiments. At any given moment in the field, enterprising and inquisitive faculty are introducing new methods of instruction and supplementing traditional ways of delivering materials with new technology. While illusive, such descriptions are not impossible. Using novel methods of computational text analysis and a sample of thousands of documents from higher education trade publications, this chapter will attempt to outline how online course delivery has been framed by observers of American colleges and universities. In particular, this chapter will address two separate relationships which define the framing of online higher education over time.

First, building on the secondary literature outlined in the previous chapter, the relationship between “distance education” frames for online higher education will be compared to “MOOC” frames during the internet era. This analysis will be aimed at understanding if similar frames defined cycles of intensified interest in online courseware, or if there are differences in the was this object (online courses) is discussed during different cycles of interest.

Concretely, this will involve seeing if periods of intensified interest in online course delivery within the field of higher education track with specific framings, or if new and old frames tend to overlap.

Second, this analysis will be leveraged to identify additional frames that might be expected to be closely associated with either a distance education framing or a MOOC framing. Operating under the assumption highlighted by the secondary literature that the distance education framing in higher education was most closely associated with cost savings, this section will examine that model to evaluate potential relationships between frames. Conversely, MOOCs were sold by their backers as having the technical capacity to quantify more things, with more detail, and at a scale previously unimaginable. The final element of this analysis will attempt to explore this relationship, asking if quantification frames and MOOC frames are correlated in the discourse in higher education trade publications.

Method

Analyzing periodicals to evaluate the structure of discourse in a field, or surrounding a topic, has been a longstanding methodological practice of social scientists in a number of fields. Traditionally, researchers working with text as primary sources have hand coded their documents, often with reference to methodological work in grounded theory (Boyatzis 1998; Charmaz 2006; Creswell 2008; Glaser & Strauss 2017; Mayan 2016). With the availability of digitized data and the computational capacity of modern computers, new quantitative methods of content analysis have become available. Until very recently, these quantitative methods have been limited to word counts and statistical analysis comparing prevalence of individual words, or researcher identified word lists, over time. Recently, innovations in machine learning techniques based on concepts from statistical artificial intelligence research have opened up new possibilities for the analysis of large samples of text documents. When combined with the ready availability of digital repositories of text documents, these new techniques have the potential to offer exciting new possibilities to researchers.

This set of articles was analyzed following the topic modeling methods clearly laid out by DiMaggio, Nag, and Blei in their very recent article in a special issue of Poetics dedicated to the computer assisted text analysis (DiMaggio et al. 2013), with consideration for more recently published work on shifts in discussion categories over time (Fligstein et al. 2017). A number of recent explanations of the algorithm behind this method of topic modeling exist, and a detailed explanation of this approach is beyond the scope of this presentation (Mohr & Bogdanov 2013; Ponweiser 2012)

Such a review should pay special attention to Blei (DiMaggio's co-author) in particular and his role at the forefront of the effort to develop the Bayesian statistical models behind much of the recent revival in social science research on qualitative text analysis. In general, this set of innovative research seeks to resolve many of the shortcomings of qualitative coding and early machine assisted text analysis. While hand coding can be very sensitive to contextualized and subtle meaning, it has well known limitations. In addition to being extremely time consuming, it introduces bias associated with the preconceived notions carried into the research project by researchers when constructing coding schemes, and when hand coding individual articles. Hand coding also surpasses early machine assisted quantitative coding in its ability to automatically produce a representation of context. It does so by assuming that each word can be relevant in multiple topics, and that each article can be composed of multiple topics.

In addressing the shortcomings of traditional methods, these new techniques can approximate context inductively, providing researchers a novel perspective into the corpus of documents they seek to analyze. In essence, these algorithms work by parsing the text and documents into multiple distributions of every word within each topic, and distributions of every topic within each article. They then re-shuffle the distributions until it finds the model that best fits the entire dataset. For these methods, the same individual word may be extremely important for multiple topics, and any individual article may be about a combination of multiple topics. Following DiMaggio et. al. (2013) these articles were preprocessed by removing meta data (Byline, Author, Title, etc), common stop words, punctuation, and excess white spaces from each article. Unlike DiMaggio, Nag, and Blei's (2013) analysis sparse terms were kept in the analysis and words were not stemmed.

To choose the number of topics, which is the main input for these models, this analysis follows an iterative process in identifying the appropriate number of topics. The objective of this process was to find the smallest number of topics in which one single topic clearly captured my central focus for this chapter (the MOOC phenomenon in this case). Guided by theory and a set of questions and hypotheses, models with 10, 25, 50, and 75 topics were run on this data. The 75 topic model was the first to include a cleanly specified single topic on MOOCs. As such, all of the subsequent results presented next will be based on that 75 topic model.

Data

To address the questions in this chapter a content analysis of data from industry-specific trade publications and news articles during the internet era. The data for this analysis is drawn from LexisNexis Academic, an aggregator and search engine for newspapers, trade publications, and scholarly journals. My search was limited to three repositories: 1) The Chronicle of Higher Education, 2) American School and University, 3) Education Stories in the News, which aggregates stories across a number of well-known news sources (including the NY Times) and draws only stories focused on higher education. These three sources were chosen in part because they each had coverage from the late 1990s through the present that captured most of the time during which the internet was available as a potential medium for course delivery. In particular, this sample was available for these three sources between September 1997 and November 2013.

These repositories were searched based on a set of three key words. Articles that matched any one of the three words "online", "internet", or "web" were returned. Searches were organized by month, covering every full month for which articles existed as of mid-December 2013. For each month, duplicate detection was employed within LexisNexis and set to the most stringent setting. This yielded a set of 12,300 articles.

Terms	Number of Articles
Online or internet or web	12,300
Online or internet or web & Course or courses or class or courseware or credential or degree	6,712

Figure 3.1

After a cursory analysis, a further filter was implemented and only articles that included any one of the six words "course" "courses" "class" "courseware" "credential" "degree" were

kept. This yielded a final sample to for topic modeling of 6,712 articles on which the following analysis is based.

Results

A visual inspection of the structure of the sample over time shows that most years had between 250 and 500 articles (see Summary data 1). Aside from the spike in 2010 (which may be due to congressional hearings about for-profit universities) there is a fairly regular distribution of articles over this period. It's important to note that the first and last year include only partial data (four months in 1997, and 11 months in 2013) so counts of articles in those two years are not directly comparable to other years.

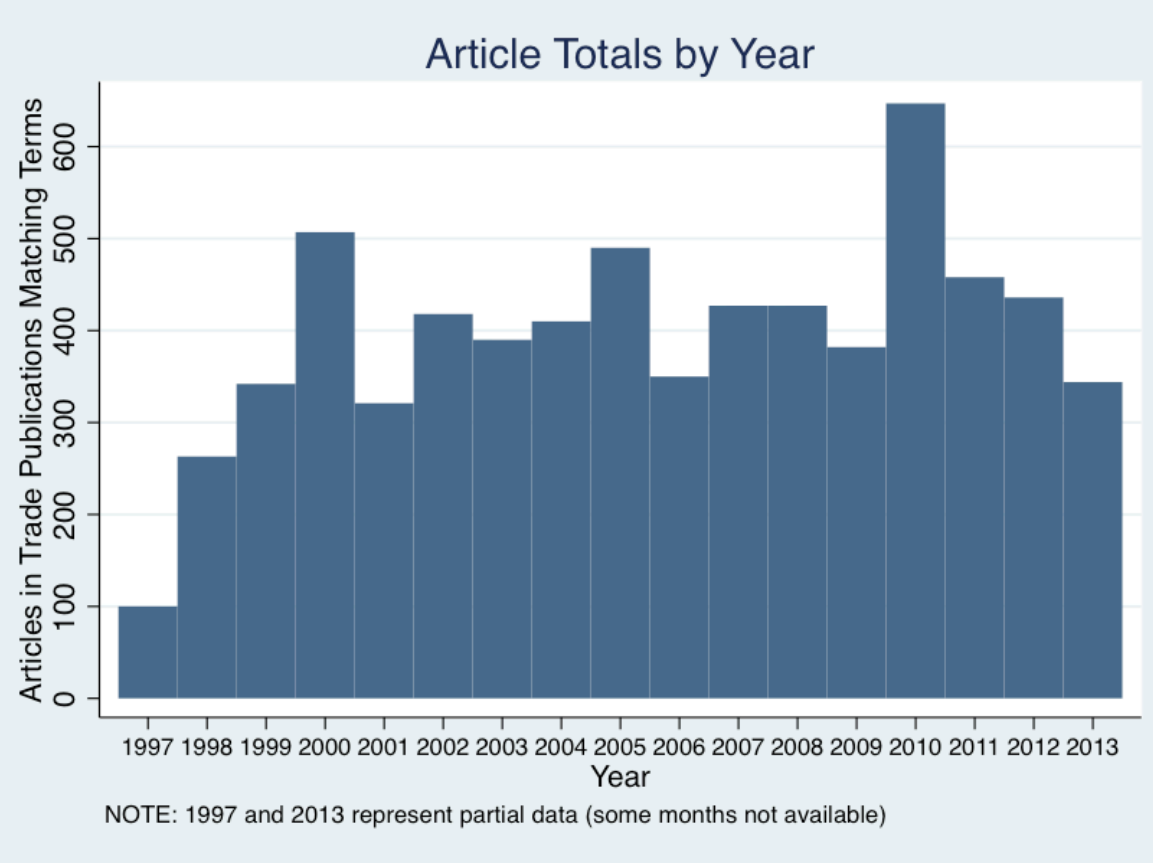

Figure 3.2

Given this sample, topic modeling algorithms were used to code each article. As noted above, the model with 75 topics was the first one to cleanly specify a single category that pertained to the recent MOOC movement. To establish this fact a word list was generated for each topic that ranked all words from most important to least important. The first 100 words were read and critical words were highlighted. If there was an interpretable pattern within the data, a title that best described the concentration of words was applied to the topic. For the purposes of this chapter, the first 100 words in the list and highlight the significant words that yielded the topic label.

MOOCs (Topic 55)				
1. students	**21. udacity**	41. text	**61. lecture**	81. make
2. moocs	22. many	42. higher	**62. system**	**82. learning**
3. university	**23. massive**	**43. social**	63. years	**83. thrun**
4. mooc	**24. class**	44. professor	**64. courses**	84. institutions
5. will	25. also	**45. jose**	**65. harvard**	85. offered
6. coursera	26. campus	46. experience	66. might	86. time
7. can	**27. stanford**	**47. san**	67. dining	87. help
8. one	**28. platform**	**48. mit**	**68. providers**	88. taking
9. new	29. first	**49. credit**	69. among	89. made
10. free	30. colleges	50. around	70. may	**90. future**
11. online	31. now	51. way	71. far	91. question
12. college	**32. education**	52. even	**72. company**	92. percent
13. like	**33. videos**	53. part	73. two	93. back
14. food	34. full	54. just	74. classes	94. said
15. people	**35. video**	55. see	**75. public**	95. small
16. edx	36. year	56. another	**76. traditional**	**96. teaching**
17. open	**37. lectures**	57. change	77. work	97. universitys
18. student	**38. world**	58. much	78. content	98. day
19. universities	39. abstract	59. take	79. become	99. though
20. course	40. well	**60. state**	80. last	100. offering

Figure 3.3

Students and observers of the MOOC movement will notice a number of immediately familiar organizations, institutions, individuals, and concepts. Each of the "big three" MOOC providers are mentioned with Coursera appearing first, edX second, and Udacity third. The only three universities that appear in the list by name are (again in order) Stanford, MIT, and Harvard. There are also a number of key terms that define the nature of the debate surrounding the MOOC approach to online course delivery such as open, free, future, public, social, world, platform, and teaching. In addition, a few terms are present that frequently surfaced during early discourse on the topic such as traditional, credit, and San Jose when referring the flashpoints of conflict that emerged early in the advent of these new organizations and efforts.

Topic 7 clearly captured another major frame associated with online course delivery: distance education. The significant terms from this model have been used to describe traditional correspondence education efforts that predated the internet, and seemed to have carried over from these precursors.

Distance Learning (Topic 7)				
1. online	**21. teach**	41. college	**61. lecture**	**81. distancelearning**
2. courses	**22. virtual**	42. like	**62. offered**	82. now
3. says	23. also	43. internet	**63. instruction**	**83. learn**
4. course	24. take	**44. material**	64. way	84. offers
5. students	**25. materials**	45. colleges	65. people	85. different
6. professors	26. time	46. new	66. just	86. able
7. university	27. use	47. want	67. may	87. semester
8. education	28. web	**48. programs**	68. taking	88. thats
9. distance	**29. program**	**49. lectures**	69. student	89. develop
10. teaching	30. say	50. project	70. content	**90. open**
11. will	**31. classes**	51. much	71. create	91. part
12. learning	**32. institutions**	52. using	72. state	92. adds
13. can	**33. class**	53. help	73. computer	**93. discussion**
14. professor	34. many	54. universities	74. available	94. used
15. technology	35. members	55. make	**75. facetoface**	**95. instructor**
16. traditional	**36. instructors**	56. work	76. well	96. associate
17. faculty	37. director	57. taught	77. might	97. put
18. one	38. offer	58. think	78. really	98. world
19. distanceeducation	39. get	59. campus	79. universitys	99. discussions
20. classroom	40. dont	60. going	80. even	100. created

Figure 3.4

An evaluation of this model shows that there are a few mentions of instructors, professors, faculty, and the traditional experts commonly associated with producing and disseminating online course content (and which were noticeable absent from the MOOC topic). Furthermore, there is no mention of words associated with technical systems or platforms which would mediate the educational process if the internet was used to deliver coursework.

The specification of these two topics enable a comparison of the prevalence of these two frames over time. The graph below plots the number of articles for which *MOOC topic* (topic 55) and the *Distance education topic* (topic 7) were determined by the algorithm to be most likely to have structured the text.

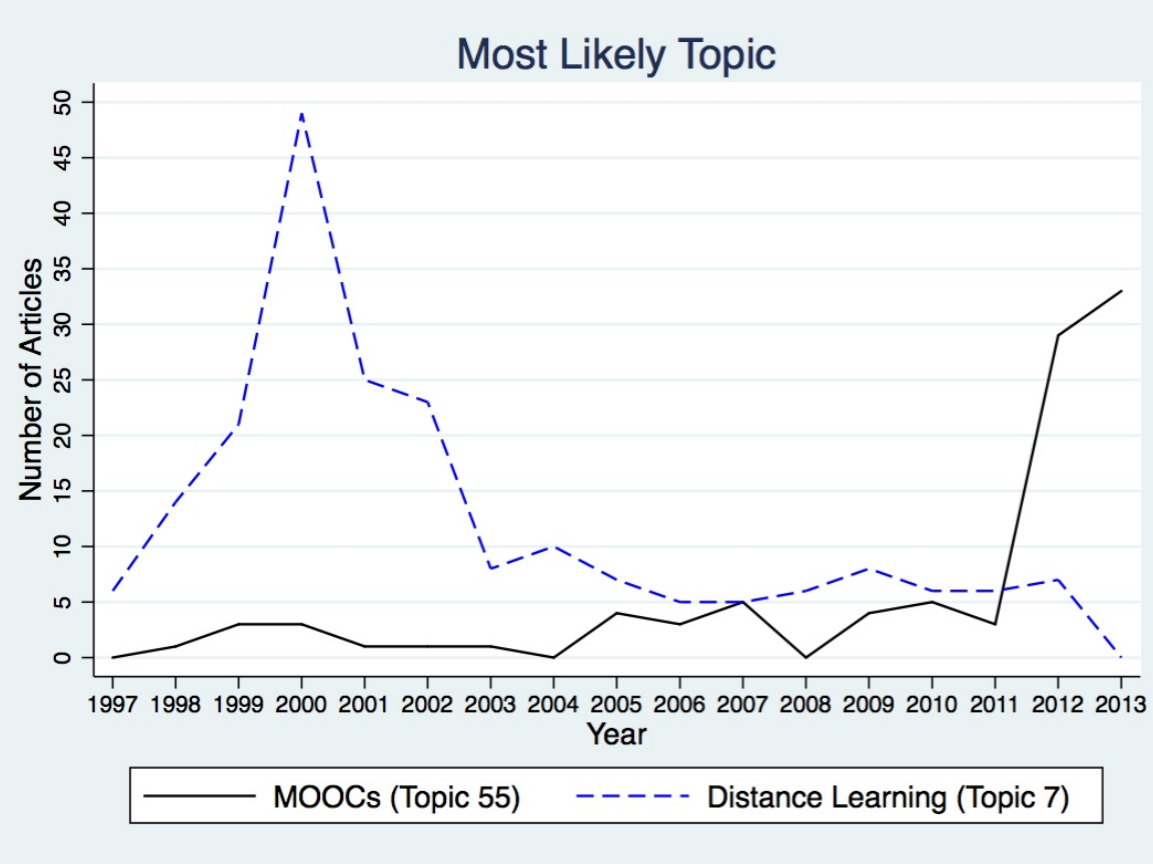

Figure 3.5

In other words, this shows the frequency of articles that most closely conforms to the ordered word lists above over time. As can be seen from the graphical relationship, there is no clear correlation between the distance education frame and MOOC frame. In fact, the distance education frame seems to map closely onto the rise and fall of the first dot-com-bubble, while the second MOOC topic unsurprisingly increased in prevalence in 2012. This give strong evidence in support of the claim that learning over the internet has been recast from a traditional mold focusing on authoritative faculty, to one focused on technical systems and empowered individual learners.

To expand this analysis additional topics are necessary. In this phase of the analysis two additional topics were identified for further exploration into relevant correlations. The first, topic 27, included a large number of words associated with the largest state university systems.

State Systems (Topic 27)				
1. university	**21. officials**	41. higher	61. school	81. may
2. says	22. offer	**42. diploma**	**62. accreditation**	**82. money**
3. college	23. also	**43. accredited**	**63. governors**	**83. distance**
4. students	24. one	44. first	64. high	84. working
5. state	**25. bachelors**	**45. tuition**	**65. southern**	85. still
6. will	26. years	46. already	**66. business**	86. former
7. education	**27. masters**	**47. public**	67. say	**87. open**
8. degree	**28. president**	48. take	**68. associate**	88. four
9. colleges	**29. credits**	**49. board**	69. enrolled	89. offering
10. degrees	30. year	**50. north**	70. three	90. south
11. institutions	**31. western**	**51. work**	71. graduate	91. traditional
12. courses	32. academic	**52. million**	**72. fouryear**	92. regional
13. programs	33. campus	53. get	**73. enrollment**	**93. learning**
14. institution	34. two	**54. virtual**	**74. consortium**	94. classes
15. program	35. transfer	**55. wgu**	**75. arizona**	**95. technology**
16. new	**36. florida**	**56. credit**	76. help	96. last
17. states	37. many	57. can	77. offered	97. plan
18. community	38. now	58. said	78. earn	98. student
19. online	39. universitys	**59. texas**	79. project	99. number
20. universities	**40. california**	60. system	80. like	100. capella

Figure 3.6

These systems included (in order) Florida, California, Texas, and Arizona. They also included a number of words associated with consortiums of state higher education systems to promote online higher education through Western Governors University. Additionally, this topic captured community (most likely in relationship to community college), associate, and a number of other words that imply a connection to the less selective realm of the field of higher education. The topic is therefore labeled the "State Systems".

The final topic of interest includes a concentration of words associated with data and measurement. This topic features many of the key concepts associated with recent broad reform efforts in US education, and those associated with the technical experts and researchers most often associated with the MOOC movement.

Data & Measurement (Topic 47)				
1. students	21. time	41. questions	61. whether	81. example
2. learning	22. higher	42. resources	**62. tools**	**82. performance**
3. information	23. work	43. better	63. people	83. text
4. education	24. faculty	**44. results**	64. just	84. good
5. can	25. need	**45. improve**	**65. measure**	85. important
6. student	26. make	**46. teaching**	66. full	86. first
7. use	**27. skills**	47. also	67. ways	87. academic
8. data	28. college	**48. traditional**	68. idea	88. see
9. will	29. using	49. used	69. even	89. approach
10. online	30. way	50. might	70. think	90. create
11. research	31. know	**51. model**	71. different	91. content
12. system	**32. access**	52. may	72. answer	92. developed
13. university	33. educational	**53. tests**	**73. literacy**	93. dont
14. help	**34. quality**	**54. based**	74. colleges	94. process
15. new	**35. learn**	**55. effective**	75. now	**95. assessments**
16. project	36. many	**56. instruction**	76. group	**96. tool**
17. technology	**37. outcomes**	57. get	77. members	**97. methods**
18. assessment	38. well	58. provide	78. success	98. portfolios
19. like	39. much	59. find	79. groups	99. change
20. one	**40. knowledge**	**60. state**	80. systems	100. sources

Figure 3.7

Among the key terms included are research, assessment/s, technology, tests, results, measure, and method. Taken together, these key words imply a conjunction of managerial approaches to education and high tech research and development practices. By channeling learning through computer mediated systems, the low cost of data storage enables the collection and analysis of "click stream" data on a massive scale. From the perspective of the computer programmers and AI experts at the core of the MOOC movement, this data is the key to building more efficient systems for teaching, while for planners such a system enables a reorganization of power from the once autonomous faculty teaching individual classes to the realm of the boardroom, potentially saving resources in the process.

Next, the analysis turns to comparing these two additional topics of interest (*State systems* and *Data and Measurement*) with the prior topics identified above (*MOOCs* and *Distance Education*). When the prevalence of articles structured from the *State Systems* topic (topic 27) over the entire period is plotted with the *Distance Education* topic there is a strong visual relationship between the two curves.

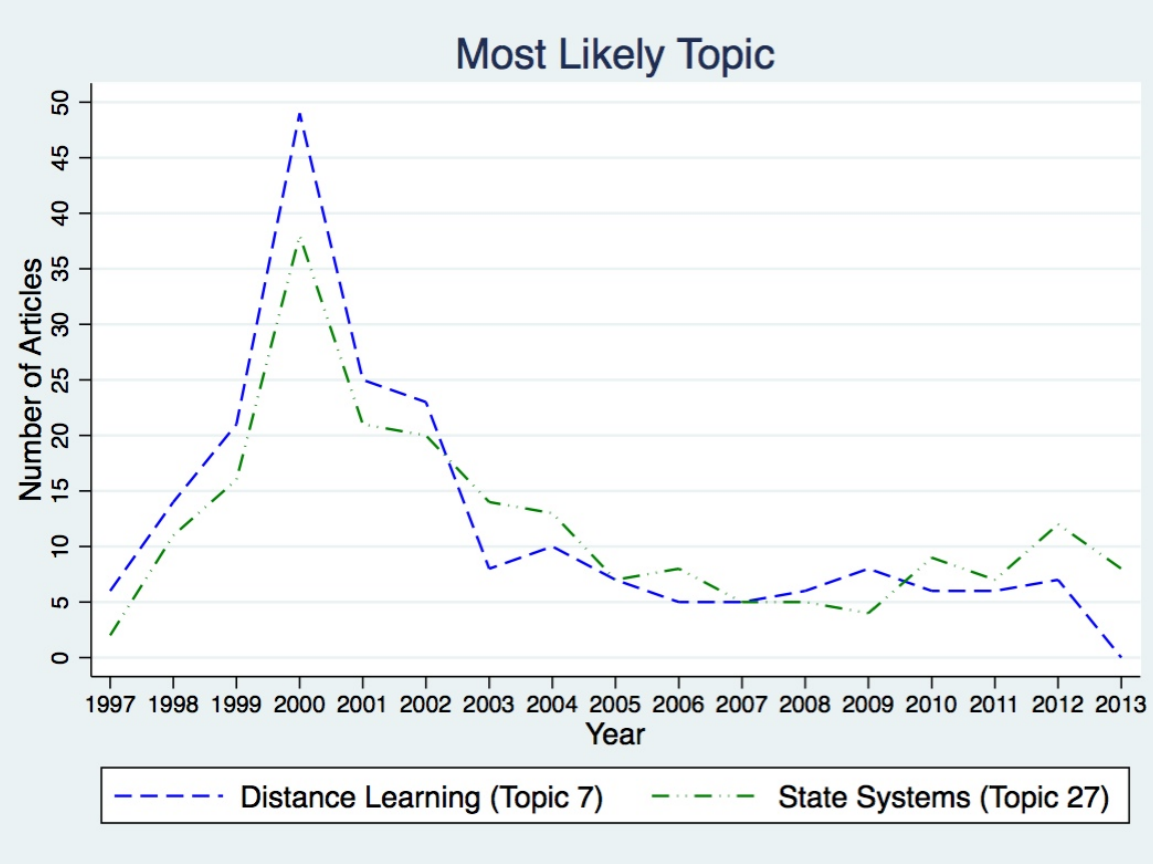

Figure 3.8

This relationship implies that in periods when articles focusing on distance education are common, so are articles that focus on large state systems of higher education (or visa-versa). Revisiting our original intent to identify frames and then try to link them to constituencies, there is some indication that more traditional frames of distance education are somehow linked to large state systems of higher education.

When the *Data and Testing* Topic (Topic 47) is plotted alongside the *MOOC* topic (topic 55) over time, the relationship is slightly less clear. For the *Data and Testing* Topic (Topic 47) a slight increase can be observed around 2001, and a more recent increase and peak around 2010 is visible but the overall magnitudes of articles in each year and their variation are small.

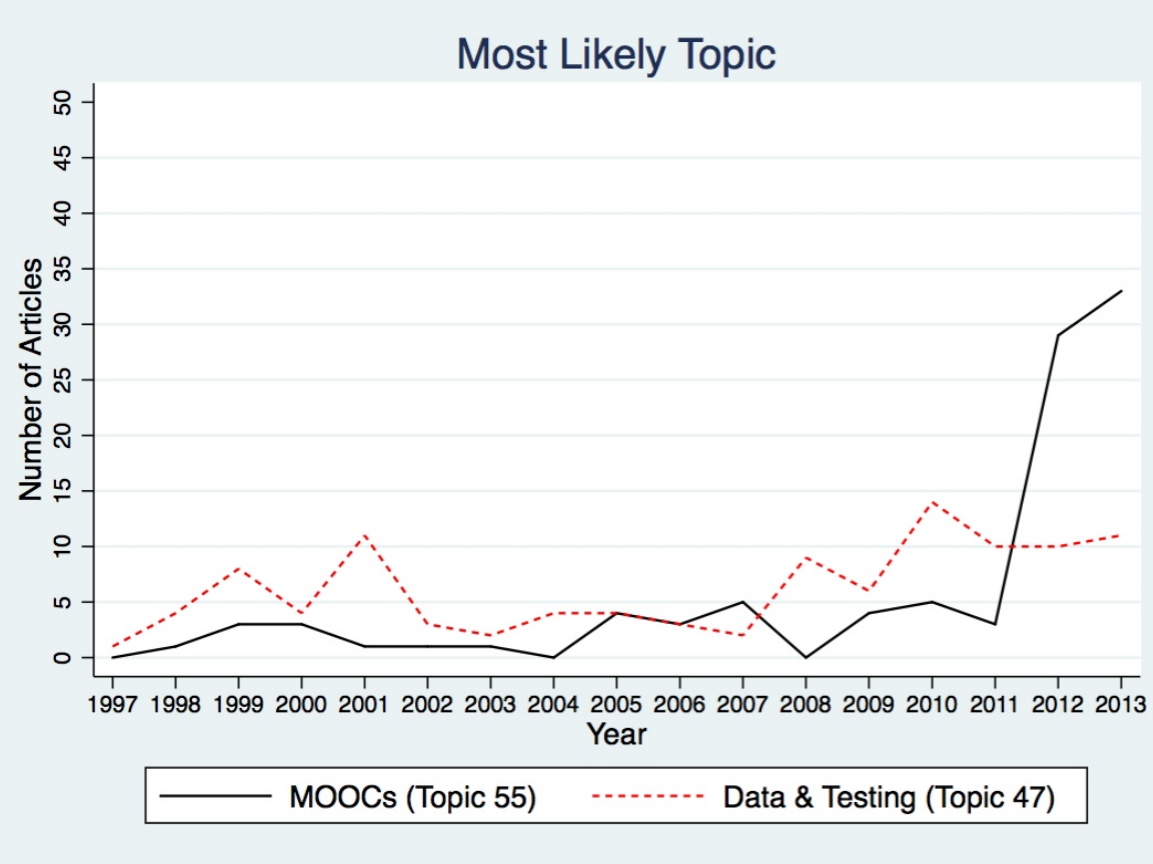

Figure 3.9

Potting the two curves together implies that the prevalence of MOOC focused articles may be slightly trailing the increase in articles focused on these topics. Until now the graphs presented have offered counts of the articles that have the topic of interest as the first most likely topic. Another way to look at this data would be to ask, how many times do each of these topics appear within the first five most likely topics to have structured the article?

