Chapter 8: Explorations of Centers for Online Learning

Visits to Coursera, Stanford Online Education, Udacity, EdX, and HarvardX Headquarters, and Reflections on Online Learning

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I NTRODUCTION

This report describes some explorations into the world of MOOCs, SPOCs, LMS systems, and other online tools that have exploded onto the higher education scene in 2013. The headlines in both academic papers and regular newspapers are extolling the era of MOOCs, the extinction of the university as we know it, and breathlessly describe robotics courses that include 800,000 students, including yak herders in Mongolia.

Clearly something significant is happening and we are at some kind of historic moment in the development of a "transformative" technology for higher education. But what does this mean for Universities, liberal arts colleges, and the experience of College for students?   How can professors adjust to this "revolution" or should they? And what will this explosion of online education technology mean for the quality of teaching in universities and colleges - will it improve teaching and learning?   or replace professors with recorded lecturers from other institutions in the new "flipped" classroom environment?

During my ACE fellowship, I have the unique opportunity to explore the world of higher education without being tied to a single department, program or even a single institution. We are able to travel across the country and beyond to learn about academic leadership, trends in higher education, and useful "best practices" that we can bring back to our home institutions. Clearly online learning had to be near the top of the agenda for any ACE fellow in 2013, and so I made it a priority to be sure to visit the founders of the main online learning centers - Coursera, Udacity, EdX, and Stanford's online education center.

I am hoping that by giving some of the details of these visits, I can convey both the nature of the technology being developed at these sites, but also something of the institutional cultures of these innovative companies, and the possible effects of online learning on today's universities and colleges. I am hopeful that both Yale and Pomona College find these descriptions useful as they develop their capacities for online education in the coming years, and am grateful to both institutions for helping me with my year as an ACE fellow.

The report gives a basic overview of MOOCs and online education, describes visits to Coursera, Stanford, Udacity, and EdX, and concludes with some thoughts about online education for a large university (Yale) and for a liberal arts college (Pomona College).

OVERVIEW OF MOOCS AND ONLINE LEARNING

The world of MOOCs and online learning is changing very rapidly. Many good summaries have been published in the Chronicle of Higher Education, and a recent online learning summit at MIT brought together a very nice set of resources, which I have attached to this document. I also provide a brief history of the development of MOOCs and online learning which places our site visits in context.

Many of the main MOOC providers are only 1-2 years old, but they arise from over a decade of increases in the development of online content and the rise of the learning management system (LMS) in education. The earliest forms of online education include the "PLATO (Programmed Logic for Automated Teaching Operations)" system from 1960, developed at the University of Illinois, which was a completely online system for experimenting with communications between teachers and students, much like a text-based chat system. By 1969, the Arpanet was founded by the Department of Defense, which created the basis of the internet. By the early 1970's, experiments with video recordings and distance learning were conducted that had some of the feel of modern MOOCs. Fully online courses in logic and set theory were offered at Stanford University from 1972 to 1992, and further experiments in distance learning in the 1970s included community college and local television stations collaborating to combine video with phone-based communications between distributed groups of students and instructors. Several of Stanford's engineering courses were offered remotely via close-circuit television to remote sites in Silicon valley, and these sort of video courses proliferated across the country during the 1980's and 1990's, and had many of the features of a modern MOOC. Also during the1980's the first LMS or Virtual Learning Environment (VLE) systems were developed, which were the precursors of modern systems like Moodle or Blackboard. A full history and timeline of the development of the Virtual Learning Environment is available at http://en.wikipedia.org/wiki/History_of_virtual_learning_environments.

The development of online materials progressed steadily during the 1990's and the early 2000's, to a point where nearly every instructor was expected to develop a class web site, providing syllabus and assignments through an online portal, and in many cases interactive features such as blogs, chat rooms, and wiki pages were provided for students through systems such as Blackboard, Moodle, Sakai, classesv2 (Yale's version of Sakai), and other LMS environments.

One of the early systems for offering online lectures was iTunesU, which still offers thousands of courses, and claims to be the largest compendium of online lectures, with over 600,000 free lectures. Yale University was an early leader in online courses with its OpenYale initiative, which provides over 30 Yale courses free of charge to give full lectures and course materials. Early experiments such as the MIT Open CourseWare initiative expanded the range of content available online to include interactive simulations, quizzes, and some lectures, and these resources evolved into the modern EdX consortium, which originally was a collaboration between MIT and Harvard to offer a unified platform for online courses.

The first complete online MOOCs include the famous courses in machine learning from Sebastian Thrun at Stanford, famously enrolling over 80,000 students, and courses in programming and artificial intelligence from Andrew Ng and Daphne Koller. The success of these courses, and the enormous numbers of students who enrolled and completed the course, give them the title of MOOC and inspired these three instructors to become the founders of two of the leading online systems, Coursera (Koller and Ng) and Udacity (Thrun). The diagram below, adapted from a presentation by Phil Hill and Michael Feldstein, shows a timeline and evolutionary tree of the early online education offerings.
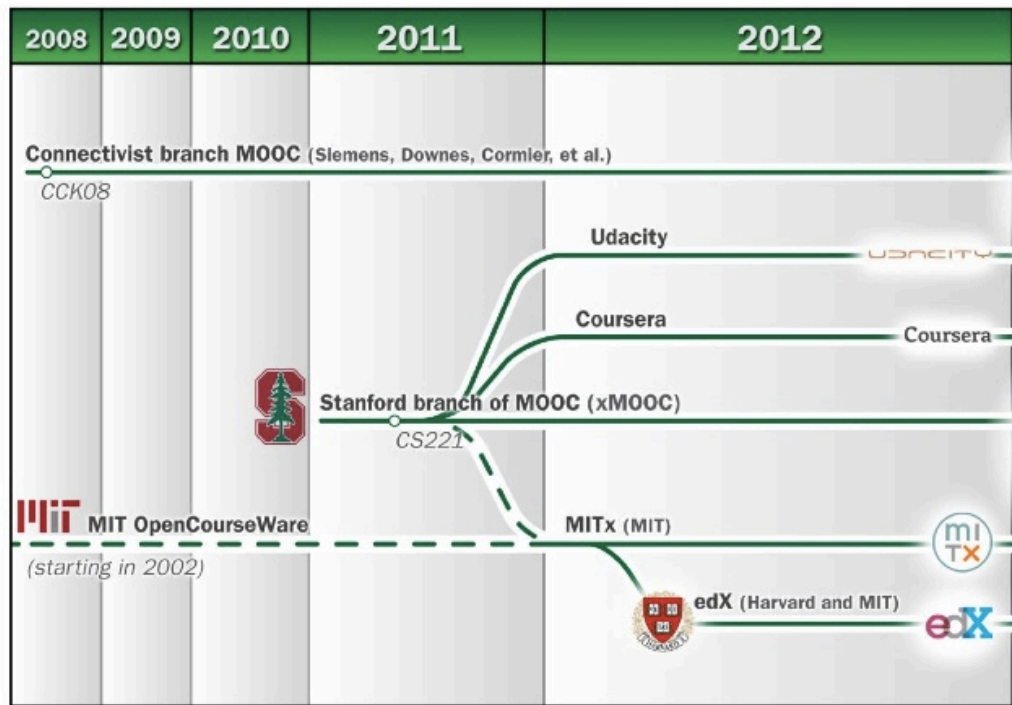

