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Leveraging Multimedia to Advance Science by Disseminating a Greater Variety of Scholarly Contributions in More Accessible Formats

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Abstract:

For the welfare of the scientific community, we intentionally "rock the boat" about the way we conduct, recognize, and disseminate scholarly contributions. As a scientific community, we are doing ourselves a great disservice by ignoring the insights, artifacts, discoveries, and conversations that naturally occur in the scientific process of advancing knowledge that do not fit into the narrowly defined form of print-style papers. By failing to recognize, reward, and publish the wide variety of scholarly contributions that do not suit print-style papers, we hinder scientific progress, devalue important and necessary contributions to science, and demotivate these types of vital contributions. Although over three centuries of scientific publishing has demonstrated the effectiveness of the print medium for conveying scholarly knowledge, the print-style paper captures only a single form of scholarly contribution in a highly limited media format. Unfortunately, the current tenure and promotion process recognizes only this one form of scientific contribution. As a result, science at large advances inevitably only by this single type of contribution. Given the radical advances in audiovisual technologies, storage and bandwidth capacities, public virtual infrastructure, and global acceptance of user-generated open content, the time is ripe to exploit the possibility of publishing more forms of scholarly contributions in a publicly available multimedia format (e.g., video). In this paper, we examine the feasibility of this proposal, develop a model to demonstrate the sustainability of this approach, and discuss potential limitations.

Keywords: Communication Media, Research Dissemination, Knowledge Dissemination, Scholarship, Academic Publishing, Video Media, Multimedia Instruction.

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1 Introduction

Scholarly contributions that have the potential to advance knowledge and practice come in many forms. However, the primary dissemination medium for scholarly contributions is the print-style paper. Although the print-style paper proliferates certain types of scholarly contributions well, it does not do so for many others. While rigorous empirical and/or theoretical research may best suit print, other contributions such as tutorials, panel discussions, demonstrations, simulations, teaching materials, advanced visualizations, and many others may better suit alternative formats. Therefore, many of these other forms of contributions inevitably fall by the wayside in the effort to produce recognizable (and rewardable) scholarly contributions through journal papers. These lost opportunities hamper potential growth for our field and science in general.

Beyond this primary problem, we also observe that, in academia, the educational and publishing landscape is swiftly changing due to often-disruptive innovations. Several efforts, such as Udacity, Coursera, and EdX, have brought free online education to the world. Similarly, free open access journals offer academic research to the public[1]. Such revolutionary changes have occurred concurrently with sharp rises in tuition, textbook prices, journal access fees, and ever-lengthening review and publishing cycles resulting from increases in scholarly output and simultaneous decreases in the number of "top" journals (Lowry et al., 2013). The traditionally slow and highly limited publication cycles found in the information systems (IS) field place IS academics at a disadvantage compared to those in other fields (Templeton & Lewis, 2015; Valacich, Fuller, Schneider, & Dennis, 2006).

History provides countless examples of what happens to organizations, societies, and domains if they do not innovate during periods of radical change or embrace disruptive innovations (Christensen, 1997). Consider recent and ongoing developments in the journalism business that have caused some slow-to-adapt iconic brands to wither (*Time* and *Newsweek* magazines; the *Los Angeles Times* and *The Chicago Tribune* newspapers). Even the brands that have survived (*The New York Times*) and prospered (*Financial Times* and *The Wall Street Journal*) have done so only by adapting to the digital revolution by revising both their product offerings (more timely and accessible content enabled by radically reduced publishing cycle times and the innovative use of video technology) and their revenue models (various pay-for-access pricing schemes). Add to these trends the threat of open access journals and alternative publishing, the current journal revenue models will likely face challenges in the future. To address the potential threats—and opportunities—that digital technologies present to scholarly IS publishing, we propose that we need to learn from the success of the surviving journalism publishers by proposing a strategy that emphasizes complementing both the current product offerings and the revenue model.

In this paper, we propose using multimedia as a complementary format for disseminating the natural variety of scholarly contributions found in academia. First and consistent with the strategy of revising product offerings, we argue that the evidence-based use of multimedia materials will help expand the "market share" and the accessibility of existing products (i.e., scholarly contributions that are currently disseminated via print journals) and bring to market a new array of multimedia products for disseminating artifacts, insights, discoveries, and conversations that are crucial to the process and progress of scientific inquiry but that one omits (and, thereby, largely loses) when shaping print-based scientific contributions. Second, we argue that revising the product offerings can (and must) be sustained with a revenue model that features new and repeating revenue streams that the introduction of market-based incentives to the existing manuscript review process will support.

Philosophical Transactions of the Royal Society first appeared on March 6, 1665, as a series of letters written between scientists (Oldenburg, 1665). This practice established the foundation for scientific journals and peer-reviewed research currently published in print form. The tradition of print journals will likely continue into the foreseeable future, but it currently fails to take advantage of multimedia's potential added value. With the advent of the Internet in the late 20th century, some IS journals have adopted portions of the new digital medium (e.g., *MISQ, JAIS, EJIS, CAIS,* and *AIS-THCI*) but have largely retained the static structure and publishing process of traditional paper journals. Some of these digital print journals now even include dynamic content. *MISQ Discovery* was a notable failed attempt by the IS community to include dynamic content. However, *MISQ* now attempts to innovate further by providing some open access content under creative commons licenses. *MISQ* and *EJIS* also provide extensive online content that supplements their journals. Additionally, entire conference tracks at *ICIS* and *AMCIS* have focused on multimedia submissions. However, with the exception of the successful adoption of online appendix supplements, the

[1] See www.doaj.org for a large index of such journals, which currently number approximately 10,000, with 1.9 million papers.

IS community has met these efforts with lackluster responses. We do not believe this lack of success reflects a shortage of interest in accessing online multimedia content; instead, it mostly reflects poor guidance and the use of ineffective dissemination designs. Effective designs have arisen in the present early-development stage of multimedia-enabled online learning where the adoption of powerful and inexpensive (and sometimes free[2]) authoring tools has outpaced the academic community's progress in validating evidence-based models of multimedia instructional design. As that community has acknowledged, the literature on multimedia instructional design remains tethered to contrived laboratory experiments (Mayer, 2012); as such, research has yet to adequately validate the use of multimedia instructional materials (Ayres, 2015; Butcher, 2014; Mayer & Fiorella, 2014).

In addition to the availability of these influential and inexpensive multimedia tools, a strong infrastructure now exists for publishing user-generated multimedia content. YouTube, in particular, has evolved sufficiently to provide an excellent infrastructure for easily publishing and organizing videos for a target community (such as academics). YouTube allows one to create channels to which users may subscribe and around which subscribers can form a community. Channels can be public or private and free or monetized. The benefits of the YouTube infrastructure, aside from cost and maintenance considerations, include the greater visibility and accessibility of publications, the opportunity to publish work immediately after its acceptance, the ability to facilitate scholarly conversations in a timely manner (through the comment feature), and (most importantly) the potential to publish a larger variety of scholarly contributions than traditional journals currently afford. However, this approach does have its limitations, which include a learning curve for creating these kinds of publications and political filtering systems that limit public expression, such as the People's Republic of China's blocking of YouTube and other public video services[3].