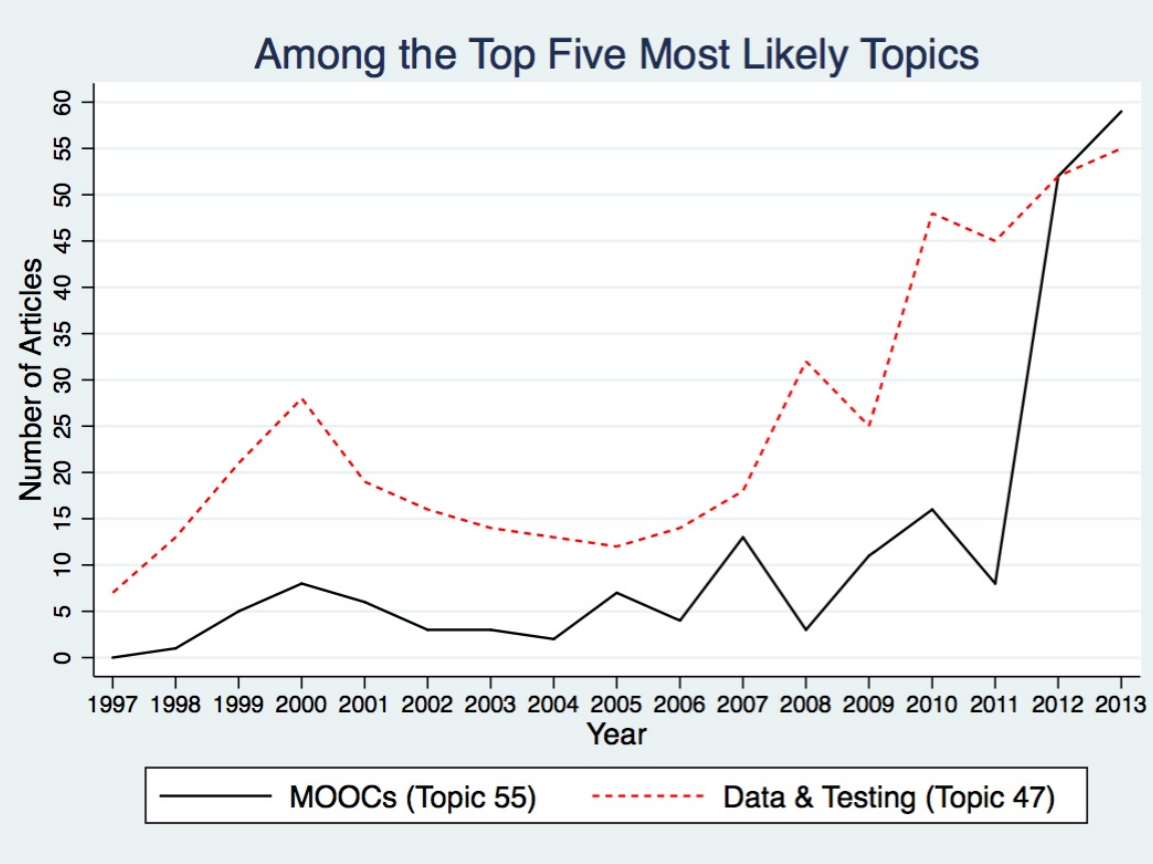

Figure 3.10

Presented this way the relationship seems somewhat more obviously accentuated, and worthy of further exploration. Here the relationship between framing and a particular constituency seems to be mediated by another set of concepts. In so far as Topic 47 focuses on technical ideas about data and analytics, and not large state systems, further analysis might focus on the group of people best positioned to make professional claims based on expertise over these technical practices.

These relationships can be used to address a number of the questions raised at the start of this chapter. In particular, the visual evidence that the uncorrelated peaks in discourse about *Distance Education* and *MOOCs* are tracked by another set of discourses. The plots also show that the first phase of internet course delivery discourse closely mapped onto frames associated with large state systems of higher education. This first phase included and highlighted community colleges and sub-baccalaureate institutions. While the ultimate outcome of the MOOC movement is unknown, it is important to point out that the main frames associated with these new experiments, and the professional communities most closely associated with them, are both indigenous to and ascendant within the academic community.

Finally, the relationship between the *MOOC* framings and *Data and Measurement* framing, while weaker than the others, deserves further exploration. While the accountability movement that swept primary and secondary schools during the 2000's has not made much headway in the post-secondary field, the particular technical solutions most familiar to

computational engineers—platform building, massive data aggregation on a micro scale, and repeated and iterative testing—are represented in topic 47 and at least loosely correlated with the MOOC topic. In general, the computational engineers that have these skills are no longer peripheral hired help in the field of higher education. They are now leading many of the institutions that dominate this new movement (MIT and Stanford), and are central to many of the others (Harvard).

Conclusion

This chapter set out to try to understand the patterns at work in discourse about online course delivery within the field of higher education. The theoretical approach adopted also prioritized a search for evidence that might point toward constituencies of interests associated with particular frames or discursive concentrations. The topics and graphs presented have yielded a few strong relationships of interest that deserve further study and analysis.

The chapter also leads toward the contours of a more general argument about the history of attempts to use the internet to deliver college level courses. In so far as major state higher education systems were closely associated with frames of distance learning in the run up to the first dot-com bubble, a long history of connection between entities predominantly interested in producing more trained labor for less money in their political jurisdictions. The spectacular collapse of some of the earliest experiments with these technologies during that period (U-learn at UCLA and Fathom at Columbia) led to a relatively depressed period of focus on the power of the internet to deliver courses. When this discourse reappears in 2012, it does so in a different guise. It is associated not with large state systems of higher education, but with elite private schools housing the top departments of computer science in the world. In so far as state colleges and universities are mentioned, they are mentioned as clients of the products produced at the symbolic apex of this field. All this is done through a mediating discourse of quantification, measurement, "data and analytics", that carries with it a set of shared epistemological assumptions and worldviews.

In the next part of this dissertation, primary data will be presented and analyzed from three critical case studies identified by the topic modeling present above, as well as by keen observers of the field, as being the central university actors in the MOOC movement. The insights of this analysis are carried forward into Part II as the analysis focuses on how administrators at traditional universities assess and respond to the quantification frames and elite status claims identified above.

PART II: Reengineering Elite Universities

4. Stanford and the Start of the MOOC Movement

MOOCs mattered to the field of higher education in 2012 as few pedagogical technologies had in the past. The power of the claims made by MOOC proponents and the pace of early activity posed existential questions to practitioners and analysts of contemporary higher education that they were forced to consider. In the previous two chapters this dissertation reviewed the secondary literature to contextualize the history that led to the MOOC movement, how each of the three key university cases fit into those histories, and how the field at large framed new developments in an ongoing process of experimentation using the internet for course delivery. In this chapter, empirical evidence from primary interviews with centrally located members of the Stanford community familiar with, and responsible for, the university's response to the MOOC movement will be presented. This chapter argues that a series of increasingly provocative local online experiments by some of the world's leading artificial intelligence experts supercharged a new era in online higher education. The unorthodox initiatives, which began as unilateral decisions by individual faculty members, were made possible by a few critical endowments present at Stanford: 1) a plethora of low cost local technical capacity; 2) newly commodified component technologies; 3) a long history of experimentation with revenue generating distance programs in the engineering school; and 4) a culture of using online courses as publishing venues in fast paced engineering disciplines.

The massive demand identified by the first few MOOCs, which registered well over a quarter of a million people, was impossible for local actors to ignore. Over widespread doubts and concerns about the for-profit approach to future MOOC development, even among the CS department, ambitious local faculty launched two venture capital backed spin-offs. The choice to move in this direction was actively encouraged by John Hennessy and his core leadership team who feared the potentially disruptive impacts of organizations that looked to make a profit by cutting out intermediaries (universities) and facilitating teaching and learning between individuals and faculty members. The actions of Hennessy, a uniquely skilled social actor, serve as a powerful example of the aggressive strategic academic capitalism applied to the teaching and learning side of the university inspired by Silicon Valley rather than other centers of higher education like Cambridge.

An Abundance of Riches: Student programmers and spare capacity

As Silicon Valley continued its recovery from the puncturing of the dot-com bubble, Stanford remained the premier destination for aspiring computer scientists. With one of the largest departments in the country, Stanford boasted world class experts in a wide array of specializations and the enrolments to match. Computer Science is currently the largest single major at Stanford and has been since the late 2000's. By 2012, one in four undergraduates at Stanford were engineering majors, as were one in two graduate students and the overall size of undergraduate enrollment had reached a new high, 25% greater than at its peak in 2000. At Harvard those numbers were with no more than one in 25 for undergraduates and one in ten among graduate students (Auletta 2012). In the same year, nearly half of all Stanford undergraduates had taken at least once course in the computer science department.

The existence of enterprising and talented students looking to find opportunities to impress faculty in the CS department created significant capacity to build and deploy all sorts of new software including online educational platforms. What's more, this human capital was available for far less money than comparable computer programmers might charge in the open

market. The most significant of these platforms was Stanford CourseWare which was designed and deployed by John Mitchell of the CS department. A member of the CourseWare development team recounted the inception of the project around 2008:

> We just got a question in class, or after class, where somebody said "can we have an online discussion group?" And we didn't find anything that existed, so we thought let's build one. And in the computer science department they have a summer research internship program for people to do projects on campus and so we got maybe six or seven other undergraduates and a few other people, and a postdoc who was interested in working on this, and so we just built a platform and ran with it. And we got some grant from John Hennessy who was the president to pay a small amount of staff time to support that as a platform for various faculty….The student work was more or less volunteer, or for credit, but we needed a few staff positions to maintain continuity as students came and went…Our goal was not…numbers, but to kind of explore what was needed. And so the model was simply, go around and ask people what they wanted and offer to build things they wanted for their teaching. Just sort of follow the requests of faculty to see what platform support, or features, technology support, would be helpful to them in their teaching. (Interview 2018a)

As development efforts persisted, the team was joined by Daphne Koller, who continued to oversee its progress and maintenance with John Mitchell until the launch of Coursera in April 2012 (Interview 2017a).

Early in the development process a few major feature requests from faculty began to surface, and one of the first was a desire to easily facilitate video capture and distribution of course presentations. Across a number of schools and departments, teaching faculty were noticing that the availability of video capture and changing norms around class attendance meant that a majority of regularly enrolled students in some programs choose virtual presentations over those delivered live, and were voting with their feet by not coming to class (Interview 2017b). One faculty outside of the School of Engineering even recalled that President Hennessy was his original source for learning about the prevalence of video capture and its impact on pedagogy in certain departments on campus:

> But Hennessey was also an engineer, and a computer scientist. He…was the first person to introduce to me that idea of giving a lecture from home, or in a room, with no students there and you're talking and they can chime into it...like I think the first time I got that idea was talking to Hennessy, right, because he was saying in the engineering world that's what was happening. Students are not necessarily showing up in the [lecture] halls because they can see them from their rooms. (Interview 2017c)

A second major feature request expressed in the early days of the development of CourseWare was for access control in the context of virtual discussion forums for items posted by faculty in their courses. In the interest of complying with copyright rules, and controlling access to work in the early stages of development, faculty wanted the ability to vary privileges for different categories of users.

> I mean we were focusing mostly on discussion forums, and how that works. And it went around and around, and there was a clear division of people which surprised me, on who wanted their things to be visible and who wanted their things not to be visible. And so because I'd worked on security, and access control, and so on, one of the fundamental things of the platform was that everything on it could be marked "course staff only", "my class only", "Stanford only", or "visible to the world". So there were four levels of visibility. And so you could put a paper up on the platform and market it for Stanford only to avoid copyright issues if it was somebody else's paper, but you could take your slides or your own handout, or your own work, and make that publicly visible to anyone, and that way you'd have some visibility into the course. (Interview 2018a)

Here again, the presence of world renowned CS faculty with prior experience in solving software challenges related to local campus demands for courseware served to advance the objectives of new digital systems to support pedagogy.[31]

Stanford's rich history with distance education experiments housed in the engineering school also served to advance these efforts. In fact, university administrators saw these efforts as essential to the financial health, and mission of the School of Engineering, explaining: "[we were doing more]than experimenting. We've had a successful online programs, not MOOC scale, but online programs for god knows how many years, 30, 40?" (Interview 2017d). These programs featured substantial development of in-house technology as well as institutionalized understandings of faculty compensation, ownership structure, customer base. Extension administrators at SCPD (Stanford Center for Professional Development) were very clear that they were running a business, and in their division, the driving force was the bottom line. One long serving SCPD manager explained:

> Our focus [at SCPD] was really...to do good work and generate revenue over expenses. So there were [a few] goals, but the end, the last one was always money...One was to sort of build industry relations, two was to think about ways we might be able to support faculty getting better as instructors [to improve] teaching and learning. Third was to benefit the on-campus students because most of the recordings benefited on-campus students by the capture and extend model. We had an asset that students to this day continue to consume and, oh by the way, it'd be nice if we can make a couple bucks! (Interview 2017e)

One central offering of SCPD had a particularly valuable asset in that pursuit: the ability to grant traditional Stanford credit toward a traditional Stanford degree. This ability was prominently featured in the master's degree programs which advertise that almost all MA's could be taken using a combination of online and in-person classes (Interview 2017e). Layered underneath these formal credit and degree generating programs, SCPD also offered broad access professional credentials which generated substantial revenue.

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[31] The norms of intellectual property in and out of the CS department and beyond will be discussed in more detail.

While SCPD programs were unique in their direct connection to industry, their integration into formal credential granting parts of the university, and the amount of revenue they generated, they were not designed to be revolutionary nor were they designed to be taught at scale. As another long serving SCPD administrator explained "they were boutique, restricted, you know, [an] elite university kind of approach" (Interview 2017a). Throughout the 2000's SCPD had experimented with releasing some of the offerings created by engineering faculty to the internet, including colloquia, guest lectures, and smaller course materials. These were not understood simply as community services, they were anticipated to serve as advertising and to drive paid enrolments:

> the approach was…for things that have credentials, or some clear value to a learner resume, those are the things that we'll build as programs that we deliver for a fee because there's some value attached to those, beyond just the knowledge and the information, whereas if a field is evolving it's just a good service to the public to make those things available for free. (Interview 2017a)

SCPD leadership did not frequently identify peers that they believed were making dramatic progress in improving the business model of what extension programs could be. Since the advent of the internet, SCPD had unlocked more supplemental revenue streams than any of its closest competitors in the online extension domain, and they believed that was due to their pragmatism:

> We had, in 1996, realized that the internet as a distribution platform was going to just flatten the world. And at the time I was thinking, okay, we're doing this for the graduate program, how can we get professional education on there? I had already lost money…on [a few] campus things so if I could just tape that thing and put it online and make a few extra bucks I could lose money on campus but make money online. It was sort of a no-brainer. So how quickly could I do that, right? And so it went far beyond the local geography, but I don't see competitors...they're not really that...Even now I'm just sort of stunned...I mean our business thinking was much farther along than anybody that we talk to. (Interview 2017a)

Well aware of the management literature (much of it presented in SCPD's offerings) which takes a rather dim view of the ability of large organizations to innovate and change, SCPD leadership believed it benefited from sufficient autonomy within the Stanford community to persist in innovating. Referencing two popular scholars of business who address these questions, one manager explained, "Clayton Christiansen would say that the incumbents are dead, just go kill yourself. I guess I'm more optimistic than that as a person, so, I like the Charles O'Reilly story better: ambidextrous organizations" (Interview 2017a).[32]

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[32] Harvard Business School professor Clayton Christensen's book, The Innovators Dilemma (2000), was widely popular in the business press and has influenced popular thinking about the challenges faced by incumbents in competitive markets. It presents a famously pessimistic perspective about how large, successful, incumbents are all but doomed in the face of smaller competitors. Due to structural conditions of markets, Christensen argues that nimble outsiders are far more likely to continue to upend and disrupt established industries as they are better able to take risks to address the needs of smaller customers demanding innovative next generation products. Lead and Disrupt (O'Reilly III & Tushman 2016) is Charles O'Reilly's answer to the innovators dilemma and lays out a set of

Managers of the unit argued that this entrepreneurial flexibility to incorporate technology was made possible by SCPD's historical position in the Stanford bureaucracy. As a revenue generating unit within Stanford's largest, most entrepreneurial, and most prestigious school, which was surrounded by faculty who were well versed in generating revenue through industry partnership, SCPD was spared from campus wide oversite:

> One of the features of SCPD being in engineering is that it was protected from university politics, and the fact that it was a revenue source inside of a school also kept it protected from that, in a way. This enabled it to be more entrepreneurial and potentially more innovative. When you're wrapped up in centralized processes it becomes more difficult to do new and innovative things. (Interview 2017a)

One of the most relevant experiments piloted by SCPD was Stanford Engineering Everywhere (SEE), a venture capital funded initiative which led to the creation and free distribution of ten courses across the School of Engineering's curriculum.

Managers at SCPD saw SEE, which launched in 2008, as being in direct conversation with MIT's OCW. However, as it was run by a unit which had a lucrative business selling educational programs bearing degrees and certificates in the same discipline, the infrastructure to exploit potential revenue streams that might follow from online offerings was already in place. The theory was to use SEE to invite anyone who wanted a Stanford engineering experience to have one, knowing that the most interested of those who interacted with the free SEE offerings, might formally apply for a paid program at Stanford. Of this group eight in ten applicants might pay for a certificate program, and the most talented and motivated two in ten applicants might pursue a masters (Interview 2017e). In announcing the new endeavor SEE's director, Andy DiPaolo, explained: "One key distinction about our program [relative to MIT's OCW] is that we provide the complete package…it has everything you need: the lecture, notes, and videos" (Guo 2008). This department wide-experiment shaped the thinking of many early faculty participants, as well as members of the SCPD community. While the materials got nearly two million hits – a significant number – the model for financial sustainability was not clear to leaders of SCPD:

> So Stanford Engineering Everywhere was a precursor to the MOOCs…We said: how the hell are we going to do that again? Who else is going to ante up, you know, $500,000 to do 10 courses, which is cheap actually. I mean people liked the hits that they were getting, and you know wanted to do good but [where is the money?]...Anyway, so that flavored my perspective on the MOOCs ultimately. I said well this is never going to work because we've been there and done that already. (Interview 2017e)

But the complexity of capitalizing on the huge upfront investments in MOOCs did not feature as prominently in faculty reflections.

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practices that organizations can follow to become *ambidextrous* and stave off the massive forces of stagnation described by Christensen.

To many of the individuals interviewed for this dissertation, the very existence of the products that had been digitized for SCPD implied that they should be openly released and shared with the world. One long serving faculty member in engineering explained:

> …we have many decades of experience making our lectures available to other people who are not in the room. And so to simply open that up to a much larger audience made that kind of a no brainer. Like, why don't we just do that? That sounds great! And I still think it's a good idea. No reason why, if someone thinks of something and puzzles through it, and has a good explanation, there is no particular reason I can see to limit the delivery of that. YouTube is up there, and people put crazy stunts up there. Why not put something meaningful up there? It should be part of what we do every day. (Interview 2018a)

Here the intellectual copyright claims, funding arrangements, and other complex compromises which scaffold the work of university faculty was reduced to a taken-for-granted opportunity to experiment without concern for revenue recovery.

This penchant for trying new heterodox things using technology was a common theme of many of the interviews conducted with computer scientists at Stanford and beyond. In particular, there was a gap between the notion of valuable intellectual property where the right lines of software might launch a billion dollar startup, and one where university funded faculty write journal articles and books for their field. When asked why some faculty might be hesitant to release their work in progress, including course notes and lecture outlines, freely on the internet, one longtime computer science professor stated:

> To me, I had no idea. I was so dumbfounded by this. The reaction I got, I went to talk to the English department or somebody, and somebody said, "No, I can't do that, that's our intellectual property". And I thought, man, if you can commercialize that, go for it! What do you mean? But then I later understood that there is a model for teaching in some fields, which you're probably familiar with…a person is writing a book over a period of years, and they kind of workshop pieces of it, so they don't want to release their intermediate or trial version before they are done with it. A technical book is a different beast. I've written two textbook-ish like books, and for those I've made every draft of every chapter publicly available because I thought people would find errors in it, and comment on it, and so on. I wasn't in the least bit worried about being scooped. It didn't occur to me. It was more like you look for consensus and adoption. (Interview 2018a)

The approach to releasing unfinished work, which was typical in CS at Stanford, was not the result of a political position inspired by organizations like the Free Software Foundation or its related entities. There was a sense that the pace of change in the field meant that expending effort to complete a book was often not an effective use of one's time. On a number of occasions interview subjects referenced that getting the resources to teach a significant online course, before and after the MOOC movement, was often a more effective way of sharing scholarly work in CS:

> Dan Boney had even talked about..."I'll never get time to write a book. This is faster than writing a book, even though it's time-intensive, it's a faster way to get access to the public and so if I were going to write a book or do this, I'd do this." (Interview 2017a)

With the dizzying pace of change in CS, and the nature of the products and artifacts produced by members of the field, electronic distribution of new teaching materials was a commonly understood method of scholarly distribution.

As reviewed above, a number of significant local endowments laid the foundation for the MOOC movement. First, the existence of significant student programing capacity and interest from CS faculty with relevant experience dramatically lowered the cost of development for early experiments. Second, there was a recognition that things like video capture and distribution were now commodities which could be freely incorporated into teaching and learning platforms. Finally, SCPD's long history of university extension, and their continued investment in faculty collaboration using new technology, continued to add local capacity and knowledge. The final ingredient added to this situation, which will be discussed below, was the demonstration of a substantial worldwide audience for these materials which materialized explosively in 2011.

Discovering a Global Market

Across the full array of interviews conducted for this dissertation, few factors stood out more consistently than the irresistibility of a popular audience for the courseware produced by faculty at elite universities. Many in the community were aware that SEE had been successful in producing huge volume of "clicks" relating to online content. However, significant questions remained about the meaning of these figures. Were people actually engaging with the material and coming back to spend time learning the content? When Stanford's first three MOOCs were announced in the summer of 2011 a new bar was set and few knew how many would meet it. The question became how many "clicks" would turn into registrations. Would individuals enter information expressing intent to spend hours a week for numerous months learning academic content if that was the only option? The results did not take long to come in. A common depiction of this historical moment was given by a long serving CS faculty member who recounted:

> The big thing I remember, in talking to Sebastian, I said "how's it going," at a faculty lunch, "are you getting people to sign up for this?" And he said "I'm over 120". And I said "120 people?" And he said: "No, 120,000!" So that was clear. Nobody had ever had 120,000 people sign up for anything they did before. And I think the enrollment for those first three things had a significant amount...350,000 people. That's like a really sizeable number. I don't think the first search engine had 350,000 people signing up to enter search queries the first day. So it was clear there was something there, but not clear what it was or where it was going to go. (Interview 2018a)

Exactly what these massive enrolment numbers meant had yet to be meaningfully understood. To some observers it represented the potential for revenue streams. For other faculty there was profound satisfaction to be derived from teaching more students in one semester than you might otherwise have in an entire career:

> [faculty would tell me] I get a hundred students in my regular class...think about the years it would take me to get 10,000 or 80,00 or 100,000 enrollments, or whatever the hell they got in their first MOOC…It'd take me like a hundred years to do that. I get a hundred students a year, I got a hundred thousand [in the MOOC], so how many in how many years? It's ridiculous. I have a chance to be famous now, and then I can leverage the hell out of it later. I'll figure out what happens later. But, it's a no brainer. I get it. (Interview 2017e)

The realization of the potential for personal celebrity was rarely mentioned during Stanford interviews without the acknowledgment that profits were likely to follow.

In spite of the ever present revenue opportunities, the early local framings of these new experiments in pedagogy focused on the democratization and access elements of free and open course materials. This access conversation was often inflected with a conception of a global demand for education, and far flung markets populated by underserved students eager for these freely available materials:

> So the interesting thing about the faculty...the engineering school had three trial MOOCs, and this was before Coursera…and those were hugely successful in terms of enrollments. That's when it seemed like, here is a new model of education. And it is. In some sense, it is a tremendous boon to people, particularly to people in China and India and Africa that do not have the kind of access to these instructors, and they get a heck of a lot out of these courses, no question. (Interview 2017d)

The taken for granted social value of access often complicated critical resistance to these new experiments. Even those who might have been compelled to advocate a slower approach from the university at large were flummoxed by these claims, to the point of questioning the very endeavor of traditional scholarship. One faculty member outlined this arc as follows:

> It's a great thing to say you've got 15,000 people from around the globe, you know, taking your course. And…I believe it was the computer scientist [who] offered that course and like what 450,000 signed up...It was a large number, I can't even remember, but yeah and so I think people were seeing dollar signs though…but it was framed so much as a democratic process. The democratization of an elite education in some ways. But the irony was that you could never get a degree from Stanford, even if you took a MOOC from Stanford faculty. And they were very explicit about that. But you knew it was a popular thing. It was a hot thing. As a faculty member I couldn't help but wonder if what I was doing would become obsolete. You know, is this the new cultural movement, is this the revolution in pedagogy? (Interview 2017c)

The angst about what implications this new direction might have for the traditional faculty was widespread. One of the most significant axes around which this turned was the role that course credit, or credentialing, would play in these new massive course delivery systems.

Among the most provocative approaches to answering this question came from Sebastian Thrun, who, having formally left Stanford to take a job at Google, seemed less restricted by

norms of conduct practiced by university faculty. The major headline grabbing promise made to differentiate his effort from others was that students would be graded against traditional Stanford undergraduates. One administrator recounted that "In August of 2011 there is a press release where [Thurn] and Norvig were going to do a course…they were going to be allowed to register free and they were going to grade them against Stanford curve. And this was the New York Times" (Interview 2017e)! To some administrators charged with monitoring parts of Stanford's online strategy, Sebastian's announcement landed as if out of the blue:

> And we heard about [Sebastian's experiment] because that was just…totally unacceptable. Putting grades up online. I mean you just sort of undermine the whole university infrastructure…we were sort of "wow, if faculty are going to start putting grades up…what are we going to do?" And so the President's office decided to celebrate...Because what else are you going to do? It's out there. This happened. I'm certain Sebastian got reprimanded behind closed doors...and no grades were put up online, right. But you had this massive public interest access…but folks in industry, or anywhere in the world, being evaluated against admitted students in the same way isn't quite...it doesn't make sense. You have an admission process for a reason. (Interview 2017a)

For many local observers, Thun seemed to have transgressed acceptable norms of faculty conduct. By promising to standardize grades for enrolled students and the general public he had threatened a core dividing line at the heart of the university. There was a shared notion that he had ceased to work as a member of the Stanford *team*, and that he was operating in a shared space with a high degree of self-interest and disregard for the interest of Stanford as a whole. As the next section will show, the individual initiative taken by Sebastian Thrun to launch a provocative project without the formal backing or prior knowledge of the Stanford administration supercharged a race to contain and contextualize these new approaches to online higher education.

From CourseWare to Coursera

While Thrun's approach to integrating new technology into higher education instruction was particularly provocative, it was not entirely different than the actions taken by his peers in Stanford CS who decided to pursue MOOCs in 2011. The set of factors that enabled Stanford to seed three simultaneous courses that yielded over a quarter of a million registrations within months created compelling new opportunities across the department and the campus. This section will evaluate how other faculty responded to these events and committed to strategies to deal with new opportunities. Evidence of the discussions and debates that took place with the computer science department will be outlined. At the core of each of the discussions was a question about how best to structure an organization that would do the work required to bring the benefits of MOOCs to a broader community. Should the venture be organized as a non-profit, and if so, who should run it, a consortium of universities or another entity? Alternatively, what might a for-profit MOOC provider be able to accomplish, and why might that be beneficial?

Following the first three MOOCs in fall 2011 a race had begun over who would capitalize on the MOOC demand most quickly and effectively. To some the tenor of these new activities by a small group of faculty most closely associated with MOOCs stood apart from past collaborations between faculty, SCPD, and other on-campus extension outlets. Rather than appearing to be guided by a coordinated and integrated strategic plan, the rush to capitalize on

MOOCs seemed by many to be driven by faculty self-interest divorced from other local priorities. One long serving SCPD administrator explained:

> It was not about them, it was about Stanford in the old model. [With MOOCs] it was about them. It was about Daphne, it was about Andrew, it was about the fame part, and it was about Sebastian doing this thing. It was about Sebastian getting his hand slapped but then at least he's the center of attention. (Interview 2017e)

The pace of change, and the uncertainty surrounding how long time peers might relate to these new projects, led a number of conflicts and statements of concern and distrust. Few were more often recipients of this distrust than Sebastian Thrun. After a recent string of successes and his formal departure from the Stanford faculty to join Google, his motivations and loyalties were often questioned. At a question and answer session following a presentation to a Berkeley conference entitled Learning Mode, Peter Norvig co-instructor of one of the first MOOCs, stated that Thrun's evangelism was to be expected "…because he's trying to build a company, and at this stage, nothing is more important than publicizing and advocating for the brand. His claims aren't those of a researcher, they are those of an entrepreneur" (Norvig 2013).

By the time the fall semester of 2011 was coming to a close it was clear that huge enrollment numbers and increasing interest from across the field of higher education would be difficult for Stanford administrators to ignore. Given the public profile and popular praise, what were they to do about an individual former faculty member who had taken aim at the university's monopoly over credentialing? In Stanford's case, the answer seemed to be: declare victory.

> We were just cruising along…and then really the match was Sebastian. Sebastian, over the summer, announced "my class will be free for everyone and I'll grade everyone on the Stanford curve and you'll see if you're smarter than Stanford students or not". That got people going! Red flag! That got people running. And then there was a huge, you probably know the story: there was a huge issue among the deans, and people discussing, what do we do with that? Do we tell him no? Well then you've taken a huge opportunity to do something good and to get recognition for Stanford and turned it into a controversy and that seemed like a bad idea. So everybody decided rather than that, to declare success around that…so the plan became to release three courses instead of just Sebastian's and put a little bit of a damper on the "we're going to grade you on the Stanford curve". That got nixed, and that was the deal with Sebastian. But then Daphne and Andrew saw that he had a company, and they didn't want to get beat at the company, and so they did this other thing. (Interview 2018a)

The public narrative of success was matched by significant work behind the scenes. Within weeks of completing the semester, and wrapping up his first MOOC, Thrun had independently secured venture capital funding to launch the project that would become Udacity. Thrun's provocative move toward MOOCs, the dramatic headline grabbing numbers which his first course generated, and the creation of a new company soon thereafter, set in motion debates across the campus about how individual faculty members, departments, and the university should respond.