Figure 1: *Evolutionary Tree of the MOOC providers of today, showing the emergence of the EdX consortium from the MIT Open Courseware initiative, and the common origin of the Udacity, Coursera and other online platforms from Stanford University courses in computer science.*

What separates a MOOC or online courses from LMS systems is a system for online learning that unifies all of the class content - lectures, assignments, discussion forum, and quizzes - in a single interface. In many cases these interfaces will also include interactive chat (video or text), game-like simulations and scenarios, and systems for uploading essays and other creative work for grading or sharing with the community. The development of these interfaces is what is new in the past year, and the pace of development has been dizzying. The line between an LMS and MOOC is a bit grey however, and policymakers for online learning should keep in mind that the development of these technologies has had a huge impact on nearly every campus, and now can seamlessly connect students, faculty and administration through portals, LMS systems and other software. It would be hard to imagine a campus without an LMS system (Moodle, Sakai etc), and

probably in a decade it will be equally hard to imagine a campus without a dynamic and well-developed online course portfolio and online course authoring system!

To learn more about MOOCs and online courses, I have attended an (appropriately) online Spring Focus Session offered by Educause entitled "Learning and the MOOC" (resources at http://www.educause.edu/eli/events/eli-online-spring-focus-session). One of the figures from these presentations is very helpful for visualizing the continuum between the LMS and the MOOC - the figure below is from the Educause presentation by Hill and Feldstein entitled "Everything You Think You Know about MOOCs Could be Wrong" illustrates the continuum of technology-enhanced learning in a series of concentric rings.
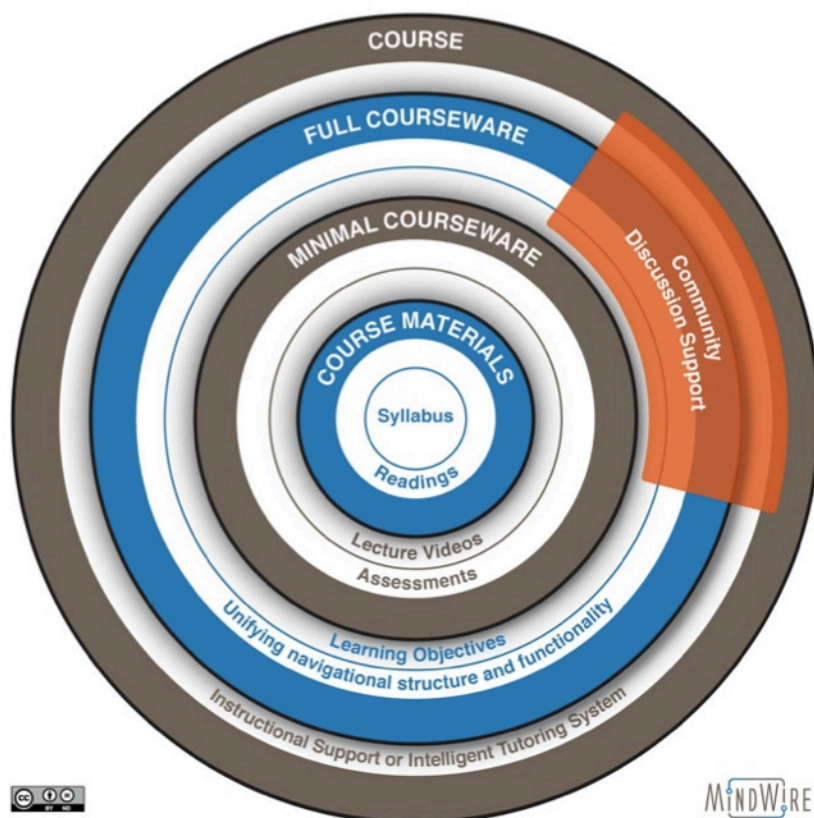
Figure 2: *Diagram showing concentric rings starting with a traditional course (syllabus + readings), then adding minimal courseware (videos+quizzes), then adding additional courseware for clarifying and unifying the learning objectives, and integrating discussion and assessment. (from Hill and Feldstein, Educause Spring Focus session presentation).*

To gather some first hand information about MOOCs, their creators, and the vision of the innovators and designers of these systems, I visited a number of the leading centers for online learning to hear from their founders and to see their technology as it is being developed, as demonstrated by their technical staff.

The first visit was to the Silicon Valley group of online education centers. Our group of twelve ACE fellows and one Yale-NUS faculty had an amazing series of meetings at Stanford, Coursera and Udacity - all in one day! We felt we were getting a glimpse of the future of higher education, and of new forms of institutional culture. Our group was really impressed by the energy and dynamic feel of Coursera, Stanford and Udacity, where there is an entrepreneurial euphoria and almost phrenetic sense of energy. In all three cases, people felt they were part of a cutting-edge enterprise really making a difference in the world.

A month later I visited the headquarters of EdX, in Boston, talked with some of their staff, and met with its founder Anant Agarwal. Further visits to Harvard's Bok Center for Teaching and Learning enabled me to see how HarvardX and online education were being implemented there. A final discussion with the MIT Learning Library staff gave additional perspective on the way in which online learning has been integrated into MIT's academic programs. In the Boston-based online learning centers, a similar sense of energy and excitement prevailed, and some aspects of their development seemed more systematic and planned than the bay-area companies, but no less impressive in the speed and reach of their technical development. In the following sections, each of these visits is described in more detail.