To lay the foundation for addressing this issue, in Section 2, we first offer a brief history of scholarly publishing, which demonstrates the lack of evolution in this arena. In Section 3, to identify best practices and potential pitfalls related to establishing online video[4] as a medium for publishing research in a multimedia format, we review unsuccessful attempts to establish related online media sources for academic research. Further, we summarize how one could couple newly developing theory and practice in the domain of online multimedia learning with commercial logic to remedy the causes of those unsuccessful attempts. In Section 4, we summarize guidelines by which one should design multimedia and these guidelines' theoretical underpinnings. In Section 5, we describe how those guidelines can shape the development of a range of submission types. In Section 6, we outline the potential body of various scholarly contributions that using a video format that incorporates newly developing, evidence-based models of online multimedia learning may provide. In Section 7, we acknowledge and discuss potential limitations of using videos to disseminate intellectual contributions. In Section 8, we conclude with a summary of the issues.

2 The (Lack of) Evolution in Scholarly Publishing

People have published scientific discoveries for centuries—often as letters or books. Copernicus's (1473-1543) thesis on the revolution of heavenly bodies (Copernicus, 1543) represents one such publication. Many publications, such as Copernicus's or the far earlier work of Ptolemy (AD 90-168) (Ptolemy, 1984), were the grand works of a single great mind. Scholars would work for many years collecting data, analyzing it, and theorizing about it. Once they felt ready to present their works to the scientific community, they would have them published; only then did the community review them. As in the case of Copernicus and many others, scholars would often delay publishing their works for fear of criticism or even charges of heresy by church leaders. Scholars were hesitant to share their hard-earned findings with others who might not share their enthusiasm about their work's evidence or logic.

Although one can find elements of science and experimentation as early as the ancient Egyptians, scholars did not standardize the scientific method until much later[5]. Roger Bacon (1214-1294), often referred to as

[2] Appendix 1 describes some of these tools in more detail.

[3] For Mainland China, Baidu offers a video-sharing platform that is substantially similar to YouTube and that may provide a parallel platform for serving the under-met needs of that large and rapidly growing market for academic publishing.

[4] We chose video as the focus platform for disseminating multimedia contributions because of (1) the useful and ubiquitous infrastructure provided by YouTube and (2) the ability of video to support animation, audio narration, talks and presentations, and visualizations. An alternative format would be a website, like a blog or wiki, but this would require much more overhead to maintain and organize, and would still be presenting the bulk of contributions in text format.

[5] While the scientific method and the dissemination of science are not synonymous, they intertwine. The dissemination process enables the scientific method to be effective. Without effective dissemination, the scientific method (particularly peer review, feedback, and building off each other) cannot work.

the father of the modern scientific method, held advanced views on the philosophy of science commonly considered to be 400 years ahead of his time (Clegg, 2013). Many great minds (many of whom were intellectually curious clergy) continued to espouse and develop the scientific method throughout the developed world. In 1620, Sir Francis Bacon (1561-1626) published his masterwork *Novum Organum* (*The New Organon*) in which he tried to replace the philosophical tradition of syllogism (deduction) with data collection, experimentation, and empirical evidence. René Descartes (1596-1650) further established the foundation for the scientific method's guiding principles in his influential *Discourse on Method* (published in 1637). Another key modern contributor to the scientific method was the great English philosopher John Stuart Mill (1860-1873), who further resolved the issue of confirmation bias in inductive approaches to science by clearly proposing the concept of falsifiability as the scientific method's key foundation.

It was through these efforts and those of thousands of scientists that developed the scientific method that we use today. However, early-stage communication with other scientists soon became a key facilitator of the process of scientific inquiry and dissemination. The scientific method we currently leverage in scientific inquiry provides a framework for the systematically developing and testing scientific knowledge: one forms questions, develops hypotheses and predicts phenomena, tests the hypotheses via experimentation, analyzes/discusses the findings, and evaluates and improves understanding of that phenomena. Falsifiability is a key foundation of these efforts. The method also calls for replication, external review, and data recording or sharing. Accordingly, members of the scientific community began to seek (and often require) peer reviews of their work prior to publication, which makes collaboration a more desirable component of the process of scientific discovery. This new process of sharing scholarly knowledge was also amenable to publishing research more frequently and in shorter formats, and thus began the scholarly periodical.

Even before *Philosophical Transactions of the Royal Society* published its first paper, *Journal des Savants* (originally *Journal des Sçavans*) acted as the first scholarly periodical. It published its first issue on January 5, 1665 (Brown, 1972). From that time until the end of 2014, an estimated 160 million scholarly documents have been published (Khabsa & Giles, 2014; Orduña-Malea, Ayllon, Martin-Martin, & Lopez-Cozar, 2014). However, the structure and format of papers in scholarly periodicals have remained largely unchanged for the past 350 years—juxtapose that with the radical evolution of communication and media technologies we have observed during that same period. Scientists still publish mostly in print journals or in online journals that follow exactly the same format (i.e., static text). Review cycles still take an inordinate amount of time, and even accepted manuscripts might not be published for up to a year so they appear in an appropriate issue. Community review and reaction and the opportunity to respond to published research require the same lengthy, temporally disjointed process.

That the traditional publishing model has well served the process of scientific discovery is beyond dispute. Equally beyond dispute is that, in the process of shaping scientific contributions to its medium and format, the traditional model does not disseminate artifacts, insights, discoveries, and conversations that are crucial to the process and progress of science. To illustrate, consider the scientific and engineering discoveries birthed by the Wright brothers (McCullough, 2015) and the means by which those discoveries were disseminated. The Wright brothers conducted numerous experiments to design a wing with a shape and composition that would best promote lift and numerous other experiments to design a lightweight motor to propel a winged vessel into manned flight. In the naturally occurring course of those experiments, the Wright brothers debated, tested, rejected, and reconsidered many alternative solutions. The resulting artifacts, insights, and discoveries represented the foundation of thought on which we built modern aviation. But that foundation did not solidify and make its way into the academic literature until Wilbur Wright shared drawings, discussed ideas, and demonstrated the brothers' invention's efficacy over the course of a year and it spread throughout the scientific community in France (the U.S. academic community initially ignored these breakthroughs). Thus, the advances in knowledge and the many intellectual contributions that the Wright brothers made did not suit the traditional journal paper format, and only parts of those contributions ever made it into a journal. Had there been a means for them to disseminate such contributions at the time, they could have avoided many redundant efforts and failures, and the science of aviation likely could have advanced more rapidly.