Much of this activity took place among the original team of computer science faculty that had been developing CourseWare, including Daphne Koller, Andrew Ng, and John Mitchell. In particular, Koller had found on-campus outlets to present the progress they had made on their work to top administrators prior to the MOOC movement. One participant at a meeting of the Trustees in 2010 recalled:

> Daphne Koller and Andrew Ng had been experimenting and they'd been using their software to flipped classes[33], and Daphne in particular – she was really the enthusiast – was really quite excited about this and felt that this was the wave of the future for teaching at universities, so she was not at that time thinking particularly about MOOCs. And we invited her to give a presentation, the two of them, to give a presentation at the board of trustees. I remember I was at a dinner during one of the trustee meetings and she and Andrew were the dinner time entertainment or whatever. And gave the presentation and talked about flipped classrooms, and also talked about the possibility of stand-alone versions [of CourseWare]… So I believe a year later they became very interested in using their platform to do MOOCs, and to open it up to a wider audience. (Interview 2017d)

Following the success of the MOOC version of her course in 2011, and Sebastian's decision to found Udacity, Koller and Ng began exploring the possibilities of building on their nascent platform and years of experience to launch their own venture. As Sebastian's example had demonstrated, straddling the role of faculty member and educational entrepreneur can cause conflict. For the CS faculty at the center of the MOOC movement, these contractions were amplified by competitive pressures to stake out claims and capitalize on the interest as quickly as possible. One administrator familiar with how this played out within the department explained:

> So Daphne and Andrew, those courses were computer science courses. And it was clear that there was a huge desire for those kinds of courses around the world. And so Daphne and Andrew did a lot of pitching it to the computer science faculty, and in the process managed to piss off the faculty royally. And the reason was…the faculty in computer science felt that they did not make it clear enough that they were planning to do a for-profit spin-off. So they were trying to get their colleagues to do courses, to produce these MOOCs, and the fact that this was going to be a for-profit enterprise that Daphne and Andrew would be founders of, was not clear to the faculty. And I don't know if that is because they were not listening clearly enough, my guess is that Daphne and Andrew underplayed that, or neglected to mention that part of it. So there was a time, and John Mitchell was quite angry at Daphne and Andrew. And actually John, I don't know what the truth is, but I think that John was involved in, or developed some of the software in the platform that then Daphne and Andrew were using...He feels that they stole some of his

[33] Flipped Classrooms are a pedagogical concept uses methods of transforming traditional thinking about time spent in class and time spent outside of class. These methods often use technologies like video capture to require students to watch recorded lectures at home and then require them to come to class to work through problem sets of challenging questions in an interactive manner during group meeting times.

> work, or whatever. That's a strong way to put it but...And of course they feel that Sebastian did the same. So there's all that sort of thing going on as well. (Interview 2017d)

Personal and professional disagreements was a key feature of the relationship between this early group of entrepreneurs. The possibilities presented by these new technologies, and the rhetoric by which they were being justified, also provoked lively debate among the computer science department at large.

By the start of 2012, as implied by the previous quote, discussions were well underway about how Stanford, Koller, and Ng might craft a response to this rapidly developing momentum. In spite of broad enthusiasm about MOOCs as a general concept within the computer science department, significant disagreement arose among the faculty who considered the implications of each scenario. Members of the department came to these discussions with significant personal experience with Silicon Valley entrepreneurialism. Many of the early innovations pioneered in the department seeded billion dollar companies, and many, if not most, faculty have reaped the benefits of the commercialization of these breakthroughs to some extent. But when the future of MOOCs became a topic of conversation divisions materialized within the department. The compelling potential of a large scale technology enhanced higher education delivery system was never in doubt:

> Yeah, I think we have a pretty, I think the culture of computer science, which is what's driving this in a lot of ways, and those were the discussions that we were in, is such that I think there was broad agreement on providing access to meaningful learning if that is possible. And I think people teaching here, and I think many in my department, and probably in others…folks feel like: "I got lucky". But many other people who were not so lucky have equal right, or should have equal opportunity, if we can, to the same things we have. So if we can spread this around we'd all be happier. So I think that was the agreed goal. No one argued with the expressed goals of Coursera…(Interview 2018a)

The issue, it turned out, was how best to structure these ventures so that they would fulfill the stated goal of democratizing education and lowering cost and access barriers. A faculty member familiar with the discussions stated that "…The debate was not whether we should do something, the debate was the business model around the mechanism for doing that…" and continued, "I didn't hear a single person say…why would you do that? But the question was financing that, and whether a for-profit intermediate company was the way to do that..." (Interview 2018a).

Given the prevalence of faculty members with deep experience in the private sectors, and as founders and entrepreneurs, what were the concerns with organizing Coursera as a for-profit venture? By and large these interviews revealed that CS faculty felt there was a tension between the needs and demands required of an investor backed for-profit company and the expressed goals of higher education, and the MOOC movement in particular. It was one thing to make money from a micro-chip design, or software as a service, but providing a meaningful educational experience to those in need seemed of a different order. One faculty member who participated in these discussions recalled:

> I was not 100% sure that this thing made sense. I didn't quite see how that was going to be a successful business and good for the world at the same time. And

> in fact there were some very heated arguments in my department involving good smart people with lots of experience around both open source and commercialization, who felt very strongly that that was the wrong thing to do. Yeah, starting a for-profit company to do this "good for the world" was a poor way to approach this. Two people who were highly vocal around this were Mendel Rosenboom, who's the founder of VMWare, and by all accounts transformed computing by providing the basis of cloud computing. Hugely successful in business, and hugely successful in research, and he thought it was horrible idea, and Nick McKeown, who was a networking person with also significant entrepreneurial experience, and a lot of experience around free open source networking.…I think that people just felt like the incentives would not be aligned…I think they were basically right but for reasons that were more complicated than anyone could have imagined at the time...(Interview 2018a)

In spite of the educational need that was acknowledged, and the power of these new systems, there was a generalized belief that traditional undergraduate education was not a sound business. Most well established institutions of higher learning are not able to keep their doors open on income generated from independent income streams not ultimately beholden to external support. One computer science faculty member made that clear:

> The fundamental thing is that people do not donate money to for-profit companies, and...most successful educational organizations are beneficiaries of government of philanthropy, and I think that is fundamentally because for most kinds of education people need the education at a time when they are not highly able to pay for it themselves. So those social mechanisms are ways to help people who don't have the financial means to better themselves. And the for-profit companies are sort of at odds with that, or sort of can be depending on how it's structured or not. (Interview 2018a)

However, the vocal critical voices of dissent in the CS department did not stop Daphne Koller and Andrew Ng from pursuing a venture capital backed for-profit company to explore further development of MOOCs. As discussed below, this decision was facilitated and shaped by the strong advocacy of elite administrators at Stanford. While the CS department was conflicted about how best to advance the development of these new tools, administrators were much more certain about how best to shape and direct these new ventures. As one CS faculty member explained, Koller and Ng acted as individuals without the support or endorsement of the full CS faculty:

> ***Subject:*** …the decision to create Coursera was a unilateral decision of Daphne and Andrew and possibly John Hennessy. It was not a vote of my department or any university entity…I think Hennessy was acting as a private entrepreneurial individual in helping them set up the company. It wasn't an official university action to create Coursera.
> ***Interviewer:*** So is that normal here?
> ***Subject:*** I don't know what's normal, I mean different presidents behave differently. This is a guy who was heavily involved in business…Yeah, he's on the boards of multiple companies and he's involved with Silicon Valley, and

> he's well known and he knows VC's and others well. So it's not out of the normal [range] of his activity to back, or to put in a good word for a Stanford Company. (Interview 2018a)

The confidential planning that was underway in early 2012 to launch Coursera was guided by the strong hand of a university president like few others. John Hennessy, who was nearing the end of his tenure at the helm of Stanford, had amassed an unparalleled network of technology pioneers and financers in his many ventures as a public and private individual. As the next section will show, Stanford's response to the MOOC movement was dramatically shaped by his unique perspective and advocacy.

Entrepreneurialism from Above

No single voice advocating a for-profit path was more influential or consequential than that of John Hennessey. Described by some of the most powerful venture capitalists in the region as "the Godfather of Silicon Valley" (Auletta 2012), Hennessy built on the work of former Provost Terman by tying the priorities of Stanford together with those of local industry. His role in shaping the final decision made by Koller and Ng to pursue a for-profit venture was widely acknowledged as is represented by a senior computer science professors: "So John Hennessy was, I don't know first-hand, but my understanding second hand was that he was instrumental in setting up Coursera and getting them funded, and pushing for that model, so that was a big commitment from the university" (Interview 2018a). This section will undertake an analysis of how elite administrators at Stanford understood the MOOC movement which they faced in 2011, and how they guided their organization in response. It will become clear that the tradition of Frederick Terman, who pioneered the effort to tie the fate of Stanford to the surrounding business community, had found a worthy standard bearer under the administration of John Hennessy.

As the consternation built on campus and across the field of higher education over the enrolments that were produced by Stanford's first three MOOCs, trustees and elite administrators were analyzing the field and crafting a response. This began with an assessment of the problem. For Stanford's leaders, who were all veterans (or instigators) of the disruptive waves which had hit other industries, the main concern was *disintermediation*. In industries such as newspaper publishing, leaders of even the largest and most important organizations were too slow to realize that online services were providing new services at lower cost that could compete with some of their most important revenue streams. In particular, by breaking out classified, and transforming subscription delivery models, papers across all levels of American life experienced gaping holes in their budgets. The carnage across the industry advertising revenue was estimated to have declined by two thirds between 2000 and 2013, and the number of newspaper firms is thought to have declined by nearly one third (Wikipedia 2018b). In the case of MOOCs the specific concern was that new organizations would offer to compensate individual faculty members for course materials without consideration for the universities at which they work. Those universities make massive investments in faculty members over the course of their careers and they are the core of the value proposition for matriculated students. If one of these new organizations could convince a few dozen or even one hundred faculty members to sign over rights to their most popular and effective course for one time payments, traditional universities feared that would have a key revenue stream dry up in short order.

Stanford administrators believed there was an acute risk that new MOOC startups would engage faculty to offer higher education course content directly to learners, therefore undermining the traditional intermediate role played by universities. One elite administrator explained that:

> [We were talking about how Daphne and Andrew should respond and]...how it should be structured, as an independent for-profit, or as part of a university. I think they at the time might have been just as happy either way. And John really felt that it should be a for-profit otherwise it's not going to compete with lots of other companies that are going to get into this very quickly. In particular you have the background of Sebastian, moving on his own, and I'll tell you what our fear was. Our worry was, are universities going to be disintermediated? So, will these kinds of companies form and then contract directly with our faculty to produce these courses, and would this then replace large portions of higher education? Then you have this problem of the business model, like the New York Times, where they get disintermediated, and all of a sudden their revenue sources go away, but they are really spending all this money to produce the news, and everybody is just parasitically using it. And so we didn't want that to happen. And so on the other hand we felt they needed to do this as a for-profit, so we told them we would help them get going provided they made their model, their business model, that they would deal directly with universities, and material would always be branded by the universities, so this would be produced by Stanford University. This would be a Stanford course. And the payments would be to the universities and the universities would reimburse the faculty for their work on it. (Interview 2017d)

At the heart of this approach was ensuring that a major player in the market would provide universities an outlet for technology mediated courses that kept the home institutions of the faculty at the center of the negotiation over ownership and reimbursement scheme. Thinking about the sort of company that they preferred, an administrator explained:

> …this company needs to work with universities, and the universities can figure out their reimbursement scheme for the faculty. And they loved that idea. They were happy with it and not in any way resistant. And in fact they liked the idea of working directly with universities, and they are, particularly Daphne, was a very loyal faculty member. [John] was convinced this was going to be the wave of the future, and that this would replace a lot of instruction…the tsunami. A potential threat not to our business, you know Stanford's business, because we occupy a very tiny niche in a very special piece of higher education. But, certainly, he thought, to Cal State, or Community Colleges, so who knows how many of them would really be replaced by MOOCs. (Interview 2017d)

While the risks to the broad access sector of American higher education were identified, there was a more general resistance to the idea that any online provider would undervalue the investment that universities make in their faculty by exploiting it without attribution or compensation. This perspective was well summarized below:

> …So the last thing I wanted was to see the universities, if this had legs, if something really developed out of this, I didn't want the universities to be disintermediated, and so I wanted to make sure that the universities kept control of their content. Universities spend huge amounts on their faculty, who developed the content, and so picking off [faculty]…you know getting them to then take that content and provide it for what is in effect a pittance to a company. They might not think it's a pittance, the faculty may not think it's a pittance, the faculty member thinks: This company is paying me $10,000 or you know, whatever. This is great! I'll just let them record some videos, or even $100,000. You know that's a pittance in comparison to what the university invests in that same faculty member to put that faculty member in the position to create that content. So I didn't want the disintermediation to happen, and that's why we, on the one hand, encouraged Daphne and Andrew to do a for-profit so they could move fast enough to be competitive...(Interview 2017d)

If the problem identified by Stanford administrators was potential disintermediation, the solution was to back a company that could move quickly in securing a large enough market share and profile to give universities a credible outlet for MOOC based online activities.

Most of the elite administrators interviewed believed university consortiums were simply not capable of moving quickly enough to secure the relevant market share, or human capital, needed to defend against less scrupulous upstarts. In a particularly poignant example of the pace of innovation possible across multiple universities, one administrator told a story about a prior experience during the 1990's to help the State of California carve out an online higher education niche. Then Governor Wilson wanted to reach agreement between the UC and private universities including Stanford, to pursue a new venture to compete with Western Governors University.

> There was a state task force at the Governor's Office to talk about online universities and online instruction, and this was back in the 1990s. And I was the representative from Stanford, and there were representatives from the UC's…[we were discussing the] Western Governors University startup, and should we have a California University online…but the California online university never materialized. And partly it was because it was very, very, funny actually. So at these meetings, this is the Governor's Task Force, whoever was running these things would say, can we get an agreement that the universities would do such and such. And I could say, yeah, Stanford will do that. And then the UC people would say "Well, that's got to go through the faculty Senate and we could probably get you an answer in a year." So, you know, my god! What a difference…That actually opened my eyes to the difference between these. I knew I could say yes because I would come back to the university and say: "Gerhart, we need to do this." And he'd say, ok, we'll do that. So I could sit there in the meeting and say yeah, we could do that. And literally, the UC people thought it would be a year before they could answer. (Interview 2017d)

Even universities that were not embedded in complex multi-campus systems had relative disadvantages vis-à-vis venture backed startups. One example was money, which could come more quickly and in greater quantities if Coursera decided to incorporate as a for-profit. This was first-hand knowledge for John Hennessy. While a faculty member in engineering, he left Stanford for a year in 1984 to found MIPS Systems, a semiconductor company which was sold less than a decade later for $230 million. An administrator familiar with the case explained: "So John Hennessey knew this very well from his own life experience…what Silicon Valley startups were like. We knew very well the amount of money that [Stanford] would invest in comparison to the amount of money that a venture capitalist would invest" (Interview 2017d).

So, after assessing the threat, and weighing the potential organizational structure of a response, Stanford administrators decided that the threat was real, that a consortium of universities would move too slowly to meet the challenge, and that incorporating this endeavor as a for-profit entity could enable rapid expansion. One elite administrator summarized it well:

> The question was, basically, did we want to set up a Stanford version, some sort of Stanford operation, or a consortium of other universities possibly, and do it as a non-profit as part of the universities, or...would it be better to spin it off as a for-profit standalone. And in the background we've also got...Sebastian. So Sebastian had taken leave from Stanford and gone to Google and they were mainly interested in him for the self-driving car work that he'd done here, but also just in general developing AI. And he got very interested in this idea of MOOCs, and there were some very, very, tense relationships between Sebastian and Daphne and Andrew. And Daphne and Andrew felt that he had just stolen their work and so forth. So he was pushing forward about how...this was going to transform education so they were very anxious to get moving very quickly and set up something. Now John and I both thought that in order to get moving very quickly the best way to do it is with a for-profit company. Universities, and particularly consortia, do not move quickly...speaking quite frankly, universities cannot hire the quality of people and coders and so forth and so on, compared to companies. Why? Because you first of all can pay them more, and secondly there is the upside of stock options so you can get these really quite good technical people but it's really hard for universities to compete there. Secondly, the amount of money you can throw at something, you know venture money, is much, much, higher than we would invest in as a university. And the time scales are just different. So you can move much more quickly. (Interview 2017d)

With access to more money, and the potential to hire quality computer programmers by enticing them with an ownership stake, leadership believed an entity like Coursera could prevent the disintermediation of higher education.

The decision to structure Coursera as a startup was not in any way an endorsement of the for-profit education sector represented by the University of Phoenix and its peer institutions. In fact, administrators went out of their way to differentiate their activities from these lower status universities. One such distinction was made by a member of Stanford's leadership team reflecting on the frequent concern he faced from faculty members who had strong categorical biases against for-profit educational providers:

> I have very negative views of for-profit universities like the University of Phoenix. The motivation is interesting. How the motivations [consequences and incentives] are ultimately quite different...You know non-profit universities and state universities, they basically compete on the basis of quality. People don't understand this but the US universities are very competitive with one another, unlike universities in Germany where it is a much more centrally run operation. But we compete based on quality. We compete for students, and we compete for faculty. We don't compete on the basis of price, and we certainly are not trying to, you know, generate a large profit. And the profit motive, and having shareholders, makes for a different set of motivations that are not necessarily student centric. and in fact can pull in exactly the opposite direction. And I think that we've seen, not all for-profit universities, but we've seen a lot of for-profit universities that are just…they are scams. And I include some of the big ones in that. And so, you know...I think that's probably part of what they thought it was. They thought doing this as a for-profit, what's going to prevent it from becoming like the University of Phoenix, or one of these other universities that doesn't take student interests seriously….(Interview 2017d)

Given the impetus for structing Coursera as a for-profit, elite administrators rejected criticism that their incorporation status would inevitably lead toward the same outcomes as were witnessed in the larger for-profit sector. In fact, multiple respondents with access to decisionmakers in Cambridge implied that some of this resistance emanated from there:

> I'm not particularly inclined toward the for-profit model. But there was a particular reason that we felt this had to be for-profit, just to move fast enough, and I can easily see Rafael [Reif] and Allen [Garber] saying no, we're not comfortable with the for-profits, and with giving our content to for-profits, so let's keep it internal, and they created their operation.(Interview 2017d)

With pace and flexibility central priorities, and given the need to attract top talent which was in high demand, leadership at Stanford believed they could use the market to craft a different sort of higher education content that would protect the role of traditional universities as intermediaries between faculty and learners.

After having decided to launch Coursera as a for-profit, Stanford administrators began to consider how they might provide a competitive advantage for this new venture. If understood as a defensive maneuver to protect against disintermediation, Coursera would only be helpful it could avoid being beaten to market by Udacity or some other Silicon Valley startup. While the lines between community service and self-interest were not always clear (and will be described in more detail later), local leadership was unified in their desire to see Koller and Ng's project have more success than Thurn's:

> That was the big one as far as structuring it, making it for-profit because that was the only way it was going to be able to compete with the other companies that looked like they were going to be created… I wanted them to win rather than Sebastian, who was doing this different model, or any of the other possible players who might appear in this game. I like Sebastian, but I was

> kind of irritated with some of the things he was saying when he went off like this on the MOOC stuff. (Interview 2017d)

There was a clear distinction between how local faculty thought about Thrun's project, Udacity, which was seen as bearing almost no allegiance to traditional faculty or universities, and a project that Koller and Ng might get off the ground. This administrator continued:

> He was spouting this stuff about how there were going to be 10 universities left. The red pill and the blue pill...have you seen these videos? Which do you choose? Sebastian is a very smart guy but he's also a showman. He's really a showman. So he was going in this other direction, and so Daphne and Andrew said, yeah, this is the way we want to go. We want to structure it the way you guys want it…(Interview 2017d)

The perception of loyalty enjoyed by Koller and Ng, earned over years of working to serve local needs with new technological tools to strengthen pedagogy, turned out to be a sizable asset to the project that would become Coursera. As they headed to launch, this new project recruited a hugely valuable asset within Silicon Valley and beyond: the personal support of Stanford's top leaders. This support took the form of phone calls to peers across the field of higher education and funders across the valley:

> So we made the phone calls and basically pitched this idea, that we don't want to happen to universities what happened to newspapers. So Coursera is structuring this the right way, so we encouraged these other universities to sign on with Coursera. Now a couple of things. The fact that it was for-profit, we tried to explain to them why we thought it had to be for-profit. Internet time, things move so much faster, and so forth and so on, and we will not be able to do it, no university is going to be able to do it fast enough, and a consortium of universities would be even worse. (Interview 2017d)

Here again the pitch focused on the speed by which things would have to move to capitalize on these new possibilities, with the for-profit status following from that fact.

The desire of Stanford leadership to see a new project with their blessing succeed in a competition against other potential MOOC upstarts was translated into direct action. The imperative to fend off disintermediation led to top administrators weighing in shifted the balance in the direction of Coursera, as explained by a person familiar with the strategy:

> You asked why was Coursera able to put together all of these universities so quickly, well, because they had help. And why were we helping? It was not something that we normally do...When a faculty member starts up a company it's not as if the university really gets involved. Why did we get involved? Well we got involved because of this fear of disintermediation, and we had seeded this idea in Coursera's founders' minds that this is how they were going to structure it. Now, as a matter of fact, I think to a certain extent it has not worked in the sense that...People think of these as Coursera courses. And you'll see people saying "thank you Coursera for doing all this". It's not "thank you Stanford, or thank you Michigan, or thank you Penn", it's "thank

> you Coursera". But who cares? The key thing is that, I think, for example, Coursera...one of the things that they have found very effective is these little agglomerations of courses where you get a certificate for taking a number of things. You're probably more up on this than I am. But that's being done with the universities. Either it's a university that gives this, and it's a group of their courses, or I think maybe in some cases they'll have several courses from several universities, but the universities are involved, and they have a very generous royalty stream that then goes to the universities. So they have actually kept to their promise about not cutting the universities out. And the fact that Rick Levin was their CEO after Daphne because Rick understands universities and…(Interview 2017d)

Here the original concept of launching a for-profit entity with university backing was described as emanating from elite administrators who found receptive collaborators in Koller and Ng. While the ultimate balancing of power between new digital startups and universities has not yet been fully established, the leadership who crafted that plan were generally pleased that their strategy defended the position of universities as mediators between faculty and learners.

Given the deep experience many among the Stanford leadership had with ensuring a positive bottom line, and the long history SCPD enjoyed as a revenue generating unit, there was remarkably little concern for the ultimate profitability of an entity produced to deliver MOOCs. In this regard the demonstration of a large market was sufficient to pursue a project like Coursera with the assumption that concerns about profitability could be delayed.

> I don't think Facebook...[or should I say], many other things started without a clear business model. You know I was in the department when Google was started. You know Google was the 5th or 10th search engines, and none of the other search engines made any money, so who's to say that this one will make any money? So who knows? Things that start out as being...I'll put it another way. If there is a clear need and there is an audience and you can connect with them, then there is a business problem you can try to solve. But if you don't have any interest then the question is moot. So at least demonstrating that there is something of interest...But in retrospect there was much more to it. There was a lot of hope and optimism and I think that let people overestimate the degree to which video based university courses would be applicable and relevant to very large segments of the world population…(Interview 2018a)

With proven interest in the type of offerings provided by the first MOOCs, and with a perceived imperative from top administrators to launch a certain type of organization, the only remaining concern was how exactly Stanford administrators might encourage the growth and development of such an experiment.

The one person who was repeatedly described as being instrumental in this project was John Hennessy, who had remarkably deep connections across the field of higher education as well as across the Valley. With well over a decade of experience at the helm of Stanford by the start of the MOOC movement, Hennessy had become more and more concerned with escalating costs facing higher education at large, and what might be done to ameliorate issues of unaffordability in the future. The entrenched cost increase for skilled labor at the heart of higher education's teaching mission dogged especially those campuses with broad access missions,

smaller endowments, and less intensive research foci. But unlike most other higher education administrators, Hennessy's unique position in the field gave him dramatic powers to shape the direction of the field:

> And so they were convinced that yes, this needed to be done, and it needed to be done quickly, and they didn't want universities to lose their content, but they didn't want to be dealing with a for-profit company, and so they went their direction. It all started at the same time primarily because, to be very honest with you, primarily because John Hennessy had become such a believer, and he was convinced that it was all going to happen and it was going to really threaten universities and so forth and so on. And I believed it would create a new outlet for education, it would have a niche. (Interview 2017d)

One of the reasons Hennessey had reached this conclusion was his long personal history of experimenting with technology in his own teaching. What's more, the labor required to grade the main method of evaluation in his discipline, technical problem sets, seemed ideal targets for automation. Using his personal experience with nascent versions of these technologies to project their potential impact across higher education at large, Hennessy was particularly sanguine about the efficiencies that might be delivered with these new platforms.

> ***Subject:*** John…sees these things from different perspectives that depends on what part of the elephant you're touching. And one of the things about John is he's a computer scientist, and he taught his courses, he's actually electrical engineering, and his courses tended to be very, very, large courses, and so very little interaction. And they are also in a technical field, where it is reasonable to think that you could get computers to provide the kind of interactional feedback that you need…you need to figure out some way to give feedback to the student, and be able to test them on their knowledge, in a field it's going to make a huge difference there. And John was and is, or was, much more bullish on what kinds of techniques could learn to be useful. Like, would we be able to get decent feedback for a writing course, would we be able to grade short answers, short free form answers? And he thought they were making real progress on this. Of course they are making progress but it's in ways that are so typically in...you know they are doing it in terms of identifying, does this answer have the right words? Oh, it has the right words in it, so this is probably the right answer. Well, maybe there was a not in there.
> ***Interviewer***: There's lot of ways to use the right words in the wrong ways.
> ***Subject***: Exactly. So John was much more bullish about the applicability, but also, I think at some point...So I have a particular view of education, and what undergraduate education does. (Interview 2017d)

In the early 2010's a number of new techniques of computational text analysis had become popularly available and technically accessible in ways that had not previously been thought possible. Early visionaries believed rapid progress could be achieved in decreasing human labor by linking these technologies to the mundane process of routine grading in writing-intensive courses. While these breakthroughs have not been widely implemented or shown to effectively reduce costs, it was not unimaginable that they wouldn't in 2012.

These multiple elements of Hennessy's personal experience aligned to entice him into action. Having been convinced of the potential "tsunami" represented by these platforms, Hennessy set to work with fellow elite administrators to ensure their chosen project enter the field successfully. When asked how it was that Coursera got off to such a successful start signing up elite universities, one elite administrator explained "…John helped Coursera in two ways. One is by lining up his friends in the Venture Community. And then the second way was that we pitched it to universities" (Interview 2017d). Expanding on the initiative taken by Hennessy and other elite Stanford administrators, this person continued:

> Two things: one is, John helped by getting some of the VCs, telling some of the VCs, you need to talk to Daphne and Andrew, so they put together some really good funding from really top VCs. And I don't remember...I think the first round was $20 million or something. That's not a trivial amount of money for a startup to raise, in probably two days, or three days, thanks to John's help. So that was the first way that we helped, getting them introduced to the VCs, and John giving, no doubt, part of the pitch, and basically saying this is going to change higher education...he was quite an enthusiast. And the other thing we did though, we made calls. John called a bunch of his colleagues, a bunch of the presidents, and some of the provosts, basically saying, pitching to them, that "we want to do this this way because we don't want universities to be disintermediated, so why don't you join on board, and Coursera is going to start-up". And a whole bunch of the universities did. And then there were a few universities that held out and didn't specifically because Coursera was for-profit. (Interview 2017d)

The actions taken by Hennessy were not trivial. As an esteemed figure on campus and across Silicon Valley his actions carried a great deal of weight, and he used that heft to promote Coursera's success. The concern for disintermediation documented above was not unreasonable, and the affordances of a for profit business model did address some of the risks associated with that concern. However, Hennessy's multiple roles as university president, personal and professional associate of Koller and Ng, and venture capital investor and entrepreneur muddied his involvement in Coursera.

