The role of online videos in research communication: A content analysis of YouTube videos cited in academic publications[1]

Kayvan Kousha
Statistical Cybermetrics Research Group, School of Technology, University of Wolverhampton, Wulfruna Street, Wolverhampton WV1 1LY, UK and Scientometrics Department, University of Tehran. E-mail: k.kousha@wlv.ac.uk
Mike Thelwall
Statistical Cybermetrics Research Group, School of Technology, University of Wolverhampton, Wulfruna Street, Wolverhampton WV1 1LY, UK. E-mail: m.thelwall@wlv.ac.uk, Tel: +44 1902 321470 Fax: +44 1902 321478
Mahshid Abdoli
Reference Librarian, National Library and Archive of Iran, Tehran, Iran. E-mail: mahshid_abdoli@hotmail.com

Although there is some evidence that online videos are increasingly used by academics for informal scholarly communication and teaching, the extent to which they are used in published academic research is unknown. This article explores the extent to which YouTube videos are cited in academic publications and whether there are significant broad disciplinary differences in this practice. To investigate, we extracted the URL citations to YouTube videos from academic publications indexed by Scopus. A total of 1,808 Scopus publications cited at least one YouTube video and there was a steady upward growth in citing online videos within scholarly publications from 2006 to 2011, with YouTube citations being most common within arts and humanities (0.3%) and the social sciences (0.2%). A content analysis of 551 YouTube videos cited by research articles indicated that in science (78%) and in medicine and health sciences (77%) over three quarters of the cited videos had either direct scientific (e.g., laboratory experiments) or scientific-related contents (e.g., academic lectures or education), whereas in the arts and humanities about 80% of the YouTube videos had art, culture or history themes and in the social sciences about 63% of the videos were related to news, politics, advertisements and documentaries. This shows both disciplinary differences and the wide variety of innovative research communication uses found for videos within the different subject areas.

Introduction

Although journals, conference proceedings, books and monographs are common primary sources for researchers in many subject areas, non-standard electronic media seem to be increasingly used in research and education. About a decade ago critical changes in electronic scholarly communication had already led to "scholars communicat[ing] with each other for informal conversations, for collaborating locally and over distances, for publishing and disseminating their work, and for constructing links between their work and that of others" (Borgman & Furner, 2002, p. 3-4). The Web has thus provided new opportunities for publicising and sharing a wide range of non-standard scientific content but much is public and may therefore be studied for evidence of online scholarly communication changes (see Barjak, 2006; Fry & Talja, 2007). Online videos, for instance, may be useful for scholarly communication within the arts and humanities, since human motion is fundamental in some visual and performing arts (e.g., dance, theatre and film). Online videos may also be useful in areas of science where records of complex laboratory demonstrations, science documentaries or academic lectures might more effectively communicate scientific experiences than would prose. For example, there are advantages of using video "to communicate scientific methods, protocols and results" and to publicise "educational and outreach programmes" (Pasquali, 2007, p. 712).

[1] This is a preprint of: Kousha, K., Thelwall, & Abdoli, M. (2012). The role of online videos in research communication: A content analysis of YouTube videos cited in academic publications. *Journal of the American Society for Information Science and Technology*, 63(9), 1710–1727. © copyright 2012 John Wiley & Sons, Inc.

Established in 2005, YouTube is a video-sharing website for public use and the third most visited website after Google and Facebook (Alexa, 2012). According to the site owners, "Over 4 billion [YouTube] videos are viewed a day" (YouTube Statistics, 2012). Although YouTube is predominantly used for entertainment, such as music and comedy (see YouTube Charts, 2012), some academics have used videos to record and publicise their scholarly-related activities online (e.g., scientific experiments, conference presentations or course lectures) almost since YouTube began. For instance, a conference keynote talk by Stephen Hawking about the universe (youtube.com/watch?v=xjBIsp8mS-c) has been viewed online about 2.5 million times and a MIT course lecture on physics (youtube.com/watch?v=PmJV8CHIqFc) has been viewed just under one million times, both according to YouTube's internal statistics. As a different kind of example, the *Journal of Number Theory* has a YouTube Channel (youtube.com/user/JournalNumberTheory) for video presentations of research published in the journal. Hence, authors can create their own videos to explain complex mathematics. The journal directs potential readers using links in article abstracts.

Several studies have previously conducted non-conventional bibliometric analyses on the web. The types of non-standard contents analysed includes PowerPoint presentations, blog mentions and course syllabuses (see Kousha & Thelwall, 2008; Kousha, Thelwall, & Rezaie, 2010) as well as online reference manager sites (Li, Thelwall, & Giustini, 2012). One recent study has also classified the contents, types and subject areas of popular YouTube videos tweeted by scientists in order to identify the overall purpose of the videos, finding popular science to be common (Thelwall, Kousha, Weller, & Puschmann, in press). Nevertheless, there seem to be no studies of the use of YouTube videos in published academic research. In particular, this investigation examines what kinds of YouTube videos are formally cited in academic publications and assesses disciplinary differences in the scholarly use of online videos in the sciences, medicine, social sciences, arts and humanities.

Scholarly Use of YouTube Videos

Although it seems that no previous research has examined citations to YouTube videos from academic publications, many studies cover potential uses of YouTube videos in education (for reviews see Jones & Cuthrell, 2011) and as a dataset for scientific research (see below). Perhaps closest to the current article, one study conducted a content analysis of 100 YouTube videos randomly selected from a set tweeted by 563 scientists in order to assess the contents, types and subject areas of the tweeted videos (Thelwall, Kousha, Weller, & Puschmann, in press). Six categories were used to reflect the overall purposes of the videos: *scientific demonstration*, *public dissemination*, *education*, *talks to academics*, *information about scientists*, and *comedy*. Videos were only included if they were "produced by or based upon an identifiable academic or academic institution", excluding most entertainment videos, for example. The most viewed videos targeted research-related information at the general public or at the informed general public. However, the study did not assess whether any of the videos were cited in academic publications.

Most studies about academic uses of YouTube videos have focused on educational applications or have used YouTube videos as a dataset for scientific research in specific areas (e.g., medicine, public health, marketing), although a few have investigated YouTube itself instead (e.g., Cheng, Liu, & Dale, in press; Snelson, Rice, & Wyzard, 2012; Thelwall, Sud, & Vis, 2012).

YouTube in Academic Education

Many academics are now using YouTube for recording and disseminating course lectures. These videos may be valuable when instructors are away or for students who miss the classes (see also Pasquali, 2007). Moreover, these videos can also be viewed by other potential users worldwide. For instance, a survey of 24 health educators in the U.S. in 2007 revealed that about 42% used YouTube videos in their courses as a resource for academic teaching (Burke, Snyder, & Rager, 2009, p. 5).

Another survey of 232 college agriculture staff revealed that 27% and 25% of the instructors who were members of *the American Association for Agricultural Education* used video-sharing sites like YouTube in their classes for assignments and discussion respectively (Settle, Telg, Irani, Baker, & et al., 2011, p. 80). Currently, many universities have their own YouTube channels where they deposit videos of course lectures and other educational content online. The YouTube channel of the University of California, Berkeley (youtube.com/user/UCBerkeley), for instance, contains over 3,000 lecture videos on different subject areas and has attracted more than 13 million views. One 45 minute YouTube video on human biology has been viewed more than 644,000 times in this YouTube channel (see youtube.com/watch?v=S9WtBRNydso), suggesting that online video lectures can have value in higher education.

Personal experiences and potential uses of YouTube videos in academic education have been discussed in women's studies (Hoskins, 2009), language learning and teaching (Brook, 2011; Muniandy & Veloo, 2011), musicology (Cayar, 2011) and history (Rees, 2008) in the arts and humanities. These issues have also been discussed in engineering (Kaw & Garapati, 2010; Fernandez et al., 2011), agriculture (Settle, Telg, Irani, Baker, & et al., 2011), computer science (Carlisle, 2010), chemistry (Franz, 2011), sport sciences (Burden & Parker, 2008), dentistry (Knösel, Jung, & Bleckmann, 2011) and nursing education (Clifton & Mann, 2011), revealing a broad interest within science and medicine.

Despite the many potential uses of YouTube videos to support teaching, there are also concerns about the accuracy of YouTube videos for academic teaching, especially in medicine and public health. There might be misinformation in videos (e.g., Hossler & Conroy, 2008; Freeman & Chapman, 2007; Pandey, Patni, Singh, Sood, & Singh, 2010) and participation from trusted government sources for posting videos has been suggested to guard against this (Sood, Sarangi, Pandey, & Murugiah, 2011).