One can similarly criticize any scientific field that does not recognize and provide a way to disseminate intellectual advances and contributions that do not fit well in the constraints of provided dissemination channels and formats. In IS (and in most fields), the dominant channel is the print-style paper. When one views the revolutions in media and communication technologies in light of the progress that scientists have made through the scientific method, it appears that an uncritical and exclusionary embrace of old traditions of scientific communication may hinder the progress of science. In Section 3, we discuss some early

attempts to break from this tradition, why these attempts failed, and how we need to think differently to make such an effort succeed.

3 Rethinking the Model of Multimedia Scholarship

The concept of using alternative media, such as video, in academic communications is not new. Individuals have made many attempts to embrace multimedia, but each has met with failure and an unenthusiastic response from scholars. To discover why such attempts in IS failed and what needs to be changed for such an effort to succeed, we investigated these prior attempts by collecting interviews with those who were involved. This section focuses on two well-known attempts in IS: *MISQ Discovery* and the *ICIS* visual-media track.

MISQ Discovery was an attempt to create a journal of living (that is, continuously updated) documents. However, of the three papers that the journal accepted, only one has received any updates. According to Janice DeGross (2013) (the current managing editor of *MISQ*), "part of the problem was that this concept was perhaps too early in the development of the Web and how people use it". Additionally, the wider IS community did not accept these documents as legitimate publications because they had never appeared in print. This mindset dissuaded authors from publishing online because doing so would not help their careers. Indeed, many deans would not attribute rigor or credibility to a non-print journal (Schwarz, 2013). Another major issue was organizing the content online: permalinks were not permanent, which led to lost content.

As for the *ICIS* visual-media track, it "was introduced prematurely", and, according to Michel Avital (who has worked closely with multi-media scholarship in IS), "our community still may not be ready to embrace visual-media for research dissemination" (Avital, 2013). As with *MISQ Discovery*, the lack of submissions from the IS community prevented the visual-media track from reaching its full potential. Interestingly, the first year the visual-media track was available at *ICIS*, the attendees had only a standing room (Cyr, 2013). Thus, although scholars are eager to consume such content, they may be unsure of how to produce it. The lack of submissions resulted partly from the difficulty scholars had in communicating their research using formats in which they lacked training (Schwarz, 2013). Although academics do have adequate skills to produce submissions in new formats, academia in general lacks a culture of media creation, which may act as an obstacle until it can establish such a culture through consistent exposure to media contributions and evidence of their impact. Until academia places greater cultural value on these types of contributions, many academics will likely find insufficient incentives to create them.

These examples confirm that some components of a model for using multimedia to disseminate scholarship in the IS community already exist. For instance, 1) many scholars have an early-adopter interest, 2) publishers and conference sponsors show some signs of being ready to embrace multimedia content, and 3) the enabling infrastructure is operational (YouTube in most of the world and perhaps Baidu in China). However, we lack other crucial components of such a movement, which the IS community's lackluster response to initiatives promoting the use of multimedia as complements to traditional papers evidences.

We contend that one can construct and employ a functioning multimedia scholarship model that model reflects a commercial logic that aligns the interests and capabilities of publishers and authors. Figure 1 illustrates a potential model in which scholars continue to pursue science as they have always done but can now earn recognition and rewards for all meaningful scholarly contributions and not just top journal papers. The model also highlights advantages in financial sustainability of scholarly activities and the potential for accelerated advancement of science while leveraging multimedia to capture and disseminate a greater variety of scholarly contributions. This new model captures a wider variety of contributions that would otherwise go unnoticed but may well enhance our knowledge and progress science.

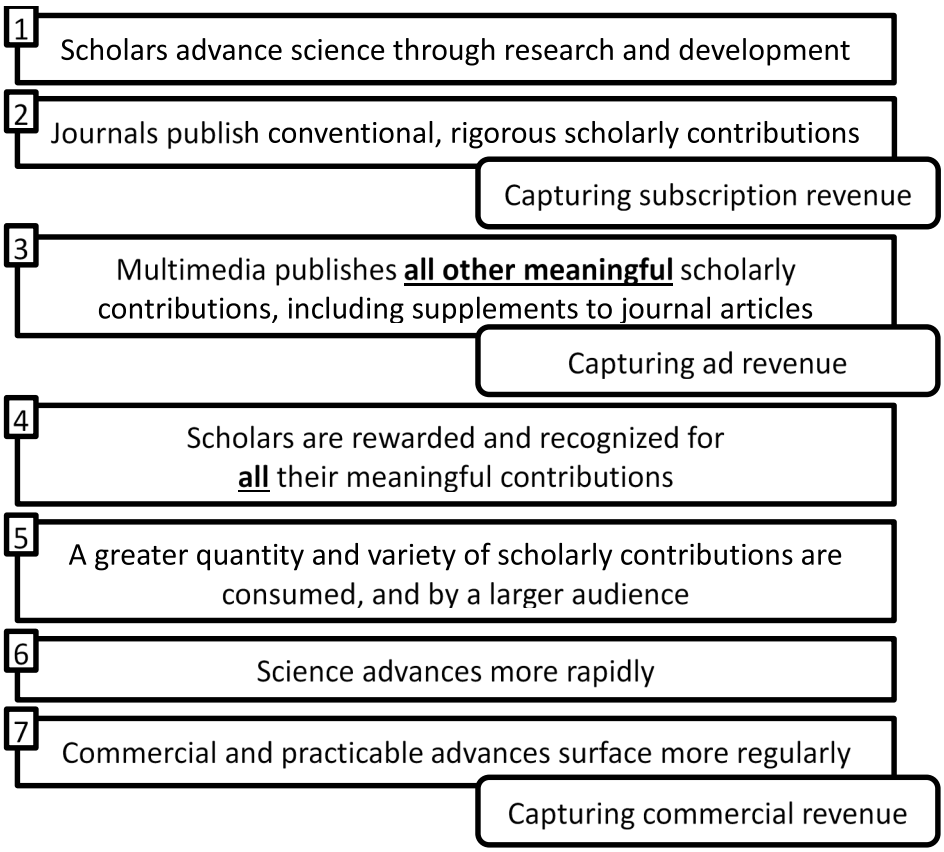


Figure 1. A Viable Model for Disseminating all Meaningful Scholarly Contributions

To be sustainable, a model for multimedia-enabled publishing must produce revenues that can plausibly generate a reasonable rate of return on publishers' invested capital and, thus, most realistically account for scale and growth. Such revenues are achievable where the supplied materials respond to demand from market segments that are either untapped (e.g., from practitioners, who seek (paid) access to author insights) or underdeveloped (e.g., from scholars eager to contribute to and consume multimedia content). That demand is most likely to be robust and sustainable where the underlying scholarly contributions help practitioners resolve persistently wicked practical problems and exploit potentially high-value opportunities; however, most scholarly efforts are more incremental, theoretical, and exploratory than practicable. Contributions as historic as those made by the Wright brothers are the exception rather than the norm. Nevertheless, such actionable insights and commercially applicable discoveries are certain to surface more regularly because publishers can capture and disseminate the full spectrum of scholarly contributions (and to potentially larger audiences) by leveraging multimedia.