Itemizing the exact nature of the personal and institutional financial ties between Hennessy, Coursera, and Stanford is complicated by the opacity of early venture funding. The level of engagement that top leadership at Stanford had with Coursera was outstanding relative to local norms surrounding faculty startups, a point made by another elite administrator familiar with Stanford's connections with Coursera:

> We generally don't fund faculty startups. In fact we have a policy not to provide funding. We do have a policy when it's our intellectual property, that is to say it is intellectual property that is being licensed that we reserve the right to invest alongside venture capital at I think 10%. So if a venture fund puts in $10 million we can put in $1 million and get the same portion of the company they did. And we probably did that with Coursera. I actually can't remember. But it kind of became our standard policy. So the reason we don't invest directly, so we won't fund a faculty startup, is because that...we're not the experts at doing that. We're not the experts in making ventures. That's

> what the venture capitalists do. John was somewhat, slightly different, because…he's pretty close [to a venture capitalist]. So having this policy of saying ok, we reserve the right to put in money since it's dependent upon our intellectual property, we're the owners of that intellectual property, is a good way of using their expertise to make the decisions. We're not making the decision we just kind of piggy back. And so I suspect that...I think that there was very likely some Stanford money, but it was piggy back money. (Interview 2017d)

Under the circumstances described above, the complexity of the role played by Hennessy is impressive. While university policy dictates that Stanford only come in as an investor behind venture capital firms that are perceived to be experts in assessing business opportunity and risk, the distinction is blurred when a university president advocates for and facilitates venture capital support. What's more, the venture firms invited to participate in the this new venture, and the actual principals who took positions on the board, have long financial and personal ties to Hennessy. A Wall Street Journal article in 2007 outlined the complexity of these links, noting that Hennessy was personally invested in Kleiner Perkins Caufield & Byers (KPCB), one of the largest and most successful VC firms in the Valley. His invitation to join the exclusive fund was delivered by John Doerr, principal of KPCB, who recruited Hennessy to join the board of Google a few months before it went public (Hechinger & Buckman 2007). While none of the interview subjects in this study brought up the direct link, it should be noted that KPCB led the Series A funding round for Coursera and continued to invest in subsequent opportunities. Furthermore, John Doerr personally joined Coursera's board of directors in April 2012.[34]

The role of advocate and ambassador played by Hennessy given his less than transparent institutional and financial interests in Coursera did not go unnoticed by observers on campus. As one member of the faculty senate during the MOOC movement reflected when asked about their thoughts on the hybrid role and overlapping financial ties that Hennessy might have had with Coursera:

> I did look once at John Hennessy's profile, and some of this is public information about his actual stocks, and I was blown away. You've seen it?... Blown away. So that's what I'm saying. There were some points, some moments where you had to wonder if auditors, or someone came in...the government...I don't know if there are laws...because some of this is a grey area. If this was truly above scale, above you know, if it was true, or if it was in a grey zone of ethics I don't know. And I didn't know enough about the law, I don't know enough about the law to know, but I do know it's kind of like the emoluments clauses when you are talking about with who the president is now. It's just one of those things, there just is not a lot of precedent, so what do you do? (Interview 2017c)

[34] As private firms, public financial disclosures of Coursera and KPCB are limited. It is not entirely clear if the financial arrangements pointed out in the Wall Street Journal article persisted through 2012, but there is no evidence that Hennessy sold his stake in KPCB since the original public disclosure of the financial tie in 2007.

While it is extremely difficult to access a comprehensive picture of President Hennessy's financial holdings, or the local investments he's made in his hybrid role, it is clear he's embraced a very broad conception of Truman and Hoover's original strategy to tie Stanford's success to that of local industry. The logic of action on display was well-rehearsed, pioneered, and perfected in the Silicon Valley regional economy. What made this particular endeavor so consequential for the field of higher education was its application to one of the core elements of higher education: facilitating teaching and learning

Faculty Engagement Pacification via New Platforms

As Stanford's response to the MOOC movement began to take shape among members of the CS department and Stanford leadership, questions remained about how the faculty might respond to these new developments. Unlike both MIT and Harvard, Stanford boasts a wide array of world renowned departments across traditional arts and science disciplines, applied science and engineering, and a number of top ranked professional schools. The disciplinary and professional diversity featured across campus meant that many important constituencies did not have a front row seat to the advent of MOOCs in the CS department. These other faculty had to find alternative sources of information and outlets to share their opinions on campus and beyond. This section reviews evidence pertaining to the response from these other areas of campus. In particular, it looks at how a broader set of administrators viewed these actions. It goes on to evaluate how these developments were received in other representative faculty bodies and particularly within the School of Education, a nominally critical location for pedological research and practice. The section concludes by discussing some of the motivating factors that encouraged a second wave of faculty to offer their courses on nascent MOOC platforms.

As the contours of the first two MOOC organizations began to take shape, many on campus wondered how these developments might impact local faculty. Aside from the existential questions pertaining to the future of the university, additional practical questions about who might teach future MOOCs, under what conditions, and what sort of oversight role might be carved out for faculty surfaced. One of the most striking things about the early MOOC movement at Stanford was the near total lack of resistance to the overall direction that MOOCs were taking. This stood in contrast to most other quarters of higher education, where faculty were speaking out against these new experiments as individuals and in organized groups. One of the people charged with gauging faculty sentiment was a member of an early oversite committee who reported:

> I was asked…to serve on a faculty committee on policy and plans for this. So…I started going around the departments and places that would invite me and talking about it. And I got very heated kinds of responses but I don't remember them saying you shouldn't do that. They were more, what about me! Like, that's ok for science and engineering, but what are you going to do for the humanities? What are you going to do for the arts?...It was more about equity across fields, which I think is a positive thing. (Interview 2018a)

The extent to which this mirrored relative strength of parts of campus was not entirely clear. It is possible that the social sciences, humanities, and arts departments did not have the power to resist such initiatives when they came from the larger and wealthier engineering quad on campus. It is also a possibility that this is an extension of predetermined local political arrangements where the only condition on the continued hegemony of engineering was that they

continue to offer handsome subsidies to other disciplines in spite of their relatively paltry share of the teaching burden.

Additionally, the early framing of these experiments, which drew heavily on liberal notions of expanding access, global civic virtue, and cost reduction, made direct opposition less likely in 2012. Outlining how this framing set the terms of the debate one faculty senate member explained:

> They subscribe to the frame of the democratization of education. They talked about inequality. Here's the globalization of education, providing greater access to those who don't have it – mind you still needed a computer and access to WiFi and the internet – and so that was the kind of liberal progressive framing that was put on it. And you couldn't really fight with that. Like yeah, you're talking about massive access, this is how we improve the literacy rate, and the numeracy rates, in all kinds of transferal of information around the world so that is just not owned by a specific social class, right. (Interview 2017c)

Liberal frames which prioritized the social utility and contributions that these endeavors might make were harmonious with the perceived priorities of some of the most important philanthropic constituencies at Stanford: the Trustees.

One faculty member familiar with the formal priorities of Trustees in the online higher education space explained:

> I feel like, and I may be just an overly optimistic person, I may be missing some pieces, but my perception of the Stanford culture is that we are sort of free to be idealistic because somehow the finances have been good. And so I think if you look at this from the point of view of a donor, which is a representative view of the board, if I'm going to donate money, or if I'm going to do something at this institution, I'd like it to go to as many people as possible. I'd like to do the greatest good for the largest number of people I can. If you're a philanthropist, that's a common thing. You like to have a measure of impact, and one measure of impact is who is benefiting from this? (Interview 2018a)

But the Stanford trustees, much like top Stanford leadership were not unaware of the profit potential that online course delivery might have if the model could be refined:

> I think most trustees that I talked to…there was a designated board of trustees committee on online education for a number of years, and they were very enthusiastic about the idea of expanding online. To characterize it simply, and maybe too crudely, they saw this as a business opportunity. It was analogous to a business opportunity for a business. Market share is a thing that people in industry talk about. And people say: "wow, you could reach more people and it would be a good thing". (Interview 2018a)

As liberal frames of openness, cost reduction, and access disarmed potentially critical voices, there was strong interest stemming from the philanthropic and commercial opportunities which existed at the time.

To further pacify any local concern, administrators turned to a time honored tool: free money. To ensure that the concerns about equity of access to these new platforms were addressed, a new position called the Vice Provost for Online Learning was created. One of the first actions taken by the new office was to unlock enough grant money to fund a few dozen new faculty MOOCs from across the campus. In describing the generous strategy, one VPOL representative explained:

> That was just kind of a unilateral decision. We had some extra money from the grant that was previous to the whole MOOC thing, so I thought the best way to kind of help the university be successful was to start giving people grants to do online courses if that was what they wanted to do. And so we just took the money that was sitting unallocated, and said let's just do this…giving away money is a good thing! The framework there was that the earlier grant from John Hennessy had paid for one staff member (a programmer) and one position that was filled by Amy Collier. Jennifer Whitham, who was the chair of the CS department, put up the money to hire Jane Manning. And we had this pot of money left over from this grant that hired Amy, and I said we have some extra money, we have $100,000 let's just give it away. (Interview 2018a)

Having witnessed the independent launch of Udacity, encouraged and supported Coursera, and now offering extra money on local faculty experiments with online teaching, there were few controversial elements under the direct control of campus leadership. This meant that even bodies which had historically served in an oversite capacity, such as the Faculty Senate, weren't required to weigh in formally. This was confirmed by a representative of that body:

> No, the faculty senate was taking on some of those issues. We didn't have to vote on those per say. There were discussions about what was going on just to keep us informed. So it was all informational, it was all embryonic and kind of toddler development stages. I think where people...where the most discussion happened was around the ethics and conflict of interest. (Interview 2017c)

While no significant resistance materialized locally, significant doubts did persist about the ultimate utility of these new platforms to approximate pedagogical practices of higher education across the disciplines.

In particular, many faculty found the affordances of these nascent platforms extremely limiting. To faculty, the hype was often not matched by their early experience using the platforms:

> John Hennessy's pitch: "this is bringing the greatest teachers to the world, and bringing Stanford of the world". That's his job, right? From my point of view it was, I'm less interested in the course level stuff, and the credits, and things like that. I'm more interested in people having a satisfying learning experience. So the MOOCs never really, as the first generation, just couldn't do what I want to do. (Interview 2017b)

The following is another attempt by a faculty member with long term exposure to digital pedagogy to expounded on his early frustration using MOOC platforms:

> I do think the internet can deliver amazing instruction. I think videogames are pretty amazing. I think social media is pretty amazing. I think YouTube is pretty amazing, and I've learned to fix the toilet from it. The MOOCs are designed in a way that makes it very difficult to incorporate all these other strengths of technology. So computer simulations of various things, that's going to change, and when it does, it'll be a really interesting platform to do stuff on. Until then, it's a talking head with automatic or semi-automatic test grading. Which isn't a bad thing, you know, it's well worn. It's just that I don't teach that way, so I'm not interested. (Interview 2017b)

Discussion of these limitations were not limited to faculty who had hoped to integrate cutting edge digital pedagogy into their first MOOCs. Those faculty who taught reading and writing intensive courses found the limitations of the format significant:

> For those of us who taught content courses that were writing intensive, writing content courses, we didn't ever feel like we had a way in. I couldn't even imagine how you could do a MOOC where my courses required students to write these critical memos, and these critical papers, and to write proposals for new research. That was a kind of integrating critical analysis of all previously done research. I couldn't imagine thousands of people trying to that. (Interview 2017c)

The limitations ensured that only the most doggedly determined faculty, with the help of significant startup funds, were able to leverage the new tools to pursue MOOC versions of their content.

Within the Graduate School of Education, questions about MOOCs took on two forms. First, faculty were frustrated that what was billed as a once in a generation pedagogical innovation had materialized without anyone having consulted their department. One faculty member summarized their feeling stating: "within a school of education we're all sort of angry that we're not consulted about this" (Interview 2017b). In addition, there was generalized concern about the credentials of many of the most ardent MOOC enthusiasts and early instructors to define best practices in teaching and learning. One faculty member explained:

> Yes I think those of us who were skeptical, those of us who weren't jumping on the bandwagon...I remember lots of lunchtime conversations, backstage conversations, and even some front stage in the faculty meetings. But what about this, and what do we know about that? Mostly they were sidebar conversations I had with faculty, other faculty. So that's what I'm saying, you had your skeptics. You also had your people who were just more orthodox about learning. We're a school of education, this is one of the sites where we actually practice the science of how people learn. How you teach, and you know, ironically, the people who were teaching the MOOCs, or talking about MOOCs were not necessarily people we would have given the big teaching awards to for the best pedagogies on the campus. (Interview 2017c)

This same faculty member continued, highlighting the comprehensive social scientific approach to pedagogy and learning that defines research in the school of education:

> Honestly I think you have to understand enough about human behavior. If you aren't talking to psychologists, or talking to sociologists, or social psychologists, or neuroscientists, you aren't getting it. The other thing is about focus. When you're on these machines listening to this, depending on the matter, complex stuff, are you really listening? Are you really absorbing it? Do you really get it? You know the writing down of things right? And so I think there was some loss in...and to me there was some arrogance, and I do remember personally thinking that the people on the commercial side really didn't understand learning. They were just trying to get the volume. The promise was in the volume, but they knew very little about how we learn and how learning is a very social phenomenon, as well as a psychological phenomenon. (Interview 2017c)

In addition to broad skepticism about the pedagogical knowledge of the mostly CS faculty claiming to have platforms that would revolutionize the university, the significance of educational insights that might be gleaned from these technologies was questioned. In particular, the lack of invitations to collaborate across the CS/education school divide was highlighted as a central challenge to the future of the research program: "So there's that kind [interesting] stuff going on, but you need people who know how to do this, and are willing to collaborate. Most people who make MOOCs don't study learning" (Interview 2017b).

In general, those faculty who were seen to have pursued the most successful MOOC strategies were those with a strong sense of personal brand and a desire to expand it. Jo Boaler of the School of Education, who had a long history developing and delivering professional development curriculum to non-matriculated students, was often cited as a successful entrant into the MOOC domain:

> Jo Boaler, who's a math education person at Stanford...who still, I think, is quite famous and quite popular. She's got an international following for her approach to how to teach math to learners across the spectrum. And she trains, every summer, thousands of teachers around the globe. And if I recall correctly she even has her own company now. So that was really interesting too...she has her own company, she was working with Udacity. So I don't know what happened with that relationship. (Interview 2017c)

For faculty with preexisting infrastructure for professional development, these new platforms were opportunities to increase the reach of their brands and scale up the work that they were already doing.

Across the campus, those faculty in CS who did not leave the department to launch startups were also using newly available outreach strategies enabled by MOOCs to reach more people. For some, the strategy was not primarily about money. It was the assumption of many in surrounding departments that by and large most Stanford CS faculty didn't really need the money that might flow from delivering a few MOOCs: "computer scientists didn't really care [about the money]. They just really wanted to be famous. They don't need the money. They all have Google money, and Google friends and family stock I guess" (Interview 2017e). The

intoxicating nature of fame was also identified as a strong motivational factor by people close to the development of early MOOCs:

> You could read into this from a psychology perspective a bunch of different ways. Like these are the unpopular kids who now have a chance to be popular, and they're getting paid well. I mean I remember this. One of the first MOOCs Dan Boneh did, he was more excited about the fact that some of the students made a t-shirt of him than he was necessarily about his enrollments. Now he gets good enrollments and he's a great faculty member, but he's kind of jazzed about the teacher thing. I don't get it, but anyway. (Interview 2017e)

The confusion cited by the administrator above brings into sharp relief the challenges of understanding the power of fame to a career researcher. Under most circumstances, these professionals spend long careers relatively or entirely isolated from popular culture as they pursue their interests. While it is taken for granted that even the towering figures of most academic disciplines will never develop an audience beyond their neighbors in the most closely related fields, the modus operandi within academic disciplines is to expand your influence by training or converting disciples of your work. One faculty member explained:

> There is some sort of market like set of issues around faculty reputation, and brand reputation. So what business are you in as a faculty member? You are in the business of becoming known for your ideas and your work. And you can tie that to funding in areas where there is funding. You can tie that to promotion for people who have promotion ahead of them. It's certainly tied to influence in all manner of ways, and so if you are going to sit and spend your time trying to figure something out, or develop a position or opinion about something, then the more you can convey that effectively to more people the more rewarding that is. And that process of reaching a large number of people, or getting recognition, is consistent with other things that we do already. (Interview 2018a)

In spite of the limitations of the early MOOC platforms, the broad harmony between the political priorities of the faculty, and the generally positive approach that trustees and elite administrators took toward these new tools, created space for faculty experimentation. Those faculty who pursued MOOC versions of their own courses often did so to extend their personal brands.

What's the Matter with Cambridge?

The evidence presented above makes clear that Silicon Valley provided the spark that launched the MOOC movement. What's more, the early steps taken by administrators to pursue a strategy that involved spinning off Coursera and financing local MOOC faculty experiments was done with little if any concern for the positions taken in Cambridge by MIT or Harvard. In so far as external organizations were monitored for the positions they would take in relation to the MOOC movement, the organizations that were monitored were the firms and startups in Palo Alto and the surrounding towns (such as Udacity). The following section will review evidence pertaining to the influence of MIT and Harvard on the actions related to the MOOC movement. The section argues that aside from SCPD, who's early competition with MIT shaped part of their

open resource investment (SEE), neither MIT nor Harvard were taken seriously as bellwethers in the rapidly evolving MOOC movement.

While the East Coast has long been the intellectual epicenter of the United States, with a dense network of storied institutions of higher education, Stanford's assent in the field of higher education has seen it chart its own course. That course, inextricably linked to Silicon Valley and the practices of modern industry in the region, has yielded tremendous success and economic reward. However, only a few years before the advent of the MOOC movement, Stanford administrators were seriously entertaining the possibility of planting a flag in the densely populated educational geography of the North East. In December 2011 – only months before the MOOC explosion – Stanford withdrew a highly publicized bid to build a science and technology institute on a large plot of undeveloped land on Roosevelt Island in New York City. The project (which was ultimately secured by Cornell for pledges of $350 in new philanthropic donations) signaled to some local faculty that Stanford was not entirely confident without a physical presence in the intellectual and financial center of the US. One faculty member recalled:

> I was a part of the Senate when Stanford was trying to vie for a campus in New York City. And they didn't win that, or they pulled out, or something. Like what would that mean to sell yourself. Why does Stanford need to come east? And what it represented could already be reproduced on the East Coast. I think that the intellectual center of this country is on the East Coast and they wanted to be in closer proximity to that. (Interview 2017c)

For many Stanford's interest in eastward expansion represented a late phase in the steady assent of a challenger to Harvard's incumbent status. It should be noted, however, that the initiative pursued by Stanford administrators was not undertaken with consideration of Harvard or MIT in particular, but was rather an extension of local entrepreneurial inclinations.

The one location where there was at least passing acknowledgement of the importance of MIT as a critical reference point was in discussions with SCPD. By and large, SCPD is far more eclectic in its selection of peers than is Stanford University as a whole. This has a great deal to do with the imperative to generate revenue that is at the center of SCPD's mission. The schools that were often referenced did not often house elite CS departments, but rather featured revenue hungry middle tier engineering schools. One SCPD leader explained:

> We have a series of colleagues, Georgia Tech is someone we look to. We know those guys well. USC is doing pretty good work. Michigan does nice work especially in engineering. All these are in engineering education. We didn't really look to the business schools because they're not really online, and we still don't look to them. They don't really know what they are doing online…Those engineering schools, Wisconsin as well, we sort of kept tabs on those guys relative to some of this. We were pioneering, and we had the first online master's degree in engineering disciplines so that people were looking to us. (Interview 2017e)

These schools are often described as innovating out of necessity, be it geographic, financial, or bureaucratic:

> I think some of the folks that are ahead now are the same universities that have been thinking about this for a long time. So Georgia Tech and Michigan, Wisconsin…There are several second-tier universities that have done a really great job over the years, just out of necessity, right. You live in a place where it's cold, and you have people distributed across the state, they can't drive in the snow, so out of necessity can do more innovative things with technology to enable them access to education, right. You have a problem that has to be resolved...They don't get all the press for what they've done because they're not releasing things for free necessarily, they have budget constraints...(Interview 2017a)

While this subset of universities represent the core reference group, it was clear that MIT was not entirely ignored.

As reviewed above, MIT was considered as the impetus for Stanford Engineering Everywhere, a set of open educational resources that was designed to expand interest in SCPD's paid offerings. One SCPD staffer explained that relationship as follows:

> I personally viewed [the SEE] effort as almost like a contest with MIT. I mean it was sort of, who could release stuff to the public faster, first, better. There was a little bit of that going on in the background… And that was the sort of, could we get a press release about having the whole package available kind of a thing. That's where I'd say it was a competition. (Interview 2017a)

Other SCPD staffers were less willing to admit that MIT was a competitor, choosing to express disdain rather than to concede to monitoring them:

> We don't look to [MIT] at all. And they don't do anything online [that generates revenue]. This sort of OpenCourseWare thing, which I don't really get...just dump the slides and video and hopefully what?...I mean most of them are slides actually. They had this service, this Chuck Vest thing. Yeah, okay, have fun with that. Sounds like a waste of time to me…You take stuff online, and then you...what do they call it? [The new edX] micro-masters or something? Yeah, I don't get it. It's not a real Master's degree. Do you like have to use a magnifying glass for this transcript? What? We have graduate certificates, they are real, so do that! (Interview 2017e)

While exact financial records from edX are hard to come by, micro-masters have been one of Coursera's strongest revenue growth areas, generating millions of dollars for the startup.

In the campus beyond SCPD, the links to MIT are far more explicitly acknowledged. While it was not the case that early MOOC founders took MIT into consideration, other members of the CS department frequently cited MIT as the channel through which the concept reached Cambridge. One such recollection went as follows:

> My understanding, which I think is consistent with the timeline that I saw is that they were approached to work with Coursera. Daphne and others approached them around the Coursera effort, and they decided, I believe it must have been an MIT decision first, and then a Harvard decision to go along

> with them, that they didn't want...either they didn't want to be involved with a for-profit company, or they didn't want to be involved in something led by Stanford, or some combination of those two things. Those are the most likely reasons for that…(Interview 2018a)

In addition to serving as a bridge between the two intellectual centers, there were frequent references to the similarities between the two CS departments that transcended the actual strategies that each university pursued. One faculty member in CS at Stanford explained:

> In some sense I think that the discussions in the CS department that I remember might be a good way to imagine the internal debate at MIT [over MOOCs]. And the computer science department here is not the same as the leadership of MIT. The leadership of MIT covers a number of different fields. But at a very crude level, the engineering schools at Stanford and MIT, as an engineering and science institution, have similar, or vaguely similar cultures, so there is some sense that the nature of the argument here might reflect some of the thinking there. You know computer science is a new field, it's a relatively small field in an academic sense if you look at faculty and researchers. I think that if you looked at the current faculty of the Stanford Computer Science Department it's probably 60-80% graduate school graduates from Stanford, MIT, Carnegie Mellon, Berkeley, University of Washington, Georgia Tech, University of Wisconsin, you know five or 6 places, and the same is true about all those places. Just as a crude indicator, if you looked at graduate school background of the faculty here and the faculty there and three or four other departments they are not heavily different. So it's the same population in that sense, but the institutions have different procedures and different culture around this. (Interview 2018a)

The similarities that straddle the two departmental cultures was understood to be operative during the discussions over what to do about MOOCs. In particular, the local debates around the negative implications of pursuing a for-profit model were assumed to have transpired along similar dimensions at MIT:

> I don't know which was primary. My guess is that the financial thing was most significant, because we had had a very antagonistic...debate in which there was clear differences of opinion around the business model of Coursera, and the MIT leadership, Rafael Reif is a computer scientist, they are going to have a similar world view, and you would expect the same issues to arise there. (Interview 2018a)

The fact that Stanford and MIT seemed to come to diametrically opposed conclusions, one encouraging the spin-off of a for profit, and the other choosing a university controlled non-profit, was not a representation of cultural differences in the two CS departments overall. One Stanford CS faculty member explained:

> If you had asked for a vote in the CS department, you would have come with the MIT conclusion. Or you might have very well come to that conclusion. It

> seemed pretty evenly divided. Let's just say, I don't know how you'd estimate that, but I think the prevailing opinions were in favor of non-profits. (Interview 2018a)

The argument presented by this participant in the deliberations within the CS department at Stanford states that the cultures of the two important departments are more similar than different. This does not immediately challenge the description of the Stanford case as presented above; what set Stanford on a path toward aggressive commercialization of MOOC platforms was the work of a marginally situated instructor (Thrun) and a decision made at the highest levels of leadership which transpired completely independently of official departmental prerogatives.

Harvard, unlike MIT, almost never featured in the responses given by interview subjects. The dramatically smaller CS department, which is dwarfed in size and standing by the FAS or Harvard, did not draw much attention from local faculty:

> ***Interviewer*:** Do you look to Harvard as a barometer for where your field is going?
> ***Subject:*** No. I mean I have good friends who are at Harvard, or who have been at Harvard in the CS department. It's a small department, it's not as influential in terms of number of faculty or number of graduate students, or anything like that. They are all excellent people, but it's a smaller place and not...if you look at rankings they are not in the same category. (Interview 2018a)

The relative vibrancy of the Stanford CS department vis-à-vis it's counterpart at Harvard was a reality that was repeatedly referenced as having transformed the preferences of America's most highly sought-after undergraduates.

Faculty outside CS with personal experience at both Harvard and Stanford often reference the distinctly different cultures and how shifting student preferences have resulted in increasingly strong preference for Stanford at the expense of Harvard.

> And I think that's part of what students want. When I was [at Harvard] people were saying that Silicon Valley, Palo Alto, that was the new Wall Street. When I was an undergraduate, New York was where you wanted to go after you graduated. And now everybody is saying Silicon Valley was. So I think Stanford was benefiting from being a titan in higher education, and that culture, in many ways. And the demand, like the application rates...yeah because at some point Stanford had the most selective rate than any other college, only 5% were getting in. And I think that demand was pushing because people saw that area as the new Wall Street. This is where I'm going to make the money. (Interview 2017c)

These cultural differences are deep and longstanding, and shape the sorts of campuses that both students and faculty members move through. This was clearly explained by a senior social scientist with experience on both campuses:

> I do think it was really telling to me that computer science is the number one major at Stanford, and you can have a hard time filling Humanities classes, but

> you still do not at Harvard. So it's a highly Liberal Arts campus. That's the cultural difference between the two. So again, it's kind of like status and honor and a difference in cultural capital between the old aristocratic, kind of learned society, and the kind of new money, kind of innovative but quick, in the moment, presentism...is what I see. And that new digital technological culture really is taking a lot of our time away from the books and the archives. You know you still will see people filling the libraries and the archives at Harvard, I think, in a way that you wouldn't see there [at Stanford]. And I felt it…was so wonderful to go into the Widener Library, to be in those hallowed halls, and those dusty stacks. I may in [time at Stanford I've] gone to the library five, six times. Maybe once a year. And so that was a different thing for me. I could feel that. (Interview 2017c)

In spite of the classical intellectual climate at Harvard which was lauded by traditional faculty, there was no evidence that local administrators were frequently considering how to most effectively emulate the incumbent in the field. On the contrary, the most consistent reports I received about scanning the behavior of a rival went in the opposite direction, where it was well known that Harvard leadership spent a great deal of time and energy discerning the patterns and practices of Stanford. One such report follows:

> [After arriving at Harvard Provost Garber said to me] "you cannot believe it, the only university we talk about at the Harvard Corporation…and among the leadership is Stanford. Everyone is constantly talking about Stanford". And he had just come from here. In that context, I suspect that there was some, and I don't know how conscious it was, but there was probably some feeling about, if this is the way Stanford is going, we don't want to follow Stanford, or have Stanford be the leader and we're just signing on. So MIT and Harvard figured they had enough weight, and they do, that the pair of them partnering would instantly be a strong competitor for Coursera. So yeah, I think there probably was a bit of that competition. (Interview 2017c)

During the MOOC movement, as with many other contemporary events in higher education over the last decade, Stanford was hard at work plotting its own course in the context of rapidly evolving technical fields. While aware of Harvard as a competitor in many arenas, evidence presented here demonstrates that Stanford's intervention in a powerful new platform that had the perceived potential to transform the future of the university was taken without consideration for Harvard. In fact, more second hand accounts of Harvard's monitoring of events at Stanford were presented than the other way around.

Conclusion

The explosion of the MOOC movement in 2011 was not by design, and while the popular perception that Stanford gave birth to the MOOC movement has some validity, Stanford did not undertake a strategy to stimulate or capitalize on these events as a corporate entity. In fact, Stanford administrators (as well as faculty) expressed many of the same doubts and fears as these experiments came to light that were heard elsewhere in the field of higher education. While the rapid growth of MOOCs was not planned, it was made possible by years of experimentation and experience with component elements and business models that created a scaffolding for a series

of increasingly ambitious experiments. Once the match was lit, Stanford administrators seized on this intense local competition among computer science faculty to supersede local departmental resistance by encouraging the formation of a new entity to capitalize on the moment. In addition to the personal prerogative and interest in these new technologies, prior disruptive experience in related industries led the main actors to fear disruption from potential – and real – new entrants into the space. To fend off these challenges, it was decided that only a for-profit organizational structure would be able to move fast enough and retain the appropriate talent to compete in the marketplace. John Hennessy in particular played many roles – mentor and colleague, university president, personal investor, venture capitalist, and early evangelist – in his early actions which normalized MOOC experiments in the field of higher education. In this example Hennessy represented a shining example of a skilled social actor pursuing strategies in line with academic capitalism. Once university strategy was set the availability of these new platforms provided opportunities for faculty to extend their personal brands through projects that resonated with the local philanthropic constituencies and which provoked no significant resistance locally.

The next chapter turns to how these trends made their way to MIT and how they were received by the original point of contact in the CS department there. It will demonstrate that in addition to confirming many of the suspicions presented above by Stanford faculty, the translation of these trends into an MIT MOOC strategy caused more disruption and consternation at MIT than was experienced at Stanford. Furthermore, it will demonstrate the limitations of theories of academic capitalism in explaining the MOOC movement, as Stanford's early embrace of profit seeking was rejected in Cambridge. In spite of that, by *insourcing* the management and direction of MIT's MOOC response, MIT leadership aggravated longstanding divisions among the faculty.