YouTube videos as a scientific data source

Many researchers have used YouTube as a dataset for academic research. The topics studied include the accuracy of information in online videos about the H1N1 influenza (Pandey, Patni, Singh, Sood, & Singh, 2010) and the diagnosis of infantile spasms (Fat, Doja, Barrowman, & Sell, 2011) in medicine and content analyses of amateur videos from coalition soldiers in Iraq and Afghanistan (Andéén-Papadopoulos, 2009), insurgency (Rutledge, 2009) and jihad-promoting videos (Conway & McInerney, 2008). Appendix A summarises studies using YouTube as a dataset for qualitative research.

Most previous investigations that used YouTube as a dataset conducted a content analysis with a coding system. Hossler and Conroy (2008) analysed the contents of 72 videos about tanning bed use and assessed the safety, risks, and benefits of tanning based upon positive, negative and neutral categories. Some other studies used expert reviewers to examine the contents of videos. For instance, Gooding and Gregory (2011) conducted an in-depth content analysis on 32 YouTube videos about music therapy based upon a reviewer’s judgments with a 16-statement yes-no format.

Table 1. Content analysis investigations using YouTube video datasets.

Article title	**Dataset**	**Broad topic**	**Main purpose**
Political advertising in the 21st century: The rise of the YouTube ad (Ridout, Fowler, & Branstetter, 2010)	3,880 videos	Political Science	To examine online video advertisements during the 2008 US presidential campaign.
Content analysis of antismoking videos (Paek, Kim, & Hove, 2010)	934 videos	Public health	To examine antismoking video messages.
Obesity in the new media: A content analysis of obesity videos on YouTube (Yoo & Kim, 2011)	417 videos	Media and commuincatio n studies	To investigate how obese persons are portrayed in YouTube.
Organ donation on Web 2.0: Content and audience analysis of organ donation videos on YouTube (Tian, 2010)	355 videos	Media and commuincatio n studies	To examine organ donation videos for the origin of the producer and positive or negative framings.
YouTube as a Source of Information on Kidney Stone Disease (Sood et al., 2011)	192 videos	Medicine, urology	To assess the validity and accuracy of videos about kidney stone disease.
When vaccines go viral: An analysis of HPV vaccine coverage on YouTube (Briones et al., 2011, in press)	172 videos	Medicine, immunisation	To examine videos with a human papillomavirus (HPV) vaccine theme.
YouTube as a source of information on immunization (Keelan et al, 2007)	153 videos	Medicine, immunisation	To review videos about vaccination and immunization with a star-rating system, from 1 star to 5 stars
YouTube as a source of information on the H1N1 influenza pandemic (Pandey et al., 2010)	142 videos	Medicine, epidemiology	To assess influenza-related videos to examine the effective use and their validity during initial H1N1 outbreaks.
Using video to build an organization's identity and brand: A content analysis of nonprofit organizations' YouTube videos (Waters & Jones, 2011)	100 videos	Management and marketing	To examine the most viewed videos on the top 100 official nonprofit YouTube channels.
YouTube videos as a teaching tool and patient resource for infantile spasms (Fat, 2011)	100 videos	Medicine, neurology	To assess videos for technical quality, diagnosis of infantile spasms, and suitability as a teaching resource.
The role of nutrition in acne pathogenesis: YouTube as a reflection of current popular thought (Qureshi & Lowenstein, 2011)	87 videos	Medicine, dermatology	To determine public views about diet and acne.
YouTube as a source of information on tanning bed use (Hossler & Conroy, 2008)	72 videos	Medicine, dermatology	To examine videos about tanning bed use, to assess information about safety, risks, and benefits of tanning.
Iraqi insurgents' use of YouTube as a strategic communication tool: An exploratory content analysis (Rutledge, 2009)	54 videos	Media and communicatio n studies	To examine insurgency videos in Iraq.
YouTube as a source of information on cardiopulmonary resuscitation (Murugiah et al., 2011)	52 videos	Medicine, Cardiology	To examine the content and quality of information about CPR.
YouTube as source of prostate cancer information (Steinberg et al., 2010)	51 videos	Medicine, urology	To assess the overall informational and scientific content of videos on PSA testing and prostate cancer.
Fat stigmatization on YouTube: A content analysis (Hussin, Frazier, & Thompson, 2011)	50 videos	Public health, psychology	To examine gender, age and ethnicity in videos displaying fat stigmatization.
Is “YouTube” telling or selling you something? (Freeman & Chapman, 2007)	50 videos	Public health	To assess pro-smoking and anti-smoking videos.
Jihadi video and auto-radicalisation: Evidence from an exploratory YouTube study (Conway & McInerney, 2008)	50 videos	Intelligence and security studies	Content analysis of jihad-promoting videos to study those posting and commenting upon martyr-promoting material from Iraq.
Descriptive analysis of YouTube music therapy videos (Gooding & Gregory, 2011)	32 videos	Musicology, health sciences	To examine information, accuracy and reliability of music therapy videos.
US soldiers imaging the Iraq war on YouTube (Andéén-Papadopoulos, 2009)	N/A	Media and communicatio n studies	To examine homemade videos uploaded by coalition soldiers in Iraq and Afghanistan

Research questions

The objective of this investigation is to assess how YouTube videos are cited in academic publications and to seek disciplinary differences in their use. In particular, the focus is on scholarly uses of online videos by categorising the common topics of the videos cited in academic publications across the sciences, medicine and health sciences, social sciences, and arts and humanities. As appropriate for the first study of its kind, the following questions address basic aspects of using online videos in research communication.

1. How frequently are YouTube videos cited in academic publications? And has frequency of use declined at any stage since the birth of YouTube (2005-2011)?
2. What types of YouTube videos are commonly cited in research articles?
3. Are there significant broad disciplinary differences in citing online videos?

Methods

To address the research questions, we extracted URL citations to YouTube videos from academic publications indexed by Scopus from 2005-2011 across four broad disciplines: the sciences, medicine and health sciences, social sciences, and arts and humanities. We then viewed a sample of the cited videos and classified their contents using the specially designed classification scheme described below.

Scopus Citation Search for Online Videos

We used Elsevier's Scopus citation database to locate academic publications citing YouTube videos. We selected Scopus instead of the Thomson Reuters Web of Science (WoS) because Scopus indexes more peer-reviewed journals (about 18,500 vs. about 11,000) (see Scopus content coverage guide, 2011) and the databases have a large overlap (see Gavel & Iselid, 2008). Moreover, our initial tests revealed that it was not possible to extract URL citations to YouTube videos (e.g., youtube.com/watch*) from the references of publications indexed by WoS through the 'Cited Reference Search' option. WoS did not index the full bibliographic information of references (including URL citations) and therefore we could not retrieve any URL citations to YouTube videos from WoS.

For Scopus YouTube citation searches, we entered the common part of the URLs of YouTube videos (youtube.com/watch) in the "References" field (REF) in the main Scopus search interface. All URLs for YouTube videos begin with "youtube.com/watch?v=", followed by a unique 11-character ID, such as "fuMNRFTxyVA". Thus, for the above video a valid URL would be "youtube.com/watch?v=fuMNRFTxyVA". However, we couldn't use the full common part of the YouTube URLs for videos in the search process because "?" is a predefined proximity search operator in Scopus and replaces a single character anywhere in a word. Consequently, we used the query "youtube.com/watch*" (an asterisk replaces 0 or more characters) instead of "youtube.com/watch?v=" for the main Scopus YouTube citation searches. The more general query "youtube.com*" was not used because it retrieves many broad citations to the YouTube website as a web phenomenon or YouTube channels (e.g., youtube.com/user/bbc) rather than exclusive URL citations to individual videos.

We restricted our search to four broad subject areas - sciences, medicine and health sciences, social sciences, and arts and humanities - in order to assess broad disciplinary differences. However, we encountered a few problems in Scopus for refining subject areas. For instance, while Scopus displays several broad subject categories in the "refine results" menu, such as social sciences and medicine, there are also some narrow related classes, such as pharmacology, toxicology and pharmaceutics for medicine as well as business, management & accounting, and psychology for social sciences (Table 2). Hence, we merged the broad categories with associated sub-classes to have a more

representative dataset for a disciplinary analysis. Although Scopus indexes "nearly 3,500 arts and humanities titles" (about 15% of the entire title list in the database), such as "literature, history, architecture and visual and performing arts" from around the world (see Scopus Arts & Humanities Coverage, 2011), it does not show these narrow classes in the refine search results option. Consequently we used 'arts and humanities' as the only available category for arts and humanities videos. Table 2 shows the broad disciplines used throughout the investigation (first column) and the merged sub-classes (excluding arts and humanities), as reported in Scopus.