C OURSERA HQ V ISIT

The Coursera people were amazingly gracious and met us in their office suite which is a nondescript professional building in Mountain View, CA. Their business partnership director, Chris Heather, was there when we arrived and he and Diane Lee opened the program with an overview of their operations in a small boardroom just the right size for our 12 ACE fellows. It struck me as paradoxical that a world-changing organization has its entire operations within the office suite size of an average medical practice, with a board room that only holds about 12 people! This for a group that claims several million students in over 100 countries!

Figure 3: *Some of our ACE fellows signing the guest log at the Coursera Headquarters in Mountain View, CA.*

After a while Andrew Ng, co-founder of Coursera, came in. He looked a bit confused, as he had just arrived and saw us all sitting there. He was not sure whether to interrupt, but thankfully did, and as he sat down he looked around at our group. Chris and Diane suggested that he should continue with the overview. He agreed, and started fumbling with his laptop which was presenting problems for projecting his slides. I again noted the irony of a high-tech company founder, one of the leading figures in the world in intelligent machine design, stymied by his laptop not projecting! After about 10 minutes of this, Diane suggested he use slides from her laptop and then Andrew launched into his amazing presentation.

Figure 4: *Diane Lee, one of our gracious hosts from Coursera, poses by a world map highlighting all the institutional partners of Coursera - these include 70 partners from around the world, hosting courses taken by 3.7 million students.*

Andrew described the platform and the philosophy of Coursera, and its role in offering access to higher education across the earth independent of location, wealth, or status. The scale and potential impact of the new technology was stunning. Part of the challenge of a MOOC which I had not realized was identifying precisely *who* is taking a course. Getting this right is crucial for awarding credit for these courses, but since people never meet each other, sophisticated biometric identifications are used to verify the identify of the MOOC students. For a $50 fee, the software will verify your identity both by video which is used each time an assignment is submitted, by an analysis of your typing patterns, and from a verification of your identity through a passport of driver's license. Another service called eProctor will watch you as you take exams. True to their philosophy of offering open access to the entire world, the course will be done free if you can write to them describing your case of financial need.

The other interesting thing I had not thought about is how an instructor can grade assignments from the tens of thousands of students often enrolled in a MOOC. The Coursera people are very big on "crowd-sourcing" and peer grading. Andrew presented results from earlier classroom studies that showed how students' self-evaluations and peer evaluations correlate very well with instructor grades from a wide range of courses. Because of this correlation, Coursera has built in peer grading into the system - a necessity when 300,000 people are taking a course!   Each student grades 5 others' papers, and in return gets feedback from 5. The software will record scores from the assignments, look for outlying and rejected points which could represent bad grading, to provide a somewhat robust system of peer grading from strangers.

Coursera offers "synchronous" courses - students begin on a fixed date, and proceed at a measured pace through the material with regular deadlines and some of the other features of an old-style university course. Andrew was emphatic that this synchronicity enhances learning, since the community of students experience the course together, and can post questions and help each other through meet-ups during the semester. He even had a plot of web traffic that showed a "heartbeat" in time which was a series of regular and strong upticks in the traffic right before an assignment was due!

There is a rapidly growing world-wide community of instructors building courses now on Coursera - I find this a fascinating and overlooked byproduct of the MOOC. Instructors, as well as students, experience a new global community to learn from. The Coursera instructors communicate through online forums, and are able to collaborate and get answers to common problems. There even is an in-person meeting of Coursera instructors at Penn in April where they will have face time with each other. The main way that Coursera spreads to new places is that an institution will partner with them, and agree to share responsibilities for developing courses. Basically the university covers the costs of producing the course, and for paying the instructor. Coursera provides the platform, limited online support, and will organize the schedule for the course, which is locked in to a semester-like timeline. Coursera will email students while they work, reminding them of deadlines and encouraging them to complete the course. Coursera also collects lots of data on the performance of students (known in the business as "analytics!"), which can be shared with the university, depending on the agreement signed with Coursera. Since everything is free, sharing money is not really an issue - but for now the university owns the intellectual content. People at Stanford were very emphatic that the content of an online course is "work for pay" and owned by the University, since it constitutes the work that the professor would do for the university on their salary as opposed to their own scholarship.

Some instructors have arranged for "Google Hangouts" to stage discussions with students. These are videoconferences that can be recorded and offered as material for other students to view (only about 20 can be in a hangout at once) and provides some level of face-time with students. The instructor of a Coursera course can respond to 100,000 emails directly, or rely on tutoring, which is provided in many cases by former Coursera students. These "alumni" serve as experts on the online forums and provide lots of help to other students.

STANFORD VISIT

Our Stanford visit followed right afterwards. We were greeted by nearly the entire team of Stanford online education - this included Robyn Dunbar (director of the Center of Teaching and Learning), Amy Collier (Director for Technology and Teaching for the Office of the Vice Provost for Online Learning), Jane Manning (Manager of Online Course Production and Platforms) and Brent Izutsu (Director of Digial Media). The Stanford group was extremely gracious in providing a lunch, and a nicely prepared set of materials that outlined the ways in which online education is implemented at Stanford and the effects it is having on faculty and students.

Amy Collier went first and gave a great overview of how they have implemented a multi-level system of online learning at Stanford. The Vice Provost of online education - installed just a few months ago - is in charge of a growing empire of content developers, programmers and faculty development people. They have a real excitement and energy, and are generously supported by the President and Provost. Stanford seems to be experiencing a headlong rush into the world of online education, with a "full court press" that includes simultaneously building two in-house packages (class2go and venturelab), running an online high school, supporting ItunesU courses, and also supporting Coursera! Stanford offers seed grants of $25K to faculty for developing new online courses, and the encouragement from all levels means that a number of exciting new projects are being developed at once, even in fields not traditionally thought fit for online education like dance and humanities.

The Stanford Class2Go platform is noteworthy, but is being discontinued due to a recent announcement of Stanford's collaboration with EdX. Class2Go was developed at Stanford, and is a simple, open-source platform that can be used to host courses with imbedded video and other great things that Coursera typically has. The open source aspect means that you can use it on your campus and customize it for your particular people and institution. Office hours for faculty, on-campus maps and logos for your college can all be added. The new version of the EdX platform will blend some aspects of the Class2Go platform with the existing EdX platform and will be offered "open source."