One key challenge that early adopting publishers will face is how to incentivize authors to produce a sufficient flow of the desired type of research and also contribute meaningfully to the process of developing effective multimedia materials. Simply relying on the authors' good intentions and curiosity would likely not be sustainable or realistic. The academic community may perceive financial rewards as unethical, and they would not be sustainable. We propose an alternative approach with an incentive that remedies a common and worsening problem in the IS academic review process: we suggest offering "fast track" manuscript reviews to those manuscripts suitable to the model of multimedia-supported scholarship and that include authors' commitments and plans to collaborate to develop the accompanying multimedia[6]. Such a review privilege would align authors' interests with publishers' interests. By adding a "demand-pull" dimension[7], this incentive would introduce an explicit market signal into academic-publishing process.

[6] The problem then, of course, is whether we can incentivize reviewers to fast-track their reviews. As a precedent, in the finance field, reviewers receive pay. We could perhaps offer a financial incentive to reviewers who provide quality reviews in a 30-day timeframe. The money to pay these reviewers would come from the three revenue streams in Figure 1.

[7] "Demand pull" and its twin "supply push" are concepts from the overlapping fields of marketing and inventory management. Push production ("supply push") is based on forecast demand, and pull production ("demand pull") is based on actual or consumed demand (i.e., market-validated needs).

Despite this incentive, early adopting authors would need to formulate their research in completely alien ways. In addition to writing and designing for an alternative format, scholars would also need the technical skills to bring those ideas to fruition. Video-creation technologies have now become sufficiently ubiquitous and user-friendly such that one can create multimedia submissions relatively quickly and easily. By providing simple tutorials for some of these tools, we may effectively train scholars to create multimedia contributions of sufficient quality, which would lower the barrier to entry and increase the number of submissions. We offer an alternative approach (where the author is not the multimedia designer) in Appendix 2.

Hence, if we rightly assume that the technological tools and infrastructure no longer impede success (Schwarz, 2013), one can argue that one additional limitation has undermined prior attempts to leverage multimedia: the lack of concrete guidance on submissions. For example, the *ICIS* visual-media track's call for papers offers the following as submission guidelines: "*In lieu of conventional text-based papers, we invite submissions that rely heavily on visual media to convey research findings and opinions on issues related to information technology*". The *MISQ Discovery* description offers similarly unhelpful and generic submission guidelines. It is no wonder scholars failed to take advantage of these opportunities. Such open-ended guidance deters rather than motivates submissions. Perhaps IS scholars did not know what to do with these publishing formats simply because they lacked sufficient guidance. To avoid repeating this mistake, in Section 4, next summarize guidelines by which one should design multimedia and these guidelines' theoretical underpinnings. In Section 5, we describe how those guidelines can shape the development of a range of submission types.

4 Guidelines for Multimedia Submissions

Although one can develop multimedia for many purposes and contexts, one must consider the architecture, limitations, and operation of human cognition when doing so. The kernel observation regarding human cognition notes that humans' working memory has severe limitations in processing capability (Baddeley, 1992, 1999; Mayer, 2009; Miller, 1956). From that fact, a large and stable body of academic literature has developed to explain how the complement to working memory (i.e., long-term memory) functions as a vast storehouse of schemas in which individuals' index experiences—often as stories, which includes those that others tell (Bruner, 1990; Orr, 2006; Polkinghorne, 1988)—so they can later retrieve and process them in their working memory to solve novel problems. That processing is subject to the effects of cognitive load, which is the total amount of mental activity imposed on working memory's limited processing capacity (Sweller, 1994).

Cognitive load theory (Sweller, 2011) is an instructional approach based on our knowledge of the architecture and operation of human cognition, the organization of information in long-term memory, and the interactions between working memory and long-term memory. Cognitive load theory focuses on identifying conditions in which one can effectively manage cognitive load to better acquire and automate schemas and, thereby, greatly increase the efficiency of one's working memory's processing capability.

Ten years have passed since Mayer (2005b) introduced the cognitive theory of multimedia learning (CTML) and the 10 principles of designing effective multimedia (Mayer, 2005c, 2005d). Since then, most scholarship regarding these principles (Ayres, 2015; Mayer & Fiorella, 2014) has focused almost exclusively on identifying strategies and techniques for mitigating extraneous load (i.e., the cognitive load that arises from the presence of external distractors)[8]. This task is the condition precedent to the sequence of two other tasks: 1) managing intrinsic processing, which is the processing required to integrate new materials with prior established knowledge; and 2) identifying strategies and techniques for fostering generative processing, which is the process of establishing "mental frames" for the material and shifting those mental frames for use in solving problems that are similar ("near-transfer" skills) and progressively less similar ("far-transfer" skills)[9].

[8] The education psychology community continues to lament this singular focus on mitigating extraneous load. As Ayres (2015, p. 5) puts it: "Whereas a great emphasis has been placed on dealing with extraneous processing (Paas & Sweller, 2014), little attention has been given to dealing with task complexity (intrinsic cognitive load). Some materials are hard to learn, regardless of the generative strategies used or the sophistication of the multimedia materials employed. Hence, specific strategies are required to deal with task complexity. Only Mayer (2005c) appears to address this issue reporting on a pretraining strategy, suggesting that more wide-scale research is required to help learners deal with complex tasks.".

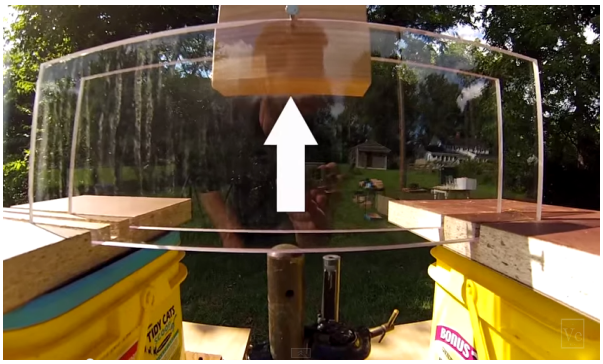
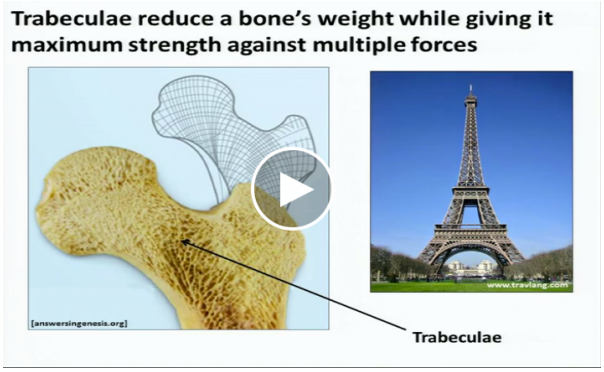
[9] Effective generative processing results in one's forming new combinations of knowledge and schemas ("elaborated schemas"). It represents the quintessence of learning because one can economically process a schema, which is a unified collection of many elements of knowledge, in their working memory as a single element of knowledge.