Table 2. Broad multidisciplinary areas and associated merged Scopus subject classes

Broad multidisciplinary area	**Merged subject classes in Scopus**
Social sciences	Social Sciences; Psychology; Business, Management & Accounting; Economics, Econometrics & Finance; Decision Sciences
Natural and formal sciences	Chemistry; Mathematics; Physics & Astronomy; Environmental Science; Computer Science; Engineering; Materials Science; Earth & Planetary Sciences; Agricultural & Biological Sciences; Multidisciplinary; Chemical Engineering; Energy; Biochemistry, Genetics & Molecular Biology
Medicine and health sciences	Medicine; Nursing; Health Profession; Pharmacology, Toxicology & Pharmaceutics; Immunology & Microbiology
Arts and humanities	N/A This category includes literature, history, architecture and visual and performing arts (see above).

We exported all data from Scopus in Excel format on 20th December 2011 and automatically extracted URL citations to YouTube videos through Webometric Analyst's (lexiurl.wlv.ac.uk) features devised to mine valid YouTube video IDs from the reference sections of publications. We used this programme to remove any incorrect YouTube IDs (e.g., youtube.com/watch=v7kuT) either from errors in the original papers or as recorded incorrectly by Scopus. Table 3 gives an overview of the numbers involved.

Content Analysis of Cited YouTube Videos

To understand which themes in YouTube videos were commonly used in scientific publications and whether there were disciplinary differences between the broad subject areas, we viewed 551 randomly sampled cited videos from research articles (omitting reviews, conference papers, editorials, letters and notes) from the Scopus searches (Table 3). In many cases we also read the descriptions of, and some comments on, the YouTube videos (if available) and searched for a lecturer or speaker biography to better understand video contexts.

The first and third authors conducted an initial content analysis of the videos separately based on a primary classification scheme derived from a previous classification of YouTube videos tweeted by academics (Thelwall, Kousha, Weller, & Puschmann, in press). In order to reach a reasonable degree of agreement on the classification procedure, the two coders first cross-checked the categorisation process for a sample of 80 videos from different subject areas, discussing the coding of different types videos. For instance, they modified and extended the initial categories during the coding process because of the existence of wider types of videos in the study (see below). Although some categories, such as music, dance, theatre, movies, comedies or advertisements, were relatively straightforward to classify, we reclassified some types of videos after a third reviewer's comments (the

second author) based upon an overview of the categories. In particular, we first assigned one category for documentaries, but subsequently extended it to three classes: 'science documentaries', 'arts and humanities documentaries' and 'social science documentaries' to reflect the different contents for documentary videos cited by articles. A similar procedure was also performed for 'video talks' in natural or formal sciences, arts and humanities and social sciences.

A challenging issue was integrating sub-classes into broader categories to answer the above research questions. We coded the cited videos into three broad categories and 16 sub-classes, as shown below. Our broad interpretation of the results can reflect the extent to which cited online videos contained natural or formal scientific themes or other topics which may be important in research communication in social sciences, and arts and humanities.

Natural or formal science videos (including medicine and health sciences)

This broad category covers online videos with natural science or formal science (maths and logic) themes: demonstrating a particular natural or formal phenomenon, explaining theory underpinning natural or formal phenomena, or describing a scholarly event or experience associated with studying such phenomena (e.g., a scientific conference). This category includes educational and recreational videos as well as academic lectures or speeches mainly for university audiences or informed public audiences in natural or formal science. We used four sub-classes to represent online videos with direct scientific or scholarly-related contents (see below). Appendix A gives more examples of different types of videos classified in this broad category.

- Demonstration of a natural or formal science phenomenon: This sub-class includes videos with an apparently scientific theme, for instance a real-time lab experiment in robotics (e.g., Stereo vision with obstacle avoidance, ID: MCLUXe9nwcI[2]), graphical demonstrations in physics (e.g., Oscillons in hybrid inflation, ID: SWGgSM0Pacs), and live surgery videos (e.g., Single incision sleeve gastrectomy, ID: aN_Oi5hTmVg).
- Natural or formal science documentary: This sub-class includes documentaries (usually with narration and edited with different types of shots) about natural or formal science. Examples include videos about polio in India (ID: HZp1VNr44Bw), oceanography (ID: vym7TQBc-TE), virology (ID: nCJdws9CnUw) and plastic surgery (ID: 1DPaqGLVv2I).
- Natural or formal science education or hobby: Although any scientific video can potentially be used for education, some videos may be specifically created for teaching (see Kaw, & Garapati, 2011, for an engineering initiative). Examples include a training video for air sampling (ID: xi8xdqJWviM) and tutorials on using a spectrophotometer, both of which were cited by the *Journal of Chemical Education* (ID: GNPfssmPbWA), and in medicine, instructions for using the bengmark naso-intestinal tube (ID: HUv13Xy0GwE) was cited by *Nutrition in Clinical Practice*. Some videos were apparently made by hobbyists but with a potential science instructional application, such as "Big Outdoor Soap Bubbles ~ Recipe & How To Do" (ID: gQmpVIgDvgQ) cited *by Advances in Colloid and Interface Science*. Nevertheless, sometimes it was difficult to decide whether videos were designed to be educational or a public TV show, such as "Brainiac science abuse - Can you smell fear?" (ID: 57pwxeqOmQs), which is an extract from a UK science based comedy TV show. For such cases, we also looked at the citing journals to assess the educational utility of the cited videos.

2 . All YouTube video examples were extracted from the sampled academic publications and we have omitted the common initial part of each YouTube video URL (http://www.youtube.com/watch?v=) and only report the YouTube IDs (e.g., gQmpVIgDvgQ) throughout the text to save space.

- Natural or formal science academic lectures: This group includes natural or formal science lectures, speeches and talks by academics in conferences (e.g., ID: o5RbyK0m5OY), seminars (e.g., ID: hVimVzgtD6w), and other academic meetings or discussions, typically to disseminate research to other scholars in the same area. As an example in medicine and health sciences, a half an hour academic lecture video 'Sugar: The Bitter Truth' (ID: dBnniua6-oM) by a professor of clinical pediatrics was cited by a research paper published in the *Journal of the American Dietetic Association.* In a few cases scientific talks were captured outside the conference or seminar format, such as in nature ('Oak Wilt in New York' by Cornell University, ID: XVUZsvyZfVE), in computing/IT exhibitions (e.g., 'IDF SF08: Parallels & Intel Virtualization for Directed I/O', ID: EiqMR5Wx_r4), or even through only slides and narrations without a talking head ('CMS/MIPPA accreditation mandates for 2012 by American College of Radiology', ID: 9f46Akv-78I).

Arts and humanities (including art, media, culture and history)

Our initial classification exercise found many videos cited by journal articles in arts and humanities with an artistic entertainment theme, such as music, dance, theatre, comedy, movies and animations. These videos may help research communication within their own fields. For instance, a ballet could be a major scholarly output and hence a YouTube video of it would be the equivalent of a video of a scientific experiment in the natural sciences. Moreover, in many humanities subject areas, such as history and cultural studies, documentaries are an important scholarly output, and historical events captured on video can also be used as evidence to support or illustrate a scholarly argument. For instance a comparison between YouTube videos and the National Film and Sound Archive (NFSA) for old Australian television programs indicated that YouTube has "more surprising pieces of rare ephemera" which can be provide as useful reference for historical research (McKee, 2011, p. 154).

This broad category is for all videos with an arts and humanities theme, irrespective of whether the videos were created by recognised academics. This is analogous to the inclusion of amateur science and natural phenomena within the first broad category. Appendix B shows examples of videos classified in this category.

