Hei Mookie! Where do I start? The Role of Artifacts in an Unmanned MOOC

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Abstract

Three artifacts were examined in a Massive Open Online Course (MOOC) called Mechanical because there is no professor to offer the course. Employing the notion of inscription from actor-network theory, the analysis focuses on the action of facilitation embedded in these artifacts and the ways in which these actions unfold. Using online ethnography, this study attempts to explicate how the designers have delegated facilitation to these objects. The findings suggest that the artifacts play a distinct role in enacting forms of facilitation and sustaining the course without teaching presence. They indicate that the artifacts do not play simply an intermediary role, but work to redistribute facilitation and reformulate social relations. While online courses have relied primarily upon teachers, with the increased size and technological interdependence of this MOOC, the examined artifacts apparently remove the need for exposure to teachers, by providing participants with peer interactions and automated coordination and testing.

1. Introduction

MOOCs (Massive Open Online Courses) are one of the educational buzzword of 2013. In their short history, started in 2008, they have already undergoing several transformations, and it is not an exaggeration to say that they are changing as we speak. Increasingly, educational institutions are considering jumping on the MOOC bandwagon and are experimenting with this form of online course to provide access to education on a massive and international scale.

This paper explores an experimental form of MOOCs offered by open educational organizations. This MOOC is called Mechanical because there is no professor to offer the course. No teachers, or coaches are supporting participants who are expected to rely on peers and digital artifacts for help. Thus, the purpose of this paper is to draw attention to the facilitating role of artifacts in this teacherless MOOC. Employing the notion of inscription from Actor-Network Theory, this study attempts to respond to this research question: are there action of facilitations embedded in the artifacts, and if so, how do they unfold in this MOOC?

Using online ethnography, an attempt has been made to shed light on the role of three artifacts in performing facilitation, by explicating the process through which the designers have delegated facilitation actions to these objects. Although this investigation takes a "designer" perspective in the analysis, the intention of this paper is to provide insights for both those involved in designing MOOCs and those that use them (e.g., teachers, facilitators, and learners).

2. The MOOC phenomenon

MOOCs are a new phenomenon under constant development and the definition of the term itself is evolving. [10] made a detailed account of the historical development of MOOCs and noted how the Wikipedia definition of the term changed within 4 days in September 2012, suggesting different interests at work. The different "interests" at work in the change of definitions are parallel to the development of MOOCs. Despite their short history, being the term coined in 2007, MOOCs have already taken two very different forms known as cMOOCs and xMOOCs [11]. These two branches are based on different pedagogical philosophies: while earlier cMOOCs were based on a philosophy of connectivism and networking, recent xMOOCs, such as those offered by the spin-offs of elite universities, are based on behaviorist pedagogy. According to [7], while cMOOCs were based on a "free-for-all approach with little central control where learners co-create a learning experience", xMOOCs are more like traditional online classes, based on video lectures, readings, and quizzes.

Describing their implications for open and distance education, [2] argued that educational institutions can see MOOCs either as unwelcomed competitors, or resources useful to test pedagogies, develop new teaching and learning approaches and assess accreditation models. [2] also noted that MOOCs can represent an unbundling of the traditional services offered by higher education institutions, both distance and campus. Unbundled services outsourced to collaborative partnerships can give rise to 'low cost and no frills' MOOCs and can contribute to provide learning opportunities at very low costs in many regions of the world [3].

3. The Mechanical MOOC

The Mechanical MOOC (hereinafter MMOOC) called *A Gentle Introduction to Python* is an open and free eight-week course offered for the first time in October 2012. 5,775 participants from several countries signed up for the first round of the course. The MMOOC offers independent adult learners without previous knowledge of programming the opportunity to learn the basics of this programming language. It is offered by a group of open educational organizations, including Peer 2 Peer University (P2PU) (p2pu.org), OpenStudy (www.openstudy.com), Codecademy (www.codecademy.com), and MIT OpenCourseWare (ocw.mit.edu). Each organization plays a specific role in the MMOOC: P2PU manages a mailing list to coordinate learning activities, OpenStudy provides a study group where learners encountering difficulties can ask questions and receive responses from their peers, Codecademy provides exercises and an interactive tutorial for practicing coding and self-assessment, and MIT OCW provides resources including videolectures and other academic materials. The MMOOC can be seen as an example of non-formal education because it takes place outside the formal school system and is short-term and voluntary. Furthermore, it does not demand prerequisites in terms of previous educational accomplishments and knowledge, and does not grant certifications of competence or attendance at present.