The Stanford group did a nice overview of the pros and cons of the in-house open source vs the "capitalist" model of Coursera and Udacity. They also pointed out some limitations of Coursera partnership agreements and urged any potential Coursera partner to insist on owning content, getting student emails, getting all student usage data, getting the "analytics," getting a service agreement to help train faculty and TAs, and even getting student IDs as part of the data entry effort if possible.

Jane Manning pointed out some of the legal issues with ownership (is the course a professor/s content or institution's?) and the copyright issues, which can be vexing for online courses since the usual "fair use" provisions don't necessarily apply. The legal realm is a bit grey here, as some of the court cases have not arisen, but Stanford's policy is to avoid being that first institution to be sued for copyright violation, or even for ADA violation. The faculty need to be taught clearly

how to implement online courses and to be completely informed about the institution's intellectual property stance vis a vis the online course. Without clear guidelines, they can be quite unhappy or confused, according to Jane.

Brent Izutsu, director of digital media, explained some aspects of content development and the degree to which production values are becoming an issue. Many online courses require more than a professor recording in his office, but instead have HD video, well-lit sets and chromakey filming in studios to avoid complaints. One easy remedy is to film in a studio the first and last bits of a class, and then have the rest done in the office of a professor. Brent noted that the presence of a large audience in an online course raises issues too, and may require release forms from all the students!

Robyn Dunbar noted that the entire process of online learning development and the phenomenon has energized discussions of teaching at Stanford, and "has brought new faculty to the table" and has helped many faculty want to work more at effective teaching. Online learning also has brought a new maturity to the process of course design. She marveled that for the first time, faculty are asking "who is my audience?" and thinking more deeply about how well their teaching is connecting with students. She indicated that depending on what catalyzed the discussion of online education on your campus, you can find different sources of funding, and that the online education can help in a wide ranges of efforts on different campuses.

The development of online education at Stanford is supported from the highest levels, and is a "many flowers bloom" approach. This has the advantage of allowing the best solution to emerge from a rather chaotic entry of many competing systems, but has the disadvantage of that same chaotic environment, which does not allow one to predict, plan or control how things evolve. Perhaps this "market based" or Darwinian approach is best, but it does present some risks for Stanford in controlling the "front" that Stanford presents to the world, and could arise in duplicated effort as different people are simultaneously supporting and developing content for multiple platforms. Should some of these platforms be phased out, it is not clear how well the efforts of course development can transport to the surviving platform.

UDACITY VISIT

The final visit of the day was to Udacity, at another non-descript office park. The Udacity building from the outside looked very corporate - again like a medical building. Like Coursera, the interior was anything but corporate. Coursera and Udacity both had writing on the wall - Coursera favored post-it notes, but had bean bag rooms, space for kids to play and standup desks. Udacity took it a level further, with an office space that looked like a cross between a game room and library common space. Whiteboard walls were covered with outlines of courses, cartoons and other creative ideas. Tables with computers in an open space co-existed with bikes on the wall, a wet bar, a kitchen, a well stocked refrigerator, a room with toys, and numerous small rooms with funny labels on the doors for private phone conversations. There was a palpable

energy and youthfulness in the place, both because the average employee seemed to be 25 years old, and because those over 40 seemed to bring a youthful joy to the work. Udacity's center was filled with natural light, and glass walls separated conference rooms and executive offices (such as they were) from the main common areas. Employee's names were scrawled on the walls using molecular diagrams, and the letters from peptide groups. A course on one wall outlined a genomics course with learning goals, and specific lectures broken down. Other cartoons were drawn on walls, and the room exuded FUN.

Our tour was being led by Stuart Frye, who directs strategic partnerships and business development for Udacity. Stuart is a voluble 30-something, making him a *senior* member of the Udacity staff. Stuart explained that the space was indeed "cooler than most startups" since this was their third office, and they learned from the past two. He explained how many of the employees love coming to work and even stay late and on holidays because of the fun atmosphere.

Figure 5: *Udacity Headquarters, where visitors are greeted by a step-on piano keyboard, a violin and stand, bicycles on the wall, and many couches and lounge areas. The well-stocked refrigerator included all manner of beers, caffeinated drinks, and it was clear that the employees enjoyed being there and also worked long hours at this startup.*

A tour around the office showed us the Dog room, and the one visibly 40+ person we saw clearly was a professor who was working with the young Udacity employees to help implement his class. Stuart explained that Udacity thinks of the current age as similar to the time when film was first invented for motion pictures. At that time, movies primarily recorded theatrical performances at first, before they recognized that they could create something entirely different from theatre and music on a stage. The invention of the "set" and "location filming" both created what we identify as a modern movie, as well as a giant emphasis on planning, production and post-production. Udacity brings many of these Hollywood type sentiments to their course design, and aims for a high quality, cinematic type of course in small numbers rather than Coursera's larger volume model.

Each Udacity course is developed carefully with a team of production technicians. The instructor visits their headquarters and records in their studio using both a camera/set and a desk which records the instructor's writing as they narrate. Additional "location" segments have made their way into some of Udacity's 22 course offerings.

Figure 6: *Stuart explaining the "cinematic" nature of Udacity's online courses, at the company headquarters "set" for recording in-person shots.*

Some of the courses also employ actors for professors who may be camera shy. Skits that dramatize physics or statistics were shown, and both used youthful Udacity employees in front of the cameras instead of professors. One statistics course had camera-shy profs who only appeared

in the background (on a TV in the living room) behind the onscreen, 20-something actors. This approach makes for a lively, visually attractive course, which would perhaps be naturally attractive to the younger demographic which could be the main market for their courses.

Clearly the Udacity courses are different from Coursera. Udacity strictly controls the production and course development, and has turned away "over 500" proposals from professors to develop courses. They are striving for quality and a unique niche in the market that includes both computer science courses (which has funded their operation through partnerships with Google and other Silicon Valley partners), and a select number of academic subjects that they feel will make for an effective and high quality course. Udacity is also partnering with San Jose State University to enable SJSU students to get credit for introductory math courses. This is a pilot program which will have 100 students in its first offering, and will offer those students 24-hour online support to answer questions and to help using a virtual blackboard to enable instructors to talk with the students and work out problems in real time if they have questions.

