

# Smart Heuristic Artificial Recognition and Visual Interaction System

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## Abstract

This paper investigates the uses of interactive video as a medium for teaching and learning activities. Based on the characteristics of interactive video annotations, various use cases are proposed and discussed. Two real experiments are then described. The first experiment is to add annotations to a video by teachers to produce course materials. The second is to produce a video and annotations on this video by student as an assessment work. The feedbacks of teachers and students are then summarized and discussed. The goal is to assess their feelings about the production of interactive videos as part of teaching and learning activities.

## 1. Introduction

Videos are widely used in education and particularly in distance education. On recent distance learning platforms such as the ones that support MOOCs, video is now the core course material. Open educational platforms like the Khan Academy host thousands of short videos for learning at distance. Recent teaching methods such as flipped classroom have also raise the interest for videos in education. Videos are expected to increase the level of engagement of students compared to traditional text course material increase the level of retention and reduce teacher intervention. Of course, the types of video, the way the teacher incorporates the videos in the organization of teaching, even the way he adapts his teaching to the videos, all these aspects have an impact on the level of student engagement. The educational interest for videos is not limited to formal education. Videos are the type of online content among the most consumed by young adults: 96% of 13-24 are consuming online video via social mediasites for an average of 11 hours

per week The consumer barometer is oriented towards brands marketing but provide interesting evidences about the informal education usage of videos. It has established that 40% of Millennials use YouTube at least once a day, to be entertained, to connect with others, but also to learn. This barometer has identified that 23% of Internet users watch online videos because they want to "learn something new". Videos are intrinsically interactive as it can be paused, rewind, speed up... Interactive annotated videos are videos that integrate an additional layer of data and metadata that trigger additional types of interactions. The interactivity layer is organized as annotations. Interactive annotations have been defined as "information pieces that can be anchored in the temporality of the video so as to sustain various processes ranging from active reading to rich media editing" We slightly extend this definition, as the anchor in the video need to be both temporal and spatial. The insertion of interactive annotations in videos shifts learners from the state of a passive viewer to the one of an active reader It must be noted that we do not consider annotations that students could add to an educational video as course notes, but only to annotations that are expected to support and enrich the information and knowledge conveyed by the video and make it interactive. In this paper we define different use cases for learning and teaching activities based on video annotations and we analyse two experiments based on the production of interactive annotated videos by teachers and students. The main goal is to evaluate the feedbacks from teachers and students with the production of interactive videos as teaching and learning material.

## 2. Interactive videos

It has been identified that interactive modules like annotated videos may increase students' engagement may improve the self-study context of students involved in a MOOC thanks to extended navigation options and reflection breaks may speed up the skills acquisition process and increase the level of retention compared to standard videos Interactive videos are based on annotations. These annotations are spatiotemporally inserted inside the video. They introduce additional interactions over standard video interactions (mainly devoted to the control of the video: pause, rewind,loop...). Different use cases of learning and teaching activities may be proposed which go beyond the main use of video as course material.

### 2.1 Video annotations

Two main types of annotations can be identified. Each one corresponds to a type of learning process. The classification proposed by Aubert et al. is organized around four types of learning processes:

active reading, annotations for assignment, live annotation, and performance annotation. The last two correspond to synchronous activities while the first two correspond to asynchronous activities on which we will focus for the Future. Semantic or learning annotations: they add a semantic layer that helps to describe the content of parts of the video. The level of interaction for the reader is quite low and consists mainly to make the annotation appear to read or access it. It may involve pausing the video. What is important is the consistency and the semantic relevance between the content of the annotation

and the annotated part of the video picture(defined by the temporal dimension: the anchor frame or frame range and the spatial dimension: the anchor location in the video picture corresponding to the anchor frame). Those annotations are mainly dedicated to active reading. The most basic annotation of this type is short text. It can also be a hyperlink to a web page or another video. Activity or assessment annotations: these annotations are not expected to describe or explain the content of the video, but to challenge the reader with respect to the content of the video. The most important anchor here is probably the temporal one. The spatial one is relatively less important. The level of interaction for these annotations is usually very high and requires the viewer to provide inputs through text and interactions: mouse clicks, drag and drop... Typical examples of the annotations are single or multiple-choice questions. Semantic annotations are basically dedicated to active reading learning processes whereas activity annotations are dedicated to assignment activities. However, it must be noticed that semantic annotations can also be involved in assignment activities. In this context, students add semantic annotations to a video that is further assessed by teachers. This use case is described in the next section.

A survey of some of the available tools and online services that offer video annotation is available in Since 2015 new ones have appeared, such as H5P which is getting popular. However it is observed tha those tools propose the same interface and features. What differ are the application context (mainly between marketing and education) and the resulting palettes of annotations types that are offered.