5. MIT

On May 2, 2012 the presidents of MIT and Harvard were joined by a number of top computer science and engineering researchers from MIT to announce the launch of *edX*. This new joint venture to reimagine higher education pedagogy for the 21st century came with a substantial investment from both schools. The leadership team included many of the most sought after academic researchers and administrators in the world and the announcement of shared intent to build a platform for Massive Open Online Courses cemented them as core reform projects for the field at large. Following closely on the heels of a number of similar projects intimately associated with Stanford, the field of higher education seemed captivated by the potential of internet technologies to strengthen learning, expand access to high quality higher education, and reduce the cost of college. This chapter uses primary interviews to analyze the internal organizational processes that produced MIT's MOOC strategy with special attention to the construction of reference groups and perceptions of threat from other universities. In so doing it will argue that the rise of computational methods and computer science researchers within contemporary American society has reshaped the institutional arrangements of the university and the field of higher education at large.

The Massachusetts Institute of Technology holds a special place in American higher education. It counts among many American technical universities founded in the second half of the 19th century that addressed the growing need for skilled labor and scientific research in a rapidly industrializing nation. Over its 150 plus year history, MIT has established itself as the premier American polytechnic university, committed to transforming children of the middle class into scientific innovators and titans of future industry in the US. Over time, this model has been emulated globally by countries committed to industrial development such as India and China. In spite of its preeminence in its subfield, MIT has not historically featured prominently in the reference groups of America's richest and most selective elite universities.

Much of organizational sociology has been focused on developing theoretical tools that remains sensitive to agency and contingency while explaining structure and persistence in fields (Fligstein 2013). While much has been made of emergence and crisis within fields, less is known about the persistent and ongoing regular competition or "normal" jockeying between rivals over time which can subtly but consequentially reshape institutional arrangements and field level dynamics. Higher education has been a particularly compelling empirical case for researchers eager to understand how status competition has become increasingly governed by the logics of accountability and measurement in the 21st century. While each of these approaches point to ongoing struggle and constant jockeying at the broad center of the field, less work has been done to evaluate how elite universities compete to set priorities for the future and redefine what is to be emulated.

This chapter focuses on how one elite university, MIT, negotiated a new technological phenomenon (MOOCs) to defend its position in the field of higher education. MOOCs, or massive open online courses, represent a departure from traditional efforts to use the internet to deliver courses in higher education which have been expanding steadily for decades across all strata of higher education. Pioneered by a new set of actors (elite artificial intelligence researchers) who emerged at Stanford, MOOCs built on frames of quantification and efficiency associated with discourse about the modern internet (see Chapter 3). Their proponents argued that the techniques they pioneered in other fields could be used to dramatically alter the cost

structure of instruction in higher education, creating new opportunities to bring courses to scale, and potentially revolutionize learning (Bowen 2013; Rhoads et al. 2015).

Given the uncertainty of the venture, MIT pursued a distinct break with its earlier (and relatively successful) online learning efforts. While it carried forward a few of the core commitments of the prior program, such as formal institutional affiliation, non-profit status, and a rhetorical commitment to openness, a major demarcation was drawn. This break was enabled through presidential imperative, and was spearheaded by a new generation of rising stars in MIT's engineering and computer science community. These leaders modeled their new project after a startup, moving quickly and aggressively into a newly prioritized space. Behind the new imperative was a competitive threat from Stanford and an increasing sense of confidence vis-a-vis their long time cross town neighbor Harvard. This chapter argues that the increased centrality of a new generation of CS faculty who backed MOOCs, and their approach to innovation within the university, provoked challenges based around epistemology and disciplinary orientation. By analyzing MIT's response to the MOOC movement this chapter will demonstrate the complex organizational and field level processes that scaffold the rise of computational methods, and computer science experts, within social institutions.

OpenCourseWare - Origins, Resistance, Continuity

To understand MIT's strategy during the MOOC movement and its decision to commit fully to edX and MITx, it is critical to assess the organizational experience and resources available to the MIT community at the dawn of the mainstream MOOC movement in 2011 and 2012. This section advances a clear version of MIT's organizational history with internet enabled courses that focuses on the experience and legacy of OpenCourseWare (OCW). Many analysts of the MOOC movement's emergence at MIT have drawn a continuous line between OCW and edX (Rhoads 2015). These observers often highlight the continuities in non-profit status, the formal institutional affiliations, and the rhetorical commitment to openness which succeeded in pacifying resistance during the OCW era. Drawing on primary interviews, this section argues that actors responsible for creating and executing MIT's online strategy experienced this transformation as a distinct break, not a logical continuation from the past in terms of process, orientation, and the core constituencies involved.

The Origins of OCW

MIT has been a significant player in online higher education since its first major foray into the space in 2001 as made clear in Chapter 3. In the context of the stock market mania which defined the period during which the "dot-com" bubble was being inflated in the late 1990's, a number of universities began to experiment with models designed to generate revenue from the intellectual property generated in their classrooms (Noble 2003). High profile experiments at UCLA, Columbia (Fathom), and a consortium of elite campuses (AllLearn) all looked to create the conditions necessary to exploit financial returns from courseware (Noble 2003; Walsh 2011). Where many elite universities saw the potential for profit, MIT saw an opportunity to reinforce cultural values around openness and digital information. The cultural commitments of early internet pioneers, while simultaneously branding MIT as a communitarian foil to university marketization and profit seeking, were at the center of the OCW initiative. To accomplish their goals, leaders of the MIT computer science department – many of whom were early internet pioneers – joined forces with elite administrators to pursue a free and open path forward into the early digital age. As one administrator familiar with teaching and learning policy noted: "[we'd

heard about] Fathom, and they brought in some consultants to see what MIT should be doing and I think the consensus among the faculty, the consultants, and the senior administration was to give it away for free, which of course was an amazing decision" (Interview 2014b).

But the objective of OCW was never to teach per-se. Rather, it was an effort to remove high quality teaching materials from the private domain thereby strengthening the educational efforts of highly motivated individuals as well as ensuring other faculty had access to the most current teaching strategies of world renowned leaders in their fields. This concept was illustrated by a senior administrator who noted that at MIT "...everybody agrees, or at least everybody whom I've ever talked to, which means everybody, that OCW was, is, fundamentally a publishing endeavor. There is nothing negative about that...A learner could do what he or she wanted with that, just as I can take a text book in mechanics and try to teach myself" (Interview 2014b). While contributions to strengthening student learning were not absent from MIT's OCW strategy, they did not often materialize as the primary objective. Rather, leaders of MIT were most concerned with distinguishing MIT's brand identity in a rapidly changing field. As one faculty member charged with implementing OCW strategy noted about the branding strategy of OCW:

> It was in direct contrast to those [Fathom etc]. It was not an accident. It was like, there are moves to make things proprietary, to put things that you need to pay for. We want to do something that makes a statement, that says: this should be free and open to the world. This knowledge is...the world supports us, we should support the world. And that was definitely a philosophy. And it is one that caught on if you look around at other OpenCourseWares around the world. The measure of that initial investment could be measured in terms of what MIT did here, but really it could be measured in how that spread through the world. There are many other OpenCourseWares, and I think without that big push from the university I think it would have been hard for everybody else to follow […] I think that...people genuinely believe in [that] here. There is a part of our ethos here at MIT with software...there is an MIT license, that has definitely been part of our philosophy here, that knowledge should be open. (Interview 2014c)

This perspective acknowledges that "openness" has a strong cultural resonance at MIT, and is widely understood to be affiliated with the emergence of hacker culture and the politics of authors of computer software during the 1990s.

The public proclamation of OCW's openness seized on two critical elements within MIT's organizational culture: ambiguity about the potential for profit from courseware, and its commitment to contributing to the knowledge commons. The work of Kelty (2008) and Hal Abelson, a CS faculty member charged with developing OCW strategy, provide detailed accounts of this fusion (2007). When core members of this planning and implementation process were asked about the intellectual origins of the decision to open-source MIT's courseware for this project they affirmed these links through references to some of the most ardent advocates of openness for the *digital frontier*: "[we built on], Free Software Foundation, Creative Commons, all that stuff" (Interview 2014d). While there was some ambiguity about the ultimate target market for these offerings (students, scholars, practitioners, universities, etc.), the core commitment to contribute to the public domain was widely shared and clearly summarized by a faculty member with a long association with OCW: "We feel like we should be sharing all this

with the world and everybody should be doing the same. It was a philosophy and...we want to share this with other faculty members" (Interview 2014c). Pioneering their own brand of freedom and openness inspired by a version of liberal politics, they set out to resist the commercialization of computer software code, which had been squarely in the domain of esoteric academic research, guided by norms of open evaluation, peer review, and non-proprietary control. This group of computer science faculty and affiliated researchers engaged in a campaign to craft university strategy around these political orientations to a weary, if not significantly oppositional, faculty. In so doing they made great headway for the values of their movement and for MIT's brand through OCW.

Resistance to OCW

The failure of other universities to accomplish broad support for online initiatives clearly demonstrates that the near universal adoption of OCW at MIT was not inevitable. A combination of political efforts of local skilled faculty, staff, and administrators had to prepare the ground for this initiative. While OCW was able to accomplish widespread adoption within the MIT community, leaders and early proponents were sensitive to potential resistance. To appease this resistance, the initial launch of the project combined meaningful financial incentives for faculty who provided courseware for publication and with robust staff support which removed the entire technical burden from faculty.

Within the context of financial incentives and with technical barriers having been removed, early skepticism did not materialize into meaningful resistance. In particular, the main concerns at the earliest stage of the process surrounded the quality and utility of posting this material in the public domain. One key faculty member charged with explaining the OCW to the faculty prior to its launch noted: "…before we launched OpenCourseWare we had individual presentations to every single MIT department and people had all sorts of things to say. The biggest objection is: 'gee this stuff isn't good enough'" (Interview 2014c). As the project moved closer to launch other concerns came to the surface, but few of them gained sustained traction. In particular there were questions about what it meant to offer courseware – a core subset of the intellectual property produced by universities – for free while students and their families were being asked to pay large sums for their children to attend the residential university. One early advocate explained:

> …There are two different versions of [resistance around undermining our value proposition]. One is: "you are taking my stuff and giving it away for free", and there were, I don't know, three people who thought that. And the other one is, "you are undermining the value of an MIT education because you are saying you can get all this stuff for free", and that was interesting because we announced OpenCourseWare the day of freshman...pre-frosh...freshman parents bring them to MIT and learning that there is a giant tuition bill and they are there now saying, "gosh, MIT is now giving all this stuff away for free". You know, so you sort of have to work through that. (Interview 2014d)

While it was not clear that a satisfactory answer was developed for these questions, accounts of the uptake of OCW imply near universal agreement that the challenges which called into question the value proposition of MIT by OCW did not materialize in any significant or organized resistance from faculty, students, or their families. Another faculty member involved in OCW governance explained:

> …there wasn't a lot of resistance to that. I remember, I was skeptical at the start, like, this is a lot of money for putting our syllabus online, which is something that I was already doing and so I always made sure that my syllabus was on a webpage somewhere, everybody in the world could see it...so this seemed like a lot of money for people to do the same thing. And there were other critiques that people had: you know, if we are doing something in online education is this the thing we should definitely be doing at this point? But it sailed through pretty...there wasn't a lot of controversy around it. (Interview 2014c)

By articulating an online strategy that was in harmony with the ideology of a well-respected and significant campus constituency, providing incentives and support for faculty, and engaging in a broad campaign to pacify faculty concerns, MIT was able to launch a large scale online courseware strategy that survived well after many of its contemporaries. MIT's online strategy was intimately intertwined with OCW for the entire 2000's. This structure defined the institutional resources available to administrators as they attempted to craft an organizational strategy for the second decade of the 21st century.

OCW to edX: Continuity or Break?

Interest in MOOCs as a potential new form of tertiary pedagogy was taking hold on the West Coast by 2010. New tools were available at lower costs and the skills required to knit them together were becoming more broadly distributed (Walsh 2011). At the same time, administrators at MIT were engaged in a broad review of their instructional technology services which included a well-staffed committee charged with deciding OCW's future. In spite of generous foundation funding, which provided the technical and staff infrastructure to launch OCW and the financial incentives that popularized it among the faculty, significant questions remained as to the future financial sustainability of the project which had become closely associated with MIT's brand. The state of this conversation in the early 2010's was summarized by one faculty member as follows:

> ...[the sustainability of OCW] never was worked out so that is the issue now. We had a good run for what, 10 years or something. So the question is, how do you transform it into something else? And so far it's the standard answer, which is, you will keep asking people for money, and whether that will succeed or not I don't know. (2014-08-14) (Interview 2014d)

The committee, working closely with Bain Consulting (among others), developed a number of possibilities for the future of OCW. These new business models included the potential of *freemium* content[35], or the integration of advertising, into the existing OCW infrastructure to develop revenue.

Members of the committee charged with helping OCW into its next sustainable iteration recalled a rather unusual chain of events which complicated the direct lineage of OCW. Months after its first meeting, and prior to the development of a consensus at the committee level, their

[35] A business model where basic levels of functionality or access to a product are free but advanced features cost money.

work was cut short. Elite administrators prioritized launching edX within what most thought was a completely separate organizational infrastructure in pursuit of a new set of MOOC based online course technologies. One long serving faculty member with intimate knowledge of this committee process highlighted the peculiarity of this decision within the MIT context: "It's quite unusual for MIT...there are not a lot of administrative mandates [independent of faculty consensus] that sort of say we are going to do this thing...and that is pretty much what happened" (Interview 2014c). Any capacity for action at MIT was seen to derive its legitimacy from what is understood to be a remarkably unified and cohesive faculty community. In addition to the unusual premature conclusion to the work they had undertaken, a number of committee members also noted the seeming lack of comprehensive strategy. They frequently noted the rapid pace of change that marked the usurpation of the committee's mandate by the edX announcement: "So I think we would have done something perhaps slightly different if we had really evaluated all the stuff on the committee...I don't think we would have gone as quickly as we would have, and maybe we needed to, but I'm not sure" (Interview 2014c).

Rather than a direct institutional lineage traced to core staff members, faculty advocates, content, or resources, the linkages between OCW and edX were more symbolic than tangible. As explained by one senior faculty member affiliated with the committee:

> ...despite the fact that it clearly did not reflect all the things that we would have recommended, it held true to some of the MIT [values]: it was based on a free model, it was a non-profit, we put a lot of our own money into it. It was really something that was institutional, unlike Coursera and Udacity which were not institutional. So a lot of that was sort of fundamentally different, and I think consistent with the values that we have at MIT. (Interview 2014c)

This resonance of the values that inspired OCW and those which edX advertised were often cited and frequently implied during my interviews and in the academic and popular press. However, when asked directly about the seeming shift of focus away from OCW toward edX, one interview subject extremely familiar with the decision to launch edX was clear that there was no obvious or discernible plan as to how to integrate the two projects: "...MIT has put a lot of money into edX. But it's not as if there is a clear strategy there…What's going on here is that everything is too confused right now. Well it's had a few years. And I don't know what to say, it's mostly confusing right now. [Now both OCW and] edX have a sustainability problem" (Interview 2014d). The confusion which typified the broader forward looking strategy for edX was re-enforced in relation to the legacy of OCW. When asked if the open content from OCW was automatically carried over into edX one faculty member explained:

> You are putting your finger on the 10 questions that haven't been answered. Remember edX has no policy right now. No coherent policy, so there is no policy that says, "how does this align with OpenCourseWare?" The one out right now is the actual license...you understand there are two licenses. There is the license by which MIT puts this stuff out to the world, and then there is the license that faculty sign giving MIT permission to use the content. So that second license, it's been a long time since I looked at it, but it pretty much says, MIT has the right to use the stuff in OpenCourseWare. It doesn't say, for example, "MIT has the right to use this stuff in OpenCourseWare and give it to

> edX." Right, so all that, if you want to be formal, that has to be looked at in terms of policy and renegotiated. (Interview 2014d)

The terms of the disconnect between OCW and edX/MITx were often framed by interview subjects, especially those computer scientists familiar with the efforts to innovate licensing agreements around OCW, as a failure to heed the political objectives of openness which were at the core of OCW.

Remaining advocates of open software, many of whom were influenced by the Free Software Foundation's efforts at MIT and who were veterans of the Creative Commons License organizing efforts, were particularly critical of the early choices made by the leadership of edX. These actors generally implied that while edX had claimed the mantle of openness which was at the heart of OCW, their commitment to the core principles of that movement were not as robust as was required. One of the early proponents of OCW's strategy of openness familiar with the leadership of OCW made this clear:

> Now be careful. edX is not open...It doesn't really have a strategy and so it's problematic from a whole bunch of issues, but I know that Anant believes in wanting to do open stuff, but he's kind of got himself into a box because he now has to worry about budgets and funding and things, and as far as I know there is no strategy. So there is no equivalent to what made the OpenCourseWare strategy successful. (Interview 2014d)

Rather than build directly on top of the professional and administrative resources created by OCW, MIT's leadership decided to move quickly in a new direction that left the long term future of edX in question. What was carried forward was the rhetorical orientation to openness, a branded organizational commitment, and skepticism about allowing non-university backers in the private sector lead this charge.

This section has demonstrated the discontinuity between OCW and edX. Built on the foundations of the open/free software movement associated with the MIT department of computer science in the 1980s and 90s, OCW achieved broad legitimacy and little resistance from the MIT community within a few years of launch. In spite of this, OCW never found secure and sustainable financial footing, and work was underway to craft a future strategy for the celebrated project as the MOOC movement gained steam. Rather than building on the organizational infrastructure created by OCW or the materials it had accumulated, the administrative leadership of MIT instead chose to break from these resources in creating a new MOOC based organization to shape MIT's online education portfolio.

Administrative Imperative and Perceptions of a Changing Field

To better understand the break between OCW and edX it is important to highlight internal and external changes afoot at MIT in 2012. This section will focus on two of these changes. First, it will review the leadership transition underway at MIT, which was closely connected in timing and professional proximity to the emergence of the MITx/edX. Rafael Reif, the incoming president, arrived with a mandate to define his term and he set to work implementing what would serve as the branding initiative for his new administration. This section will then move on to a discussion of the fluid organizational field in which MIT found itself when President Reif took charge. In particular, it will evaluate the shifting status hierarchies within the field and in relation to Stanford and Harvard in particular. It will also

evaluate how those hierarchies were interpreted locally in planning a path forward during the year of the MOOC. This section will argue that a presidential prerogative was key in marshaling MIT's robust bureaucratic resources to effectively compete with MOOC organizations that were out of Stanford, which were perceived as a direct threat, while cooperating with Harvard, perceived as a non-threatening resource.

Administrative Imperative and Capacity at MIT

In early 2012, before MOOCs had captured the collective imagination of higher education practitioners and reformers, MIT was undergoing a leadership transition. Susan Hockfield, who had led MIT since 2004, was preparing to make way for Rafael Reif. The new President Reif was a long serving faculty member in the Department of Electrical Engineering and Computer Science (EECS). In multiple interviews, respondents familiar with online courseware policy noted that President Reif was interested in defining his presidency by seizing momentum in this space. Across multiple interviews with administrators associated with OCW and with the MIT's early efforts to create a new MOOC strategy, respondents cited the significane of incoming President Reif in committing publicly and fully to MITx/edX. One conversation with a figure central in shaping the wider organizational strategy resulting in the creation of the Office of Digital Learning, which MITx and OCW were organized under, was indicative of this push:

> I think Rafael did it a lot himself. You know, Anant [Agarwal], who ultimately headed up edX, he was someone who really believed in it. He was certainly an enthusiast, but I have to think the imprinting of the philosophy came from Rafael himself. And I have to think that actually it's not the way Harvard operates, it's not so much in Harvard's DNA as ours. (Interview 2014c)

As recently as October 2016 President Reif's official public biography is framed by his commitment to edX as the central vehicle to define his early presidency (see figure 1).

Figure 5.1: http://president.mit.edu/biography, retrieved Oct 1st, 2016.

While the relationship between Harvard and MIT referenced in the above quote will be covered in more detail below, it is worth noting that among people familiar with both universities MIT was frequently cited as having a stronger capacity for relatively rapid organizational decision making, especially in the context of experimenting with new technologies and initiatives.

To move quickly within academic institutions requires a great deal of coordination. MIT, unlike Harvard, is notoriously centralized with limited authority granted to individual schools, centers, and departments. When considering MIT's pace of action, some version of the following sentiments were often noted:

> MIT is much more monoculture than Harvard is. A hugely important distinction between the two places, beyond the fact that one's an engineering

> culture and the other one is not, is that MIT is the most centrally organized university on the face of the planet. So, there's one faculty at MIT, literally one faculty, they meet monthly...MIT's always had one academic calendar…All the space at MIT is owned centrally…At MIT [all the tuition revenue] flows into the center and they give line item budgets to the schools and the departments…So one of the reasons that MIT is less bound by tradition than Harvard is that the central organization of MIT allows a set of conversations which allows the whole institute to move forward together…So you know, it's a totally different world. (Interview 2014e)

This capacity was frequently acknowledged, and even bragged about, as a defining feature of MIT's organizational culture. This vision of the capacity for executive action and organizational follow through was clearly summarized by a central figure in the establishment of edX who explained, "The president has to take an interest. If it doesn't come from the top, it doesn't work. When the president says, damn it, this is going to be the center of everything, people take it seriously, right? So we've been lucky...our new president who is the old provost is facilitating the thing and that's it: people make change" (Interview 2014f).

Visions of the Field - Competition from Stanford, Cooperation with Harvard

This chapter has made the case that the development of a MOOC strategy at MIT represented a break from the organizational legacy of OCW, often in messy and undefined ways, and that the imperative for this break originated with the incoming President Reif. This section will argue that the imperative which drove MIT's leadership to prematurely abandon its internal OCW committees and pursue a different and uncertain path was the perception of a competitive threat from Stanford over the perceived direction and practices of the field of elite higher education. It is important to note that MIT pursued a path designed to differentiate itself from its perceived peer group. In so doing that subverted its own capacity to generate profit or revenue in the foreseeable future but succeeded in gaining widespread positive press. MIT also chose a collaborative strategy with Harvard, who's competitive threat was estimated to be in decline, to defray the costs of the experiment.

Across nearly every interview with people familiar with the committee work on the future of OCW, or the early MITx/edX strategy, the central impetus for action was the perception of a competitive threat from Stanford. Often, this threat to MIT's position as a leader in the field of online course delivery was perceived as something approaching a crisis. This perception of crisis crystallized when Stanford Computer Science Professor Daphne Koller (co-founder of Coursera) visited Cambridge to present her new initiative to researchers and administrators of both MIT and Harvard. One person familiar with that event recalled the tenor of the meeting as follows:

> Yes, we said oh my God Stanford is...Daphne Koller is starting to launch Coursera then...And Daphne came by and said we are starting this thing and we'd like MIT to be part of it. She came and talked to several of…Well you know, A) it's proprietary, and B) you can't really expect MIT to follow Stanford doing anything. So that was the actual motivation. And then a whole bunch of nice stories got told about it. (Interview 2014f)

Rather than a considered evaluation about where MIT's capacity could be most effectively utilized, as was the approach to the process out of which OCW was developed, the campus community felt a greater sense of urgency and a deeper fear about the possibility of being overtaken by its west coast competitor. This was clearly reflected by another member of an important OCW oversight committee who said: "I like to think that the committee informed the decision a little bit, but it was done hastily, in response to what Stanford was doing, very clearly" (Interview 2014c).

Proponents of a bold move in the MOOC space were less interested in the measured approach advocated by members of the OCW committee and their associates. A central actor in designing the edX strategy made this clear, stating:

> …the reason edX was launched so quickly, was...we were sitting on our thumbs, not doing anything, and then Coursera launches and we're like "shit!", we need to move. And so we launched edX in like 3 months…[so] Coursera happens and we go ok, we need to up our game, this can't go private sector, this has got to be public sector, right? (Interview 2014f)

Another central feature of the narratives used to describe the process at Stanford which launched the MOOC movement was the propensity of Stanford to pursue a strategy of profit oriented spin-offs. MIT faculty and decision makers had a relatively universal understanding that Stanford was pursuing a unified strategy in the MOOC space that involved the university seeding Coursera and Udacity in the anticipation of future profit. When asked about the sort of environment that one might find if doing similar research at Stanford, and if things there might be similar or different to the atmosphere at MIT or in MIT CS this profit paradigm was further stressed:

> You are going to find, first of all, that people are less likely to talk to you. They are more interested in the pot of money. You can see the Udacity and Coursera spinoffs are examples of...basically they are running on that whole image that they started, and their university has been very successful, which is the Silicon Valley startup. (Interview 2014g)

Here, the organizational forms that have been so central in defining the dramatic success of the modern high tech economy in the SF Bay Area are deployed as pejoratives. Profit is thought to supersede intellectual community, cordiality, and openness which defined the MIT academic community.

Revisiting the committee charged with determining the future of OCW, another distinction became clear regarding the choice of collaborators and competitors. Key administrators and staff made frequent reference in interviews to shifting peer groups which resulted in increased competition with Stanford which simultaneously increased the potential for cooperation with Harvard. This perspective was captured succinctly by an OCW committee member:

> No, [planning OCW's future] was all done internally…And we produced a report with lots of different options, but I think at the time it was when you know Coursera and Udacity were really sort of coming to light, and it was clear that Stanford was going to be doing big things. And I think, this is my personal perspective, I think at one point in time when Harvard was our rival,

> really now Stanford is our rival. So when Stanford was doing something big, that made MIT move quickly. So I'd like to think the report had some influence, but it wasn't fully processed when they realized that we needed to do something fast to get on the landscape before Stanford owned the whole world. (Interview 2014c)

This sentiment, reiterated repeatedly, and mirrored in interviews with respondents from my other cases, represents a meaningful shift in the relatively historically stable apex of the field of higher education. Changes in the structure of the modern economy and professional hierarchies have propelled universities which are heavily weighted toward STEM fields, and which boast rich CS research traditions (such as MIT and Stanford) to ascendency in a field once dominated by traditional liberal arts institutions. In such a context, Harvard becomes less of a threat and raises the possibility of technical experts and administrators at MIT cooperating with Harvard to supplement their central contribution.

On all things related to engineering, technology, and the internet, the interview respondents at MIT did not reference any meaningful competition from its nearest neighbors. This began with the perception of an organization wide commitment to grappling with the politics of the internet, which the CS community at MIT had organized around the free and open software movement. One longstanding member of the CS faculty at MIT explained that, "Harvard doesn't have the tradition in working on this. So it's just different. Openness is in the MIT culture and Harvard is just not that thing. They have the opportunity to transform, but whether they will or not remains to be seen" (Interview 2014d). The implication of the final reference of this response was focused on Harvard's much publicized organizational expansion into academic engineering and computer science as a prioritized area of growth in 2007 (Guizzo 2008). While it was clear that members of the MIT community had observed these developments with concern, by the mid-2010's consensus among my respondents was that Harvard would not soon succeed in asserting its prominence in the traditionally neglected field of engineering. One former elite administrator noted:

> I'd say it's about a decade [since they began investing in engineering]. Actually they haven't made as much progress as I thought. I think everybody feared they would go around and cream some catches, and hire the talent that we were bringing in, and then say "we are now the greatest engineering school in the world". Well, they didn't know engineers. That won't work. We have people, you know faculty members who come and go, but not many, but very few of them are in the engineering. Most engineers are happy if they are very good, and at this school, they wouldn't be overly inspired to the crimson change. (Interview 2014h)

Given the perception of the leadership of the MIT community that Harvard's investments in engineering were not a contemporary threat, the leadership of MIT had the option of considering a potential alliance between the two Cambridge powerhouses.

In describing the recent history of the relationship between MIT and Harvard, the complementarity of the two institutions was frequently stressed. From the perspective of organizational theory, these two local schools might be understood to have structured themselves to avoid competition with one another. As one long serving elite administrator described:

> I think most of the outside perception is that the two institutions are at each other's throats, and that we're deeply antagonistic, and aggressive to each other, but the truth is we are very collaborative. Many of them went to the same school, they live in the same neighborhoods, their kids are in the same playgroups, they teach each other's, and guide each other's students. So I would imagine that the two institutions would be close in Cambridge. And I suspect there is far more of it than is documented. Part of that is those reasons I mentioned, but one other piece is that there have been some complimentary things about the institutions. [We have one] education professor, that's it. There are other people who have little pieces of it but Harvard has a whole school of education, a whole department of cognitive science and psychology...we have brain science but we don't have cognitive psychology. And they have other assets we don't have. And they claim to have a school of engineering but its presence hasn't been widely discerned. (Interview 2014h)

At the dawn of the MOOC era, from MIT's perspective, the traditional complementarity of the two Cambridge universities had not been upset by Harvard's major investment in engineering and CS. In partnering with Harvard, leaders of MIT and members of the broader community felt free to harness the resources available at the other end of Mass. Ave. without threat.

Resistance: Discipline, Status, and Epistemology

It has been argued above that MIT's strategy during the MOOC movement represented a break from the organizational resources they had built during the decade long, broadly popular, OCW project. While some questions had been asked about the utility of OCW given MIT's broader mission, remarkably little resistance had been generated. Capitalizing on the imperative of a new presidency, and interpreting a shifting organizational hierarchy in the field of US higher education, MIT's leadership worked to combat a perception that Stanford was moving to usurp the dominance of OCW as the gold standard of elite online offerings. This section argues that the pace and orientation of the roll out of MITx/edX had a different effect locally. In spite of the commitment to non-profit organizational structure and openness at the level of the learner, the internal constituencies who had once supported OCW were far more likely to consider, and pursue, active resistance.