Also unlike Coursera, Udacity relies on automatic grading and feedback for the courses, which leverages some of the expertise of their founder, Sebastian Thrun. Sebastian dropped into our session and sat with us for nearly 40 minutes to explain the company philosophy and answer our questions. He explained how Udacity is entirely student centered, and as something of a renegade academic, would favor reform of universities to make them massively more efficient, perhaps without the presence of administrators!

EDX VISIT

On March 31, I visited EdX headquarters, which is near MIT near the Kendall Place Metro stop, with fellow ACE Fellow, Rob Sabal. I arrived a bit early to the place-1:00PM instead of 1:30PM. When I arrived, they very kindly offered me birthday cake! Today was the March birthday celebration, and so they had two cakes they were enjoying. I also passed a baby who was being wheeled out by her mom. Already two points for EdX - family friendly and fun!

The birthday cake table was crowded with a large number of the employees. I could see the youthful demographic - perhaps an average age of 30 or so, but perhaps with a bit more of a male group than Udacity and they seemed very serious - even while eating cake. There was the usual socializing but also a number of them talking about code or some appointment or other of their work. EdX had a very interesting vibe which was fun, but also focused and a bit more on the serious side than Coursera or Udacity.

While getting chocolate cake, I happened to run into Anant Agarwal, who was having an animated conversation with the group. Anant was quite friendly and remembered me from our short introduction at the ACE national meeting in Washington DC. I told him that I had just arrived, a bit early, and had enjoyed biking a bit earlier through Boston. He was immediately curious, and asked about my bike - I got him very interested in my little folding Brompton bike, and he pledged he would walk over to it to see it.

Within my first 15 minutes at EdX I had met its founder, had some chocolate cake, and now someone kindly brought me coffee! I sat with the cake and had a nice talk about biking with Diana, the receptionist and administrative assistant. Since I had a bit of time and since Anant was so busy I decided to walk over to where my Brompton bike was parked and fold it up to bring into the office, so Anant would not have to trek across the street.

After a few minutes, Howard Lurie (Vice President for Content Development) came along and introduced himself right on time at 1:30PM. Howard pointed out some of the organization of the EdX space, and I took my coffee into his office and we had a nice chat about some of the motivations that Yale/NUS and Pomona might have toward online education. Rob showed up a few minutes later and joined in the conversations. Howard wanted to know what ACE fellows were, and so I gave him some of the explanation of this, and as I was talking, Anant walked in. Anant also wanted to know what ACE fellows do, so Rob filled in the rest of the talk and started over the beginning. Then I got to ask him some questions.

Figure 7: *View of EdX headquarters near MIT, showing a similarly youthful, and slightly denser and more intense environment than some of the California online companies.*

Anant was energetic and personable, and sat at the edge of the seat as I asked him our first question - "How is EdX different from Coursera and Udacity; What is your educational philosophy and where do you see EdX going with online education?" Anant pointed out that

EdX is non-profit and really is designed to align with the principles of its partners - Harvard, MIT, etc - all of which exist as non-profit institutions of *excellence*. These founding institutions were referred to as their "brand parents." Anant stressed how important the excellence and rigor of these institutions and their offerings were to EdX. He also stressed the point that EdX is "guided by principles and not profit." This is embodied in their decision to offer the entire EdX system to the world as an open source Python system. Anant said that as an investment model, the response from the financial world would be "are you nuts?" But the open source approach is compatible with their core philosophy, even if it produces competitors to EdX in the coming years.

The open source EdX system includes the authoring platform, the LMS (Learning Management System), the EdX Studio program, an EdX 101 course for developing new MOOCs, and the necessary software for serving the system. This means that any institution can be an EdX partner, or could also host the system themselves!

Anant explained that EdX is "very deliberate" about adding universities to their group. He and Howard also hinted that a very big new announcement, perhaps involving Stanford, in the very new future.. They were evasive about it however since it has not happened yet. (note: Since the meeting described here, Stanford and EdX announced a collaboration to merge Class2Go and EdX in a new open source environment). The idea of being careful about partner universities is that it will maintain a brand that has very high quality, and in which the rigor of the online courses matches that at the home institution. In addition, EdX is unique in the degree of "analytics" it offers about the students. They require students to submit a lot of information about themselves, which may ultimately reduce the number of students enrolled (reducing "profit") but will enable them to develop higher quality courses through the study of how the various cohorts of students perform, which units are more effective and which need improvement.

There are other unique aspects of the EdX platform. This includes a very advanced Artificial Intelligence Assessment engine, and the ability to arrange small group "cohorts" in classes, which is especially useful in humanities. Anant is also proud of the many "virtual laboratories" that are built into some of the EdX courses. These are known in the business at EdX as "blades" and include both simulations and virtual laboratories.

I asked him later about this, and whether it might be possible to extend these virtual laboratories into actual laboratories - this could include remotely operated telescopes, submarines and ROVs, laboratory equipment that can be controlled online. He was very curious about this, and we discussed some of the robotic telescopes I have worked on over the years, and the array of global online telescopes. Even if this idea could not be scaled, he felt there could be a role for this, perhaps as a reward for the top scoring students; the winners in a test could be given telescope time and observe galaxies. Or conversely, cohorts of students could develop observing programs and run the telescope after collaborating online as a group to decide targets and observations. I agreed to correspond more with him about this, and he mentioned the MIT virtual microscopes that are available online.

Anant got called away and so Howard filled us in more on the business side of EdX, partnership, and how the courses are implemented. The business model for EdX does include some revenue sources. These include money for certificates or for proctored exams, a fee-based premium user support service (which gives additional access to grad students), money from employers who pay EdX to get names of top exam scorers as potential hires, and some kinds of licensing agreements, such as the one with SJSU to create a hybrid course in electronics.