- Music: This class includes music videos or live singing performances. They were mostly cited by music journals such as the *Journal of Musicological Research* ('SHINDIG', ID: NIcIsVKmmRY) *Leonardo Music Journal* (Air piano, ID: EA90JC9PUKg) and theatre and drama journals (*Contemporary Theatre Review*, ID: 9EbQs2yKts8).
- Dance and theatre: This class includes videos of performing arts, including dance (e.g., ballet) and plays. Most citations were either from dance journals such as *Dance Chronicle* (ID: vkgWoXTYo3o) and *Dance Research* (ID: FkZhDcB-OfA) or music journals, such as *Musicology Australia* (ID: D2LKAl3tfXg) and *Nineteenth Century Music* (ID: EMyk67l5ico).
- Movies and animations: This class includes complete movies and animations or extracts from longer movies. Most citations to movie parts appeared in film and literature review journals such as the *Quarterly Review of Film and Video* (ID: yqi_C2vOars) and *Review - Literature and Arts of the Americas* (ID: B3rRkCJbK0E). One interesting example is *George Orwell's "1984"* complete film (ID: hATC_2I1wZE) produced in 1954 in black and white and cited by *Literature and History*.
- Comedy: Humorous videos are important in YouTube (see youtube.com/comedy). This class includes amateur comedy videos – apparently designed to be funny but not extracts from TV shows (e.g., *Chav Hunting*, ID: N9_YhKbrhnY, cited by *Paedagogica Historica*). Humour is in this category both as a type of light entertainment and because humour research falls within the humanities subject area. Comedy videos were not cited by humour research in our sample but were cited for a variety of other reasons. For instance, a comedy video about physician assistant

training (ID: aX7jme2b0N0) was cited by a paper entitled "teaching medicine to millennials" published in the *Journal of Physician Assistant Education*.

- TV shows: This category includes previously broadcast TV shows available via YouTube. These are included in the Arts and humanities broad category because they serve a primarily entertainment purpose. For instance, a TV show video "Ashton Kutcher beats CNN in Twitter contest to reach 1 million followers" (ID: iIuJvcclLxs) was cited by *Reference Services Review* and a short public TV interview with director Spike Lee was cited by the *Journal of Homosexuality*. This category excludes news and TV documentaries.
- Arts and humanities documentaries: This category covers documentaries with artistic, historical or cultural themes. For instance, documentaries about 'Sanford Meisner', a famous American actor and acting teacher (ID: zNuFSrsYfpM), 'Julian Voss-Andreae', a German-American contemporary sculptor (ID: LqsQYVFAgPo) and Akira Kurosawa, a prominent Japanese film director (ID: G1STFM39vJ4) were cited by *Theatre, Dance and Performance Training*, *Leonard* and *Theoretical Inquiries in Law*, respectively. This class also includes documentaries with historical themes. For instances, a black and white narrative clip about Britain in the 1970s (ID: qyW7jHjZrrk) and a historical film capturing Thomas Edison in Paris in 1900 (ID: CNuoruvYzMs) were cited by the *History Workshop Journal* and *Early Popular Visual Culture*, correspondingly. Two videos about the history of science: 'The History of Autism' (ID: VaZUig03gT0) and 'First Video Game?' (ID: u6mu5B-YZU8) seemed more related to the history and philosophy of science rather than science itself. Thus, we also classified them in this category.
- Arts and humanities speeches (including academic talks): This category is for talks by artists, philosophers, historians, literary figures, religious people and academics in the arts and humanities. For instance, a speech by IPS Teofan Arhiepiscop (ID: 9YdTkrfmxz0) was cited by the *Journal for the Study of Religions and Ideologies*, an Emmy acceptance talk by actress Sally Field (ID: ImoMGyJjWIk) was cited by *The Drama Review - A Journal of Performance Studies*, a talk by choreographer Wally Cardona (ID: cqzDoxujPVk) was cited by *Dance Chronicle* and a speech by English writer and novelist Alan Moore (ID: BrBbeBezezw) was cited by the *Journal of Graphic Novels and Comics*.

Social sciences (including political sciences and marketing)

Some of the cited videos seemed to primarily relate to social science subject areas, mainly political sciences, communication studies and marketing and business. These videos seem to have some connection to academic subjects in social sciences – such as news reports and political speeches to journalism and communication studies or commercials and advertisements videos to marketing and business. Appendix C shows examples of different types of videos classified in this category.

- News, correspondents' reports and amateur news videos: This sub-class includes different types of *news pieces, live correspondents' reports and interviews* such as *The Wall Street Journal* report on the financial crisis (I*D: _mzcbXi1Tkk),* a *NBC* report on looting by the police after Hurricane Katrina (ID: NmQW6xLECUU) and a *CNN* interview with Former Secretary of State Henry Kissinger (ID: TnIu9AffqX4). This category also includes amateur videos by the public or citizen journalists from newsworthy events across the world, such as the September 11 attack on the twin towers (ID: K8dX3foxozQ), which was cited by research about media convergence and surveillance published in *Convergence*.
- Advertisements: This category covers videos that are essentially advertisements. For instance, the "dove evolution" (ID: iYhCn0jf46U) and "iPod Touch" (ID: KKQUZPqDZb0) advertisements were cited by marketing and business journals: the *Journal of Database Marketing and Customer Strategy Management* and, *Business Horizons* respectively.

- Politics, activism and business: This category includes talks by politicians, political talks by non-politicians, such as activists, and talks by business managers. We found many speeches by politicians (e.g., presidents, leaders, parliament, judicial members, military officials) referenced by social science journal articles, perhaps because YouTube has become a political campaigning medium (e.g., Church, 2008; Gibson & McAllister, 2011). The 2008 US elections, for instance, produced channels "with 220 million views" (Cornfield, 2009, p. 214 as quoted by May, 2010, p. 502). In particular, a speech by US President Barack Obama (ID: QkNpUEWIhd4) was cited by the *European Journal of Social Sciences*, a speech by Sayyed Hassan Nasrallah, the secretary-general of Hezbollah, (ID: HalvZUHlenU) was cited by the *Arab World Geographer*, a speech by justice Kennedy (ID: xeQRpNQmWOU) was cited by the *Law Library Journal* and an Iranian presidential debate between two key candidates in 2009 (ID: 9DNmR15Lui8) was cited by the *Middle East Journal.*
- Academic talks by social scientists: We found a few social science academic lectures. As an example, a lecture by Michael Wesch, Professor of cultural anthropology, about social media applications and educational portals of the future (ID: J4yApagnr0s) was cited by the *Journal of Adolescent and Adult Literacy* and an academic speech by Michael Fullan, Professor emeritus in education (ID: xLgrLwJ3Cf8), was cited by the *Journal of Mathematics Teacher Education*. Sometimes it was difficult to recognise lectures as either academic or political. For instance, a speech by Dr. Ronald Ernest (Doctor in Medicine) about 'a constitutional approach to dealing with security threats' (ID: VrCqVYVxEoA) seems to be an academic talk. However, he has a political background (e.g., as a U.S. representative, candidate for President of the United States, and a Republican). Hence, we classified the above case as a talk by a politician.
- Social science documentaries: This category includes documentaries with social, political or journalistic themes which deal with social science issues. For instance, documentaries about *Marshall McLuhan* (ID: faK9HUvH2ck), Omar Khadr's interrogation in Guantanamo Bay detention camp (ID: yNCyrFV2G_0), the early 1980s protests against the *Santa Cruz Beauty Pageant* (ID: agyEAhwrVUU) and the bad situation of Romanian children in orphanages (ID: VDR5xpLEx-U) were cited by articles in communication, law, women's studies and educational research journals, respectively, and were all classified in this category.

Results

Citing and cited YouTube Videos

Table 3 gives an overview of Scopus publications citing YouTube videos and URL citations to videos in the four subject areas as of 20th December 2011. In general it shows that 1,808 Scopus publications (e.g., articles, reviews, conference papers, editorials) cited at least one YouTube video in their reference lists. Science with 630 and medicine and health sciences with 212 URL citations to YouTube videos had the highest and lowest number of citations. However, these figures are in absolute numbers and therefore in the following section we reported the normalised results per publication in each discipline in order to give a more representative picture of the prevalence of videos in academic publications. Table 3 also reports that about 53% (964) of the publications citing YouTube videos were articles, although this varies greatly between disciplines. The fourth column of Table 3 shows the number of sampled articles with at least one valid URL citation to a YouTube video for the subsequent content analysis. The fifth and sixth columns report the total number of URL citations to YouTube videos in the publications and mean YouTube citations per article. For instance, it indicates that 2,382 valid YouTube citations appeared in the reference sections of 1,808 publications indexed by Scopus.