Resistance: Epistemologies

This section will outline a key fissure exposed during interviews: epistemology. At MIT resistance frequently emerged based on disciplinary understandings of legitimate goals and methods of scholarship and of higher education in general. In any modern scientific community, the foundation on which knowledge is built are its methods and practices that guide the inquiry and the standards of data and evidence which may be considered valid. The contemporary American university is categorized by multiple intellectual communities organized into disciplines, each with different answers to these questions, and live debates about what constitutes legitimate scientific products. These debates, which play out in faculty hiring and advancement, refereed journals, and honorary academies and committees, respond in complex ways to the advent or popularization of new methods of knowledge generation, evaluation, and interpretation. In the context of the MOOC movement at MIT, these epistemological divisions

came into conflict as local actors attempted to develop a shared foundation for an understanding of teaching and learning.[36]

Among the engineers and CS faculty who were interviewed, as well as quantitative researchers in related fields who had experience with modern computational methods, there was often broad skepticism expressed when describing work attributed to learning researchers. One member of the computer science faculty stated:

> Look at it this way: there has never been the opportunity to do an educational experiment before two years ago. And there are many people who have been saying that they have been doing educational research, but now say, gosh, there has been no educational research despite 200 years of people writing theses and dissertations about these things. Right, has there ever been any real research?...just imagine that we are going to make a company called Amazon 20 years ago. And we are going to figure out what books people order and we are going to have people hang out in bookstores, and when people come in to order books we will interview them and have them fill out questionnaires and you did a really good research project and a PhD project you got to interview 30 people that did something. Amazon doesn't sell books like that, but we still do educational research like that. (Interview 2014g)

In responses such as these, the epistemological divisions among research communities are brought to bear in crafting contemporary university policy. The affinity of the MITx/edX strategy of platform based data collection and analysis resonated strongly with CS researchers who had leveraged similar systems to refine complex processes across multiple domains over the previous decade. The rise of "evidence based medicine" was another often cited analogy of the success of these activities, as described later in the same interview:

> ***Subject***: …[in] medicine, you have some brilliant people who make a breakthrough, you never say "God, we don't have large statistical numbers about if these treatments work or not". And the same thing is true in education. So if you ask if there is an opportunity, sure there is an opportunity.
> ***Interviewer***: And that opportunity is for experimental...
> ***Subject***: For evidence based...I think the analogy with medicine is perfectly good. Brilliant people who figured out things by looking at 10 patients. You don't want to take anything away from them. But that's not how we run medical research. We continue to have educational people say, gosh, I taught this in my one class and we had 50 students and they did really good...There will be room for that, but we won't call that serious research anymore. (Interview 2014g)

In this statement above, there is little ambiguity about a hierarchy of knowledge, or what methods and evidence are most valid from this perspective. In spite of the lack of openness achieved by edX often criticized by some in the world of CS, there was broad consensus that

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[36] See Lamont (Lamont 2009) for a recent analysis of the challenges of collaboration in decision making across disciplinary boundaries.

learning platforms such as edX would provide the epistemological foundations for the first "real" research into learning ever.

These perspectives, and the disciplinary assumptions behind them, did not go unnoticed across the campus. Members of School of Humanities, Arts, and Social Sciences at MIT, while a much smaller in numbers and in power, often resisted these characterizations. As if responding directly to such medical analogies, one such senior faculty member stated:

> People often see medicine as the holy grail. [They argue] we need to be doing research that gets us like medicine. And education research has failed because they haven't done that very well, and now MOOCs can let us do that. We can do our controlled randomized tests by giving people different things here and there. But it's really ignoring why people...the reason why we haven't done that in education is not because we haven't thought of it, it's because we realize it's not the best way of answering a lot of questions. (Interview 2014i)

This is a clear statement of the terms which have come to characterize the debate over MIT's investment in online courseware. The core political commitment of OCW to openness did not evoke conflict along the epistemological lines that became evident during the creation of the edX strategy. The terrain of this conflict is advanced further by this interview passage, also from a social scientist privy to the campus organizing process which resulted in the launch of edX:

> …it was in an email to an engineer I had an argument with last week about some of this. And he said that at the committee meeting you and [senior arts faculty members] said that his idea of education, because he's an engineer who makes software for schools, it's just technology. "Would you have me say it's just history? You would get upset. You insulted me." And I had to write two screen-fulls to explain what it means to understand something within a timeline, within a context, and technologies can be made, and sent out into the world, without knowing what the consequences will be, not even having thought about it. And he wrote back, and he said: "I now understand all your concerns, you are 100% correct, but if we lived by your worries we wouldn't have electricity, we wouldn't have this, we wouldn't have that…" And I wrote back: and we wouldn't have nuclear weapons, or atomic weapons, either. Some genies don't go back in the bottle. And I fear that these online courses are a nuclear weapon for education. That's my concern. And I'm convinced that not any of these engineers gave any thought to that. (Interview 2014j)

Not only does this passage mark a substantial conflict pertaining to the method of inquiry represented by two disciplinary actors charged with coming together to govern MIT's future decisions about internet enabled courseware, it features a much larger cultural conflict. This division expresses concerns about the normative implications of an orientation to educational practice from the perspective of different disciplinary communities. On one hand, engineers who are eager to experiment broadly with new forms of technology in higher education, and those who remain committed to protecting the symbolic boundaries of higher education against erosion or dilution.

Resistance: Discipline & Status

These divisions were common in a number interviews with senior faculty at MIT across an array of disciplines outside engineering and related fields. These conflicts were most frequently explicitly articulated by non-engineering faculty. Among technical faculty and staff members conflict was often represented by dismissiveness of current research agendas in non-technical fields and the scientific products generated there. This section will evaluate the articulations of divisions present among this set of faculty.

Social science faculty at MIT often noted a sense of marginality which conflicted with the organizations in which they were trained. MIT is one of the few elite American universities with an explicit focus on engineering and technology and, as was often repeated, social scientists on campus often had to negotiate this disciplinary balance carefully. In response to a question about who such faculty felt they were resisting, one member of this constituency explained:

> …so, who is on the other side of the table? On the other side of the table are some computer scientists who like to make things. Oh, well, maybe I can make an interface. You know for data management. An interface. Maybe for security. Now whether they plan to sell it to somebody, or they plan to [do something else is less clear]...There are those who, this is their world, and they see opportunity for invention of more of their stuff whether they are motivated by curiosity, or status, or money, I don't know. Ok, I'm sure it's all three. (Interview 2014i)

In addition to suspicion of the motivations present above, there is a sense of alienation from the institution that would support a dominant disciplinary community inclined toward such rapid and substantial investment in these unproven technologies. This suspicion extended to the tone and tenor set by the leaders of the new online experiments represented by MITx/edX.

> …at the department heads lunch we were presented by Anant with a picture of MITx. It was absolutely...what shall I say: shocking. Shocking…There was no question but that we were all surprised. All surprised…the presentation by Anant was like a startup company, and that this was going to transform the world, and this would be...What were the major points that got people upset? Major point was peer grading…well you know we don't just grade right and wrong answers, we look for the way the problem is formulated. And you might get most credit for an answer if you've got the right framing and formula, even if you don't have the right answer…we [in the social sciences also] know that what is popular is not always what is right in any objective or moral sense. (Interview 2014j)

Additional fissures emerged as the potential for a partnership with MIT's nearest neighbor, Harvard. As noted earlier, leaders of MIT had come to downplay the threat from Harvard in regard to its preeminence as a center for engineering teaching and research. This ease was not experienced by faculty in non-technical disciplines who repeatedly expressed concerns that a partnership with Harvard would further marginalize them. This sentiment was expressed in one meeting in the run up to the announcement of the cross Cambridge alliance.

> [an administrator had] an open meeting with the faculty from humanities, arts, and social sciences to discuss this. And I would say there were 20 people in the room…And Rafael presents it and says this is going to take a great deal of money, and we are going to have to figure out how we are going to be able to do it and we are not going to do it by ourselves. And so we are going to have to get help. This is...and he said something to the effect of "we are going to have to figure out how to do this, and we are going to get some help, perhaps down the street". Now, he didn't hear them, or he answered in a way that they went berserk. Berserk…That they, the humanist faculty heard him say "we are going to have to go to Harvard to get help with the Humanities and Social Sciences"...I said do you hear why they are so upset? They get constantly denigrated. He said "I wasn't talking about the content I was talking about getting money!" I said "you are preoccupied with getting money, they are preoccupied with not being cast out of MIT's education". (Interview 2014j)

This concern was reiterated by social science faculty who worked to position themselves more centrally in the activities associated with this new initiative:

> And [social sciences] don't want to be the caboose on this train. [He said] "Oh you don't have to worry. You are not going to be the caboose. You are going to be right in the middle of the train", and that's a direct quote. I said no, you have the wrong point, we want to be the engine this time. This time it begins in social science. Because this is about human beings. (Interview 2014j)

These two passages reflect that fact that the ambition and epistemological assumptions embedded in MIT's MOOC strategy exposed fissures within the intellectual community which did not come to the surface around OCW.

At the most general level, the non-engineers I spoke with expressed concerns about the future of the academy, and a sense that incorporating startup culture and market oriented education, even if it was organized as a non-profit, threatened the fundamental mission and legitimacy of MIT. One faculty member in particular noted:

> [I often say] "They legitimated the university of Phoenix". And when I say that to them, they say to me: "how could you say that? How could you confuse Berkeley and Stanford and MIT with the University of Phoenix?" I said then, because you don't know the American population and I do.…I don't know what number you want to put on it, somewhere between 60 and 90% of the American population does not know the difference between the University of Phoenix, the University of Arizona, Arizona State, Berkeley, Michigan, MIT. They are all "The University of", and now, well MIT is doing this and Stanford...I'll go over here. It's cheaper, oh they are free, but these guys tell me they are going to help me. That's what they did. And they don't understand… (Interview 2014i)

For this faculty member, the stakes were much larger than the success or failure of edX and the potential impact on MIT's brand. The elimination or erosion of the symbolic distinction between the gold standard of residential education represented by MIT and its peers (Harvard, Stanford,

etc) had the potential to do harm to individual students whose choices surrounding higher education are notoriously inefficient (Hoxby & Avery 2013). They also have the potential to confuse the popular perception of what sort of higher education system should be the goal, and what model might be imagined in the pursuit of future reform projects.

Conclusion

MIT has long occupied a privileged position in a subfield of higher education that prioritizes applied sciences. Through technical innovation and practical problem solving MIT has made tremendous contributions to the American project since its founding. Over the 150 years since its founding MIT has carved out a niche that largely avoided competition with Harvard, its older, richer, and arts and science focused cross town neighbor. With limited resources dedicated to social science and policy research, MIT has not traditionally played a central role in debates about the future of the American university. The advent of the MOOC movement created new opportunities to reevaluate many of these taken for granted assumptions about how MIT relates to hierarchies and reform discussions within the broader field of higher education.

While John Hennessy's talk of a "MOOC Tsunami" has yet to fully materialize, structural opportunities to disrupt or re-organize inter and intra-organizational relations do exist. This chapter used the tools of organizational sociology to evaluate the actual logics employed by key decision makers at MIT. It shows that, rather than being driven by pressure to cut costs or increase profits internally, or to build directly on organizational legacies, actions were shaped by perceptions of unsettling competitive pressures from a newly ascendant elite actor: Stanford. The perceived threats led administrators to break from experimental work organized internally and to associate the MIT's long cultivated identity as a leader in elite online higher education with the MOOC movement. This strategy was enacted to compete with Stanford through a cooperative relationship with its seemingly less threatening neighbor Harvard. These changes elicited a substantial amount of faculty resistance not present during past experiments, which often focused on epistemologies and organizational and cultural practices of the central proponents of edX.

This implies that the second order consequences of the ascent of computer scientists into the center of debates about higher education reform are important to highlight. At more than one of the universities in my study, teaching and learning centers historically staffed predominantly with professionals from education and psychology have been eclipsed, if not formally replaced, with new groups of professionals more closely aligned with CS and engineering. This signals the unique nature of this moment of transformation. Unlike past academic trends, where rising fields garner attention and additional resources, the rise of CS has had broad impacts on an array of activities in higher education. While fields such as physics after WWII or bio-tech during the 1990s achieved significant funding and enrollment boosts, they had limited impacts on distant fields such as literature, nor did they impact core functions of universities such as teaching and learning.

What's more, the hierarchies which differentiated elite schools – those focused on engineering and technology (MIT) versus from those more closely tied to broad liberal arts foundations (Harvard) – can be seen to be eroding rapidly during this period. MOOCs alone did not initiate these trends. They are, however, a productive perspective from which to analyze the process by which decision makers work to adapt to broader social and technical change. From this vantage point the significance of contingent events in shaping possibilities for action become clear. This also illuminates the process by which complex environments are interpreted by agents, and how organizational responses are crafted to pursue varied agendas. How

organizations respond when agreed upon boundaries between sectors of an organizational field erode is also illuminated.

While the past two decades have witnessed an expansion of technology firms in the economy and culture at a rapid pace, researchers of higher education would be unwise to ignore the broader impacts of these trends among universities. As actions at MIT and Stanford increasingly influence reform discussions that orient policy and practice throughout the field, it signals that the future of university culture is becoming more focused on emerging engineering disciplines. MITs incorporation of Harvard into its new project implied a lack of threat from its nearest neighbor and a reorganization of its reference group to focus on other ascendant engineering centric universities. No matter what the costs of these competitive engagements are for the elite campuses, their status as bellwethers in the field of global higher education is likely to offer increased legitimacy to other organizations interested in pursuing similar reforms, and to increase pressure on those who seek to resist by following alternative paths.

6. Harvard

Since its inception in 1636, Harvard University has understood itself to be the premier institution of higher education in America. Current Harvard partisans go as far as to describe themselves as having "invented" residential higher education in America. These superlative self-assessments have been in broad correspondence with popular perceptions, domestically and internationally: that Harvard is the pre-eminent global model against which the field of modern higher education is to be benchmarked. On at least a few fronts, this claim of preeminence has a strong empirical foundation. Established in the early 17th century, Harvard is indeed the oldest university in America, as well as its first corporation. In addition, Harvard has successfully achieved supremacy in financial holdings, boasting an endowment of $37.6 billion by 2015, nearly 50% larger than its nearest university competitor. Global assessments of research impact also consistently rank Harvard as the world's top performer (ARWU 2016). In the language of organizational sociology Harvard would be considered an "incumbent" par excellence.

To persist as the perennial incumbent for more than four centuries is a remarkable feat in any organizational field. This accomplishment is more significant in a field that has experienced multiple reorganizations of its central clientele (from clergy to local Brahmin to a modern national and international elite) and resource flows (local philanthropy, to state largess, and later commercial science). There have been no shortage of challengers in the field of higher education and Harvard has often found itself lagging behind in ascendant fields. Time and again it has used its significant resources to regain or maintain its pole position. As far back as the 1880s faculty of the newly incorporated Johns Hopkins University sensed an opportunity to overtake the nearly 250 year old incumbent. Hopkins, which is credited with introducing the German model of graduate education and secular disciplinary specialization to the American university, was served by administrators who believed their moment had come to supplant the stogy and backward looking leaders of Harvard. Reflecting on their early success as a university, Hopkins' leadership believed they had the "advantage of freedom from tradition and bad precedent", and that after having "felt the bones of the Mammoth" they came to "believe there is more strength in growing ideas than in mere form and bigness, more hope for young life than for settled old age, which desires chiefly comfort and quiet" (Hawkins 2002 p. 309). Later, with war raging in Europe, Harvard found itself trailing behind its peers in military contracting across the applied sciences as well as appointments to the most sought after and valuable discipline to the war effort: physics. While some members of Harvard's physics department were recruited for the war effort, the university played a smaller part than did their peers at Caltech, UC Berkeley, MIT, and the University of Rochester. Not to be left behind, Harvard went on an aggressive hiring spree and recruited a number of the top young faculty in the discipline, paving the way for four Nobel prizes to be collected by Harvard physicists in the second half of the 20th century (Keller & Keller 2001 p. 231).

In both of these cases, history has shown that predictions of the imminent decline of Harvard had yet to materialized. Harvard's well-worn playbook of waiting until intellectual fields and movements mature before investing their sizable resources into faculty and equipment required to dominate have kept them in good stead in traditional disciplines which define the core in American higher education. However, Harvard's structural impediments that enabled Stanford to dominate high tech industrial innovation during the second half of the 20th century remain relevant today (O'Mara 2005; Saxenian 1996). Following from the microprocessor, the

internet has continued to drive economic growth and promote technological transformation across American industry and society. The experts who pioneered these advances represent disciplinary traditions, approaches to science, and cultural expectation which are odd fits with Harvard's FAS centered culture.

By the mid-2000s there was growing evidence that Harvard could no longer afford to ignore the academic communities in applied sciences such as electrical engineering and computer science at the heart of these transformations. The announcement in 2007 that Harvard would be transforming it's relatively small department of engineering into the newest top level division was deeply significant (Kaletzky 2007). The new School of Engineering and Applied Sciences can be seen as an acknowledgement, after nearly four hundred years of relegation of the applied sciences to secondary citizenship status on campus, that major changes are afoot in higher education. By the time MOOCs swept across the landscape of the American university, from Stanford to MIT, Harvard administrators did not believe they had the luxury to ignore them.

The empirical question at the center of this chapter is: given Harvard's status as an incumbent, its particularly strong association with residential education, and a massive endowment that buffered it against the financial pressures facing many universities, why did it commit so publicly and substantially to an unproven online teaching and learning technology? This chapter will evaluate whether Harvard's MOOC strategy was driven by the desire for new revenue, an often citied prediction from scholars and analysts inspired by work on academic capitalism. Such an approach would be in broad conformity with the actions taken by the leadership at Stanford. In particular, this first empirical section asks: why did Harvard move so publicly and so quickly, given its reputation for methodical and relatively conservative actions? Could it be explained as a revenue generating scheme for administrators, departments, or individual faculty or leaders? Using evidence presented below this chapter argues that theories of academic capitalism do not adequately explain the evolution of the decision making process at Harvard.

This chapter argues that field theory provides a much more salient set of analytical tools to evaluate proximate causes and motivations of Harvard's MOOC strategy than does academic capitalism. It particular, evidence presented here will show that elite administrators endeavored to defend against the perceived threat of a newly defined set of university peers that were more closely associated with engineering specialties of computer science and artificial intelligence research. The decision to partner with one such school, MIT, was designed to hedge against another: Stanford. In pursuing this strategy Harvard administrators leveraged competitive *and* cooperative approaches to defend their status within the field (Fligstein 2013). They also used the opportunity to advance their agenda both to make Harvard a relevant player in the competition over high tech innovation in higher education, and to explicitly re-engineer their internal organizational culture to more closely emulate their perceptions of engineering-centric universities. These actions were not without resistance from faculty, but a concerted campaign was able to pacify this resistance by offering MOOCs as a platform for advanced faculty to engage in professional prestige projects within their fields. By using field theory to evaluate the positions taken by individual actors this dissertation will bring new insight into the microprocesses which structure agency in the context of fields.

MOOCs at Harvard: In Pursuit of Profit?

Theories of academic capitalism have been incredibly helpful in framing macro change within the contemporary university and have guided a substantial section of the research efforts in higher education. As Chapter 4 demonstrated, multi-billion dollar endowments are often signs that campus leaders are extremely savvy finding new ways to strengthen their bottom line, and given the strategies of action at Stanford, an analyst might reasonably expect profit to motivate Harvard's actions on some level. As such, the utility of these theories in explaining Harvard's response to the MOOC movement, especially in relation to Stanford and MIT, will be evaluated in this section. To accomplish this, a set of likely sources of MOOC interest at Harvard will be derived from theories of academic capitalism. If Harvard's MOOC strategy was driven by market pressures, or academic capitalism in pursuit of profit, one might expect to find evidence of the impetus for these experiments associated with units (1) with experience generating revenue through course content or (2) less wealthy departments in acute need of additional streams of revenue. This section will assess the response to MOOCs of two units with extensive experience generating revenue: the Harvard Extension School and HBS (Harvard Business School). This chapter will then evaluate how relatively less wealthy departments such as the arts and humanities related to the possibility of increased involvement in the MOOC movement.

Harvard Extension School: An Unsuitable Home for MOOCs

By 2011 Harvard had built a robust infrastructure to house many of its experiments in technologically enabled distance education, community outreach, and pedagogical innovation. The Harvard Extension School, which was covered in detail in Chapter 2, served as a relatively safe location within Harvard's sprawling and decentralized bureaucracy to house these experiments which might have otherwise seemed an odd fit for the status position of the core Harvard brand. The extension benefited from that fact that it generated substantial revenue for the individual faculty who taught in it and for the bottom line of the FAS, Harvard's largest and most powerful administrative unit. When the longtime dean of the Extension, Michael Shinagel, published a book in preparation for retirement, his final two chapters pointed to an expanding presence for Harvard Extension online (Shinagel 2009). As the Extension expanded online new research arms and infrastructure were introduced. By the mid 2000s an Office for the Study of Online Teaching and Learning was established within the Extension, foreshadowing the significance of the research dimension of online coursework during the MOOC movement. Extension was also regularly offering online courses which enrolled hundreds of fee paying students. Taken together, these successes led to plans for Extension to grow into a new building in Harvard Square as it renewed its commitment to next generation teaching and learning technologies (Shinagel 2009 p. 197-9).

In spite of this legacy, and the significant resources and experiences which had been concentrated at Extension over the 2000s pertaining to online course delivery, the Extension was almost entirely sidelined during the MOOC movement. Rather than building MOOC platforms on the proven success and broadly agreed upon legitimacy of the revenue structure and remuneration process, edX and HarvardX were clearly structured as organizationally and symbolically discontinuous from efforts at the Extension School. This section will argue that the opportunity to house online experimentation within the low status and peripheral extension unit did not conform with the presidential level initiative designed to compete with challenges that were perceived to emerge from other elite competitors.

By 2012 it was clear that the future vehicle for online course delivery from Harvard was edX, and that President Faust and the Harvard Corporation had broken with the continuity of Extension's online efforts. This perception was reflected by a faculty member:

> I know plenty of people who teach in the Extension School. I took Extension School classes when I was a young person. I do know people who teach in the school now in those ways...the relationship between HarvardX and the Extension School though, in any formal sense, largely has to do with the coincidence of hiring a new Dean of Continuing Education...shortly after the decision that the Harvard administration made to partner with MIT and edX. [HarvardX] has nothing to do with [Extension]...(Interview 2014k)

Other faculty pointed out that any new major initiative, including MOOCs, that would carry Harvard's name into the world could not realistically be organized under a unit with such low status as the Extension. As they explained:

> The brand of Extension is still marginal...some people feel this is not really Harvard. How can you have the most prestigious university in the world that has the most stringent entrance requirements, have an open enrollment arm? That seems counterintuitive. I think if you really asked members of the Harvard Corporation the question about "is Harvard Extension really Harvard?", they'll say: well yes, they do a good community service, but to the extent they give degrees they have reservations about what Extension is…(Interview 2014a)

As Harvard pursued an online strategy based on promoting MOOCs to the world, the Extension seemed too peripheral and low status to provide a viable organizational pathway.

In the section above Harvard Extension, a unit with extensive experience generating revenue from courseware, has been evaluated to understand if desire for revenue could explain Harvard's MOOC strategy. It has been shown that while administrators had the capacity to build on proven and profitable revenue models using the internet to deliver courses pioneered through Extension they chose not to host or support Harvard's MOOC activities there. Rather, administrators chose to associate MOOC efforts with the core Harvard brand for symbolic purposes rather than house them in units that were experienced profit makers. Taken together, this implies Harvard was engaging in competition for status rather than the pursuit of profit.

Harvard Business School: A Model Without a Business

Other schools at Harvard had also worked to integrate additional experimental channels for course delivery to capitalize financially on their content and expand access beyond traditional residential students. Few schools were more aggressive and/or successful in these endeavors than HBS. The Business School is one of the most lucrative beneficiaries of Harvard's decentralized and autonomous relationship between schools. It has a long history of generating revenue from faculty courseware in the form of teaching products and case studies and publications. Many faculty and administrators familiar with this strategy note that profitable online efforts have been the product of incremental improvements rather than revolutions in the field. They have largely been successful because they leveraged well-worn distribution pathways to paying customers

that existed before the internet. The advent of new approaches was met with skepticism by many of these actors, one of whom stated:

> ...these are simple things, simple customers who have simple problems, and [our courses are] customizable, and so in our world, the corporate universities, they demand just in time customized, configured to the problem that company faces, so they teach people in the context of the problem. So a MOOC about first year marketing just doesn't connect. And it has nothing to do with the technology per say, but it's the business model, to get to the customer, that's a big deal. And so I just...it always happens, and I feel bad for the guys who are trying to make these big MOOCs…(Interview 2014l)

This faculty member continued:

> I put my course on HBSx...and about 40% of the course is there, and we have customers who are buying it, and financially it looks like it's going to be quite successful. But our distribution channels to the marketplace are exactly the same channels to teach our cases and subscriptions to the Harvard Business Review…Every day I become more and more convinced that we need to either buy the University of Phoenix, or have a deal with them, that is pervasive. Because their channels to a different class of folks is just very different. And I just don't understand that, and nobody here understands that, because we've never been there, and our sales people don't know who those customers are, and no channel. And there are some others like, it's what the University of Phoenix really knows from a distribution as a partner, is they know the equipment employers need, in terms of the skills, so when they are done they have a job, because that boundary they just blow out of the way. So there is a job out there that the University of Phoenix and a few others know pretty well…But the ones that came out of Stanford [Udacity, Coursera] I don't think they thought at all about the channel. So they find themselves with neat stuff...and there just isn't a job arising in people's lives, so they punt, and go after vocational things, and God bless them... (Interview 2014l)

While HBS has a long history of university sanctioned pathways to revenue generation for faculty, professors and administrators with experience in these areas were highly skeptical about open access MOOCs. Apprehension centered around an unspecified business model caricatured as "a shot in the dark" and "potentially a really cool waste of time", and there was broad consensus that the HBS brand be protected from such speculative experiments (Interview 2014m).

Again, this section demonstrates that units with experience generating revenue from courseware were deeply skeptical of the MOOC movement's ability to produce revenue in the foreseeable future. Both the extension and the Business school had crafted business models that produced steady profit streams without running afoul of university regulations. Where Extension was passed over because of its low status, HBS chose not to embrace the movement because there was no foreseeable link to paying customers, and no strategy for sustainability, let alone profit. Again, this section has provided no evidence that academic capitalism advances our understanding of Harvard's MOOC strategy in stark contrast to the approach at Stanford.

Arts and Science: Disinterested Skeptics

Given the removal of Harvard's MOOC efforts from the domain of the Extension School toward a more central bureaucratic location, and the skepticism about MOOCs evident at the second revenue generating unit, HBS, little evidence exists that edX represents an enhancement of profit seeking activities at the level of already successful university subunits. If the impetus for MOOCs was not associated with units best prepared to exploit courseware for profit, the possibility remained that they may have been associated with units most in need of supplemental revenue. These units could include departments in the arts, humanities, and sciences which faced dwindling enrollments and few proven market opportunities to recoup some of this cost. At Harvard these are some of the strongest departments in terms of historical campus influence, symbolic significance, and international prestige.

Throughout fieldwork for this dissertation in Cambridge, FAS professors almost never associated MOOCs with the potential to increase revenue for their disciplines or departments. There was very little interest from groups (departments, research units, etc) in these fields to pursue an online strategy involving MOOCs, or any other internet technology, to boost revenues and support ongoing academic activities. For the most part, faculty from these departments who were interviewed for this project were clear in stating that they were not even consulted about MOOCs. It was, by and large, the opinion of subjects in these departments that the impetus for Harvard's involvement in the MOOC movement came largely from elite administrators. As was frequently repeated by subjects during interviews, a faculty observer of HarvardX noted "...I think it was really elite administrators. I think different pieces of this appeal to them in different ways…" (Interview 2014m). This sentiment was echoed, in a more expedient fashion, in other conversations with faculty serving on administrative committees at the time of the edX announcement:

> ***Interviewer***: Was there a sense that a lot of your colleagues were eager about another outlet to teach...an online outlet?
> ***Subject***: It was not driven by faculty interest in teaching. I would be fascinated to hear any evidence anyone could present to me otherwise. I see no evidence of this." (Interview 2014k)

As was the case with nearly all the interviews conducted with faculty, the broad contours of arguments about academic capitalism, or the increasing marketization of the university, did not provide helpful frameworks to explain the emergence of MOOCs at Harvard.

Very much unlike the experiences at Stanford and MIT, the preponderance of evidence suggests that there was no discernible pattern of faculty support for MOOCs by department or professional community that explains the decision of Harvard to join MIT in launching edX. Harvard's interest in MOOCs did not emerge among the relatively small CS department as it had in the other two case, or those units with the most experience generating revenue with courseware (Extension or HBS), nor did it emerge among those with the most acute need for new revenue streams (Arts and Humanities). The next section will evaluate an alternative impetus behind the MOOC movement at Harvard, elite administrators, who were often cited by faculty as pushing for Harvard to join the MOOC movement.