The extant literature provides substantial guidance on how to minimize extraneous processing, which we can apply to our context. Although the literature still provides little guidance for managing intrinsic processing and fostering generative processing, some examples in practice that—by dint of their large usage volumes—appear to point the way to effective guidelines for designing multimedia materials for scholarly publishing. Table 1 illustrates two videos that exemplify such guidelines, which we then analyze in Table 2.

Table 2 summarizes the two levels of guidelines for effective multimedia design as applied to the videos referenced in Table 1. We strongly encourage the reader to first view these two short videos prior to processing Table 2.

We draw these guidelines largely from literature on multimedia design and cognitive load theories (e.g., Mayer, 2005b, 2005d; Paas & Sweller, 2014; Paivio, 2010; Sweller, 1994). Items 1, 2, and 3 below help authors avoid designs that would distract from the messages in items 4 and 5. Items 4 and 5 provide authors with guidance for replicating and illustrating the path of cognitive processing that they undertook in the scientific process that produced their scholarly work.

Table 1. Videos Exemplifying Elements of Effective Multimedia Design

"Bullet Block Experiment" (YouTube)	"Talk Nerdy to Me" (TED Talk)
	
Length: 1:51 Number of Views: 1,020,581 **Link: https://youtu.be/vWVZ6APXM4w**	Length: 4:30 Number of Views: 1,819,991 **Link: http://www.ted.com/talks/melissa_marshall_talk_nerdy_to_me**

In Section 5, we outline the types of submissions appropriate for multimedia design delivered through the video format, their possible structures, examples of each submission type, and which kind of review process would likely best fit each submission type. Additionally, we offer a video tutorial[10] showing one way to make a video presentation and examples of each video submission type. When academia embraces video as a publishing format for multimedia contributions, this kind of detailed guidance will be important to provide as much scaffolding as possible to potential contributors; however, we provide these details now simply as possibilities and placeholders, not as inflexible design requirements.

5 Types of Scholarly Contributions Suited to Video

In addition to regular scholarly articles, a traditional journal often includes other types of submissions. For example, many include (in various forms and under various labels) editorials or articles on issues and opinions (such as this paper), research commentaries, teaching cases, and review articles. We propose that the video medium will allow for a much larger set of submission types, including (but not limited to) the following: (1) original scholarly works, (2) research notes, (3) research commentaries, (4) research dialogs, (5) opinions and debates, (6) editorials and guest commentaries, (7) tutorials, (8) teaching materials, (9) panels, (10) keynote speeches, (11) research briefs, (12) media supplements to print articles, and (13) practitioner oriented content (see Table 3)[11].

[10] Example tutorial on how to make a video: http://www.youtube.com/watch?v=ZrGewwTAUEY
[11] Under the submission requirements, the guidelines regarding length are maximums.

Table 2. Guidelines for Effective Multimedia Design as Applied to the Videos in Table 1

Level 1: minimize extraneous processing
1. Minimize or avoid using talking heads: using talking heads provides little to no instructional value (a still image of the authoritative expert suffices), requires a costly and logistically problematic development process, and results in production values that are likely to be inadequate (most subject matter experts (SMEs)] lack the skills needed to speak non-extemporaneously into a video camera).
a. "Bullet Block Experiment" (BBE): in this short video, the most prominent images demonstrate the experiment; the talking head image is incidental. An exception is where using the (inexpensive, casual, and brief) talking head incorporates hand gestures to convey significant information (see the passage from 1:01 to 1:36).
b. "Talk Nerdy to Me" (TNTM): in this tightly scripted, polished, costly video, the video only intermittently focuses on the talking head (of a highly trained speaker) and does so with effective supporting visuals.
2. Avoid clutter: do not use extraneous visual or aural elements.
a. BBE: the video generally tightly frames the video images; the video focuses on illustrating the upcoming demonstration/experiment.
b. TNTM: the TED stage uses professional lighting and sound that favor the speaker. The supporting visuals use text sparsely and appropriately. The message of the presentation includes teaching points about designing documents effectively.
3. Minimize jargon: minimize or avoid the use of jargon.
a. BBE: where the video uses jargon (1:01 to 1:36), it visually explains them.
b. TNTM: the presentation confirms that jargon can confuse readers and offers suggestions about how to avoid using jargon.
Level 2: manage intrinsic processing/foster generative processing
4. Tell stories/use examples/pose problems: for learners with relevant prior knowledge, apt stories, examples, and posed problems encourage them to draw relevant inferences.
a. BBE: the script appeals to the viewer's curiosity about the problem and its solution. The video's illustrating how to prepare for the experiment attracts the viewer's curiosity
b. TNTM: the script tells a story of a problem (how to help scientists and engineers communicate more effectively) and its solution.
5. Replicate the discovery process and support it visually: as the viewer begins to draw relevant inferences, provide information that naturally occurred to the authors in their original discovery process; give the viewer the chance to experience that path of cognitive processing before revealing the answer.
a. BBE: the short collage of talking heads is an inexpensive and minimalist device for presenting the viewer with alternative answers to the problem. At the 1:35 mark, a sparse list of the alternative answers annotates the image of the talking head. Note that the most compelling visual is that of the experiment's setup. In the follow-up video, the most compelling visual is that of the experiment's demonstration and the confirmation of the correct answer, which the video fully explains.
b. TNTM: the presentation concludes with a symmetry that recalls the statement of the problem at the beginning, and uses humor as a closing device.

Each video submission should be good quality in terms of both the visual execution and the intellectual contribution. With the exception of keynote addresses and panels, submissions should also be brief and typically should not extend longer than an ideal conference presentation (15 minutes or less). Research that shows the average adult attention span is roughly 20 minutes further supports this maximum length (Cornish & Dukette, 2009). With few exceptions, such as keynote addresses and conference panels, video content should mostly include screen capture or animation with voice narration rather than video recordings of a presenter talking. Abundant research has shown that, regardless of many individual factors, viewers learn and comprehend best when one conveys information via relevant images (or animation) and accompanying narration (Mayer, 1997, 2002, 2005a, 2009; Ollerenshaw, Aidman, & Kidd, 1997). In Table 3, we offer submission guidelines to provide sufficient guidance for structuring these submission types and, thus, resolve the aforementioned fatal flaw of providing insufficient guidance to scholars. However, while the literature does support many of these submission guidelines, they are only suggestions and placeholders

for now. Once we undertake a real initiative, we will inevitably need to refine and redesign the submission requirements through an iterative process of learning what works. In Table 3, we reference the "SenS-8"[12].