The attribute "mechanical" is ascribed to the absence of a professor to offer the course and the provision of a peer learning environment in which MOOC participants are expected to rely on each other to understand content and overcome difficulties. The absence of a professor is a characteristic that differentiates the MMOOC from existing MOOCs in which professors still offer the course.

The MMOOC organizers believed that online learning tools have become robust enough to be used with a minimum amount of coordination, and that learners could use these tools and help each other in their learning process without a central authority [7]. The Mechanical MOOC developed from the assumption that it is possible to use lightweight and free or low-cost technologies to run a MOOC, and from the intention to give participants the opportunity to form groups around topics they are interested in. With regards to the former consideration, the organizers of the MMOOC wanted to setup a MOOC that is different from both cMOOCs and xMOOCs. In their opinion, cMOOCs were too unstructured for many learners, and recent xMOOCs seem to be competing for developing expensive central platforms that require significant resources to develop [18]. However, they observed that both types of MOOC offer opportunities for scalability - that is, they can reach larger and larger numbers of learners at a lower cost - because of "peer learning environments that allow to support each other, and because of assessment engines that automate feedback" [7]. In his blog *OpenFiction*, [7] wrote that the lesson of open education over the past 10 years seems to be that three main components of education, namely content, community and assessment can be unbundled, with each component being provided by independent sites. Carson added that this unbundled environment would not look as neat and polished as a custom-created platform where all the components are closely integrated would look. However, in the unbundled platform also called "unplatform" [8], the organizers hoped to bring together the best available OER without having to create something new. They believed that reusing OER would bring a significant cost advantage and would constitute a model that could empower more open education projects to experiment with MOOCs. Thus, the Mechanical MOOC was born from these assumptions: "it is an attempt to leverage the power of the open Web, by loosely joining together a set of independent building blocks", as the P2PU executive director put it [18]. To tie together these building blocks, P2PU developers decided to use a lightweight infrastructure (Figure 1) based mostly on off-the-shelf and free tools, and to use inexpensive bulk email software to automate all the organizational tasks, create group of participants and manage a mailing list for these groups in the MMOOC. According to the organizers, this e-mail list driven model also means that new rounds of the course can be started at any time, allowing multiple cohorts of learners to move through the materials and even support one another.
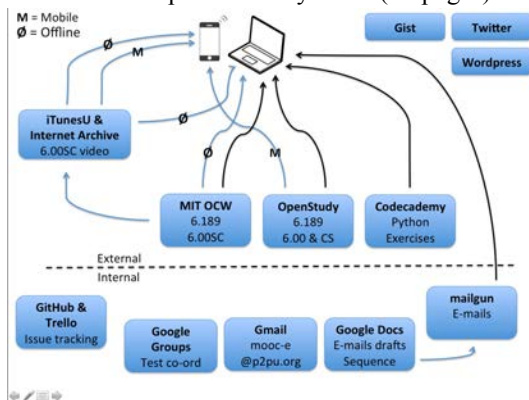
Figure 1. The unplatform

4. Theoretical perspective

This study is informed by actor-network theory (ANT). In an ANT perspective, both humans and non-humans (such as technologies, for example) can be conceptualized as actors, that is, "as entities that do things" (p. 241) [15]. This perspective is valuable because in this paper I argue for a main focus on the sociomaterial agency of artifacts. Adopting this focus enables to view human and material agencies as constitutively 'entangled' [17], thus shedding insights into understanding the relationship between actions of facilitation and digital technologies.

Such is the importance of artifacts in this MMOOC that, arguably, there cannot be this type of MOOC without artifacts playing facilitation. The very idea of *The Mechanical MOOC, international man (or machine) of mystery,* could not exist without all the existing artifacts included in the unplatform (Figure 1). Since there is no professor in this MMOOC, it is necessary to explore how the participating sites facilitate participants through working with these artifacts. A specific aim of this study is to indicate, through empirical findings, that these artifacts carry intentions and anticipations of actions and form a part of the agency of the activity in the MMOOC.