Table 3. General statistics for YouTube citing and cited sources and sampled videos for content analysis (as 20th December, 2011)

Broad disciplines	Statistics for sources of YouTube citations			Statistics for URL citations to YouTube videos	
	No. of Scopus publications with YouTube citations*	No (%) of research articles** with YouTube citations	No (%) of sampled research articles for content analysis	Total YouTube citations in publications***	YouTube citation per publication
Sciences	630	195 (31%)	120 (61%)	765	1.21
Social Sciences	581	450 (77%)	261 (58%)	809	1.39
Arts and humanities	385	200 (52%)	110 (55%)	586	1.52
Medicine and health sciences	212	119 (56%)	60 (50%)	222	1.05
Total	**1,808**	**964 (53%)**	**551 (57%)**	**2,382**	**1.32**

*Excluding general YouTube citations (e.g., www.youtube.com) or YouTube channels (e.g., youtube.com/user/bbc)
**Omitting reviews, conference papers, editorials, letters and notes
***These figures also include more than one YouTube citations per papers

YouTube citations over the time

Figure 1 shows that since YouTube was launched to the public in May 2005 (YouTube FAQ, 2012), there has been a consistent upward trend in citing its videos within academic publications. For instance, while we only extracted three and 32 Scopus publications citing YouTube videos in 2006 and 2007 respectively, in 2008, 2009 and 2010 the number of academic publications with at least one YouTube video citation increased dramatically to 105, 317 and 632 online videos, indicating about 2-3 times annual growth. Although there was also an increase in the number of publications citing YouTube videos in 2011 (719 videos), this number is an underestimate because the last issues of some journals in the year 2011 may have not been published or indexed by Scopus at the time of data collection, 20th December 2011. Nevertheless, Figure 1 suggests that increasingly many academic publications cite online videos, especially in arts and humanities and to some extent in social sciences. Figure 1 also compares the annual growth in the number of publications citing YouTube videos across the four broad disciplines. It shows that although in all areas there are similar upward trends, the absolute number of publications citing YouTube videos in medicine is much lower than in the other broad disciplines. This is discussed in the conclusions.

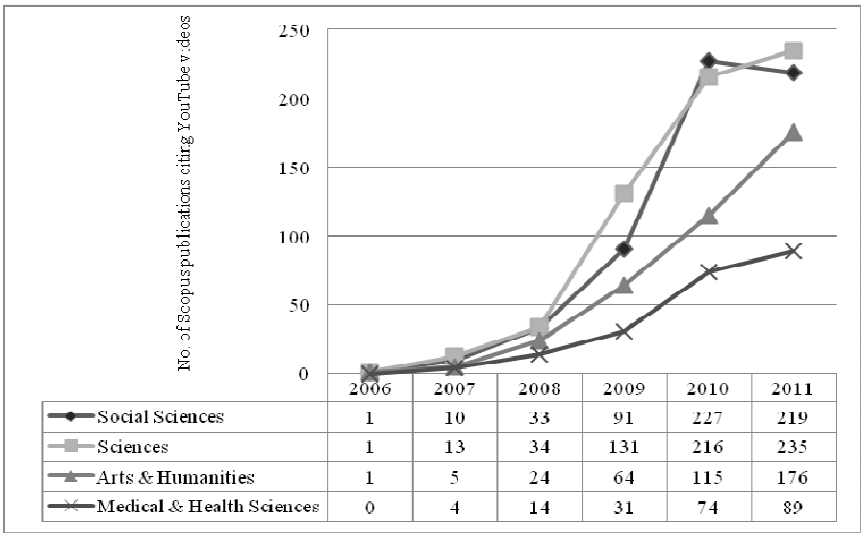

Figure 1. The number of academic publications citing YouTube videos over the years in four broad disciplines.

Publication Types

In the four broad disciplines the dominant types of sources citing YouTube videos were journal articles (53%), conference papers (24%), reviews (12%), and other types of publications (11%) including editorials, letters, notes and short surveys. However, there were huge differences between types of sources citing YouTube videos across the broad disciplines (Figure 2). For instance, in social sciences the majority (77%) of citations to YouTube videos were from journal articles. In contrast, in the sciences conference papers (63%) were the most common type of citing sources, particularly for computer science (e.g., proceedings of IEEE or ACM) in which authors have more dependency on conference papers than journal publications (see Bar-Ilan, 2010; Moed & Visser, 2007).

Figure 2 also shows that in addition to journal articles in the arts and humanities (52%) and medicine and health sciences (56%), there are relatively many YouTube citations from review papers (30% and 20% respectively). The results show that YouTube videos can be cited in different types of publications.

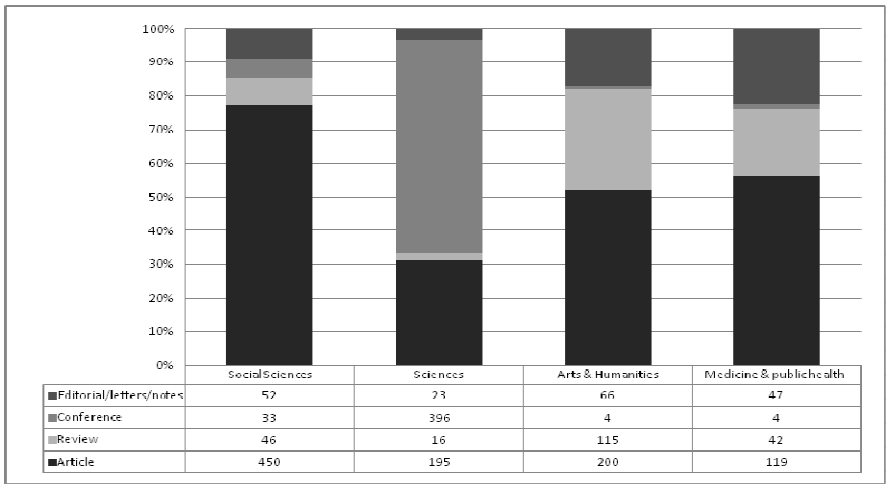

Figure 2. Types of document citing YouTube videos in the four broad subject areas.

Normalised comparison of YouTube citations

Table 3 reports the absolute numbers of citations to YouTube videos in the four broad subject areas. However, it does not disclose the proportion of cited YouTube videos per publication in each broad area. For this reason, ratios were calculated by dividing the number of citing sources as well as citations to YouTube videos by the total number of Scopus publications in each broad area from 2006 to December 2011. We selected the above years for Scopus publications because YouTube launched in May 2005 (YouTube FAQ, 2012) and we didn't find any citations to YouTube videos in Scopus publications before 2006.

Most importantly, the sixth column of Table 4 shows that the proportion of documents with at least one YouTube citation is much higher in the arts and humanities (0.3%) and social sciences (0.2%) than in the sciences (0.01%) and medicine and health sciences (0.006%). Hence, it seems that in social sciences and arts and humanities online videos are more commonly used in research communication than in science, and medicine and health sciences.

Table 4. Citations to YouTube videos in publications indexed by Scopus (2006-Dec. 2011)

	Total number of articles and percentage citing YouTube Videos				
Subject area	Articles (% citing YouTube)	Reviews (% citing YouTube)	Conference papers (% citing YouTube)	Other - notes, editorials, letters (% citing YouTube)	Total (% citing YouTube)
Sciences	195 (0.005%)	16 (0.012%)	396 (0.021%)	23 (0.011%)	630 (0.010%)
Social sciences	450 (0.163%)	46 (0.124%)	33 (0.200%)	52 (0.149%)	581 (0.159%)
Arts and humanities	200 (0.377%)	115 (0.317%)	4 (0.158%)	66 (0.277%)	385 (0.333%)
Medicine and health sciences	119 (0.005%)	42 (0.010%)	4 (0.005%)	47 (0.008%)	212 (0.006%)
Total	964 (0.014%)	219 (0.035%)	437 (0.022%)	188 (0.022 %)	1808 (0.018%)

Scholarly contents of cited YouTube videos

The overall results of the content analysis of the 551 sampled YouTube videos cited by research articles indexed by Scopus showed that 31% (172) were natural or formal science videos whereas 32% (174) had art, culture and history themes (e.g., music, dance, theatre and movie parts) and 37% (205) had contents related to the social sciences (e.g., news and politics). However, there were huge disciplinary differences across subject areas. Figure 3 gives an overview of types of YouTube videos cited by research papers in the sample across the four subject areas. Most importantly, it shows that in sciences and medicine and health sciences about 78% and 77% of the cited videos had scientific themes, respectively, including demonstrations of a natural or formal science phenomena, natural or formal science documentaries, natural or formal science education or hobby videos and natural or formal science academic lectures (see methods and below for more details), while in arts and humanities only 1% and in social sciences 12% of the cited videos had scientific contents. One possible explanation for finding relatively many scientific videos in the social sciences is that there

were many science education videos from multidisciplinary education journals (9.2%), such as the *Journal of Chemical Education* and *Physics Education*, which were indexed in the social sciences by Scopus.