EdX partners also pay substantial funds to join in to EdX through one of two modes, which are described as "Self Service" and "Full Service." An article about this revenue model appeared in the Feb 21 issue of the Chronicle (http://chronicle.com/article/How-EdX-Plans-to-Earn-and/ [137433/](http://chronicle.com/article/How-EdX-Plans-to-Earn-and/137433/)). The basic idea is that the Full Service mode has a large upfront fee to join EdX ($250K) but includes full support in course development, with a production team and every conceivable bit of training and production support. The Self Service model includes a lower upfront fee, but revenue sharing with EdX. The best way to summarize this is to quote the Chronicle article:

> *"Once a self-service course goes live on the edX Web site, edX will collect the first $50,000 generated by the course, or $10,000 for each recurring course. The organization and the university partner will each get 50 percent of all revenue beyond that threshold. The second model, called the "edX-supported model," casts the organization in the role of consultant and design partner, offering "production assistance" to universities for their MOOCs. The organization charges a base rate of $250,000 for each new course, plus $50,000 for each time a course is offered for an additional term, according to the standard agreement.*
>
> *"How EdX Plans to Earn Money," Chronicle of Higher Education, Feb. 2013.*

Although the edX-supported model requires cash upfront, the potential returns for the university are high if a course ends up making money. The university gets 70 percent of any revenue generated by the course. However, if the university also has self-service courses with edX, the university will not get any revenue from the edX-supported courses until edX has made the equivalent of $50,000 for every new self-service course and $10,000 for every recurring one. The university partners can choose which model they want to use on a course-by-course basis, and every 12 months they have the opportunity to switch from one to the other. "If it's more in the university's interest to switch models, then edX will recommend that they do that," said Mr. Agarwal."

Howard filled in some of the details of EdX as it goes public with its "open source" materials. One possibility is that any university will create new courses using EdX Studio, and can offer full or small units online. These smaller units would be known in the EdX world as "SPOC"s which stands for "Small Private Online Course." We talked with Howard about how online education is catalyzing discussions on campuses about teaching, raising the visibility of teaching, and causing professors to reconsider how they teach. This is perhaps one of the most profound effects of online education, and much of it is very positive, as it shifts the focus toward teaching and toward faculty collaboration on campus.

Developing online courses requires some training to help faculty deal with the fundamental paradigm shifts needed to implement an online course. The online course is not about filming someone in front of a class, but should reproduce the experience of being in a friendly office hour, with the professor talking directly to you and writing out things for you on a pad right in front of you. EdX seeks out partner institutions that are able to ask achieve this kind of online course, by asking "hard questions" that are able to help professors "re-think the entire system they were educated with."

One cool thing that EdX does is to allow more capable students to grade comments on discussion forums. EdX has figured out how to create a hierarchy of online students. This process is known as "up-voting." A truly exceptional student amasses what are called "karma points" for especially helpful comments and answers in the discussion. In one case they discovered a South African doctor had been anonymously providing expert advice in one of their courses, and clearly deserved his "karma points!" Instructors at EdX have also commented on the extremely high quality of some of the student feedback. Since online lectures and discussions can be paused and re-viewed, students can find subtle faults in the instructor's facts or arguments, which can help the instructor to create a course even more rigorous than the on-campus live experience.

One other observation from the EdX people is that an online course is not necessarily a filmed lecture. These do have their place; and everyone enjoys a great lecture, which has dramatic elements to it. As Howard said, "Great lectures are theatre.. but we also need GAMES!" The next shift in online education may be to create courses that operate much like a video game. This new format could provide entirely new forms of education as well, that instead of being adaptations of in-class courses, are invented and optimized directly for online use.

During our tour of EdX, we met Rebecca Peterson who manages new partners to EdX and has the official title of "Research Director-Online Education." She told us that many many conversations are ongoing with potential partners - these even include Yale, and NUS, as well as the Claremont Colleges in a consortial partnership. Chor Chuan, the president of NUS, is friends with Anant, and this could mean that NUS could join BOTH Coursera and EdX, which may be the case for other universities. Our visit ended with a pledge to go to visit the Bunker Hill Community College, which is partnering with EdX to offer their Python course online. This visit may happen in a few weeks with the several ACE fellows based in Boston attending. With that, we were sent off, and left to contemplate the "brave new world" of online education!

COURSERA THOUGHTS - PROS AND CONS

Since NUS and Yale (as of last week!) are members of Coursera, I took a moment to think about Coursera's approach, and how it might be used at the new Yale-NUS College. There is clearly an opportunity for Yale-NUS College to become a leader in online learning within the community

of liberal arts colleges, and within NUS. Both will enhance the visibility and reputation of the new College, and so should be pursued.

My thoughts about Coursera are several and are summarized below:

- The Coursera system provides a relatively easy and flexibly entry point to online learning for universities, who then take on the challenge of developing the course.
- By not taking responsibility for content creation (except through the Coursera "Mooc on MOOCs" which trains new instructors) Coursera saves a lot of overhead and difficulty allowing for them to grow at very low cost.
- The offloading of content creation provides both a strength and weakness - universities can experiment, and in some cases push the envelope and find new ways to improve online education, but in many other cases are required to reinvent the wheel, and duplicate production costs in their efforts.
- The worldwide network of partners and students has transformative potential in creating new communities of professors and students. This part of interlinking among both Coursera users and producers could have a very profound impact, well beyond the immediate impact of transferring content from an individual course to an individual students.
- The quality control of Coursera is limited, and in many cases different institutions may re-create the same course which would be offered online next to each other. A lack of central quality control, curriculum development and coordination degrades the quality of the effort, but also accelerates its growth.
- Coursera has developed as a "spin off" from Stanford, who is now in an uneasy partnership with them. Maintaining some kind of institutional connection to Stanford will be very important to maintain the prestige of the organization and to resist "mission creep" which could push Coursera into a capitalist for-profit mode. The connections to Stanford will also help Coursera maintain quality and plan more thoughtfully about how to extend the platform to provide better learning experiences.
- The massive scale of Coursera courses offer many downsides to students. There is no barrier to entry, so your "peers" in a class can range widely in dedication and preparation. The two-dimensional nature of the course limits activities to reading and viewing on a screen and taking tests and filling in equations and boxes on a screen. Face-time with instructors is very limited, as is any other work in the 3-dimensional world. For education to be real, students need to DO things in the world, meet other peoples, take measurements, construct things, and experience some of the practice of these fields outside of computer simulations.
- The synchronous nature of Coursera offers some benefits for students with the time and schedule that allows them to participate. Many working adults and non-traditional students would benefit from much more flexibility in this scheduling however.
- "Disagreggating" the content can be done for partner Community Colleges to help their instructors mix in Coursera lectures for "flipping" classrooms. The lack of access to individual lectures and the difficulty for searching for more than courses limits the value of the Coursera content. If there were a fully searchable video library, with an ability to find all lectures that

talk about WWI or Beowulf and jump to the part where this is mentioned, the value of Coursera would be MUCH higher to both professors and students.