One concept from ANT is of particular relevance to this study: inscription. Facilitation in this MMOOC is seen as decentered and embedded in technologies and digital resources to such an extent that it is hard to account for this process without examining those materials. In ANT, technology is seen as an inscription of human agency. Inscription is defined as the act by which humans cast relevant patterns of action into material objects, and delegate them to perform action programs and capabilities [1]. As a result of delegation, material objects become vehicles of human agency, therefore replacing humans in doing things and performing functions in complex networks of humans and non-humans [1]. [16] provided a good example of how material objects become vehicles of human agency by illustrating how a hotel manager tried to find a way to ensure that customers will leave their room keys at the front desk before exiting the hotel. Since talking to customers or putting a sign with the imperative statement that keys have to be left at the front desk was often not enough, the manager attached a large metal weight to each key, which made it cumbersome for customers to carry their key around and increased the likelihood that they would want to leave it at the hotel. In that sense, one can say that the metal weight inscribes the desired pattern of action, in other words, that this new bulky appendage inscribes the hotel manager's imperative "please leave your keys at the front desk."

Introducing the concept of inscription seems to be appropriate in the context of the MMOOC. In fact, inscriptions invite us to pay attention to technological objects that have been inscribed with actions of facilitation, which may or may not succeed. Therefore, a main goal here is to uncover how and where actions of facilitation are inscribed. Three aspects of the notion of inscription [19] are especially relevant in this study and will be explored in the empirical analysis: (a) The identification of explicit anticipations of actions of facilitation in the MOOC, which were held by designers, (b) Who inscribed them, and (c) How these anticipations were translated and inscribed in the artifacts.

5. Methodology

5.1. Research design and setting

[10] warned that studying MOOCs is a challenge for several reasons, including the novelty of the phenomenon and the fact that the few academic studies available are about cMOOCs, because there has been no time for systematic research on the recent xMOOCs. Given that the MMOOC is different from both cMOOCs and xMOOCs, and that scholarly studies are not yet available, an inductive, exploratory case study [22] of three artifacts used in the MMOOC was conducted. Although the MMOOC unplatform includes a variety of artifacts, this study focussed on three of them: the email scheduler run by P2PU, the study group *MIT 6.189 A Gentle Introduction to Python* run by Openstudy, and the interactive coding interface provided by Codecademy. Based on a preliminary examination of online documentation, these three artifacts were selected because they represent three components of the role of the teacher, respectively: coordination, pedagogical support, and assessment. The analysis employed principles of online

ethnography [14] because the study occurred in a widely distributed virtual setting. In this setting, a multi-sited ethnography was conducted [14]. [14] argued that this space can be characterized as a field flow, organized around tracing connections among sites, rather than as a location in a singular bounded site (p. 61). Therefore, employing a connective approach meant following hyperlinks and exploring what these links were about and what they achieved in a snowballing approach, in the sense that what happened at each point of connection was an invitation to move on [14]. To perform this ethnography, since the three selected artifacts were developed by three independent participating sites, 'travelling' from site to site was needed to follow both the documents representing the artifacts themselves, such as emails, questions and the coding interface, and a cascade of other documents, including press articles, blogs, and videos. These documents can be seen as the primary mechanisms through which participants know their communities and act within them [12]. This study was inductive because *a priori* definitions of constructs were not used. The analytical focus was neither on facilitation as a 'formalized concept', nor on the private experience of facilitation, but on the sociomateriality of artifacts through which actions of facilitation were organized and produced. For this reason, it was useful to broadly ground this research in an ANT perspective, which was used as an entry point to analysis and interpretation.

5.2. Data collection and analysis

Results are presented from an empirical study conducted from the beginning of October 2012 until the end of May 2013. Data gathering encompassed non-participant observations of closed questions (consisting of questions and answers) in one study group, reading openly available documents such as the MMOOC web site, blog entries written by the educational organizations involved in the MMOOC and press articles, watching openly available videos, and semi-structured phone interviews with few key informants [6] (Table 1). Using online documentation and emails exchanged with some of the MMOOC organizers, key informants were identified with a group of eight people who represent the four educational organizations and have been primarily responsible for the development of the MMOOC.