Perceiving and Responding to The Field: The MOOC Decision

Popular narratives of the emergence of the MOOC movement often highlight the May 2nd, 2012 news conference hosted by MIT and Harvard to publicly announce their new joint venture as a critical turning point. The serving presidents, Susan Hockfield and Drew Faust (of MIT and Harvard respectively), took to the stage to promote the possibilities and potential of this new, but only vaguely defined, project for students on their respective campuses in Cambridge and around the world. Few analysts, however, have presented primary data about the internal process that led to Harvard's decision to move aggressively into the online higher education space in the way that it did. In this section primary data is presented from interviews with a number of well-placed subjects with first-hand knowledge of the deliberation process and ultimate choice taken by Harvard.

As this section will show, the main considerations made by elite administrators at Harvard were influenced by perceived strategies pursued by other elite universities in the field, notably Stanford and MIT, and those actions were seized on as an opportunity to reform the culture of Harvard to be more nimble and innovative. The decisions taken at Harvard were not made in response to grassroots demand among faculty or students, newly ascendant engineering or computer science departments, the continuity of preexisting local experiments, or an attempt to increase profits or reduce costs. Rather, the decision to pursue this well publicized path was made by top administrators based on the perceived risk of falling behind other elite universities. It was also seen as an opportunity to move the organizational culture of Harvard in the direction of practices associated with nimble high technology firms. Of additional significance, the key competitors were not traditional Ivy rivals in the North East, nor were they the organizations with years of experience and vast data sets in the for-profit sector; they were highly selective universities with strong engineering and computer science traditions (MIT and Stanford). Moving America's oldest and richest university toward being more responsive to technological experimentation and positioning it as a hub of pedagogical innovation and risk taking were important elements in the strategy driven by elite administrators.

Elite Administrators: Pursuing Profit or a Hedge?

The preponderance of evidence from interviews with administrators familiar with Harvard's MOOC strategy demonstrates that Harvard's actions were less responsive to cost or profit than perceptions of threat from technologically focused universities. None of my interviews yielded sanguine assessments of the prospect for near or medium term financial gain associated with edX. Even the most optimistic administrators set the bar at generating enough revenue to avoid taking large annual losses and, in spite of the substantial pot of startup capital which had been pledged, there was fear of a need for recurring transfers of funds from Harvard to edX in perpetuity. One administrator offered this summary:

> "...it's one thing to say that information should be free, it's quite another to decide that somebody else should bear the cost of providing it. So in the end, somebody has to bear the costs of organization, storage, retrieval, archiving it, making available, and if you don't, unless the government is just going to provide it as a governmental function, which I don't think the government will, then somebody is going to have to pay for that. And the challenge going forward, is what's the business model that sustains that. It's interesting, if you take a look at some of the you know biggest internet companies, and people

> sometimes point to them, they give away their product, nominally, but the costs that the consumer pays for having access to that for free, is that they give up, in some cases some of their privacy. Look at all Google knows about you because of your click stream. Or they pay for it because you are willing to tolerate the ads the come with it, but I'll sound like [an] economist. There is no such thing as a free lunch. Somebody's got to pay for the creation and the sustaining of the resource. So, if edX don't solve that problem, then this stuff...will go the way of Fathom and eCornell…(Interview 2014e)

The subject continued:

> ...it wasn't that we were necessarily looking for a great economic return, you know. I think people would be very happy if edX figured out a way to cover its costs in steady state. Nobody expects that it's going to...make Harvard rich. Now there are some of us who have higher expectations for edX, and that is, you know, I would hope that what we would learn through edX would be ways of helping institutions of higher education figure out how to deliver content on their own campuses at lower costs…(Interview 2014e)

These responses make clear that Harvard's commitment of symbolic and material resources to a MOOC venture preceded any clearly articulated path to profit or even sustainability. Though implicit parallels were drawn to the capacity of other high technology online firms to generate revenue from free offerings, nothing approaching a road map was present. In fact, a substantial amount of doubt about any reasonable path toward revenue neutrality was pervasive.

If these actions were not driven by profit, and were without a plan for imminent sustainability, what shaped the choices of these administrators to pursue this largely unscripted path? Using the language of the market, one central figure explained:

> ***Subject***: The way to think about the investment we made in edX is that we bought an option. We bought an option. We bought an option on an emerging market.
> ***Interviewer***: So is it that you can think about it in terms of that level of speculation? I wonder the extent to which that's a material market or a symbolic market.
> ***Subject***: Symbolic. It's symbolic.
> ***Interviewer***: So what is this market?
> ***Subject***: It's the market for pedagogical innovation is the way I would put it. Harvard and MIT wanted the opportunity to be players in the development of what some might argue represent potentially the most important pedagogical innovation since Socrates developed the Socratic method.
> ***Interviewer***: And who are the competitors in that market?
> ***Subject***: At the time at which we made the decision, it was unclear who the competitors would be. Who knew? But places like Harvard and MIT don't wait for others, you know. MIT seems to be a little more comfortable moving faster, and you know Harvard saw an opportunity to collaborate with MIT and went for it. And it was the right decision. (Interview 2014e)

Among the many layers presented in this metaphor is ambiguity related to a profit motive defined in financial terms. The edX decision, as depicted above, is a defensive move designed to maintain a limited position in a speculative field with uncertain outcomes and opaque future prospects. While the subject does not name the competitive forces surrounding this decision in this quote, other work presents evidence which implicates the early actions of a national network of artificial intelligence researchers, many of whom were based at Stanford University (see Chapter 4). Furthermore, this passage highlights the dual nature of Harvard's strategy that involved partnership with one engineering intensive school (MIT) to best compete with another (Stanford).

Perceptions of the Field: Origin Stories and Identity Questions

In spite of the local resources familiar with online course delivery previously discussed, administrators charged with crafting university policy seemed almost exclusively focused on developments elsewhere when contextualizing Harvard's decision to join edX. The most frequently referenced driving forces behind this decision were perceived developments at Stanford and the anticipation of risk associated with non-action. One key administrator explained:

> ... [President] John Hennessy at Stanford is talking to a number of institutions about trying to do something in the for-profit space and a lot of us are uncomfortable for a variety of reasons doing that. And when MIT goes forward...to establish MITx...our hand gets forced by Hennessy. Now John is out there talking about this to folks and MIT is worried that Stanford is going to steal and march on MIT in a field which MIT has won, and so MIT preempts Stanford by announcing MITx not even knowing what MITx is gonna be. And, you know, very quickly Anant and others commit...to do a MOOC version of [his circuits course]. And MITx is born. And then, at some point...Susan approaches Drew, somehow the connection gets made to Harvard, "do you want to join us in this". Harvard, which generally operates at a slower clock speed than MIT I think decides rightfully, and I say rightfully but it's self-serving because I was part of the decision...We decided to join MIT in part because Harvard is not quite sure what its strategy is, but it figures if they are doing it together with MIT they'll figure it out collectively, we will figure it out. And by joining forces with MIT it almost forces Harvard to act faster than Harvard is used to acting...which I think is very beneficial in a variety of ways. So that's how edX is born. (Interview 2014e)

While strategies designed to accelerate the pace of action and reform at Harvard will be revisited in more detail below, responses such as this clearly outline mechanisms familiar to organizational sociologists. In a period of uncertainty, actors in the field observe one another to craft strategic action.

To other actors, a similar origin story of the MOOC movement at Harvard was often repeated with only slight variation in minor details and timing. While these were common perceptions, they existed somewhere between legend and fact and were rarely evaluated as arguments to reconsidering local MOOC strategy. Chapter 4 documents that events at Stanford were far more fluid, less coordinated, and similarly uncertain than they appear in these origin stories. They were also understood by administrators at Stanford as being motivated by the

broader interests of the field rather than direct profit seeking. However, these stories represent a version of an external threat which was relatively stable across the Harvard community. One common story involved a trip taken by Daphne Koller in early 2012 on the invitation of administrators at Harvard. A second hand account of the event proceeds as follows:

> [a colleague] told me between the time that Daphne Koller first set up the appointment to come talk to people at Harvard, and the time she had arrived, it had spun off from Stanford. They thought they were going to meet with a Stanford professor to talk about online education and that is the way the appointment was set up but when she actually came and talked to the people at Harvard she was a corporation. (Interview 2014n)

The same story, as retold by a participant in the meeting, unfolded similarly:

> I believe it was the office of the provost that invited Daphne Koller. She was just starting Coursera, with Andrew Ng, and a small group of us...and Daphne Koller gave a really lovely presentation on why she thought MOOCs could transform not so much education of residential students, but sort of democratize education in a larger sense. She was eloquent, and she had us wrapped around her finger, until it was revealed after an hour...that Coursera was going to be backed by venture capital. And then it was like, taking the air out of a balloon, voom, suddenly...you can see Harvard saying well, in that case, I don't know...(Interview 2014a)

Two of the central conclusions that can be drawn from these "origin stories" is that the MOOC movement was perceived to have begun as an organized corporate agency by Stanford, that a conscious decision was made to spin this experiment off into Silicon Valley as is to be expected at Stanford, and that such practices were not in line with Harvard's values or modus operandi. It is important to note that observations are heavily filtered through local cognitive frames and assumptions, and that while strategies for action involve some mimicry, administrators demonstrate substantial agency and control over the specific contours and look to leverage local symbolic and organizational resources to orient the responses they choose.

High-technology: Competition and Reform

In other discussions, subjects provided further information which can be used in contextualizing a more explicit window into the lenses they depend on to conceptualize the broader field and to organize their actions. One central feature was competition:

> American higher education is extraordinarily diverse and intensely competitive, so higher education institutions come in all shapes, flavors, colors, sizes, right? And they compete for students, they compete for faculty, they compete for staff, they compete for resources, they compete for mindshare. That competition drives innovation. [The] story is a story of that competition in some ways between Stanford and Harvard and MIT, right? Um, and, MIT's really responding to what's largely a Stanford initiative because the first MOOCs come out of Stanford, right? They don't come out of MIT. And then Hennessy saying well maybe we should form a for-profit entity to capture

> the value of this, and I think Hennessy is looking for cover from other university presidents, and when MIT gets wind of it and aren't comfortable doing it, so goes off on its own and enlists Harvard. So, competition, reaction, strategic response, right? So, this competition...everybody is watching what everybody else is doing, and some will succeed, some will fail, where it's Darwinian. Those that fail, either will, not that the institutions will go away, but those efforts might become the Fathoms, or the eCornell's of the future, and that could be edX. I mean that history remains to be written, but what happens is when they fail they don't always go away. Sometimes they get reborn in different ways. Udacity is a great example. (Interview 2014e)

While it may not be surprising that this competition is thought of as a positive component by the richest and most successful actor in the field (Harvard), the scope of Harvard's reference groups is remarkably limited. While the field at large is broad and diverse, it is only the actions of a select group of other elite actors which are monitored and evaluated for potential response.

The construction of a set of peers which are to be monitored when setting priorities or evaluating potential threats happens both informally and formally. Official internal departments responsible for orienting new members of the Harvard administration to their roles do this explicitly. One such entity is responsible for maintaining a slide deck called "Harvard 101" aimed at helping new community members understand how Harvard compares in the field of higher education. Historically, the schools which served as the benchmarks were remarkably limited, as explained by an administrator familiar with the process:

> I'll tell you the story as I understand it looking back in time...In institutional research we often benchmark ourselves on any number of things with a set of peers. And we would put together these exhibits...we have a set of exhibits we call "Harvard 101" where you try to provide for new leaders, new deans, new people in the community, in an internal way [with answers to the question]: "how do you see Harvard relative to other institutions?" We would often have in those early days in my role a kind of canonical set of peers that included Yale, Princeton [pause] um, and maybe the other Ivies. (Interview 2016a)

The canonical reference set against which Harvard historically measured itself focused on the richest and oldest schools in the oldest intercollegiate conference in America: the Ivy League. In spite of the long historical lineage of this group of peers, changes in the late 2000s led internal authorities to reconsider who is given membership in that group.

> We as a team worked on a project we called "The Elephant Deck"...The goal was to take a 30 year look and put together a bunch of strands and say: how did we get where we are now? The phrase that came out of that project was "decades of additive growth", and a desire to be more intentional and not just "we're wealthy and we're just adding, adding, adding", but...how are we thinking intentionally as a university? That project ended up kicking off subsequent projects where we were more self-reflective and it became clear to us that the rise of engineering out there was not matched with what we were doing here...That I think was around the time we began to think differently about the canonical peers. So, always MIT has been a very important

> institution for Harvard to think about because they are in Cambridge right down the road. They were just so science engineering focused...then Stanford, at least from me, I see it...The rise of engineering, the kind of ambivalent stance around the Palo Alto scene, and venture capitalism, and the worldliness that comes from mixing it up with industry...There was sort of a line there…"That's not who Harvard is", and then it was wait a second, maybe we need to be...And I don't know...We need to talk about this. The Business School's doing some certain things, and we now have this Engineering School and we've decided to grow it...and how do we think about this? So I do think there was a shift of the canonical peers and now we would never not show Stanford and MIT, and you know sometimes it's Caltech depending on what it is we are benchmarking…(Interview 2016a)

Seen in the context of this shifting reference group, Harvard's decision to aggressively pursue MOOCs in 2012 becomes clearer. Having chosen to closely monitor the actions of ascendant peers more focused on new engineering disciplines, and in spite of some ambivalence about the compatibility of these new strategies with Harvard's core traditions, Harvard administrators believed it was imperative to match or keep pace with innovations associated with these campuses.

Among this reference group, edX is conceived of as one of many responses to the social and economic impact of new technology, which is required of elite universities in the digital age. The internet and associated information technologies were often comingled with a need to define a global presence for universities in this elite peer group. One elite administrator explained:

> In a world in which technology increasingly is driving huge changes in society, and the economy...if you are an educational institution you had better have a decent footprint in technology. If you are a research university you want to be relevant. So it's not surprising that all of these institutions have decided that this is what they want to do….Once the decision is made that, you know Bill Bowen has talked a lot about this, that once Princeton makes the decision that the life sciences are going to be important, Princeton starts hiring faculty, starts recruiting different kinds of students, ok. You see Yale making major investments in science and engineering at the same time. Alright. So my point is that, it's not that Harvard has decided to become like MIT because of edX. Right, that's the tail wagging the dog...There are much, much, larger forces that are [present] in a world in which technology [is critical]. (Interview 2014e)

The rapid evolution of technology is seen here as an existential challenge to the contemporary university administrator. While it is not clear exactly what sorts of changes might be ushered into universities in this impending technologically advanced future, it is clear that struggles over faculty, students, and facilities signal a new front in the battle between elite actors in the field.

Translating the "need to have a footprint in technology" into tangible organizational practice goes beyond hiring experts in particular subfields; it also means introducing new practices to the Harvard community. Furthermore, it is important to make clear that investments in new research trends have historically been siloed, and have not impacted the provision of undergraduate education or the delivery of courseware. For instance, while the bio-tech trend of

the 1980-90s enabled by Bayh-Dole had a profound impact on the university (Berman 2012; Powell et al. 2005), it had little or no impact on student learning.

Insofar as the paradigm of rapid, iterative, trial and error development was perceived to be more closely associated with engineering culture and schools with close ties to that culture, some administrators saw the potential for change in this direction.

> Well it's not so much, I don't know, one of the things I remember saying at a [high level planning] meeting is, "not only do I think we have to do this," but I literally said "I think by doing it in partnership with MIT it will force us to act faster than we're typically comfortable acting, and that will be good for Harvard." Harvard will learn how to do business differently....That's the big difference between Harvard and MIT. MIT is willing to fail, and sort of say what can we learn from that, and let's try it again. It's far less conservative than Harvard. (Interview 2014e)

It is also important to note that administrators at Harvard perceived MIT very differently than it did Stanford. While MIT's organizational culture was worthy of emulation, enough core similarities existed to allow Harvard to prioritize cooperation rather than competition (its approach to Stanford).

To move quickly within academic institutions requires a great deal of coordination. Harvard, unlike MIT, is notoriously decentralized with expansive authority granted to individual schools, centers, and departments. When considering Harvard's pace of action, some version of the following sentiments were often noted:

> Harvard is much harder to understand because MIT is much more monoculture than Harvard is. A hugely important distinction between the two places, beyond the fact that one's an engineering culture and the other one is not, is that [Harvard is not as centralized as MIT]...At Harvard: every school has its own faculty...For years Harvard had multiple academic calendars for each school. Some had exams before Christmas, some had exams after Christmas. I mean they didn't even start on the same day! That's now been harmonized, but…At Harvard each school owns its own space. At Harvard, the schools own their own tuition revenue…At Harvard, every…conversations has to take place in every single school. So the Faculty of Arts and Sciences will have one completely different view than the Business School, which will have a different view than the Law School, the Kennedy School, the School of Public Health, the Divinity School, or the Medical School. So you know, it's a totally different world." (Interview 2014e)

In spite of this fact, many elite administrators treated this as a test case, proving ground, and symbol of the Harvard of the future: nimble, more centralized, and capable of responsive corporate action in the face of technological change. Efforts toward this end were lauded by these actors:

> So here I give Harvard enormous credit for taking the plunge, and sort of saying, this initiative represents a really important moment in time in higher education, and notwithstanding the challenges of getting everybody on the

> same page at Harvard, we cannot let those challenges keep us from being a part of this moment. So, I give credit to Mike Smith (Dean of the Faculty of Arts and Sciences), to Drew Faust (President), to Allan Garber (Provost), for saying we need to do this. We understand there is going to be some anxiety, we understand there is going to be some teeth mashing, but we can't afford to be on the sidelines as this is getting shaped. (Interview 2014e)

As anticipated, these rapid moves did not go unnoticed by faculty, and the perceptions and resistance to these tactics will be dealt with in greater detail in the next section.

While pushing for reforms in organizational culture on campus, stressing innovation also involved recasting Harvard's history. Shaping Harvard in a way that would allow it to respond to new technology nimbly and flexibly, Harvard administrators also worked to craft an image of America's oldest university as a perennial pedagogical innovator:

> If you go back in time some of the greatest innovations in higher education have occurred at Harvard. Let me explain three of them. Alright. The case method for teaching in Law School, it was Christopher Langdell, the Dean of Harvard Law School [1870-1895] who creates it. Similarly, different kind of case method, but also the same name was invented at the Harvard business school. Um, medical education, problem based medicine, I think is born at Harvard Medical School. Again Harvard is not monolithic, and there's been plenty of educational innovation at Harvard over the years. Well Harvard, at least in the United States, the residential college is a Harvard invention, one of longstanding tradition at this point, imported you know from Cambridge and Oxford, but still I think, I could be wrong, I think Harvard you know was one of the first. So...not the residential college, but residential education as we know it in that form, the SAT comes out of Harvard. (Interview 2014e)

On one hand, references to centuries old practices that began in Cambridge seem counterintuitive when attempting to cast Harvard as a university with a strong culture of innovation. What this does signal is the power of the discourse of innovation, and how that discourse has become hegemonic even at a bastion of traditional virtue such as Harvard. The choice to partner with MIT on edX as a hedge against perceived developments at Stanford can be best understood in this context.

Faculty Participation: Resistance and Unanticipated Opportunity

The prior section provides evidence about the specific prime actors responsible for the edX partnership and Harvard's MOOC strategy: elite administrators working to defend against threats from elite engineering universities by transforming Harvard's organizational culture. To build a sustained and broad based educational project at Harvard, however, other constituencies had to be engaged. At first, a significant level of resistance surfaced from faculty who bristled at the centralized decision making, rapid pace of movement, and speculative nature of edX, as un-Harvard. Among these faculty skeptics, who were a broad group representing multiple departments, doubts were leveled against the financial outlays dedicated to these courses. It was often strongly implied that they were distractions from the real work of scholarship: guiding intellectual debates and academic fields rather than reaching the masses. While the prospect for learning research enabled by big data was a perceived strength of the project, there was broad

pessimism both within and outside the online education research community about the likelihood that these projects would make a contribution.

In spite of these many challenges, HarvardX was inundated with faculty interest from a wide array of disciplines and departments when it became clear that these new platforms had the capacity to advance the personal and professional objectives of substantial segments of the faculty. Reinforcing prior conclusions, these incentives were not of the financial variety; they had to do with late stage career advancement and political work within their disciplinary fields. Therefore, in spite of the broad skepticism and targeted resistance, HarvardX was able to offer a desirable platform that could be used to maximize faculty professional objectives in unforeseen but desirable ways.

Resistance: In Defense of Harvard culture

The fall of 2012 saw a rather suspicious climate among regular faculty at Harvard University with regard to the newly announced online higher education strategy. Across the campus, faculty reflected on this period as a struggle to make sense of an initiative that was announced to the world at the same time that it was formally announced to the faculty. One senior faculty member with multiple relevant committee appointments noted: "I think, like most members of the faculty, I was surprised to find out that we were sort of the last people to find out about edX, which was indeed sort of the case. It was after the fact, it was certainly after the fact...there was no sense of an obligation [from the administrators] to explain it" (Interview 2014k). This sense was often repeated by subjects, another of whom stated: "It pretty much just popped all of a sudden. Harvard announces they're going to put $60 million into this joint venture that is going to be led by this engineering professor at MIT. Then they were just nowhere…" (Interview 2014o). While faculty frequently leveled concerns about the nature of the announcement and the pace and pattern of decision making, these were no luddites. Each had stories referencing the rapid pace of technological progress in their classrooms, and meaningful personal reflection about updating their own pedagogy in response.

The question facing most faculty was: should Harvard be tackling issues of internet technology and higher education now, and/or should it be done in this manner? This often echoed sentiment is present in this response: "It's not to say that it is wrong for what it is, it just feels wrong to me for what Harvard is" (Interview 2014o), and re-enforced here: "It's the hastiness, the prematurity, and the lack of consultation that I find troubling, not the thing itself which I think will one day be kind of great, it's just this is not that day" (Interview 2014k). Continuing in the theme, another faculty member explained that Harvard's internet strategy should be:

> ...structured in such a way that it grows out of our classroom, rather than competing with our classroom. To me to see our faculty ignoring our students, who've paid tuition to be in residence, in order to serve some undefined remote audience that just happens to sign up or pay some random fee...to me that's a diversion of university assets, and it's ok in my mind as research, I think it's a wonderful research project, but as a future vision of the direction of the university, it doesn't seem right to me." (Interview 2014o)

This was reinforced on May 23, 2013, when concerns were catalyzed into an open letter which requested a campus wide conversation about the online strategy (Fandos 2013).

The open letter, signed by a broad swath of advanced Harvard faculty from multiple departments, but most of whom were concentrated in FAS rather than the professional schools, raised a number of concerns related to the "costs and consequences" of edX and HarvardX and requested more meaningful faculty consultation and oversight. The letter, which was reported to have been drafted by a core group of five faculty members and circulated for signatures, was intended to begin a conversation about the impact of modern technology, and Harvard's online efforts in particular, on Harvard's brand of residential undergraduate education (Interview 2013a).

Many faculty observers resented the blurring of boundaries (and frequent conflation) of science and technology that seemed implicit in the messaging they were receiving from the administration. The desire to encourage Harvard to move quickly and to be more nimble was frequently seen as anti-scientific. One relevant faculty member stated:

> My vantage was simply that, um, this was a major...commitment on the part of the university to an unexplored form of education, with no consultation of the faculty and no presentation of any empirical evidence about the pedagogical effectiveness, the economic implications, the implications for the production and dissemination of knowledge...It was just absent of these things. Any questioning was met with: "This is how these things must work, because this is how innovation happens. It's essential that we not consult you or listen to you or slow down because this is the only way in which change now happens in the world in which we live." As an [FAS faculty member], I find that preposterous, and completely intellectually indefensible, and utterly devoid of any supporting evidence whatsoever....Many of these projects got off to a very fast start, and then burned out, and failed, and turned out to be embarrassments to the institutions that had subscribed to them. Some of them failed because people dragged their feet and said we as a faculty are unwilling to do this so they had to be abandoned, but most of them failed because they weren't well thought out, people had in fact not done what is our obligation as educators which is to think about how this involves the sharing of knowledge and modes of instruction that are important in the world and how this is consistent with our educational mission. (Interview 2014k)

When pressed about the rapid prototyping approach to research development within engineering organizations, often characterized by building a minimally viable product for iterative testing, additional resistance was raised:

> I think it's wildly overstated to think that model even works in technological innovation. It certainly isn't how science works and one of the things that I think people get quite upset about is the conflation here between science and technology. You know I think these are largely salespeople outside of the university, the people who want to tout the greatness of this as an innovation...they see it in some way as having the kind of trappings of science. This is, as if somehow this is science, and scientists think it's crap...like this is an actual scientific method approach. And it's not. Actual scientists would…[my peers who are] scientists, would find this incredibly laughable, but technologists talk about their work as if it's scientific, but it's not, it's not

> how science works. Science is actually slow; and painstaking, and involves a lot of hard work. It's not about "oh fuck it, let's just try it and if it fails we've learned something because failure is so brainy". I mean it's willful anti-intellectualism is what it is. (Interview 2014k)

Skepticism about edX here is couched as an imposition of a different mode of science and research, based on a different set of cultures, practices, and representing a different epistemology. When pressed about the axis of this division, most observers rejected claims of tension between humanities and sciences. Rather, they (correctly in the assessment of this researcher) intuited a culture shift emanating from elite administrators and university stewards designed to create a fast paced "innovative" environment.

An additional layer of skepticism was applied to the motivations and orientation of early faculty teachers of MOOCs. One of the largest and most successful courses often picked out for evaluation was Michael Sandel's "Justice" course. The on-campus variant of this successful lecture course is taken by 25% of undergraduates at some point during their time at Harvard, and is distributed through multiple online channels. Faculty often referenced this course as a "lucrative marketing machine" for books and other associated products. One faculty member remarked: "I am more interested in being at the cutting edge. I'm more interested in shaping outstanding doctoral research and the direction of the field, rather than reaching popular audiences" (Interview 2013b). Often in conjunction with implied judgement of such commercial ventures, faculty also regarded the main teachers of these courses as sub-elite scholars who are understood to be less productive and to have less of an impact on their field than those who eschew large scale teaching work for the more internally valued activities tied to disciplinary prestige (on the construction of academic excellence, see Lamont (2009)).

Big Data & Learning Research

Another avenue through which the project was promoted was as a space for research on teaching and learning. While the appointment of a faculty member from the GSE (Graduate School of Education) to head the research committee was significant, the unfolding of the priorities of the platform development team at edX and the executives in charge of HarvardX complicated efforts to exploit new data streams for learning research. In general, the hopes for the mantra of big data was greeted with skepticism:

> This is a conversation I had once, and [my discussion partner] works as a computer scientist, and he says, people just want to believe, they have this kind of medieval idea that it's a cure all...but it's just a fucking mess, I mean it's a mess, a mess of data that you need method and time to analyze. It's incredibly promising, but right now, it's a mess. We don't have the tools, we haven't taken the time...there are no shortcuts. It's not going to tell us more about education unless we know what the question is. (Interview 2014k)

In particular, conflicting research cultures between technical experts working on developing the software platform and traditional education researchers created issues. The charge from learning researchers is often that big data platforms which capture everything often fail to build in orienting questions, so "...what they are doing is they are trying to gather data from what they've done that will give them an idea about how to do it better, but if you start with the wrong idea you're not going to improve it..." (Interview 2014o). Because of the limited results yielded by

these systems and techniques in their early days, a great deal of skepticism persisted regarding the long term future of research efforts in these platforms as they were constructed in the first few years:

> So people will continue to do this sort of fishing in the exhaust stuff but I think...it will become increasingly untenable...I don't know if there are people other than me who are pointing out how silly some of this stuff is but I have some reasonable influence in pointing that out and I think other people will as well. People will keep doing it, but also, people will look around and be like "come on, you know, having lots of data points doesn't solve any of the design problems you have". (Interview 2014p)

These concerns were echoed at all levels of the research community and led to a subdued commitment among established education scholars. (Interview 2014q).

Pacifying Resistance

Given the complex terrain of prestige in the academy, and the limited impact of MOOC related research, administrators were still able to pacify MOOC resistance through a strategic campaign. While at first the rapid uptake of HarvardX among the teaching faculty across the university as it went into its second year seemed surprising, a deeper understanding of the common objectives of many advanced career academics provides some insight. In particular, advanced faculty were frequently engaged in competitive exercises for distinction such as membership in honorary societies, learned academies, and top posts in professional associations.

In the face of questioning and resistance, HarvardX offered a valuable alternative incentive: robust technical resources and substantial production budgets. For some, these large budgets were an unseemly part of the problem with these new experiments. One rather irate senior faculty member who believed none of the human elements of MOOC pedagogy had been worked out in spite of the large outlay of capital, lamented that "...they are spending public broadcasting, documentary type money with a public broadcasting approach, going on location, and videos and labs...they just built the thing in Widner [Harvard's main library] that will knock your socks off! Totally fucked up!" (Interview 2014o).

