Online Persuasive Learning

A study into the effectiveness of social-proof based online persuasion in a MOOC course

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***Abstract*—Robert Cialdini's six principles of persuasion have been successfully applied in sales for decades. Many commercially driven organisations continue to discover new implementations of the key principles for influencing human behaviour online. And, as a result, knowledge of online persuasion has increased. Which, in turn, has resulted in improvements in time spent and/or conversion rates. Online learning environments could also benefit from these new implementations. Especially Massive Open Online Courses (MOOCs), that are known for their high dropout rates of MOOC learners. And, moreover, MOOC learners could make optimal use of the course and meet their learning intention. One Cialdinis' persuasion principles is social proof. This principle is often applied with success in e-commerce. Therefore, this research aims to investigate the effect of a specific social proof implementation within a MOOC course. The tested course is hosted on the Coursera platform, and the experimental setup is tested with an A/B test. A total of 345 MOOC learners were enrolled in Terrorism & Counterterrorism course. The learners in the experimental group (n = 69) were exposed to information relating to the behaviour of successful students. This online persuasive learning (OPL) message is shown at three critical moments in the MOOC. Learners in both groups are equally likely to complete the course. However, learners that are exposed to the OPL message are more likely to complete more course items. Cohen's effect size value (d = .10) suggested a small-sized significance.**

Keywords: MOOC, persuasive learning, learning analytics, persuasion.

I. Introduction

Since the emergence of Massive Open Online Courses (MOOCs) in 2008, the popularity of these online courses has increased substantially (Taneja & Goel, 2014). A MOOC is a specific type of distance education. Unlimited participation and free and open access play an important role in defining what a MOOC is. The term MOOC was introduced by Dave Cormier (McAuley, Stewart, Cormier, & Siemens, 2010) as an acronym. The acronym stands for a) **Massive**, to indicate that the number of learners is often much higher compared with traditional higher education courses. Numbers vary from a few hundred participants to 380.000 enrolments for the most popular MOOC course (Understanding IELTS: Techniques for English Language Test, which started in May 2015 (Liyanagunawardena & Williams, 2016)). b) **Open**, reflects the openness of MOOCs - virtually anyone can participate in a course, regardless of educational background or university enrolment. Initiatives such as open educational resources (OER) and OpenCourseWare (OCW) (Tovar Caro & Lesko, 2014) stimulate the open accessibility of course materials, c) The course materials are only made available **online** and therefore accessible for anyone with an internet connection. d) while **course** represents the teaching unit, xMOOC of cMOOC (Smith & Eng, 2013). An xMOOC is based on the curriculum that is used by the university that offers the course. Whereas the educational content xMOOC is determined prior to the start of the course, the education content of a cMOOC is determined by the learners in the MOOC. The first MOOC, Connectivism and Connective Knowledge (2008) by George Siemens (Mackness, Mak, & Williams, 2010), was setup as a cMOOC. However, nowadays most MOOCs are xMOOCs.

The New York times declared 2012 "the year of the MOOC". In one of its articles, Pappano (2012) discussed fast growing MOOC platforms like EDx, Coursera and Udacity. Gallagher and Garrett go even further by reporting the disruptive effect of MOOCs on traditional higher education (Gallagher & Garrett, 2013). For instance, total MOOC enrolments exceeded 35 million in 2015 (Shah, 2015).

Although MOOC enrolments run in the millions, the dropout rate is significant. Course completion is low compared with traditional higher education. According to Onah, Sinclair & Boyatt (2014), the completion rate is approximately 13%. A survey conducted among MOOC professors has shown this percentage to be closer to 7.5% (Kolowich, 2013). A large scale study involving 3.5 million MOOC learners, covering the three biggest MOOC platforms, revealed an average completion rate of 6.5%. (Jordan, 2014). Based on these figures, the total drop- out is somewhere between 30 and 33 million. This problem is raised frequently in both academic literature and the press.