Figure 3 also shows that in arts and humanities 80% of videos had artistic themes. As also shown in Figure 3, 63% of the cited videos in the reference lists of social science journal articles were classified in the social science broad category.

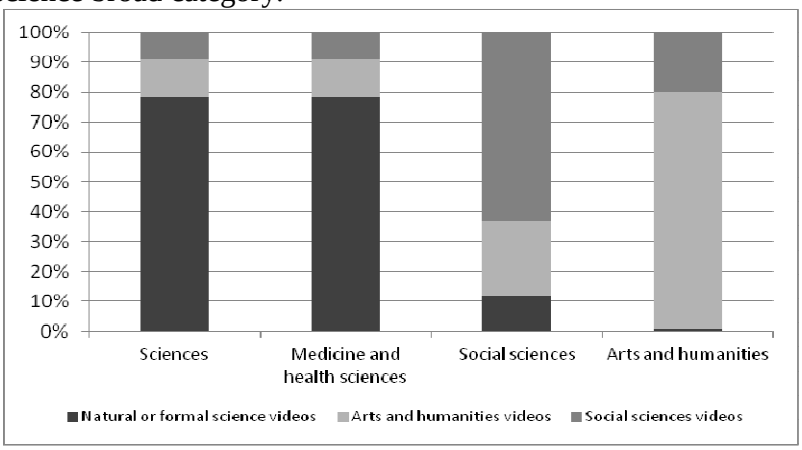

Figure 3. Overview of the different broad disciplinary types of YouTube videos cited by research papers in the four broad disciplinary areas.

Appendix D give more details about the percentages of cited YouTube videos based on the 16 sub-classes used for the content analysis of the videos. In science, most cited videos (51%) had directly scientific contents, especially based upon demonstrating real-time laboratory experiments in physics (e.g., electric charge sniffer, ID: vAQ64Sv4iqY), chemistry (palladium (Pd) nanoparticles, ID: iEcbHSGHATw), biology (sexual behaviour of insects Themira + Nemopoda, ID: Z1eWftJrU2M). Most importantly, we found many real-time laboratory experiments in computer science, such as for robotics (e.g., Sonys robot, Qrio, ID: 9fBIRitTROE) and intelligent and control systems (e.g., CyberC3 intelligent vehicles, ID: 868WDdPRzLI).

Although in medicine and health sciences we also found many scientific videos (about 17%), for instance real-time endoscopic surgery (ID: 02EC7rMoSuo), most videos cited by research articles were documentaries with public health themes (35%) such as documentaries about autism (ID: JnylM1hI2jc) and viral diseases (ID: nCJdws9CnUw). Educational videos seem to be significant for medical education (15%) such as instructions for shoulder examinations (ID: RsTObF8W9Ds) or using a specific medical device, such as ultrasound for lung comets (ID: 7y_hUFBHStM). In both natural and formal sciences and medicine and health sciences, 10% of the cited videos were natural or formal science lectures, speeches and talks by academics in conferences, seminars, and other academic meetings. Perhaps these academic lectures were cited because the contents were never published elsewhere or it was more convenient for the researcher to access the live speeches and talks through YouTube searches.

Performing arts (27%) including music, dance and theatre and arts and historical documentaries (16%) were two most common themes of cited videos in arts and humanities. Arts and humanities lectures and talks (12%), movies & animations (10%), comedies (7%) and finally public TV shows (6%) were other themes of videos cited by arts and humanities journal articles, suggesting that in this subject area wide types of artistic, media and entertainment outputs can also be valuable for research communication.

In the social sciences, the most common types of cited videos were speeches by politicians and activists (21%), news reports (20%) and documentaries with social, political or journalism themes (10%) (see methods). Many of the news related cited videos were broadcast by national or international news agencies, such as BBC, CNN, and NBC. A wide range of subject areas in the social sciences cited this type of video, from sociology (in *Sociological Research Online*, ID: UaQMK72FYXs) and communication and media studies (in *Communication Studies*, ID: 9SDHxaYhqAo) to law (in *Louisiana Law Review*, ID: NmQW6xLECUU) and psychology (in *Journal of Black Psychology*, ID: NTixCXmrezY). The results also showed that about 9% of the cited videos in social sciences were advertising videos (e.g., ID: KKQUZPqDZb0), which were commonly cited by marketing and business or law journals (e.g., *International Journal of Advertising*, *Buffalo Law Review*).

Interdisciplinary uses of online videos

In several cases we found interdisciplinary citations of YouTube videos, such as non-scientific videos being cited by scientific publications. Even art and entertainment videos are sometimes used for scientific discussions in the sciences or medicine and hence cross traditional boundaries between established academic areas. Some journal articles published in the hard sciences and medicine and health sciences cited non-scientific videos, such as music, parts of comedy films, commercials and public TV shows. For instance, an opera sung by 'Roberto Alagna' (ID: f6urNGBR95w) has been cited by a paper about the acoustics research published in the *Journal of the Acoustical Society of America*, a music video by 'Radiohead' with 3D plotting technologies (ID: 8nTFjVm9sTQ) has been cited in an optics engineering research in *Optics and Lasers in Engineering*. In rare cases, the same interdisciplinary use of videos can be seen for medicine and health sciences. For instance, a dance performance video (ID: B87kwTqf7lw) has been cited in an article about using music and dance for helping Parkinson's disease published in the *Clinical Nurse Specialist* and part of a drama in a hospital (ID: QmX5IQmMt3U) has been cited in an article about family medicine and music and a comedy video (ID: aX7jme2b0N0) was cited in a paper about medical education.

In social sciences and arts and humanities we also found several cases of interdisciplinary use of YouTube videos in research. For instance, a real-time demonstration of robot capable of 'autonomously folding a pile of towels' (ID: gy5g33S0Gzo) was cited by research paper published in the *Yale Law Journal* about standards of patentability, a video of a 2-D monitor for the remote browsing of scanned books and manuscripts (BSB Explorer, ID: qmMMMVnNxLI) was used by a library science paper, a science lecture about climate change and earth system modelling (ID: 8wX1rLqRfNc) was cited by *Historical Records of Australian Science*, and the "lady gaga – Love Game" music video (ID: 1mB0tP1I-14) was cited in a sexology investigation. Moreover, talks by non-academics can be cited for different reasons. For instance, an Obama press conference (ID: p4EKY7rCF_c) was cited by the *Quarterly Journal of Speech* from the perspective of discussing ways of speaking and delivering a public address. Hence, videos can potentially be used by academics in completely different contexts to those imagined by their creators. To give another example, a news montage comedy video (Alice in Oblivion, ID: DypZ7UFvNnk) was cited in a criminology context (Sheptycki, 2009, p. 331).

Limitations

Although this study seems to be the first attempt to assess how YouTube videos are cited in academic publications and to understand the value of online videos in scholarly communication across broad fields, we did not assess the motivations for citing videos in the context of the scientific literature. Thus, a more qualitative study is needed to understand how online videos are used in research communication. For instance, we classified the advertising video "dove evolution"

(iYhCn0jf46U) as non-scientific, but are not presenting an analysis of why it was cited by a research paper (Southgate, Westoby & Page, 2010, p. 362) published in the *International Journal of Advertising* to support a scholarly discussion about viewing TV advertisements online.

Another practical limitation was the complex and subjective issue of coding video contents. We discussed the coding system after the initial classification process and modified it several times to get general agreement. For instance, we first merged TV shows and news related videos into one class but subsequently split them into two sub-classes because TV shows are more related to arts and humanities whereas the news is more associated with the social sciences (e.g., political science and journalism). Furthermore, some scientific demonstrations can also be used for academic education and in rare cases it was difficult to recognise whether they were created for a scientific demonstrations, entertainment or teaching. We also separated out speeches by academics and non-academics, including arts or humanities speeches and political speeches, based on the descriptive information below each video (e.g., conference name, seminar, university, academic position of speaker), audio information (e.g., introducing of speakers) or visual information in the videos (e.g., university logo or banners in the video shot) in order to identify the audiences of speakers. However, there is no reason why a non-academic talk (e.g., a chef, ID: O3AqE0YV4K0) should not be used for scholarly reasons by researchers.

Finally, the method used in this paper to identify YouTube citations underestimates their number because videos could be cited without URLs, such as by name or with URLs in footnotes or embedded in the article text rather than in reference lists, and because URLs with errors in were ignored.