Table 1. Collected Data

Source	Collected data	Period of Time
Mailing list	96 postings	21-09-2012 – 31-01-2013
Study group	211 closed questions	From the start – 16-04-2013
Online documentation	Blog entries, videos, press articles	20-08-2012 - ongoing
Semi-structured phone interviews	3 key informants	April 2013

Analysis started with reading and marking significant passages of online documentation, MOOC blog posts, and statements and questions that addressed the giving or receiving of help in the study group. Marked passages were coded inductively, which means that texts were examined with an open attitude, seeking what emerged as important and interesting from them. Constant comparison analysis [21] was used to search for connecting threads and patterns among the excerpts labeled with the same code, and also to look for connections among the various codes that could represent themes. Themes and their connections were combined to form "stories" in which the artifacts were unpacked, describing which intentions were inscribed and which interests were spoken for. The analysis of online documentation was conducted before starting the interviews to explore artifacts beforehand and generate relevant questions to ask. When presenting the data, people's names were anonymized and in one case the nicknames chosen by the course participants were used as they appear in the study group. Written informed consent was obtained by key informants before interviewing.

6. Findings

The following are the main findings from the analysis of the three artifacts. Given that specific interests and contexts characterize these artifacts, a brief description of each of them is presented before introducing the findings.

6.1. The email scheduler

The email scheduler is a bulk email software used in the MMOOC to send, receive and track messages, and manage a mailing list. Every week, it sends out emails to thousands of participants, pointing them to lectures and notes provided by MIT OCW and the

Python tutorials provided by Codecademy. Although the email scheduler prompts participants to use these resources, it also encourages the exploration and use of other open resources available on the Internet. Furthermore, it nudges participants to seek, give and reward support from their peers using two study groups run by OpenStudy.

MMOOC participants can work alone or in small groups. By using a functionality of the email software that allows for creating mailing lists via an application programming interface (API), a P2PU developer was able to sort participants into groups and place all these groups into one mailing list. Thus, groups of learners would use the mailing list to communicate with each other. Groups were formed according to predefined criteria, including, among the others, time zone and learning style indicated by participants in the sign-up form. The email software played a critical role in forming groups, because it allowed the developer to write a script that would automatically pick random users in a certain time zone and with a certain learning style and place them together into a group. Grouping participants randomly would have been impossible without this email software, because random selection was a research requirement on P2PU to examine what group configurations, based on size and other criteria for group learners, would result in the most effective engagement throughout the whole class. The email scheduler created about 120 groups during the first round of the MMOOC (started on October 15, 2012) and about 60 groups during the second round of the MMOC (started on November 26, 2012), ranging between 20 and 40 participants in size.

The idea of using this type of email software originated with a P2PU developer who was very fond of TED talks and thought watching videos in a group and then having conversations about those talks would be a good idea. This developer envisioned a group where all of the organizational tasks, including signing up and registering for the group, selecting talks, managing the schedule, reminding group members when to watch videos and fostering discussions, are automated. Thus, he wrote a simple script to manage all these organizational tasks, and built the initial prototype for the email scheduler. According to this developer, this application could be used to support a learning group that scales with demand. Later on, this application became the tool used to tie together disparate resources used in the MMOOC.

6.1.1. The role of the email scheduler for connection and awareness. As said earlier, the MMOCC runs on an unbundled platform, in which the organizers hoped to bring together the best OER available without having to create something new. In fact, one of the

aims of the organizers is reusing existing educational resources, instead of creating new *adhoc* resources, to gain cost savings and develop a model that can be proposed to other open educational projects willing to offer MOOCs. As one organizer made clear in an interview:

"So those pieces were there: I had the content, I had the interactive platform, I had the exercises that would give automated feedback to an almost unlimited number of people. So the only thing that was missing, really, was a way to sort of stitch them all together".

The missing part was the email scheduler brought in by P2PU. The analysis of the activities performed by this artifact are critical to understand how coordination works in the MMOCC, because such analysis can reveal the time structure of the course and the content of the actions performed. The email scheduler sends away weekly messages that are intended to connect participants to the OER provided by MIT OCW, to the questions asked in the study group on OpenStudy, and to the coding interface provided by Codecademy. In the posts sent by this application, we find course management information, information for receiving pedagogical support, and social direction. During an interview, one organizer co-responsible for writing these weekly posts said:

"And so the course was structured then with two emails a week. So there's a whole bunch of emails that lead up to the start of the course, and then there are two emails a week during the course as it goes forward, and one is the set of assignments for the week and the other one is just designed to be sort of an inspiration, just a touch point to remind students that the course is going on".