H5P (HTML5 Package) is an open-source content collaboration framework based on Javascript focused on the creation of interactive HTML5 content and particularly videos. H5P is supported by popular content management systems such as Wordpress and learning management systems such as Moodle. It currently offers 12 different annotation types covering the semantic and activities categories.

## 2.2 Use cases

Interactive videos are mainly produced and used in a teacher-centered workflow: teachers produce the video, add the interactive annotations and then make it available to students on an LMS or MOOC platform so that they can watch and study it. However, many more use cases can be investigated for teaching, learning and assessment.

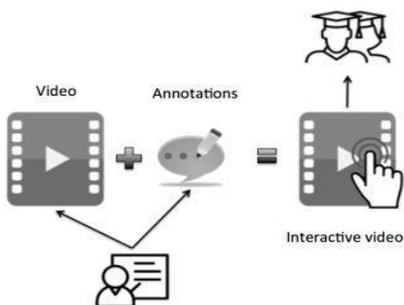


Figure 1 . Use case 1: Active video reading

The use case described in Fig. 1 corresponds to the most obvious and basic one: the teacher produces the video, annotates it and releases it on an LMS for example, as course material.

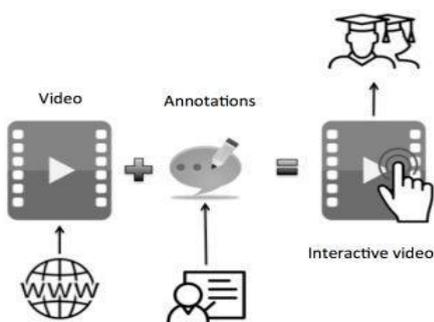


Figure 2 . Use case 2: Variation of active video reading

The use case proposed in Fig. 2 is a variant of the previous one. The teacher selects an existing available video and annotates it. This use case offers the possibility for the teacher of appropriating reusable educational contents. It offers an attractive scenario for the reusability of open educational resources, as it opens the way for teachers to adapt the content to their own requirements and needs (reusability as adaptation). Although use cases 1 and 2 are focused on active reading activities, they can mix semantic and activities annotations.

The following use cases are oriented towards assignment activities and involve students as authors of the annotations. Although the outputs are mainly expected to be assessed by teachers, they can also be reused as course material for active reading activities.

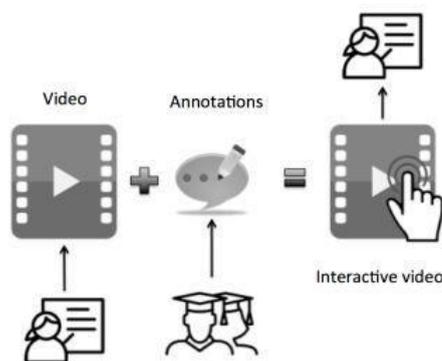


Figure 3 . Use case 3: video annotations assignment

In the third use case (Fig. 3), the teacher chooses/produces a video and students have to enrich it with annotations. Those annotations can answer explicit questions addressed by the teacher or they can illustrate the knowledge that the student is able to express. The interest in comparison with an equivalent written exercise, as an essay, is to start from situations illustrated by the images and to have a mode of expression that promotes

conciseness and precision. Collaborative online frameworks such as H5P offer the possibility of collaborative group activities.

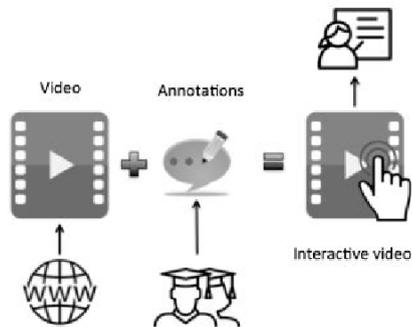


Figure 4 . Use case 4 : variation of video annotations assignment

In the fourth use case (Fig. 4), students have themselves to select an existing video and annotate it. The teacher can then evaluate the relevance of the choice the video and the annotations. The last use case, depicted in Fig. 5, is the most demanding for students who must produce the video themselves, then annotate it. This use case seems complex, as it requires students to film and upload a video. However, this can be achieved using a smartphone. The upload of the video can also be done with applications such as Youtube, which facilitate the transfer of videos. This step does not look too complex for students, as they use video applications, such as Snapshat or Instagram.

This use case requires the student to be equipped with a camera. The rate of smartphone ownership among students in developed countries is currently quite high (and still increasing). A survey conducted by Nielsen in 2014 show that in the US, 85% of Millennials aged 18- 24 own a smartphone. Another survey conducted by Harris Poll in 2015 shows that smartphone ownership among students in grades 4 through 12 is 80%. And the rate of

students using smartphones in class is 53%.