MOOCs receive a great deal of attention from researchers. This can also be concluded from an early systematic review of MOOC research (Liyanagunawardena, Adams, & Williams, 2013) and the MOOC Research Initiative (Gaševic, Kovanovic, Joksimovic, & Siemens, 2014). While MOOC courses produce large amounts of data, much of the research is focused on data mining, as identified by Ebben and Murphy

(2014). For this reason, part of the research focuses on characterizing MOOC learners. With these learner characteristics, Greene (2015) demonstrates that accurate predictions about learner retention can be made. Learner behaviour during the early stages of the MOOC is also a useful predictor (de Barba, Kennedy, & Ainley, 2016; Ye & Biswas, 2014). Although much is known about data that predicts retention, less is known about interventions that target improvements in MOOC retention rates.

Limited research, for example by Hone (2016), has shown that better instructor interaction and perceived effectiveness help to improve MOOC retention. Khalil (2014) demonstrates that enhancement of online learning skills and student-to-student interaction also have a positive impact on retention rates. Other researchers have found that goal-oriented feedback (Davis, Chen, Jivet, Hauff, & Houben, 2016), promoting self-regulated learning (Hood, Littlejohn, & Milligan, 2015) and a focus on digital skills (Rothkrantz, 2017) have a beneficial impact on MOOC completion rates.

Despite the above, no attempt has been made to improve MOOC retention rates through the use of online persuasive techniques. The absence of such techniques was also noted by Wilde in her position paper (Wilde, 2016). Wilde argues that the use of learning analytics in combination with persuasive technologies will improve completion rates. Persuasive technologies, or the science of persuasion, are mainly based on the six principles of influences (Cialdini, 1993). In his work, Cialdini distinguishes six basic phenomena in human behaviour. These are scarcity, reciprocation, consistency, liking, authority and social proof. The latter is widely used for online persuasion, and includes online user reviews and ratings as well as presenting information about the behaviour of others. An exemplary social proof-based experiment was conducted by Goldstein (2008). In order to persuade hotel guests to reuse their towels a message focused solely on environmental protection or a message merely focussed on the behaviour of towel use of other guests (e.g., “the majority of guests reuse their towels”) was shown. The latter message proved to be superior in terms of towel reuse. Likewise, a campaign to encourage people to wear seatbelts proved to be effective with the use of social proof (Mirsch 2017). Similarly, this phenomenon is utilized in e-commerce environments. With the use of persuasive techniques online, the purchase intention of online products (Jeong 2012) or online tickets (Fenko 2017) are successful implementations of online social proof-based persuasion. The hypothesis proposed here is that persuasive learning based on social proof has a positive effect on completion rates.

This paper presents an experiment based on the social proof principle. The aim of the experiment is to influence the behaviour of the MOOC learner by implementing this principle. The study uses quantitative data from an A/B test to analyse the effect of a specific social proof implementation on the completion rates. The research offers some important insights into the use of persuasion in an online learning environment.

II. Methodology

In this study, a controlled experiment was conducted on the Coursera platform (Coursera, 2018a). When conducted on an online platform, this type of experiment is generally referred to as an A/B test. A controlled experiment approach was chosen to evaluate the effect of social proof-based intervention and to establish the possible existence of a causal relationship (Box, Hunter, & Hunter, 2005). A suitable MOOC was chosen in collaboration with the MOOC supporting department of the Centre 4 Innovation (centre4innovation, 2018) at Leiden University. The following course was selected: Terrorism and Counterterrorism, taught by Prof. dr. Edwin Bakker and drs. Jeanine de Roy van Zuijdewijn. To achieve enough statistical power, Leiden university’s most popular MOOC was selected. This is particularly important given the limited impact that the intervention is expected to have on the experimental group. Some 144,000 people have so far enrolled in this specific MOOC. On average, 4,000 people enrol for each session.

Terrorism and Counterterrorism (Coursera, 2018b) is an entry-level MOOC, taught in the English language, with subtitles in Spanish, Ukrainian and French. The expected time commitment is 30 hours. This included reading, quizzes, video lectures and writing assignments. The course curriculum (see Appendix for details) is divided into a six weeks course. Each week ends with a graded assignment. To pass the course, all graded assignments have to be completed.