In the same interview, the organizer went on describing what he saw are the main benefits to learners from this automation of organizational tasks,

"Well one of the benefits is that it's a much more flexible environment than the traditional MOOC because you can start the sequence and end the sequence whenever you want. Like we do cohort people together with the mailing list but we also publish the content out to the blog so anybody could start through the sequence of material at any time if they wanted to. And part of the problem with the current way the MOOCs are being offered is they're being offered according to an academic calendar because that's just the way academics think, right? ... When we ran the first couple of sequences of the Mechanical MOOC we ran three overlapping sequences; we had three different start dates and all the students from all the different groups were active at the same time".

These excerpts show that the email scheduler is supposed to connect participants to OER, but also to provide flexibility for individual learners working at

differing paces. The purpose of sending emails is to "*provide a loose structure and a cohort of learners to study with, not to enforce a rigid progression that must be strictly adhered to*".

Individual participation is expected to be facilitated by the availability of ubiquitous documentary artifacts that mediate people interactions and support their participation. In this setting, hyperlinks to these artifacts seem to play a twofold functional role [5]. First, by pointing learners to links to resources, instead of broadcasting content, these hyperlinks suggest the vision of learners implicitly anticipated by the organizers. MMOOC participants are envisioned as self-organized learners from all walks of life, who are expected not to rely on a course instructor (teacher or facilitator), but can pursue their learning alone and/or as part of a support group, where they can help each other to understand content and figure out difficult programming concepts. As the MMOOC organizers said in one weekly message, "*we believe we've assembled some of the best tools out there for learning independently and connecting with a large support group, but the energy that will power the course comes from you*". These self-organized learners can be seen as self-directed learners defined as individuals undertaking learning alone or as part of a group, without the assistance of an 'educator' (e.g., teacher, instructor, facilitator), although there can be a "resource person' who does not regard him/herself as an educator [20].

Second, hyperlinks play a functional role in coordinating learner activity across participating sites, because they make visible the network among the independent sites forming the MMOOC "unplatform". The lack of a central platform where people can log into to access all course information and materials can be confusing and requires additional work from the MMOOC participants to keep track of them. To help participants stay on track, the mailing list acts like a push technology, providing an awareness notification service. By entering one's own email address at http://mechanicalmooc.org/, participants sign up and receive e-mail notices about what happens every week in the course. While this artifact acts to support awareness, it also presupposes that the MMOOC participants are capable and willing to keep themselves organized and use the educational resources provided by heterogeneous sites for their learning.

6.2. The study group *MIT 6.189 A Gentle Introduction to Python*

This study group was born from the collaboration between OpenStudy and MIT OCW. The aim of the study group is to allow students and independent learners around the world to connect and help each other in their process of learning Python while using OCW course material. At the time of this writing, this study group counted 1201 members and 327 asked questions.

On their web site, OpenStudy is described as a "social learning network where students ask questions, give help, and connect with other students studying the same things". This social platform is aimed at making the world one large study group, regardless of school, location or background. Thus, OpenStudy is supposed to work as a virtual meeting place where learners from across the globe can form study groups on a variety of subjects. When OpenStudy was developed, the designers envisioned a platform supporting "open social learning". As a cofounder of OpenStudy explained during a seminar, they thought that social media and games play a main role in many students lives nowadays, thus they decided to draw from the features of these environments. Therefore, at the time of designing the platform, she underscored that they imagined a Facebook-like platform where the "*point is to study together, not to trade pictures and jokes*", and "*a World of Warcraft where students earn points by helping each other*". In the words of the same cofounder, "*if you give these digital millennials a Facebook-like environment, the social interactions keep them engaged, and then the peer-to peer learning and the interactions that result from that lead to pretty deep learning*".

The next section describes how the designers of OpenStudy inscribed their value of learner engagement in the study group on Python, by embedding online reputation mechanisms that structure a process of peer recognition to support participant engagement.