Discussion and Conclusions

Temporal trends in citations to YouTube videos: In answer to the first research question, we found a steady upward growth in citing online videos within academic publications since YouTube launched in 2005 in nearly all broad fields from 3 and 32 Scopus publications citing YouTube videos in 2006 and 2007 respectively, to 719 video in 2011, indicating that the academic use of YouTube videos is increasing in scientific publications. It is not clear, however, whether more scientific or scholarly-related video contents are being increasingly uploaded online or whether authors are increasingly willing to cite YouTube videos. The general trend since 2008 is approximately linear rather than exponential, with the increase in the total number of YouTube citations being 226, 328 and 270 in 2009, 2010 and 2011 respectively (using updated figures from April 2012). Assuming a sigmoid shape for the growth, the increase in YouTube citations seems likely to start to slow down soon, before perhaps even tailing off at a stable value.

Common types of YouTube videos cited by articles: In answer to the second research question, the content analysis of the sampled YouTube videos cited by research articles showed that in science, and medicine and health sciences the majority of the cited videos (about 78% and 77% respectively) had a direct scientific theme. However, art, culture and history videos (about 80%) in the arts and humanities and news contents, advertisements, social documentaries and talks by politicians (63%) in the social sciences were also commonly cited.

Disciplinary differences in citing online videos: In answer to the third research question, the results showed significant broad disciplinary differences in citing online videos. Most importantly, half of the cited videos in the sciences were real-time demonstrations of a particular scientific phenomenon, object or lab experiment in subjects such as computing, physics, chemistry, and biology. In medicine and health sciences, one-third of the cited videos were documentaries with medical or public health themes. In contrast, in arts and humanities hardly any videos had a directly scientific theme (1%) and almost half of the cited videos (45%) were related to visual and performing arts (37%) including music, dance, theatre, movie parts, and comedies suggesting that online videos are valuable in some

arts and humanities fields where human movement and performances are important and perhaps difficult to fully describe in text. In the social sciences, about 40% of the cited videos related to politics (e.g., news reports and talks by politicians) perhaps because they can potentially be an object of study in political science and world studies and many political videos can be easily accessed through YouTube.

One unexpected feature of YouTube is its potential for interdisciplinary citations. For instance, music, dance, and movie extracts may be cited by research papers in hard sciences for scientific reasons. Further qualitative investigations into motivations for citing YouTube videos to may give a better understanding of the importance of this aspect of YouTube use. For example, a contextual analysis of citations to YouTube videos in full-text publications could reveal in more detail how YouTube videos are used across disciplines to support scholarly arguments.

Two drawbacks of YouTube citations are that they take time to make and article readers may not value them because they are not peer reviewed. Future research could perhaps explore these two issues through a cost-benefit analysis and a study of reader or referee perceptions of YouTube citations.

Finally, in terms of the overall influence of YouTube on academic publications, it seems that YouTube videos are being used by a small but increasing number of researchers to support discussions. However, it is not known whether this is because more videos are available online or because scholars are more willing to use online videos for research communication. This particularly occurs in the arts and humanities (0.3% of articles cite YouTube videos) and social sciences (0.2% of articles cite YouTube videos). These citations seem to give academics two different types of advantage. They can take advantage of video to better *describe* their research, for instance by filming a performance (typically moving images with music or dialog, sometimes essentially just music) or experiment (typically moving images with an audio explanation). Alternatively, researchers can better *support* their arguments by drawing upon previously ephemeral or hard to access sources of evidence, such as videos of real-life events (often primarily video) or others' talks (essentially audio). In both cases, academics are using online multimedia to extend their ability to communicate their arguments or findings through YouTube citations, although readers should perhaps take a more critical attitude towards YouTube sources than towards peer-reviewed sources. Hence, it seems that YouTube is genuinely enhancing scholarly communication, albeit in a minority of cases and mainly in the social sciences, arts and humanities, and that wider groups of scholars would be advised to consider whether YouTube can enhance their publications too. Whilst some scholars would have no need of multimedia to support their papers, others may not use it because of the lack of peer review, unaware that it has become acceptable in some scholarly areas.

Acknowledgements

This research is part of the FP7 EU-funded project ACUMEN on assessing Web indicators in research evaluation. Thank you to the referees for their helpful suggestions, including a title change.

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Appendix A. Examples of natural or formal science videos (including medicine and health sciences) cited by articles indexed by Scopus.

	Citing Journal Article			Cited YouTube video	
	First Author	**Title**	**Source / Publication year**	**Video title**	**YouTube ID/ Views**
Scientific demo.	Colon M.J.	Completely intracorporeal retraction of the gallbladder for laparoendoscopic single site (LESS) surgery	Surgical Laparoscopy, Endoscopy and Percutaneous Techniques / 2001	9388GS Single Incision Sleeve Gastrectomy Using a …	aN_Oi5hTmVg 3,013
	Cleary P.A.	On the stability of a bicycle on rollers	European Journal of Physics / 2011	Sad first time on Rollers	E2tF0tK7P_s 585,266
	Puniamoorthy N.	Bending for love: Losses and gains of sexual dimorphisms are strictly correlated with changes in the mounting position …	BMC Evolutionary Biology / 2008	Themira + Nemopoda	Z1eWftJrU2M 121
Sci. documentary	Dickey T.	Shedding new light on light in the ocean	Physics Today / 2011	Radiance in a Dynamic Ocean	vym7TQBc-TE 233
	Abarshi M.	Optimization of diagnostic RT-PCR protocols and sampling procedures for the reliable and cost-effective detection …	Journal of Virological Methods / 2010	Cassava Brown Streak Virus	nCJdws9CnUw 1,215
	Hedo J.M.	Computer model for numerical simulation of emergency evacuation of transport aeroplanes	Aeronautical Journal	A380 EMERGENCY EVACUATION TEST	XIaovi1JWyY 118,023
Sci. education	Marra N.	Evolution of the air toxics under the big sky program	Journal of Chemical Education / 2011	dt 8530 ch 1 intro	xi8xdqJWviM 140
	Van Den Bosch S.	Erythromycin to promote bedside placement of a self-propelled nasojejunal feeding tube in non-critically ill …	Nutrition in Clinical Practice / 2011	Bengmark Naso-Intestinal tube	HUv13Xy0GwE 4,900
	Kempson D.	Family caregiver provided massage for rural-dwelling chronically Ill persons	Home Health Care Management and Practice / 2009	Foot Massage Lesson by Health-Choices Holistic Massage School	yyi7i2CmIkk 236,836
Sci. academic	Limoncelli T.A.	Successful strategies for IPV6 rollouts, really	Communications of the ACM / 2011	Google IPv6 Conference 2008: IPv6, Nokia, and Google	o5RbyK0m5OY 16,138
	Silva E.	Accreditation and you	JACR Journal of the American College of Radiology	CMS/MIPPA Accreditation Mandates for 2012	9f46Akv-78I 289
	Livesey G.	More on mice and men: Fructose could put brakes on a vicious cycle leading to obesity in humans	Journal of the American Dietetic Association, 2011	Sugar: The Bitter Truth	dBnniua6-oM 1,841,505

Appendix B. Examples of arts and humanities videos (including art, media, culture and history) cited by articles indexed by Scopus.