The experiment consists of two groups. Upon registration, each participant was randomly allocated to one of two groups. Allocation started after the enrolment end of the previous session. The allocation enrolment is conclusive for the duration of the course. This is done to ensure that a control group learner is never exposed to a social proof-based persuasive notification and vice versa. The above corresponds to the default setup of the A/B testing functionality of the Coursera platform. The control group (group A) receives the regular course content and no additional material is added. The experimental group, on the other hand, is shown specific social proof-based notifications. These notifications are included at the end of the last video for weeks 1, 2 and 3. The first notification is shown in the last video of the first week (video 15) just before the first assignment . The second notification is displayed in week two, in the last video for that week (video 9). The last notification is planned in the notorious third week of the course, again, at the end of the last video (video 7). The notification is shown to the experimental group and consists of a small but noticeable fly-in message. The message contains information relating to the behaviour of successful students at that particular moment, using the social proof principle . The experimental period starts during the 3rd session of 2018, which begins on 8th of April and ends on May the 5th. While the session starts on April the 30th, the is the time when enrolled learners are given access to the assignments and course materials.

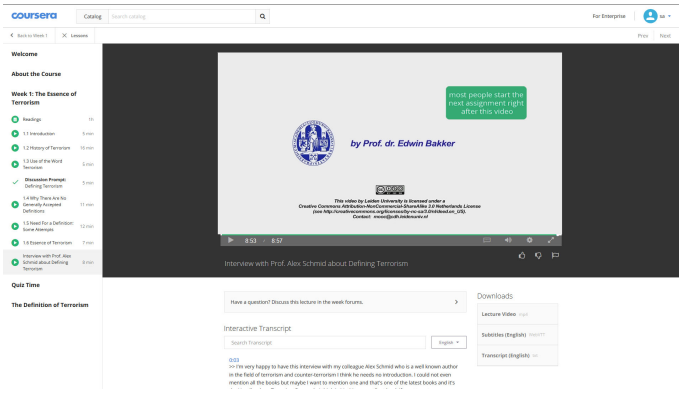

Figure 1 visualization notification on desktop

All three notifications contain the text "most people start the next assignment right after this video ". The end position of the message in the video is visualized below. The box eases in from the bottom of the video. The background colour, as well as the font family, are in line with the corporate identity of the Coursera platform. More details about the design of the message box can be found in the design & interaction document in the appendix. A visualization of the notification on a mobile screen can also be found in the appendix.

The data needed for the experiment is: 'Assignment completion', 'Course completion' and whether or not the participant is assigned to the control group (A/B test). The data for this experiment can be conducted without the use of personal identifiable Information (PII). Data is provided by the C4I data analyst and contains a hash reflecting the user ID in combination with other key data. A detailed description of these variables is included in the codebook (appendix).

Table 1

Key Metrics

Variable	Measure
Course completion	Whether or not the learner has completed the course of the specific session
Social proof notification	Whether or not the Online Persuasive Learning notification has been implemented
Course item completion	Whether or not the learner has completed a particular course item

III. Results

Data obtained from various studies, related to social proof-based e-commerce implementations, indicated that this persuasion technique resulted in higher conversion rates. According to Jeong (2012), a claim about the popularity of a specific product proves to enhance the quality perception and the purchase intention. Similar effects were found by Fenko (2017) and Kaptein (2012).

In this study, a social proof-based persuasion implementation is tested on the MOOC learners. A total of 345 MOOC learners were enrolled in the studied session of 2018 of the MOOC course Terrorism & Counterterrorism. The results of the experimental group (n = 69), exposed to information relating to the behaviour of successful students, are compared with the control group (n = 276). The table below summarizes the demographic characteristics of the MOOC learners in the experiment. Most Personal Identifiable Information (PII) is optional at enrollment and, therefore, the view of the learners characteristics is limited. Although, the available information gives some insight in the learners' group composition. The course is especially popular among full-timer workers and Bachelor degree students. This, as with other demographics in table one, corresponds with the learners of the average of other Coursera's courses.