Table 3. Submission Types and Examples

Type	Brief description	Editing/review options	Example requirements	Example video
1. Original scholarly works	Traditional scientific, scholarly work using any accepted method and epistemology. Expected to be high in rigor, originality, and contribution. Ideal when one can explain the core story more effectively through visual means.	Only peer review.	1. 500-word abstract 2. 15-minute video 3. Full transcript 4. Full dataset 5. Complete analysis in an appendix 6. Full bibliography	Original doctoral work described in video format (http://youtu.be/2thPLCpyyB0).
1. Research notes	Work that extends a well-researched phenomenon or theory that promotes meaningful dialogue in an IS research community.	Only peer review.	1. 500-word abstract 2. 15-minute video 3. Full transcript 4. Full dataset 5. Full analysis appendix 6. Full bibliography	1. Physics experiment and hypothesis (http://www.youtube.com/watch?v=vWVZ6APXM4w). 2. Explanation of results (http://www.youtube.com/watch?v=BLYoyLcdGPc).
2. Research commentaries	Rigorous scientific expositions that illuminate and attempt to change extant practices in method, theory, or epistemology	Only peer review, and more carefully screened by SEs to judge suitability to wide audience.	1. 500-word abstract 2. 15-minute video 3. Full transcript 4. Full dataset 5. Full analysis appendix 6. Full bibliography	This video focuses on how bias might harm research and change the way we interpret data (http://youtu.be/me08Vh9Wmok).
3. Research dialogues	Specific responses to published works in any SenS-8 journal that challenge, critique, or provide alternatives to the work.	Peer review by 2-3 AEs or SEs acting as the reviewers; carefully prescreened by EIC to judge suitability to wide academic audience.	1. 250-word abstract 2. 15-minute video 3. Full transcript 4. Full dataset 5. Full analysis appendix	This video responds humorously to sociomateriality (http://www.youtube.com/watch?v=68cEbf5CaBo&).
4. Opinions and debates	Controversial and timely opinion pieces that involve substantial rigor and support and are of wide value and interest to the IS community.	Peer review by 2-3 AEs or SEs acting as the reviewers; carefully prescreened by EICs to judge suitability to wide academic audience.	1. 250-word abstract 2. 15-minute video 3. Full transcript 4. Full dataset 5. Full analysis appendix	This video adopts a controversial perspective on the current state of the educational system (http://youtu.be/zDZFcDGpL4U).
5. Editorials and guest commentaries	Less-rigorously supported and non-peer reviewed commentaries on current issues and trends.	Non-peer review; SEs and EICs screen for appropriateness.	1. 250-word abstract 2. 15-minute video 3. Full transcript	This video comments on the issue of open access academic content (http://youtu.be/L5rVH1KGBCY).

[12] Authors often incorrectly refer to these journals as the AIS-8: "Although the AIS supports the Senior Scholars Forum, the SenS-6 and SenS-8 baskets are official recommendations of the Senior Scholars, rather than the AIS itself" (Lowry et al., 2013, p. 996).

Table 3. Submission Types and Examples

6. Tutorials	Hands-on guides on how to do something related to scholarly output (e.g., using a specific research method, successfully writing grants, writing theoretical articles effectively).	Non-peer review; SEs and EICs screen for appropriateness (guest expert screener optional).	1. 250-word abstract 2. 15-minute video 3. Full transcript	This video instructs viewers on how to handle second-order formative constructs in SmartPLS (http://youtu.be/kPeUTKjMF7o).
7. Teaching materials	Work of any kind used to teach students, from full lectures, to laboratory exercises, to cases, to instruction on a specific concept (preferred to full lectures).	Non-peer review; SEs or AEs screen for content-delivery quality and permissions only (guest expert screener optional).	1. 250-word abstract 2. 15-minute video (30 minutes allowed for lecture) 3. Full transcript	This video discusses how a transistor works (http://www.youtube.com/watch?v=IcrBqCFLHIY).
8. Panels	High-quality recordings of traditional panels given at IS conferences or virtual panels put together outside a conference.	Non-peer review; SEs or AEs screen for content-delivery quality and permissions only.	1. 250-word abstract 2. 60-minute video max 3. Full transcript 4. Permission from source conference and panel members	This video is a panel discussion on Moore's Law (40 years later) (http://youtu.be/pjz0CAof-Zg).
9. Keynote speeches	High-quality recordings of traditional keynote addresses given at IS conferences.	Non-peer review; SEs or AEs screen for content-delivery quality and permissions only.	1. 250-word abstract 2. 60-minute video max 3. Full transcript 4. Permission from source conference and presenter 5. Original slides	This video is a TED talk about the genomic revolution (http://youtu.be/u8bsCiq6hvM).
10. Research briefs	Presentations of journal papers already accepted by or published in SenS-8 journals given by the authors of the papers or someone authorized to create a brief for them.	Non-peer review; SEs or AEs screen for content-delivery quality and permissions only. If not submitted by the original authors, the original authors may screen for accuracy of representation.	1. 250-word abstract 2. 15-minute video 3. Full transcript 4. Permission from authors	This video summarizes the arguments and findings in Lowry et al. (2013) (http://youtu.be/LZQIDkA-ke0).
11. Media supplements to print papers	The various forms of video supplements that accompany print papers published in SenS-8 journals (e.g., to explain an unusual methodology, provide video footage for a case study, depict a simulation, render complex visualizations of a phenomenon, or demonstrate an experimental phenomenon).	Non-peer review; SEs or AEs screen for content-delivery quality and permissions only.	1. 250-word abstract 2. 15-minute video 3. Full transcript 4. Permission from authors	This video is a simulation of prioritizing tasks (http://www.youtube.com/watch?v=InvXOFEfm6o).
12. Practitioner-oriented content	Videos that either summarize the practical implications of a mature body of work, or present ideas primarily targeted toward practitioners, rather than academics.	Peer review only and more carefully screened by SEs to judge suitability to practitioner audience.	1. 250-word abstract 2. 10-minute video 3. Full transcript 4. Applicable permissions	This video explains exactly how acoustic levitation works and how to implement it (https://youtu.be/0K8zs-KSitc).