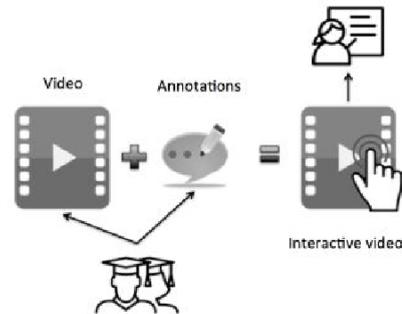


Figure 5 . Use case 5 : Interactive video assignment

### 3. Experiments

Two experiments have been conducted in this research. The first one involves students and corresponds to the use cases 4 (and 5). For both experiments, feedbacks have been collected in order to analyze the feelings respectively of teachers and students with respect to this kind of activities. The second one involves teachers and corresponds to the use case 2.

#### 3.1 Student work

This experiment has been conducted in 2016 as part of the assessment of the bachelor course "introduction to information and communication technology" with a class size of 120 students. This course is part of the first year of a bachelor in information and communication science. The rate of laptop ownership of the class is 99% and the rate of smartphone ownership is 93%. For the assessment work, students have to produce a mini-illustrated encyclopedia: they have to select four concepts studied in course and propose their own definition for each concept. The mini-encyclopedia is developed as a simple web site. Among the four definitions, one must be produced and published as an oral recording (using

the Soundcloud platform), and one must be provided and published as an interactive annotated video (using the Youtube platform). The two others can be provided as text-based definitions, following the Wikipedia model. For the annotated video, the choice of the Youtube platform is made for its convenience: it includes a smartphone application that manages the video recording and upload. The Youtube platform also involves an annotation editor. Although this annotation editor is mainly dedicated to produce marketing videos, it offers the basic semantic annotations. Students can either produce their own video or select an existing one. Few weeks after the end of the course, a questionnaire has been sent to the students including 9 questions and 24 answers have been collected. The 8 first questions are likert scales with four levels (1: fully agree / 4: fully disagree). For the last question, students have to indicate their global feeling by selecting one keyword from a pre-defined list: useless, motivating, pedagogical, pointless, enriching, actual, complex, technical, visual, multimedia and accessible. The answers have been collected anonymously. The results of the likert scale questions are presented in Table 1. The level of agreement is defined as the sum of the percentage of the answers "fully agree" and "agree". The results of the last question are presented in a pie chart graphic in Fig. 6.

The results obtained show that the activity is technically accessible for the students. To complete this aspect, it must be noted that this course is the only IT course that the students follow during their first year of bachelor. Moreover, they did not receive any training during the course and seminars regarding video, filming and

annotating. They only received a list of online tutorial resources describing how to use the Youtube annotations editor. Students also show a massive interest to use their own mobile devices in their learning activities. Our hypothesis is that this type of activity is perfectly aligned with the informal digital skills that young adults develop with their own mobile devices: smartphones and laptops. We also see that they are aware and sensitive regarding the inputs at the different levels: engagement, creativity, and pedagogical, that this type of activities can bring. Although students compare this type of activity more favorably in terms of motivation than traditional written activities, they are more mitigated regarding the ratio efforts/gains.

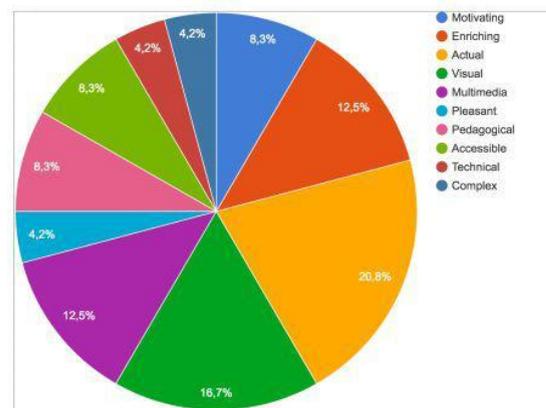


Figure 6. Students' feelings

We can cluster the different keywords selected by students into three main categories: The first cluster includes: motivating, enriching, pleasant and pedagogical, which corresponds to 33.3% of the answers. The second cluster includes: visual and multimedia, and corresponds to 29.2% of the answers. The third cluster includes: technical, complex and accessible, and corresponds to 16.5% (8.2% for technical and complex and 8.3% for accessible). It confirms the global positive feedbacks of the other questions. We see that students first identify the contribution of the activity,

then the type of production and finally the technical aspect.

### Conclusions

In this paper, we survey the notion of interactive annotated video. We then propose five used cases of learning and teaching activities involving teachers and students. Two of these use cases have been experimented and qualitative and quantitative feedbacks have been collected. Although these results cannot be simply generalized, they clearly indicate the technical feasibility and the interest and adoption expressed by the main stakeholders. Students and teachers can control the complexity of the annotation activity and the added value is clearly identified regarding engagement and pedagogy. Regarding students, the possible learning activities based on annotated videos contents are probably aligned with the informal digital skills of students. It opens the way to introduce and develop BYOD in course organization and activity.

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