6.2.1. The role of online reputation mechanisms for assessment and pedagogical support. Given the close connection between engagement, social interaction and learning, engagement appeared to be a critical process to inscribe in the platform. A way to inscribe engagement is suggested by this metaphor used by a cofounder of OpenStudy in a blog entry:

"*Engaged students are the ones who raise their hands in class to ask questions, who chat with their classmates, and who stay back to interact with their teachers. They are the ones who join clubs, participate in sports, find a cause to champion, volunteer, and who help out in the community*".

The designers did not want to develop an educational game, but "an educational experience structured as a social game". As a cofounder of OpenStudy explained, the designers built a social platform enabling "*a learner anywhere in the world, anytime, to raise a hand and say "Hej! I want some*

help!" According to their vision, the behavior to be motivated to support social interactions and engagement is to be good and helpful. Participants need to develop soft skills including "*helpfulness, courtesy, teamwork, problem solving, engagement, to name a few*", and be rewarded for demonstrating mastery of these skills. To motivate this helpful behavior, the designers created a credentialing system to assess the development of soft skills. Online presence aware components embedded in the interface provide, at any point in time, study group members with information about who is online and see questions posted on Python, and the levels they are in. As a beginner in programming in Python, a participant starts as *Hatchling* and can reach higher levels, such as *Rookie* and *Lifesaver,* on the basis of the engagement in the subject (for example, time spent online), willingness to help others, and number of responses provided to other participants. This excerpt comes from a talk given by a cofounder of OpenStudy at a seminar:

"We got a large number of people ... with the sheer amount of data that we collect, we were able to say, "You know, this person, who is been answering questions regularly, frequently and quickly is a good, real-time problem solver. And then we have people who are engaged and spend time just answering questions on this topic. They are team workers. They are people that are good to be working with. People who are not rude, that are courteous, you ask for help and they give you help. These are key attributes for online learners and we put all in these numbers in what we call the SmartScore" (Figure 2).

Figure 2. The SmartScore

Each participant's problem solving skills, teamwork, and level of engagement are mapped and 'translated' into an individual scorecard, called SmartScore, which is visualized next to the participant's name. This kind of informal assessment is performed through a combination of web analytics data

and data from crowdrating. Web analytics include data such as number of users, number of questions and answers, frequency of asking questions and giving answers, and time on site. Crowd rating is a form of peer recognition based on offering medals to participants giving good responses to their peers' questions (Figure 3).
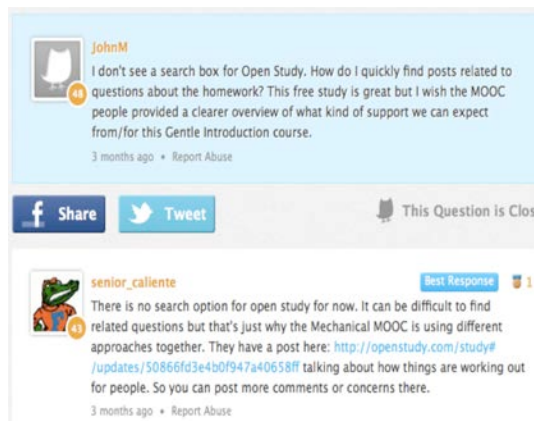

Figure 3. Example of best response and awarded medal

Crowd rating data include calculations of received medals, number of fans and fan testimonials. Rating a response as 'best response' to those providing good help by offering them a medal is a code of conduct in OpenStudy. As the same cofounder said during a seminar:

"For every question that is asked, you find the number of medals given increases. What does that tell you? It tells you, when you ask a question, someone thinks your answer is accurate. But it's more. Not only the person who asked the question, but others in the crowd are saying, "That's a good answer, let me give you a medal for that". We think that this is very telling. We use concepts like this to say, "How does this person progress in their learning journey?"

The two excerpts reported here point to the designers' belief that this rating mechanism can report on skills and competencies demonstrated in the study group, in a manner that can be more effective than grades. This rating mechanism is in fact part of a plan to rethink evaluation and assessment. "*You can think of it as going beyond grades*", as the same cofounder wrote in her blog. Furthermore, rating a response as 'best response' may act as natural scaffold to help participants learn what makes a good response. In the study group, help does not come from a single teacher, but from what can be described as collective knowledge and expertise of the study group peers, enacted through the user interface. Individual participants evaluate by themselves whether a response

is valuable to them. There is no teacher doing this job on behalf of learners. Learners asking questions – or other learners lurking – decide independently. Observations of questions and responses suggest that rating a response is an online reputation mechanism enabling people to see what others think about a response. It enables people to see whether the study group can be valuable to them. Thus, it can be argued that this technological feature aims at building trust and cooperation among individuals.