	Citing Journal Article			Cited YouTube video	
	First Author	**Title**	**Source / Publication year**	**Video title**	**YouTube ID/ Views**
Music	Burke P.	Rock, race, and radicalism in the 1960s: The rolling stones, black power, and Godard's one plus one	Journal of Musicological Research /2010	SHINDIG! #37	NIcIsVKmmRY 19,400
	Gaffney K., Manno A.J.	Navigating the gender box: Locating masculinity in the introduction to women and gender studies course	Men and Masculinities / 2011	P!nk - Stupid Girls	BR4yQFZK9YM 21,674,202
	Capulet I.	With reps like these: Bisexuality and celebrity status	Journal of Bisexuality / 2010	Lady Gaga - LoveGame	1mB0tP1I-14 82,904,677
Dance and theater	Bale T.	Dancing out of the whole earth: Modalities of globalization in the rite of spring	Dance Chronicle / 2008	Abel Cruz dos Santos dancing Le Sacre du Printemps	vkgWoXTYo3o 15,099
	Jarvinen H.	Critical silence: The unseemly games of love in Jeux (1913)	Dance Research / 2009	Jeux parte 1	FkZhDcB-OfA 7,734
	Kelly M.T.	Contemporary dance and evolving femininities	Journal of Integral Theory and Practice /2011	Lamentation - Martha Graham	xgf3xgbKYko 471,016
Movie s and animations	Lea D.	Horror comics and highbrow sadism: Televising George Orwell in the 1950s	Literature and History / 2010	1984 by George Orwell / Nineteen Eighty-Four / Film Movie	hATC_2I1wZE 415,291
	Taylor V.F.	Teaching labor relations with norma rae	Journal of Management Education /2011	NORMA RAE — ReThink Review	6IJZx4S6NT0 21,847
	Neto L.C.-L.	The musical universe of Hermeto Pascoal	Popular Music and Society / 2011	Desenho Aquarela do Brasil	_mQHr8bAojU 2,143,149
Comedy	Swenson C.	Next generation workforce	Nursing Economics / 2008	Nursing Back	5kVv2aqnEjs 480,174
	Sheptycki J.	Guns, crime and social order: A Canadian perspective	Criminology and Criminal Justice / 2009	Alice in Oblivion-News Montage	DypZ7UFvNnk 1,252
	Platt A.	Teaching medicine to millennials	Journal of Physician Assistant Education / 2010	Emory PA C/O 2010 Rap Video - "KNOW!!"	aX7jme2b0N0 76,352
Public Show	Jacobs M.	Libraries and the mobile revolution: Remediation=relevance	Reference Services Review / 2009	Ashton Kutcher beats CNN in Twitter contest to reach 1 million…	iIuJvcclLxs 17,533
	Arndt D.	Two-wheel self-balancing of a four-wheeled vehicle	IEEE Control Systems Magazine	Most Cars Driven on Two Wheels Simultaneously	pobOY1g0QBI 531,232
	Koski C.	Afghanistan at a crossroads: The quest for democratic policing in a post-9/11 era	Police Practice and Research /2009	Afghan women policing for rights	vSuKVTxsxzk 5,729
A&H documentar	Voss-Andreae J.	Quantum sculpture: Art inspired by the deeper nature of reality	Leonardo / 2011	Quantum Sculptures with Julian Voss-Andreae	LqsQYVFAgPo 940
	Shirley D.	'The reality of doing': Meisner technique and British actor training	Theatre, Dance and Performance Training / 2010	Sanford Meisner - Theater's Best Kept Secret	zNuFSrsYfpM 100,166
	Sunder M.	Bollywood/Hollywood	Theoretical Inquiries in Law	Akira Kurosawa: Influences and Influence	G1STFM39vJ4 99,031
A&H speech	Van Dyke J.	Vanishing: Dance audiences in the postmodern age	Dance Chronicle / 2010	Wally Cardona: Really Real, an artist discussion	cqzDoxujPVk 648
	Means-Shannon H.	Seeing double: The transforming personalities of Alan Moore's Promethea and the Ulster Cycle's Cuchulain	Journal of Graphic Novels and Comics / 2010	Alan Moore at the Magus conference	BrBbeBezezw 2,871
	Pellegrini A.	Behold the body	TDR - The Drama Review - A Journal of Performance Studies	ally Field - Emmy Acceptance Speech Uncensored	ImoMGyJjWIk 534,829

Appendix C. Examples of social sciences videos (including political sciences and marketing) cited by articles indexed by Scopus.

	Citing Journal Article			Cited YouTube video	
	First Author	**Title**	**Source / Publication year**	**Video title**	**YouTube ID/ Views**
News report	Lowry C.B.	Three years and counting-the economic crisis is still with us	Portal	Rahm Emanuel on the Opportunities of Crisis	_mzcbXi1Tkk 79,780
	No author	The suspension theory: Hurricane katrina looting, property rights, and personhood.	Louisiana Law Review / 2010	ops loot Wal*Mart after Katrina in New Orleans	NmQW6xLECUU 46,824
	Hassid S.	Developments in the residential energy sector in Israel	Advances in Building Energy Research / 2011	Henry Kissinger Interview	TnIu9AffqX4 17,432
Ads	Southgate D.	Creative determinants of viral video viewing	International Journal of Advertising / 2010	dove evolution	iYhCn0jf46U 14,061,599
	Ang L.	Community relationship management and social media	Journal of Database Marketing and Customer Strategy Management / 2011	iPod Touch Ad - Nick Haley	KKQUZPqDZb0 2,589,276
	Malouff J.,	Effects of vicarious punishment: A meta-analysis	Journal of General Psychology / 2009	Yul Brynner - Anti-Smoking Commercial	JNjunlWUJJI 663,141
Politics	Abdulkadir M.	Africa's slow growth and development: An overview of selected countries	European Journal of Social Sciences / 2010	Obama in Ghana Parliament: Full Speech	QkNpUEWIhd4 65,428
	Khoury L.	Hezbollah's war of position: The Arab-Islamic revolutionary praxis	Arab World Geographer / 2009	Sayyed Nasrallah Martyrdom of his Son Hadi	HalvZUHlenU 29,315
	Dasgupta S.D.	My Friend, Advocate Ellen Pence	Violence Against Women / 2010	Ellen Pence, Battered Women's Movement Leader	r9dZOgr78eE 10,071
Acad. talks in soci. sci.	Weller M.	Using learning environments as a metaphor for educational change	On the Horizon / 2009	A Portal to Media Literacy	J4yApagnr0s 142,126
	Brown L.	Mathematics teacher and mathematics teacher educator change-insight through theoretical perspectives	Journal of Mathematics Teacher Education / 2010	Michael Fullan ELDA Summer Institute	xLgrLwJ3Cf8 3,752
	Terantino J.M.	Emerging technologies YouTube for foreign languages: You have to see this video	Language Learning and Technology / 2011	Randy Pausch Last Lecture: Achieving Your Childhood Dreams	ji5_MqicxSo 14,561,526
Soci. Sci. Doc.	Kotchemidova C.	Emotion culture and cognitive constructions of reality	Communication Quarterly / 2010	McLuhan's Wake	faK9HUvH2ck272 7,245
	Fonseca R.	Nikki Craft's Aesthetic feminist activism [O activismo estÃ©tico feminista de Nikki Craft]	Revista Estudos Feministas / 2010	Myth California 1982 to 1983	agyEAhwrVUU 1,408
	Tepfer J.	Arresting development: Convictions of innocent youth	Rutgers Law Review / 2010	Raw Video: Cop grills 15-year-old Tim Masters	76S1UB3pws 3,725

Appendix D. Classification of cited YouTube videos in academic publications based on a content analysis in the four broad disciplines (sciences, social sciences, arts and humanities, and medicine and health sciences)

Broad fields	**Natural or formal science videos**				**Arts and humanities videos**							**Social sciences videos**					
	Sci. demo	Sci. doc.	Sci. edu.	Sci. lecture	Music	Dance / theatre	Movies	A & H doc.	Comedy	Pub. show	A & H speech	News reports	Ads	Politics	Social sci. talk	Social sci. doc.	Total
Sciences	61 (50.8%)	14 (11.7%)	7 (5.8%)	12 (10%)	4 (3.3%)	1 (0.8%)	1 (0.8%)	3 (2.5%)	3 (2.5%)	2 (1.7%)	1 (0.8%)	0 (0%)	3 (2.5%)	0 (0%)	0 (0%)	8 (6.7%)	120 (100%)
Social sciences	4 (1.5%)	0 (0%)	24 (9.2%)	3 (1.1%)	20 (7.7%)	0 (0%)	4 (1.5%)	6 (2.3%)	6 (2.3%)	25 (9.6%)	4 (1.5%)	53 (20.3%)	23 (8.8%)	55 (21.1%)	7 (2.7%)	27 (10.3%)	261 (100%)
Arts and humanities	0 (0%)	0 (0%)	0 (0%)	1 (0.9%)	20 (18.2%)	10 (9.1%)	11 (10%)	18 (16.4%)	8 (7.3%)	7 (6.4%)	13 (11.8%)	9 (8.2%)	5 (4.5%)	4 (3.6%)	2 (1.8%)	2 (1.8%)	110 (100%)
Medicine and health sciences	10 (16.7%)	21 (35%)	9 (15%)	6 (10%)	0 (0%)	2 (3.3%)	0 (0%)	2 (3.3%)	2 (3.3%)	1 (1.7%)	0 (0%)	0 (0%)	2 (3.3%)	0 (0%)	1 (1.7%)	4 (6.7%)	60 (100%)
Total	75 (13.6%)	35 (6.4%)	40 (7.3%)	22 (4%)	44 (8%)	13 (2.4%)	16 (2.9%)	29 (5.3%)	19 (3.4%)	35 (6.4%)	18 (3.3%)	62 (11.3%)	33 (6%)	59 (10.7%)	10 (1.8%)	41 (7.4%)	551 (100%)