6 Potential Added Value to the IS Research Community of Multimedia Delivered through Video

Scholarly contributions in traditional text-based journals have abundant value, some of which one might also capture in multimedia form delivered through video. However, in this section, we focus on multimedia's unique value-adding advantage for scholarly publications.

First, learning preferences vary (Kolb & Kolb, 2005; Komarraju, KArau, Schmeck, & Avdic, 2011; Schmeck, 1988). Some will prefer a print journal for communicating and accessing scholarly knowledge. However, for others, videos might be more accessible, more engaging, and a more natural medium of expression. One of video's more engaging and effective advantages is that it can include social cues, such as expression and emphasis, more effectively than in static text, where such cues are lost (Burgoon, Birk, & Pfau, 1990; Burgoon, Blair, & Strom, 2008). Truly, a picture is worth a thousand words: pictures can heighten credibility, trust, interactivity, and learning (Lowry, Wilson, & Haig, 2014).

Second, perhaps due to the constraints of conventional text-based papers, few students and practitioners find academic journals accessible, interesting, or useful, which limits published scholarship's influence on practice. Typically, the omnipresent rigor-versus-relevance debate represents this issue (Straub & Ang, 2011). Granted, few research papers are intended for general public consumption. However, are there scholarly contributions that might be more consumable for the general public but that we do not disseminate because of the current constraints and expectations of conventional research papers? Given this question, we wonder how much one can attribute our perceived lack of relevance to a lack of accessibility and to a filter on publishable content that limits the variety of scholarly contributions that can be disseminated. Accordingly, conveying a variety of scholarly contributions through video may, at the least, capture a greater market share of consumers and broaden the reach of IS research. We additionally propose practitioner-oriented content as a type of submission that would benefit from the multimedia format.

Third, this medium could also help capture non-English-speaking audiences by allowing one to select various translations of closed captions. YouTube can provide closed captions by allowing authors to upload a transcript and synchronize it with the video. Currently, YouTube can automatically translate closed captioning into over 100 different languages. YouTube also provides automatic script detection (removing the need for a transcript), although the voice-recognition software it currently uses does have its errors.

Fourth, multimedia formats allow dynamic animations, visualizations, and demonstrations that paper does not. Thus, multimedia provides a greater spectrum of communication tools and flexibility for conveying ideas. For example, actual point-and-click walkthroughs would be possible for tutorials. By explaining a process through narrative form, these walkthroughs would often provide much clearer and more replicable demonstrations than one can achieve in print. These additional advantages of multimedia might also enable unforeseen forms of scholarly contribution.

Fifth, research briefs would lend increased visibility and accessibility to traditional IS journal papers. If a paper were available in two places and in two different forms, it would be more visible than if it were available in only one place or one form. Additionally, one could use the research brief format to update and explain the effects of papers (on research and practice) and, thus, make valuable contributions to the literature. Although one can write research briefs using traditional print-based papers, few research brief-type papers exist. An entire submission category devoted to research briefs could encourage authors to submit more papers of this type than any traditional print journal has afforded.

Sixth, teaching materials submissions could act as a quick-review repository for teachers seeking to refresh their knowledge of topics they must teach in IS. Journals with this section could also provide a means of standardizing learning materials across institutional boundaries. Individuals and organizations have expended considerable effort do so with massively open online courses (MOOCs), which have started to revolutionize content delivery (Boyd & Kasraie, 2013). Indeed, *The New York Times* named 2012 "the year of the MOOC", and the *Chronicle of Higher Education* called MOOCs the "campus tsunami" and argued that "college may never be the same" (Boyd & Kasraie, 2013, p. 87). However, the leading organizations running MOOCS (EdX, Udacity, and Coursera) are tightly controlled and do not allow open submissions from the public or provide double-blind peer reviews. Allowing for a peer-reviewed system to develop course material might result in higher-quality material because multiple parties (authors, reviewers, and editors) at multiple institutions can refine it.

Seventh, teaching materials and tutorials submissions would provide a way for clinical (teaching) faculty to make scholarly contributions in areas of their expertise without having to wade through the rigor requirements in academic writing and publishing. Such contributions from clinical faculty could be helpful to a university's teaching environment especially because they publish state-of-the-art materials that supplement teaching.

Eighth, using YouTube would enable individuals to immediately and interactively discuss publications. Every YouTube video has an area for comments directly below the video viewing frame. Thus, using video could make literal the engaging in a conversation metaphor of scholarship by building on the interactivity of e-journals envisioned by Kling and Callahan (2003). If necessary, a journal officer could regulate the comments section by preapproving all submitted comments or even blocking repeat offenders. However, we believe that, with transparently identifiable commenters, the community would naturally police itself, which would make overhead for monitoring unnecessary.

Ninth, print journals have physical limitations. Even after a journal accepts a paper, it does not guarantee publication in the near future. A paper may not appear for a year or more. Such backlogs are unfortunately the rule for *MISQ, ISR, JMIS, EJIS, ISJ*, and even *JAIS*, which ironically still follows a traditional publication process despite being electronic. However, with an online provider such as YouTube, one could make each video could available immediately when the editor approves it (after the review process), which would reduce the wait time between acceptance and publication to virtually nothing. This process would not only be faster but also, by cutting out the traditional print-production process, be less costly than traditional journals (Kling & Callahan, 2003). Special issues might be an exception to the "publish immediately" model if editors decide to publish a playlist (a set of related videos published at the same time) on a particular topic.

Tenth, European countries, elite grant institutions, and elite universities have increased pressure for journals and authors to provide open access content[13], which poses another challenge to traditional print journals. This practice also continues to spread in the United States in medical grant research as mandated by the National Institutes of Health. Perhaps the greatest bellwether of this trend is some of the most elite institutions' requiring their faculty to provide open access content (e.g., Harvard University, Massachusetts Institute of Technology, University College London, Queensland University of Technology, University of Minho, University of Liege, and ETH Zürich). Research has shown that open access papers appearing in traditional journals receive much more cites than non-open access papers in the same journals (Gargouri et al., 2010; Harnad & Brody, 2004).

One of the greatest challenges with the open access trend is that many open access journals do not have an ISI impact factor from Thomson Reuters, which is an increasingly important measure of journal quality (Lowry et al., 2013), and, relatedly, many are not ranked in their respective fields. This issue is not insurmountable, however, because Thomson Reuters does list a good number of open access journals in all major fields, and this trend is increasing. In fact, the largest open access journal in the world, PLOS ONE, successfully operates under the pay-to-publish peer review model and achieved a highly respected ISI impact factor of 3.234 in 2014 while publishing 30,000 papers in the same year.