6.3. The Python programming exercises and the coding interface

The Python programming exercises have been developed by the Codecademy developers for the MMOOC. These exercises are included in 12 tutorials on Python basics. To help practicing their coding, learners can use an interactive coding interface, which Codecademy claims to be "*the easiest way to learn to code" – for free*".

Codecademy describes itself as an organization providing the easiest way to learn the basics of coding in a variety of languages. To help beginner programmers develop coding skills, Codecademy offers free and interactive tutorials and a built-in system of rewards (e.g., points and badges) to keep learners motivated. The idea of finding an easy way to learn coding originated when one of the two co-founders of Codecademy needed coding skills to develop a business idea, and soon realized how hard to learn programming from books and materials on computer science can be. Then the cofounders envisioned a way to learn programming that is "*totally different from books that are one-way learning experience. We think it should be more interactive, more fun than something in a book, where you read for half an hour and then you go code*".

The next section describes how the designers of Codecademy inscribed their value of "making coding easy to learn" in an interactive coding interface which aims to support self-assessment.

6.3.1. The role of the coding interface as externalizing artifact for problem-solving and assessment. In March 2013, Codecademy developers introduced a new learning interface and described three anticipated effects of the use of this technology. According to their vision, learners could expect an immersive experience and a better feedback loop, which the developers so described on the organizational web site:

"*An immersive experience: we've simplified the interface to let you focus on what matters: the lesson, your code, and what you're building.*

A better feedback loop: it's easier to learn when you can see you're doing. For most screen resolutions, you can now always see a visual preview of any webpage you are coding, or a terminal output of your code".

This description points to several delegated facilitation actions nested into components of the interface: 1) a web console where to write, submit and save code; 2) a display showing the output of submitted code, or providing instant feedback to the code, and 3) features such as "Stuck? Get a hint!", or the Q&A Forum to offer suggestions and help (Figure 4).
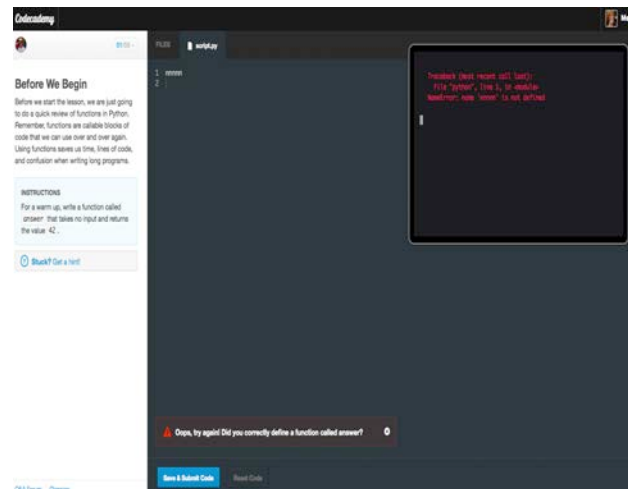

Figure 4. The coding interface

These components are externalizing artifacts that play a critical role for learning programming. Learners may encounter difficulties in describing their problems to their teachers or other peers. However, as [9] pointed out, if either the output of coding can be sent to the teacher, or even better, if both the teacher and the learner can see each other's outputs and work on the same problem collaboratively, then a more efficient study environment can be established. The analysis of the coding interface suggests the adoption of an approach aimed at building a collaboration of sorts through facilitation embedded in the design of tools, without the presence of a human teacher. These tools inscribe the collaborative process by shifting key facilitation actions into the components of the coding interface. The supporting role for assessment played by this technology is exemplified by what the MOOC-E (a moderator monitoring the study group *MIT 6.189 A Gentle Introduction to Python)* responded to a participant asking what to do with the homework once it was finished:

"No homework submission. It will be clear with most assignments if the code runs correctly or not, and Codecademy gives instant feedback".