While to many faculty the loosely justified expenditure of university resources was troubling, others saw it as an opportunity. In spite of the often rancorous debates about Harvard's engagement with the MOOC movement, and in the years following its launch a remarkable influx of faculty proposals inundated university administrators. The new roster of HarvardX teachers included representatives from across the campus, some of whom had publicly expressed concerns about edX, including signatories of the open letter. Those with a more positive conceptualization of the role of broad access teaching were captivated by the possibilities:

> ***Subject***: Rob Lue [Director of HarvardX] would go around to the faculty and say "we're going to educate the world." It's every teacher's dream. So they thought originally that it would be hard to get Harvard faculty to sign up to do these things, but they were overwhelmed with requests.
> ***Interviewer***: And the faculty are doing this because they want to reach a wider audience?
> ***Subject***: Absolutely, you spend your life writing articles that nobody reads and all of a sudden this seems like world television. (Interview 2014o)

Staffers associated with HarvardX were in a strong position to evaluate the universe of motivations that attracted faculty. One such observer outlined at least three central motivations of early HarvardX instructors:

> I think that they were interested for different reasons. I think some people were really excited because they saw this as an opportunity to do something really innovative and new, and they were also people who had been thinking a lot about their teaching for a long time for whom this is a new [exciting experimental] tool...So I think that was one subset. I think for some people the idea of being a very visible presence in the world, some kind of a rock star teacher thing, was appealing, and flowed from the sense of the personal piece of it, and also from getting their content to the world. You write a journal article and how many people read it? Depending on what it is, maybe somewhere in the dozens, maybe in the hundreds, probably not in the thousands...but who knows? Some small number. Whereas these numbers [online] are staggering, and I think the idea...you know I really care so much about baroque architecture from this period of time that I want to spread the word. I think there is that aspect of it. Then I think there are some people for whom this feels like a real legacy project, so it's actually interesting. I think that's connected to the Rockstar thing, but different, in that for them this is very much about having their content continuing to live on, or to live on with a much bigger audience. The latter half of their careers, it's interesting, because you would think this was all sort of young faculty, who are like yeah, new technology, cool, it's actually like a bunch of the first people was much older. I think Greg Nag is a great example, and he's in I think his 80s, and I think this is a legacy project for him. This is about putting his way of reading the Greek epic into the world and building community around it so that this community continues without him. So I think all of those different pieces, different motivations, and you know some combination of them for a lot of different people as well. (Interview 2014m)

Other senior scholars interviewed for this project elaborated further on their motivations. For some of this group the choice to participate was driven by professional ambition which, while related, is not synonymous with intellectual legacy. For these faculty, a common ambition was to assume an executive or leadership position in national disciplinary/professional associations. Leveraging the ample resources provided by HarvardX, these faculty could use MOOCs as a platform for their candidacy and a springboard into elite academic positions (Interview 2014r).

Conclusion

America's colleges and universities are under renewed pressure to educate more people with fewer state resources. These pressures have been felt across a broad swath of the academy, but Harvard's status and wealth have enabled it to remain at least partially immune from these direct financial imperatives. A related set of structural changes has more specific consequence for all of higher education. These changes have to do with the increased pressures on universities to shift even more resources away from teaching and learning activities toward areas that enable them to more effectively compete in arms races with peers on a broader set of fronts. This has

left one of the core functions of higher education organizations neglected and vulnerable to reform.

Through the 2000s an increasing number of entities emerged and expanded to meet the demand for higher education, seeking to introduce new efficiencies by changing institutional expectations of traditional colleges and universities. These included for-profit providers, as well as nonprofit organizations, many of which used the internet to facilitate their expansion. In spite of this expansion, Harvard administrators did not engage directly with these experiments until another elite university (Stanford), which had recently been formally elevated into its benchmarking reference group, came to be associated with a variant of these experiments.

While the early talk of a "MOOC Tsunami" has yet to fully materialize, structural opportunities to disrupt or re-organize teaching and learning still exist. This chapter used the tools of organizational sociology to evaluate the actual logics employed by key decision makers at Harvard. It shows that, rather than being driven by pressure to cut costs or increase profits internally, organizational actions were shaped by perceptions of unsettling competitive pressures from a newly ascendant set of elite actors: schools closely associated with computer science and engineering. The perceived threats led administrators to break from experimental work organized through Harvard's Extension and Business School and to associate the core Harvard brand with the rapidly moving field of digital pedagogy. This strategy was enacted to compete with Stanford through a cooperative relationship with its neighbor MIT. While these changes elicited a substantial amount of faculty resistance, leaders of HarvardX were able to overcome roadblocks by offering significant resources to faculty eager to pursue projects of independent personal, intellectual, and professional ambition.

This implies that the second order consequences of the ascent of computer scientists into the center of debates about higher education reform are important to highlight. At more than one of the universities in my study, teaching and learning centers historically staffed predominantly with professionals from education and psychology have been eclipsed, if not formally replaced, with new groups of professionals more closely aligned with CS and engineering. This signals the unique nature of this moment of transformation. Unlike past academic trends, where rising fields garner attention and additional resources, the rise of CS has had broad impacts on an array of activities in higher education. While fields such as physics after WWII, or bio-tech during the 1990s, achieved significant funding and enrollment boosts, they had limited impacts on distant fields such as literature, nor did they impact core functions of universities such as teaching and learning.

What's more, the line which divided elite schools which focused on engineering and technology (MIT) from those more closely tied to broad liberal arts foundations (Harvard) can be seen to be eroding rapidly during this period. MOOCs alone did not initiate these trends. They are, however, a productive perspective from which to analyze the process by which decision makers work to adapt to broader social and technical change. From this vantage point the centrality of contingent events in shaping possibilities for action, the process by which complex environments are interpreted by agents, and how organizational responses are crafted to pursue varied agendas, becomes more clear. This section has also demonstrated how organizations respond when agreed upon boundaries between sectors of an organizational field erode.

While the past two decades have witnessed an expansion of technology firms in our economy and culture at a rate which may ultimately be unsustainable, researchers of higher education would be unwise to ignore the broader impacts of these trends on our field. As Harvard works to compete directly with Stanford, it signals that the future of university culture

may be more focused on emerging engineering disciplines than it is today. This wave of defensive investment at Harvard seems not to be limited to a silo in one unit's budget, or in one new quad in Cambridge or Allston, but pushed into the organizational DNA of a university older than the country it has shaped since its inception. No matter what the cost of these competitive engagements are for the elite campuses which pursue them, their status as bellwethers in the field of global higher education are likely to offer increased legitimacy to other organizations interested in pursuing similar reforms, and to increase pressure on those who seek to resist by following alternative paths.

7. Conclusion

The MOOC movement was an unforeseen acceleration of a set of powerful trends that have been reshaping American society for some time. Using the empirical case of the MOOC movement at elite universities this dissertation evaluates the process of embodied technological change as it unfolds in one organizational domain: elite higher education. Computational engineers are using their tools and techniques to promote software as a solution to some of the most vexing reform challenges facing American society. Higher education has been plagued by cost escalation and access challenges since the 1990s. In 2012, a new generation of computer science researchers in the blossoming subfield of artificial intelligence found themselves at the center of these reform debates, a conversation which they had not historically had access to. This dissertation evaluates how leaders at some of America's most prestigious universities responded to these developments in the context of the increasing importance of applied science in the American academy.

Concluding this dissertation requires dedicating some attention to the overall impact and outcome of the MOOC movement. This is a complicated proposition for many reasons, not least of which is the fact that the MOOC movement is not entirely over. The organizations which launched during the first few months of 2012 employ hundreds of talented people and continue to grow. They are hard at work converting the enthusiasm of the MOOC movement into a sustainable practice in whatever corner of the global training market they can find interest. To conclude, this section briefly recapitulates the argument made in the substantive sections of this dissertation and reviews the theoretical contributions it makes. Finally, it ends with a short discussion of the legacy of the MOOC movement for the internal arrangements of the universities in this study and the external MOOC organizations which emerged from it. In many ways, the MOOC has come full circle. What began as a marginal practice developed mostly at the periphery of elite higher education, MOOCs brought online course delivery to the center of the field. As the movement matured, many indications imply that MOOCs have found most lucrative success, and their most loyal audiences, beyond the traditional undergraduate core. Finally, this section offers some thoughts for the future of research on the impact of technology on higher education.

MOOCs: Back to the Margins

Part I of this dissertation reviews the history of distance education prior to 2012 to contextualize the dramatic and rapid pace of change in 2012 at each of the university cases and in the field at large. Chapter 2 highlights the long legacy of distance education at Stanford and Harvard and the fundamental differences in how each university used its local educational outreach investments. Where Stanford prioritized deeper connections with local high tech industry through customized programs developed and delivered by its engineering department, Harvard used their outreach efforts to facilitate access to its hallowed confines to urban populations who would have been otherwise excluded. At each university these programs generate meaningful revenue that flowed in the dominant divisions on campus (Engineering at Stanford and FAS at Harvard). They also used these units to experiment with new teaching technologies and business models that expanded income while sharing it equitably between faculty and departments. By the advent of the internet, both Stanford and Harvard had built on top of these institutional legacies and contractual agreements to expand their reach. MIT,

however, pursued a different path. With no significant extension operation, and skeptical of the gold rush mentality of the late 1990s, MIT extended the concept of openness which grew out of political ideology among some early computer engineers to make all of their course materials free and open to the world via the internet. As internet technologies matured, and computer science expertise became increasingly sought after by corporations, universities, and learners, incremental development gave way to an explosion of interest and a flurry of activity.

Chapter 3 approaches the historical contextualization of the MOOC movement from a different perspective. Using over 6,000 articles from trade publications and periodicals associated with the field of higher education over the internet era, the analysis asks if the MOOC phenomenon was an extension of prior online education framings or a break from them. Using computational text analysis methods to estimate an LDA topic model, it provides additional evidence that the MOOCs did represent a shift in frames used to describe online higher education. In addition to the general pattern of mutual exclusivity between "MOOC" frames and "Distance Learning" frames, the analysis also provided evidence that the actors associated with these two frames were substantially different. Where large states with significant public university systems defined the increase in "Distance Learning" frame, elite universities evaluated later in this dissertation were associated with the period of the "MOOC" frame.

Having provided institutional context and evidence of a few of the novel aspects of the MOOC movement, Part II of the dissertation turns to an analysis of the strategic calculations and local contestation which resulted in the MOOC strategy at Stanford, MIT, and Harvard. Overall, Part II shows how the cresting fortunes of a new generation of computational engineers, and universities at which they are most powerful (Stanford and MIT), have compelled arts and science incumbents to engage and chase new models of elite higher education. As they do so, they remain heavily influenced by institutional legacies and patterns of practice which constrain and define their strategic approach.

Chapter 4 evaluates the consequential local legacies which led to the start of the MOOC movement at Stanford and the subsequent response by top administrators. It argues that a number of conditions made the explosive growth of MOOCs possible, including: 1) Stanford's longstanding commitment to fostering intimate and overlapping connections with high-tech firms and startups across Silicon Valley, 2) the excess local technical capacity offered by high numbers of student engineering majors, and 3) a laissez faire attitude about curricular adaptation and innovation within SCPD to scaffold new experiments. These local conditions combined with a competitive faculty culture in one of the most highly sought-after fields in engineering: machine learning and artificial intelligence. Peter Norvig, who co-taught one of Stanford's original MOOCs with Sebastian Thrun, provides insight into the self-perceived status of these new experts in the following quote from his widely used textbook on Artificial Intelligence:

> Along with molecular biology, AI is regularly cited as the "field I would most like to be in" by scientists in other disciplines[37]. A student in physics might reasonably feel that all the good ideas have already been taken by Galileo, Newton, Einstein, and the rest. AI, on the other hand, still has openings for

[37] A version of this quote appeared in the first edition of this textbook published in 1995 and has been carried through to each subsequent update in varying forms (Russell & Norvig 1995). Unfortunately, the statement is not accompanied by a citation and efforts to identify the study from which this statement is derived have so far been unsuccessful.

> several full-time Einsteins and Edisons…AI is relevant to any intellectual task; it is truly a universal field. (Russell & Norvig 2010)

Judging from the massive numbers of registrants for their fall 2011 MOOC, this assessment of demand was not far off. When Sebastian Thrun flouted academic norms by undercutting the sanctity of Stanford's credentials and later launching Udacity, the responsibility to craft a formal university response fell to President John Hennessy. President Hennessy is in many ways the figure most comprehensively representative of the theoretical perspective of academic capitalism. In developing his MOOC strategy for Stanford he fused fears of disintermediation with the potential for profit. To respond to the creation of Udacity, he and his leadership team worked to secure venture backing and university partners for Coursera, an organization with opaque financial ties to both Stanford and Hennessy himself.

Chapter 5 shows how the reverberations of the MOOC movement enveloped the continent from Stanford to Cambridge through networks of academic artificial intelligence researchers based at MIT. Anant Agarwal, leader of MIT's CSAIL, worked with Rafael Reif (who was soon to be named President) to marshal the will of the faculty to pursue a new MOOC venture. While the chapter makes clear that MIT's efforts were driven by the actions of one of the closest competitors in their self-defined reference set, they did not emulate the fundamental orientation of the response they observed. In particular, MIT's decision to launch a university controlled non-profit signaled the limitations of arguments about academic capitalism in explaining the MOOC movement.

This dissertation argues that the isomorphic pressures which drove change in this field had to do with the epistemological and disciplinary transformation underway in American universities. In particular, the increasing importance of applied science and computational engineering in elite higher education, which has shifted longstanding university hierarchies. In Chapter 6 this dissertation evaluates how leadership at Harvard, the longtime incumbent in the field of higher education, came to craft a response to the MOOC movement. It argues that competition with Stanford, fraught over the realm of applied science and engineering, encouraged deeper collaboration with MIT. It also led administrators to move this new online platform out of its anticipated home in the low status University Extension to its symbolic center. This was then narrated as an essential university priority located at the heart of campus, and leadership went so far as to build an online teaching studio in Widener Library. The central objective of this strategy was to signal Harvard's intent to reverse its historical neglect and hostility toward applied sciences. More generally, top Harvard administrators wanted to use the MOOC movement to transform the decentralized and high minded organizational culture of their university to learn from high tech firms which are considered to be nimble, fast paced, and iterative. These objectives, while rarely made explicit, were resisted vociferously by members of the faculty who believed these reforms were a betrayal of the scientific ideals of Harvard's brand of theoretically driven disciplinary scholarship.

At its heart this dissertation has two empirical questions. The first has to do with the role of technology in organizational change. The second, has to do with the future of the university as traditional incumbents defined by liberal arts disciplinary cores, and universities which focus on applied sciences merge. From an empirical and sociological perspective this dissertation uses two theoretical approaches to understand the actions of three elite universities during the MOOC movement, a period of uncertainty for higher education which began in 2011. First, the literature on academic capitalism was reviewed. This scholarship highlights the increasing entrepreneurial actions of university faculty and organizational leaders in higher education as traditional resource

streams are lost. As an alternative, field theory was presented to understand how organizations define common problems and depend on patterns of action which tend to reproduce stability and hierarchy among groups of related organizations. The evidence presented above shows that while the lens of academic capitalism is a compelling frame to understand the actions of Stanford and its leadership team, it is substantially deficient in explaining how other elite organizations crafted responses in Cambridge. However, field theory has an under theorized notion of agency and action at the micro level.

In the interview data I present in this dissertation, we see that actual organizational strategy is made by agents in common fields who come to radically different positions based on disciplinary orientation, institutional context, and organizational history. As such, the interview data which underpins this analysis provides new opportunities to extend field theory to the level of individual patterns of action. In particular, this dissertation presents interview evidence of how the microprocesses by which actors combine institutional legacies and personal prerogatives result in organizational strategy and action. As this dissertation shows, this is deeply influenced by complex processes of the constant definition and redefinition of competitive peer groups at multiple levels of each organization, as well as between fields subsumed within those organizations.

MOOCs: Successful Failures?

Early evangelists promised that MOOCs would usher in a period of unparalleled disruption across higher education, enabling the top scholars in every field to teach millions of students across the world, thereby rendering most broad access schools redundant. While these ambitions of the MOOC movement were envisioned to be fundamental transformations of the global market for education, the results were often far less profound. The promised tsunami that was predicted to wash ashore and transform traditional higher education may still be gathering strength, or it may have headed in an unanticipated direction. Three years after the most bombastic MOOC claims captured the popular imagination, the tangible results on each campus were relatively circumscribed. By 2015 the MOOC movement seemed to be losing the attention of higher education reformers. The general applicability expected at broad access schools seemed not to have materialized as results from San Jose State and other schools documented at least as many challenges as there were cost savings. While thousands of MOOCs have been designed and delivered online, and millions of learners had taken some form of free/low cost instruction, few in the academy persisted in predicting that MOOCs would call forth the imminent decline of the university as we know it.

This was not lost on faculty who were interviewed toward the end of the data collection process. As one mid-career faculty member put it “For me it's a fascinating kind of social, historical, cultural moment in American higher education, because it’s the first time I’ve lived through an experiment like that that went bust almost. To see that kind of large-scale investment, that kind of excitement…all for what?” (Interview 2017c). From the perspective of this dissertation, that assessment may be correct. Elite universities in this study saw another year after year increase in the number of applications to their residential programs, with Harvard also recording record interest in their computer science major (The Harvard Gazette 2018). They also explained new levels of philanthropic giving. Notably, the three universities took this opportunity to pursue internal reorganizations that consolidated a number of legacy departments which were created to provide new services related to the increasing significance of the internet and digital technologies in the day to day life on each campus.

Following a few intense years of bombastic rhetoric and existential concern, one of the most clear examples of pressures toward conformity faced by these schools as they each pursued independent MOOC strategies was the tangible bureaucratic internal reform project. In all these cases, Stanford, MIT, and Harvard, new divisions were created which brought traditional teaching and learning centers with legacy tech service units under new amalgamated administration. Now the units that had once been responsible for installing the ethernet jacks in the dorm rooms sit beside learning designers and teaching coaches. At Harvard, the first ever Vice Provost for Advances in Learning, Peter Bol, was appointed in 2013 to contain both the Harvard Center for Teaching and Learning and HarvardX. At the other two sites, computer scientists or engineers were elevated to head these new positions. At Stanford this new entity, Vice Provost for Teaching and Learning, was created in 2014 as an expanded version of the earlier MOOC response VPOL and was run by CS professor John Mitchell. At MIT Sanjay Sarma, an EE faculty member was made Vice President for Open Learning, a sprawling holding unit that spans the campus that was created in 2016.

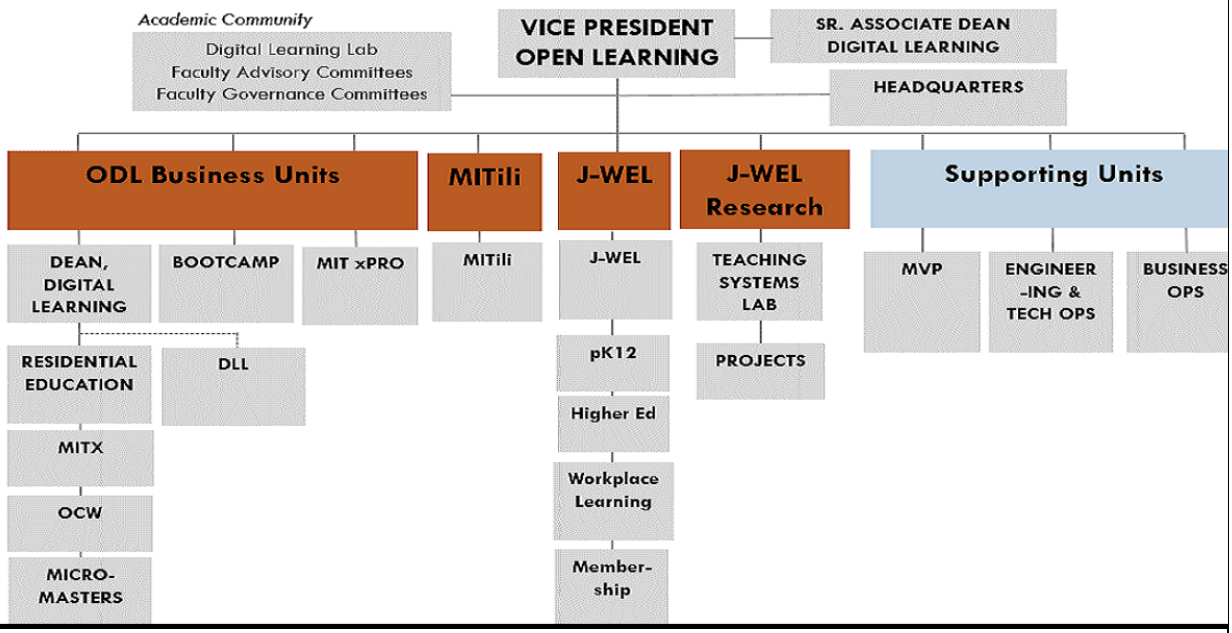

Figure 7.1 (MIT Open Learning 2016)

With these appointments, each university took the occasion of the MOOC movement to fuse teaching and learning with online course delivery and a host of other legacy units within the same bureaucratic home.

While these bureaucratic legacies seem somewhat mundane when compared with the ambitions of the early MOOC pioneers on each of these campuses, the story of MOOC based organizations beyond the three campuses is very different. From that perspective, MOOCs have yielded phenomenal success. As was predicted by many respondents at SCPD, leaders of MOOC organizations began follow the money into the lucrative corporate training market sooner rather than later. Many SCPD administrators believed that arts and science courses required of college undergraduates were never where the action was, even when they were taught by the best and most charismatic titans of their disciplines. On the other hand, career development certificates,

and credentials with labor market value, seemed to have an unlimited demand and massive potential for profit.

Udacity was the first of the three MOOC organizations to chase the professional education market. In 2014 Thurn announced a partnership with Georgia Tech to offer a full CS MA degree for $7,000. The project maintains rigorous admissions criteria and leads to a full, traditional, Georgia Tech degree. Rather than come to campus, students enrolled in the online program to take courses from a distance with more classmates than anyone would have previously thought possible. In 2017, 1,000 students were enrolled in the Udacity program at Georgia Tech and they have plans to add a second MA program in analytics with the same format (Straumsheim 2017). In addition, smaller "micro" masters and "nano-degrees", multi course sequences that yield certificates, turned out to be a lucrative market and Udacity, Coursera, and edX have each worked to capitalize. While Coursera did not move as quickly or aggressively toward professional training, pragmatism and innovative combinations of offerings from traditional universities has turned out to yield handsome returns.

These choices have proven to be spectacularly lucrative. From a financial perspective, MOOCs look like a resounding success. While edX's non-profit status yields little public financial data, both Udacity and Coursera have persisted in Silicon Valley and continue to generate press coverage about their progress. Both Udacity and Coursera have also continued to raise additional venture capital. Their current valuations are staggering. In 2015 Udacity raised $105 million in Series D funds at a valuation of $1 billion, entering the club of vaunted Silicon Valley unicorns, startups with valuations over the billion dollar threshold, less than 3 years after they launched (Zakrzewski 2015). Approximately 20 months later Coursera closed its own Series D round with a total valuation of $800 million (Lunden 2017). While they are not quite both unicorns, Coursera and Udacity likely have a combined value of north of $2 billion by the summer of 2018. For an academic department to produce two companies worth billions of dollars out of unknown technologies in 5 years is an astonishing feat.

But the bureaucratic transformations and financial value created belie the singular legacy of the MOOC movement at these three universities and in the field at large. As this dissertation argues, this period of intense development exemplified the process of organizational change resulting from the transformative impact of digital technologists and computational engineers in the academy and beyond. In particular, this dissertation focuses on one empirical example of how new technical experts pushed claims of reform to reshape both internal and external hierarchies in higher education. An often overlooked and understudied sea change is underway in American higher education as digital technologists and their methods spread across the field into previously unthinkable terrain.

Implications for the Future

This dissertation has advanced the argument that the MOOC movement can best be seen as a coming together of the historically separate but neighboring fields into a single unified hierarchy. As applied sciences focused universities and the experts who inhabit them have gained in access to resources and symbolic capital, traditional arts and sciences universities have been forced to directly cooperate and compete with them. It is through this lenses that the preceding analysis of Stanford, MIT, Harvard was undertaken.

This is not the first example of the reorganization of the field of higher education in America. The literature contains other historical examples of changes in disciplinary order and internal logic of the American university. It also bears witness to the transformative impact that

technologies of science have had across disciplines and on the field at large. Some of these moments have had a profound impact on the institutional logic of higher education, such as the advent of the German model of graduate disciplinary education. Other transformations such as the proliferation of quantification and statistical analysis across the academy in the mid-1900s changed research practice and prestige structures across fields of scientific practice. Furthermore, events have transpired to produce major shifts in disciplinary hierarchies over time such as the rise of physics following WWII, or the revolution in bio-sciences which captivated policy makers and scholars in the 1980-90s. The question raised by this dissertation, and which has yet to be answered, is, what sort of academic transformation is represented by the MOOC movement and the rise of applied sciences and computational engineering.

At the broadest level, recent breakthroughs in artificial intelligence research have transpired in a much different macro-institutional context than prior revolutions in scientific technology such as the proliferation of statistics and quantification. Statistics emerged as a technology of statecraft, co-constituted with the advent of the desire and ability of the modern states to produce data on their entire governed populations. In the more recent "big data" revolution corporations have been the sponsors as well as the data intermediaries which produce both the raw materials for these analyses, and the demand for their results. When statistics were developed in the service of statecraft, the significant power and massive size of modern corporations was absolutely unfathomable. In additional to macro analysis of the modes of power implied by these new arrangements, there are more tangible questions to be addressed in the context of higher education. In education, and across American society, understanding how best to manage and govern the proliferation, aggregation, and analysis of this data under these new structural conditions is as essential for learning sciences as it is for other domains.[38]

An empirical inquiry into the impact of applied science and computational engineers on universities could take many forms, and how one might fix an object of analysis to gain leverage on these questions is not obvious. Beyond the MOOC movement a place to start might be to analyze formal organizational efforts made by elite colleges to integrate and promote applied sciences into their university structure. Such approaches might compile and compare the recent creation or elevation of applied science and engineering units at schools like Harvard, Yale, Berkeley and other. From another perspective, drawing historical comparison to prior disciplinary ascents such as physics and bioscience might also prove fateful. There are also questions to be answered about how these new methods, and the experts who practice them most convincingly, are incorporated (or not) into neighboring fields. Using the proliferation of statistics as a point of historical comparison one could ask if computationally intensive methods will remained siloed in (all be it expanding) departments or whether they will find new homes in neighboring disciplines. A disciplinary takeover could unfold through replacement of faculty, or space in journals, with work done by researchers trained in computational engineering disciplines. Alternatively, the integration of new computational methods could be accomplished through traditionally trained disciplinary experts supplementing their methodological abilities with new skills, much as was the case during the period of the proliferation of statistics. Which model transpires will likely have a profound impact on the nature and practice of research and teaching at America's universities.

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[38] While a series of recent meetings convened by Stanford's Center for Advanced Research through Online Learning made progress on these topics, there is still a great deal to do. For a review of the conclusions of these meetings see Ithaka S+R's report (Alamuddin et al. 2016).

Whatever the ultimate outcome of these processes on the structure of scientific production, these trends are already reshaping undergraduate identities. Rivera's (2015) inquiry into the articulation between undergraduate cultures on elite campuses and the most prestigious professional firms that recruit from top schools demonstrate the increased significance of high tech firms in these labor markets. Binder and Davis (2016) subsequently present work demonstrating that undergraduate cultures are already shifting in response. The continued dominance of majors in fields related to computer science at places like Stanford, or its future growth at places like Harvard or MIT, is an open question. But with new fortunes minted every day, and demand for digitization across an endless array of fields, it appears unlikely that the tide will turn back toward traditional arts and science disciplines anytime soon. This begs a new set of questions about the future of the American elite, as we would be shortsighted not to at least consider: what will elite student culture look like if 25-50% of students at Princeton, Penn, or Chicago become majors in CS or other applied sciences (as is the case at Stanford)? What impact would that have on places like Williams, Amherst, Oberlin? How might CSU East Bay respond? This dissertation has demonstrated that all of these universities are watching one another, but how they may interpret the signals sent as they build the future of higher education remains an open and compelling question.

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Appendix A: Glossary of Terms & Abbreviations

AllLearn	An early online higher education site launched by a consortium of elite universities.
CM	Carnegie Mellon University
Coursera	One of the first company set up to take advantage of MOOCs. It was founded by Daphne Koller and Andrew Ng.
CourseWare (Stanford)	An early technical platform designed by John Mitchell and Daphne Koller.
CS	Computer science
edX	MOOC based organization launched by MIT and Harvard in 2012.
Fathom	An early online higher education provider associated with Columbia University.
HarvardX	The entity established at Harvard to support local MOOC production and pedagogical innovation.
HBS	Harvard Business School.
HCP	Honors Cooperative Program at Harvard.
HP	Hewlett and Packard
Micro-masters	Combinations of courses that lead to certificates but not formal masters credentials.
MIT	Massachusetts Institute of Technology
MITx	The entity established at MIT to support local MOOC production and pedagogical innovation.
MOOC	Massive Open Online Course
OCW	OpenCourseWare, MIT's project to publish course materials on the internet for free.
OLI	Open Learning Initiative
R & D	Research and Development
SCPD	Stanford Center for Professional Development
SEE	Stanford Engineering Everywhere
SITN	Stanford Instructional Television Network
THEN	An early online higher education provider associated with UCLA.
Udacity	The first company set up to take advantage of MOOCs. It was founded by Sebastian Thrun.
VPOL	Vice Provost for Online Learning

VPTL	Vice Provost for Teaching and Learning
WGU	Western Governors University
WGBH	Boston based public access television.
CAO	Chief Analytics Officer
DARPA	Defense Advanced Research Projects Agency
IEEE	Institute of Electrical and Electronics Engineers
CSAIL	Computer Science and Artificial Intelligence Laboratory, a research unit of MIT.
FAS	Faculty of Arts and Science, Harvard's largest faculty division.
KCBP	Kleiner Perkins Caufield & Byers, a large venture capital company in Silicon Valley.