Table 2

Demographics Characteristics of MOOC Learners (N = *345*)

Characteristics	*n*	*%*
Gender		
Female	122	35
Male	164	48
Missing	59	17
Employment Status		
Employed full time	26	8
Employed part time	8	2
Retired	1	<1
Self employed full time	3	1
Self employed part time	2	1
Unable to work	13	4
Unemployed looking for work	3	1
Missing	289	84
Level of Education		
Associate degree	1	<1
Bachelor degree	35	10
College no degree	13	4
Doctorate degree	4	1
High school diploma	9	3
Less than high school diploma	1	<1
Masters degree	18	5
Professional degree	5	1
Missing	259	75
Student Status		
Full time degree student	22	6
Not degree student	26	8
Part time degree student	11	3
Missing	286	83

USA, Canada, India, Mexico and several European countries make up the half of the learners' population. This deviates from Coursera's course average where the Nord American and Asia countries dominate the population. Countries that take up at least 1% of the course population, can be found in figure 2.

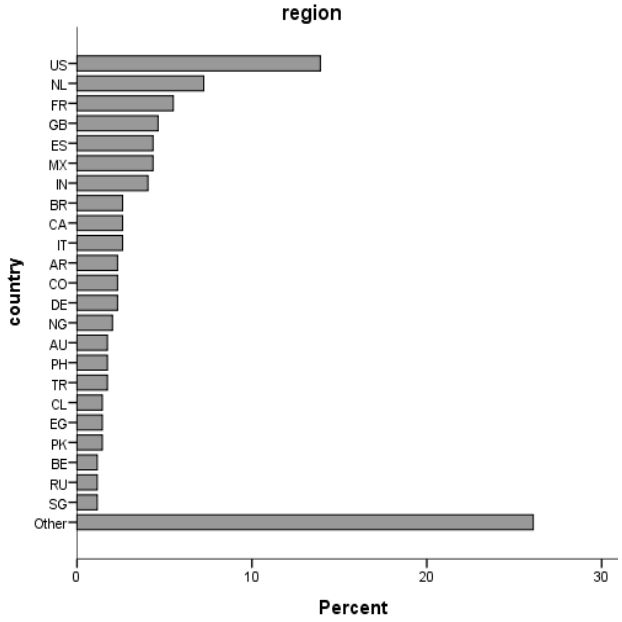

Figure 2 region of orgin

The retention rate of the experimental group (n = 69), and the control group (n = 276) can be found in table 3. A Chi-square test of independence was calculated comparing completion rate of the controlled experiment. This test did not reveal a significant interaction (χ^2 (1) = 4.2, p = .04). And, therefore, learners exposed to the behaviour of other learners are equally likely to complete the MOOC. This result does not correspond with the previously mentioned studies. Although the overall retention rate does not significantly differ, the data regarding the number of completed items reveal some noticeable information.

Table 3

MOOC course Terrorism & Counterterrorism learners control group and experimental group

	Control		Messages	
Retention	*n*	*%*	*n*	*%*
Not completed	248	90	59	86
Completed	28	10	10	14

The group difference on completion rate does not differ, however, the course items completion do. An independent sample t-test revealed that, on average, learners that are exposed to the OPL message are more likely to complete more course items (M = 16.03, SE = 10.91), than learners who did not saw the OPL message (M = 11.75 , SE = 9.92). This difference, -4.28, BCa 95% CI [-7.139, -1.411], was significant t(97.94) = -2.96, p = .004; the difference represent a small-sized effect, d = 0.10 according to Cohen's convention (1988). A meta-analysis of e-commerce experiments (Browne 2017) also concluded that informing users of others' behaviour has an average conversion rate uplift of 1.9%. Levene's test for equality of variances was found to be violated for the independent sample t-test , F(1,344) = 3.43, p = .065. Owing to this violated assumption, a t statistic not assuming homogeneity of variance was computed. The absence of equal variances may be explained by the session data. The exported session data from the Coursera platform contained three different branches, or groups, of learners. Two of these groups were part of the control group and one group was exposed to the experimental condition. It can be assumed that assignment of the condition is not completely random, as the numbers of learners per group indicated. The statistical significance should be interpreted with this in mind.