However, problems can arise with the interface, as shown in the following instance in which a participant shares with peers the output of his/her code, which s/he thinks is correct although the feedback from Codecademy says otherwise:

*"**Exchoordo***: Is it code academy, or is it me? This looks fine, but codeacademy says "Oops, try again. Check your syntax".*

***SweetXOGranni**e: Code Academy doesn't tolerate much creativity. You have to put in exactly what it expects or you will get an "Oops," even if your code would work just as well. Try yours in Python on your computer to see it works".*

In the case reported in this excerpt, Exchoordo managed to fix the syntax error thanks to the help of a peer who provided a good suggestion. This finding suggests that when something goes wrong with delegated facilitation, the human-to-human relationships can re-emerge to provide help. It can be argued that shifting key facilitation actions into components of the coding interface introduces a new set of technical actors with responsibilities with performing the system, enacting facilitation and repairing breakdowns.

7. Discussion

To date, a significant volume of literature, scholarly and for educational practitioners, focuses on the roles of instructor facilitation in online and distance learning [13] [4]. Instructor facilitation is seen as an important indicator of teaching presence, defined as "the design, facilitation and direction of cognitive and social processes for the purpose of realizing [students'] personally meaningful and educationally worthwhile outcomes" (p. 5) [4]. In this approach, instructor facilitation together with the technology used in a course play a critical role to organize and promote peer participation and a richer and more effective meaningful dialogue among learners. However, this view presupposes an intermediary role of technology, which eases communication and access to resources, but also poses serious limitations to the development of meaningful learning activities that require active instructor facilitation to be overcome. Consequently, technology is not seen as a vehicle of human agency, capable of redistributing facilitation and reformulating social relations. In contrast, the findings of this study suggest that technologies themselves play a distinct role in enacting forms of facilitation and sustaining the course without teaching presence. This study has sought to demonstrate how artifacts used in the

MMOOC, designed intentionally without teaching presence, aim at redistributing facilitation and reformulating social relations. For example, the email scheduler is explicitly built to minimize commitments to coordination through communication. The study group *MIT 6.189 A Gentle Introduction to Python* has set out to supplant the role of teacher as a gatekeeper for monitoring and grading through reliance on an automated crowdrating system to assess problem solving, teamwork, and level of engagement. The coding interface handles automatic testing of code submitted by learners and provides immediate feedback. The findings have shown that these artifacts do not play simply an intermediary role, but work to redistribute facilitation and reformulate social relations in a large-scale course. While online courses have relied primarily upon teachers, with the increased size and technological interdependence of the MMOOC, the examined artifacts apparently remove the need for exposure to teachers, by providing participants with peer interactions and automated coordination and testing. This claim seems consistent with the anticipations of the type of learners and type of participation held by the designers of the artifacts. The envisioned learners are independent and self-organized, capable of pursuing their learning alone and interacting with their peers. The delegation of facilitation to the three artifacts suggests decentering of authority and responsibility, most often inscribed in the technical design of the artifacts. For example, assessment that we usually consider a teacher activity is partially shifted to the designers that developed and implemented the artifacts, which thereafter redistribute responsibility for accomplishing assessment. While this activity still presupposes forms of social interaction, it is ultimately inscribed into software by the designers, and thereafter sustained by the artifacts themselves. However, delegation to the three artifacts does not result in the wholesale transfer of human facilitation across a sociotechnical divide, but rather in a reconfiguration of that activity, bringing new technological and human actors into the mix.

8. Conclusion

This study has used the concept of inscription to describe how facilitation has been delegated to artifacts, by drawing attention to the design and implementation of artifacts. Three important aspects have emerged from the analysis of delegation to artifacts. First, acts of delegation have been traced, as the designers developed and implemented the technologies that are expected to facilitate the MMOOC. Second, the way in which delegation cedes actions of facilitation to the artifacts themselves has

been described. Facilitation has emerged as a hybrid encompassing several actors – such as email scheduler, rating system, interactive interface, texts, designers, and study group participants – which together organize and produce actions of facilitation. Last, the way in which delegation reconfigures what and who facilitates and sustains the MMOOC has also been described. Delegation casts light on the redistribution of responsibilities and reconfiguration of social relations in the MMOOC.

This study has taken a "designer" perspective to examine how delegation has been inscribed into artifacts; therefore future research should investigate the extent to which artifacts exert facilitation by examining the extent and manner in which artifacts are used. The program of action inscribed into an artifact does not determine necessarily the use of an object, and people may deviate from this program and use the object in unanticipated ways.

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10. References

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