EdX Thoughts - Pros and Cons

Anant indicated that he is personal friends with the NUS President, Chor Chuan TAN, and also that some at the Claremont Colleges have been in conversation with EdX and may become partners in the future. Since EdX is also going to be releasing its entire environment as open source, it also could be a viable approach to online learning for anyone interested in experimenting with the medium.

My thoughts about EdX are several and are summarized below:

- The EdX system is a more unified approach to online learning, since it includes the entire content development system (EdX Studio + authoring tools), an assessment "engine" and a Learning Management System as part of the package.
- EdX is going to become completely open source and freely available, which is a great step forward and will enable a very wide group of institutions to start online courses with its software.
- The strong emphasis at EdX to grow carefully, and to choose its institutional partners deliberately, enables them to maintain an edge in content quality that will make them a prestige online channel compared to Coursera, which seems to be growing somewhat haphazardly.
- The extension within EdX courses to virtual laboratories and cohorts for discussions makes their platform extremely attractive as it offers more than the "Massively Online" type of course.
- The way in which Anant is interested in technology suggests that EdX could expand even further to include online telescopes (something I discussed with him), online microscopes and lab equipment, and many other completely new types of experiments.
- The Virtual Observatory, virtual electron microscopes, Sloan Sky survey, Virtual Laboratories Center at Northwestern (http://www.ilabcentral.org/), Scripps Oceanography Labs online ocean observing buoys, and many other technologies offer a chance to merge online courses with truly exciting and valuable experience working with actual scientific equipment and data. EdX seems most likely to move into this space, due to proximity with MIT and its founder's interest in technology.
- The truly non-profit nature of EdX, guided by "principles and not profits," make it more compatible with Pomona and Yale than some of the other more investor-friendly online education services.
- Since Wellesley College is one of the EdX partners, it may be the case that EdX is more interested in small liberal arts institutions than some of the other online systems, and the Claremont Colleges might be a good additional liberal arts partner for them.

VISIT TO HARVARDX

To get more perspective on how an elite institution is developing courses for one of these online providers, I made a trip to Harvard's Bok Center for Teaching and Learning, which is also home of the HarvardX offices, which are the center for Harvard's online course development. Harvard and MIT founded EdX, and while EdX is responsible for the platform development and technical side of the online courses, HarvardX is more concerned with developing new online courses with their faculty, and translating some of the classroom experiences to this new format. At the Bok center, I met with Terry Aladjem, director of the Harvard Bok Center, along with John Girash, who is in charge of the STEM side of Harvard's teaching center. In a later visit I met with Rob Lue, the Faculty Director of the Center. I wanted to learn from them how online learning is implemented, and what challenges and benefits arise for faculty in developing online courses.

Harvard's Bok Center has been responding to a very rapid expansion of activity related to the EdX/HarvardX partnership. This large amount of activity has been stressing the available space and staffing for the center, as they are getting many requests for help from faculty to develop the new courses and to create new video content.

Harvard recently received a major gift from the Hauser Foundation of $40 million for teaching and learning (http://news.harvard.edu/gazette/story/2011/10/education-and-innovation/). This gift has been used for new grants for faculty to develop courses through a "Hauser Grant" program. A large amount of money (~$30 million) went to EdX to help develop the online platform, but a similar amount has not yet been made available to help develop courses on campus.

John and Terry confirmed that the demands for online education support were high, and pointed toward the appointment of Rob Lue, the new Faculty Director of the Bok Center, as one who can help get additional resources, and help manage the large demand for online courses. I met with Rob to talk about his thoughts on online learning.

Rob was also surprised by the enormous effect that the HarvardX project has had in shifting Harvard's culture to become more aware of teaching. The project has had a "catalytic effect" that has "energized faculty broadly," resulting in over 100 faculty interested in developing online courses, and a series of Town Hall meetings on online instruction where between 100 and 130 faculty discussed the details and techniques of teaching for nearly 3 hours. Rob has set up these meetings to rotate between various parts of the Harvard campus. These meetings have been scheduled for large auditoriums in the social science, graduate education school and public health school, with further meetings to come. These meetings have been unprecedented for Harvard faculty, and Rob is delighted to see the proliferation of conversations about teaching across all divisions and departments, making this online learning effort "a one Harvard thing."

Rob also explained why Harvard "jumped into" online learning. In his words, Harvard "looked at it with the lens for scholastic opportunities." They recognized that there was going to be a huge

change induced by the wave of online courses - the question was whether to "watch from the sidelines to see what wins" or instead be a player and lead some of the changes coming.

THOUGHTS ABOUT ONLINE LEARNING AND POMONA COLLEGE

Pomona is exploring how to enter online learning, and is being careful to consider options that will preserve the character and quality of the education, and not dilute Pomona's mission. The difficulties for a small place like Pomona to develop the capacity to develop and support online courses is much higher than for the larger R1 institutions, and the justifications for such an effort are more difficult as small colleges like Pomona are centrally focused on their on-campus student population, and are in general less ambitious in their aspirations to have "global reach" than places like Yale.

Despite these difficulties, it would seem that among the liberal arts colleges, Pomona College and the Claremont Colleges could be uniquely suited to take on a major Five College Claremont online learning initiative. This is due not only to the substantial resources of Pomona College, but the ways in which the 5-C consortium offers a uniquely complementary set of liberal arts institutions that can provide much more as a system than individual liberal arts colleges, while sharing the costs of a production and support effort for online learning. The initiative could build upon the strengths of the partner institutions, leveraging Harvey Mudd's excellent courses in science, computer programming and engineering, along with CMC's courses in economics and public policy, and Pomona's courses in a wide range of fields in both sciences and humanities. Scripps and Pitzer can provide additional contributions in humanities, environmental studies and other fields. The effort could be a great way to build further ties between consortium members and to showcase star professors in Claremont to the larger world. The enhanced visibility this would bring to the Claremont Colleges would help recruit students and faculty, and generally enhance the prestige of our consortium.

Two other benefits will come from the online education effort. First, the reach of these courses will extend to all types of students across the country, including those in under-resourced high schools. By combining the effort of online education with a robust outreach effort to targeted high schools (perhaps with in-person guest talks and classes led by Pomona and Claremont faculty and students), online education could be a great way to increase the diversity of our Pomona student community, and to have a much larger and more substantial impact on the under-served student population in the Los Angeles region and beyond. Second, by creating online courses and sharing the techniques of teaching prevalent in Claremont, the exercise will help further discussions about the latest educational theories of teaching that can help our classes on campus in Claremont improve. The online learning efforts generally have given a unique opportunity for developing new courses that make use of the latest education research, which emphasizes constructed learning, active pedagogy, and reverse course design using assessable learning outcomes. Having our faculty in Claremont engage in this effort will help them become

part of this conversation and could also enable Claremont to take the lead in developing the best online and in-class experience in the nation, building on our long tradition of excellent teaching for undergraduates.