Supplementary, a proportion sample t-test was carried out. This test is commonly used in e-commerce where it is known as an A/B test. The observed difference in conversion rate (42.86%) is not significant (p = .173). There is no real difference in performance between the control group (CR:A) with a completion rate of 10.14% and the group that was exposed to the OPL messages (CR:B) with a completion rate of 14.49%. This relative equality is also indicated by the limited power of only 62.57%.

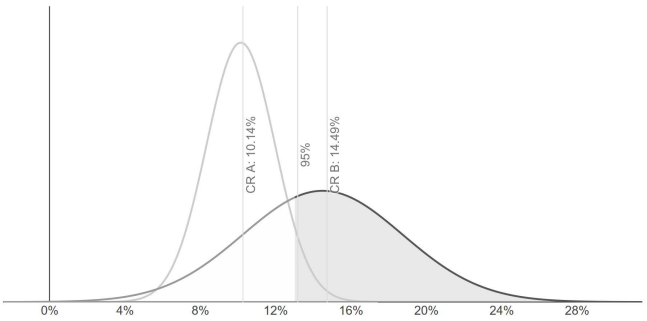

Figure 3 proportion sample t-test

These results indicate an effect of online persuasion in an online learning environment. This indicate, therefore, that social proof-based persuasion can influence the engagement in MOOCs.

IV. Conclusion

Prior work has documented the effectiveness of influencing behaviour with the use of social proof (Mirsch 2017). Likewise, the use of persuasive techniques online, prove to be effective in purchase intention of online products (Jeong 2012) and the purchase of online tickets (Fenko 2017). These studies, however, were focussed on influencing online

behaviour in a product or service in a purchase situation. In this experiment, the use of a social proof-based intervention is tested to which extent a social proof-based intervention improved the retention rate of MOOC learners in the online learning environment on the Coursera platform.

The controlled experiment shows that participation in the social proof-based persuasive notification group did not differ in the retention rate of the MOOC. A small, but significant difference was found in the completed course items between the two groups that participated in the online persuasive learning experiment. These findings indicate that social proof-based online persuasion, almost exclusively used in e-commerce, can be effective in the persuasion of online learners. Furthermore, the retention rates were consistently significant in all of the three weeks where the notification message was shown.

This indicates, therefore, that MOOC engagement can benefit from social proof-based online persuasion. This is the first experiment to the knowledge of the author that applies social proof-based online persuasion techniques, to investigate its effectiveness in a MOOC. The results provide MOOC and other online learning environments a new approach to enhance online learning with persuasion techniques.

However, some limitations are worth noting. Although the intervention was proven to be significant with a large group of the participants with limited statistical power, the experiment ran only on the MOOC Terrorism and Counterterrorism. In terms of gender, age, student status, highest education and employment status the Terrorism and Counterterrorism learners do not differ from the whole Coursera learner population. Such is not the case for the region of origin since the learners of this MOOC are primarily originated from European countries. It is unknown to what extent this affects the effect of the experiment.

V. Future work

Apart from the origin of the learners, the way in which the learners interact with learning material and with other learners differs from MOOC to MOOC. Future work should, therefore, include social proof-based persuasion experiments in other MOOCs and other implementations of social proof. Moreover, other e-commerce persuasive techniques, such as reciprocation, consistency, liking, authority and scarcity should be included in MOOC related research. Especially the latter is proven to be very effective in e-commerce. The results with this specific online social proof-based persuasion experiment are promising. This setup is an implementation in online learning and derived from a successful social proof-based implementation, as used in e-commerce. Besides this specific social proof-based implementation, there are many more effective examples of this social proof principle that could be beneficial for the engagement in online learning. On top of that, others implementations based on scarcity, reciprocation, consistency, liking and authority are continuously applied in e-commerce and can provide opportunities for online learning. It can be concluded that OPL is still in its infancy and can, considering the impact on e-commerce, be a solution to the notorious low retention rates. Especially because the application of persuasive technologies in online learning is virtually not existing, there is a lot of "low-hanging fruit". Applications are, therefore, fairly easy to implement. The author argues for standard and continuous A/B testing of persuasive technologies in online learning. In other words, online learners are continuously learning on the learning platform, the learning platform should learn continuously as well. In this way, scientific advances in OPL can be made. Findings in OPL can guide online learning platforms in developing more effective courses and, with that, get the most out of the learners time and intention. Learn when you're learners are learning.

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I. APPENDIX

Appendix A Design & Interaction Document

Online persuasive behaviour

Design & interaction document

Notification

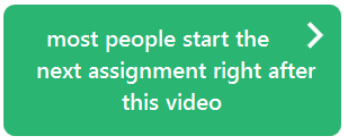
Content

Al three notifications contain the following text:

most people start the next assignment right after this video

Design

- Size of the block: 250 x 110 px
- Font familiy: Sans-serif
- Fontsize: Headline-2 (20px)
- Padding 15,10,10,15
- Background color coursera (#2ab573)



Position (end position)

covers a part of the video. Examples of the suggested positions can be found below.

- Desktop
  - x: +/- 1500px y: 180px
- mobile
  - right side of the notification has a 10% margin to the right of the video

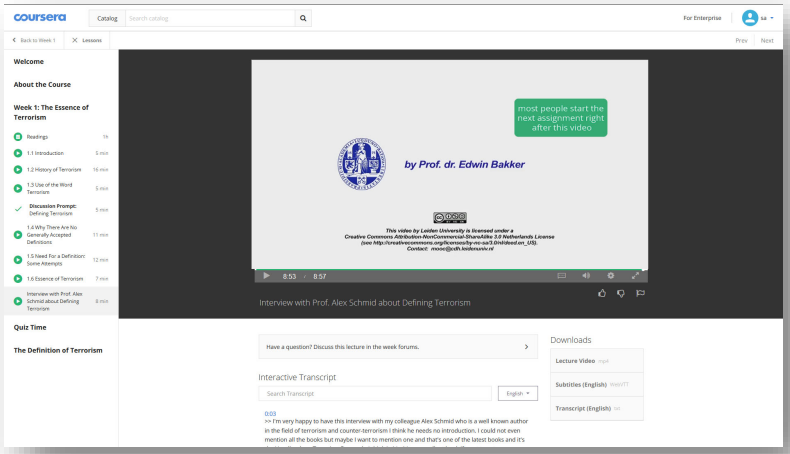
Behaviour

- Start animation 8 seconds before the end of the video.
- Start position outside the bottom of the video.
- Move to end position in a vertical movement
- Total animation time is ~1000ms.
- Velocity (ease out)
- Messagebox is visible at end position for the remaining tim of the video ~7 seconds.

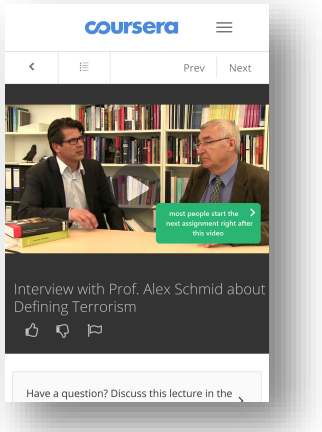
Visualization

APPENDIX A

Visualisation of the end position of first notification (week 3)



visualization message box on desktop



visualization message box on mobile screen

Mock up

A visual mock-up, including behaviour, of the intervention can be seen here. In the link below a video of the prototype can be seen.

Prototype: https://vimeo.com/269632904