It should also be pointed out that among the online providers I have visited, EdX stood out as the one which we should work with. The fact that it proceeds deliberately and carefully chooses its partners means that its quality will be high. The completely non-profit nature of EdX will also help the online initiative get wide faculty support. And the release of the entire EdX platform for free and in an open source manner will allow Pomona to begin experimenting with the technology even without becoming an EdX partner. With a bit of technical staffing support, Pomona could also customize the EdX platform for our campus as well, giving a signature online learning environment that would be transformative not only for online courses but for our entire set of courses at Pomona.

THOUGHTS ABOUT ONLINE LEARNING AND YALE UNIVERSITY

Yale is carefully studying how to proceed with online learning, and perhaps wisely has been standing somewhat above the fray waiting for some clarity to emerge. Yale also appears to want to control its entry into the online world carefully to present the best possible face of Yale to the outside world. It is however important for Yale to begin developing a plan soon and perhaps some more modern online content. Nearly all of the best universities are represented in this online education world, and Yale's aging "Open Yale" front sends a message that Yale is 6-8 years behind in this effort. Certainly Peter Salovey's call for a "more innovative Yale" would be served by a more significant online presence, and perhaps the goal to improve the undergraduate STEM and Math experience at Yale could be served by an entry into the online world. The best online platforms include interactive experiences, webconferencing, and online support, and if Yale were to enter into the fray, they might consider developing a new version of "Open Yale" which includes an integrated videoconferencing, tutoring, and discussion technology that could enable some of the small seminar format that works so well at yale to be integrated into a global seminar room. This might also serve Yale's interests and strengths in leadership development - the Global Fellows and academic leaders trained and educated at Yale could be part of the discussion easily with such an integrated platform.

I would suggest that the main weakness of the existing online platforms is the lack of this sort of interactivity, and perhaps Yale has an opportunity to create something new which is not aimed at "Massively Open" but instead to help transport the Yale course to a global online audience, which can be controlled and selected to optimize the experience for Yale students in New Haven. This could actually be a win for Yale in that the online technology would enhance the New Haven experience in substantial ways, rather than just being part of the "disseminate knowledge" part of the Yale University mission statement. Doing online education in this new way could also be a more valuable contribution by Yale than just joining into one of the existing initiatives.

My understanding of Yale's unique approach is to preserve the human element in all aspects of its work, and to extend the concept of culture to include not only the campus community but the surrounding world. The online education can help promote this goal, and should be consistent with Yale's campus experience. Initial experiences, related by Bill Whobrey, of summer courses offered online suggested that having these face-time experiences through video conferences were essential for helping build an online community, and for preserving interactivity and making discussions meaningful for students. The discussions of teaching, and new ways of convening groups across New Haven and across the globe can also help make Yale a more "unified" Yale as well!

E P I L O G U E / C O N C L U S I O N

In the month of so since this report was first drafted, a number of big events have happened - typical of the rapid pace of evolution of online learning! Yale has decided to join Coursera, and is also revitalizing its "Open Yale" web site to be easily searched and indexed, with captions being developed for some of the courses. EdX and Stanford also have announced a merging of their platforms to create a new version of the EdX platform which will integrate some of the features of Class2Go. EdX also has announced that it will release its entire platform and operating system, including authoring software as an open source package to enable anyone to create online courses without official affiliation with any of the major players of online learning.

This rapid pace of change needs to be considered as well in reacting to the online learning movement. The evolution of the existing platforms will happen at a very fast pace, and within a few years time will give them dramatic new capabilities that will enable them to provide more features, and better emulate the experience in small classes and even laboratory sessions. The proliferation of online courses will also open up a rapid rise in the production quality of online content, and new and creative sources of media will be available for thousands of conventional, hybrid or flipped courses.

The entry of online learning at this date (2013) is reminiscent of the entry of web sites 20 years ago, when I began my academic career as a young assistant professor at Pomona College. At that time, the College did not even have a web site, and such things were only found at exotic particle physics and NASA laboratories. The arrival of my first daughter in 1994 caused me to experiment with this infant technology, and I created a very basic static web site to offer baby pictures to our relatives - which was one of only a few web sites in Claremont at that point. Now twenty years later, web sites have matured to a point where a College could not do any of its business without the web - everything from admissions to enrollment management to library collections are online, and courses too are now expected to have web sites with blogs, streaming video and other features that would have seemed outlandish 20 years ago.

This observation leads me to a pretty certain prediction - whatever online learning looks like today is only the beginning, and in 20 years our College and University system will be similarly interwoven with online courseware to a point where it would be difficult to imagine teaching without some of the currently exotic features as online quizzes, imbedded video lectures, interactive simulations and instruments, and advanced threaded discussion forums that are all part of the online platforms. For this reason, any college hoping to be a leader in 20 years should develop proficiency in developing technologies to enable their professors to become part of this movement. It will require a concerted effort to retrain faculty, to develop infrastructure for authoring and serving online courses, but the result will be as transformative as the arrival of academic web sites 20 years ago. If done right (as can be the case when quality institutions lead) these technologies will also be a great force for empowering students, enhancing learning, and interconnecting national and international campuses in exciting new ways.

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Leading Platforms and Initiatives in Online Learning

[EdX](#) – A consortium led by MIT and Harvard, founded by Anant Agarwal, and with a growing list of affiliated universities
[Coursera](#) – A consortium began by two Stanford Faculty, Daphne Koller and Andrew Ng, which includes a large number of international universities
[Udacity](#) – Began by Sebastian Thrun, this Silicon Valley startup is going to offer online math courses for credit in a partnership with San Jose State University
[Minerva Project](#) – An attempt to provide the highest quality learning experience with online discussions and content and a global student and faculty base, to create an online university and a lower cost elite college degree.
[NPTEL](#) - Indian online education Initiative

From the MIT/Harvard Meeting "Online Learning and the Future of Residential Education," March 3-4, 2013

http://www.onlinelearningsummit.org/

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