Moreover, increasing numbers of high-quality print journals with ISI impact factor ratings provide open access. The downside is that they charge authors exorbitant fees for this service. For example, most *IEEE* journals will publish papers as open access, but the authors must pay US$1,350 to US$1,750 per paper (IEEE, 2013). Similarly, *EJIS* currently charges authors US$2,600 for open access publications. These fees are not minor given the research budgets of most academics. Given the cost pressures faced in academia, such practices could escalate such that only elite institutions or academics with large research grants could afford open access content in quality journals. YouTube has the potential infrastructure to deal with this pressure in a cost-effective manner (e.g., via advertisements), which could eliminate exorbitant fees and provide open access.

Last, but only speculatively, the review process for videos may be less daunting than for traditional journal papers. While the total time investment for reviewing a traditional paper and a video may be equivalent, the initial (first pass) investment of the SE, AE, and reviewers (to get the gist of a video submission) could be 15 minutes or less (because of the length restriction). Thus, initiating the review process would feel much

[13] For example, in 2013, the U.K. Higher Education Funding Council for England proposed a mandate that, after 2014, all peer-reviewed journal publications must be openly available in the authors' respective institutional repositories regardless of where or how the papers was published in order for the given paper to "count" in the "Research Excellence Framework" that assesses the scholarly contributions of all British universities (Sweeney, 2013). Despite the protest of for-profit publishers, similar, even more aggressive initiatives have begun to sweep Europe, which has made open-access publication increasingly widespread.

less demanding for the review team and the editors compared to the familiar daunting task of reviewing a traditional journal paper. Given their short runtime, one may be able to more easily and quickly extract a video submission's intellectual contribution compared to a traditional print paper. Ideally, one can easily determine a traditional paper's contributions, but we argue that such well-written papers are the exception, not the rule.

7 Potential Limitations and Solutions

Multimedia conveyed through video would certainly not be a panacea for conveying all types of scholarly contributions. Our proposal has several limitations, which we discuss in this section with potential solutions. Despite these challenges, we believe the value video would add would outweigh its potential drawbacks. Future research and publishing efforts need to address these issues more directly to help academia adopt new media formats.

First, video would clearly be a new format for disseminating scholarship. Like all radical changes, many would view such an effort with skepticism until it proves its worth, which is a long-recognized hurdle for electronic journals. However, video's novelty and potential may be able to entice high-profile editors and submitters from the beginning, particularly if high-profile journals or the AIS embrace it. Acquiring quality submissions from excellent scholars requires a gradual and incremental process that starts with good, experienced editors capable of shaping submissions with potential into quality work, which then attracts submissions of a similar high caliber. This process will take time, but it is doable as has been the case for *JAIS*, which has risen rapidly in journal-quality rankings (Lowry et al., 2013; Lowry, Romans, & Curtis, 2004). However, if video submissions are to add a unique value that traditional journal papers do not provide, then the ideals of rigor and quality are not unrealistic but a matter of time and commitment. To jump-start this agenda in the beginning, journals that embrace these new formats need to invite high-profile authors to submit content, or such journals may need to focus on the more naturally fitting submission types for the video format (e.g., keynotes, panels, tutorials).

Accordingly, during the formative years of the endeavor, journals that embrace new media may also need to minimize the investment required to publish videos, which they could achieve by emphasizing publication in some sections with more relaxed review standards (e.g., tutorials, research briefs, and teaching materials). Tutorials would likely garner many citations (and views) and would not require substantial time investments from their creators. Tutorials would also be popular because of the common use of methods (employed by a majority of scholars) that are particularly well suited to a tutorial submission[14]. Young scholars who may be eager to translate seminal scholarly works into a video format could drive research briefs. In addition, authors who may want to elaborate on a topic they previously discussed could motivate research briefs. Teaching materials would likely have a high view-count, which would increase the visibility of the publications they appear in. Again, such an effort would benefit most if embraced by the AIS and/or by elite journals. If the AIS supported the initiative, and with senior AIS members as editors of these types of submissions, the concept would have some immediate credibility and would also be immediately visible to the primary target community.

Second, YouTube videos are not as searchable as PDF files. However, YouTube has recently implemented an "interactive transcript" function, which automatically transcribes every video. Users can click on a dropdown menu immediately below the video to view the transcript and click on a phrase to move to the corresponding point in the video. One can also search these transcripts. Currently, the automatic transcriber function is not perfect (i.e., it does not always recognize the words in the video correctly), but transcriptions and search functionality will inevitably improve over time. Additionally, authors can edit the transcript to ensure its correctness, or they can upload their own transcript. Creators can also insert anchors in the description box below the video frame to jump directly to key parts of the video.

Third, the People's Republic of China and some Middle Eastern countries continue to block access to YouTube and other public video providers. Academics and consumers routinely overcome this barrier by using a virtual private network (VPN) or an IP-cloaking service, which are freely available online. Nevertheless, the barrier could be a major limitation to using YouTube as the content infrastructure for video submissions. In particular, Chinese scholars' output has increased. Their being unable to view published scholarly videos would decrease not only the reach of the publications but also the likelihood of someone

[14] Consider, for example, the Gaskination YouTube channel, which provides SEM and other statistics tutorials. The videos on that channel have garnered over 2 million views in the past four years.

in China submitting a video for review. Conversely, transcriptions to other languages, such as Mandarin, could facilitate additional reach to such scholars and provide further incentive for them to access the channels through VPNs. An option to overcome this issue is to reproduce the content in YouKu, which provides similar features as YouTube but is available in China.

Fourth, creating videos requires equipment (e.g., a microphone and screen-capturing software) and skill. One can purchase microphones of sufficiently high quality for less than US$30, and screen-capturing software is equally inexpensive (e.g., http://screencast-o-matic.com is US$15 per year). It may be appropriate and beneficial to hold workshops at *ICIS* and *AMCIS* on how to develop video presentations. Whether or not video achieves viability, such special workshops would likely attract significant attention and participation, which could contribute to the groundwork for such an initiative. The annual Academy of Management conference conducted a professional development workshop on this topic in 2013. On announcing such an initiative, one could first add an entire set of tutorials on how to create such videos as tutorial submissions.

Fifth, videos require spoken English, which is perhaps difficult for authors who speak English as a second language. Many such authors already struggle with written English. Thus, requiring well-spoken English would add to their burden and create additional dissemination barriers. However, authors do not need to narrate the video personally—they could hire a fluent English speaker just as they would hire a copy editor or transcriptionist. To make this approach less cost prohibitive, they could hire out the job to a crowdsourcing service such as Amazon's Mechanical Turk.

Last, and perhaps less of a "limitation" and more of a "critical issue that we need to resolve" is how to attribute credit and value to scholarly contributions that are not print-style journal papers. The whole system around author, article, and outlet impact is built around citations. Although videos can be cited and likely increasingly will be, would that be the best or only measure of impact? Initially, citations alone may have to suffice as an impact measure, but, as the medium becomes more ubiquitous in the scholarly community, some consideration must be given to the impact relevancy of a video's "likes", "shares", comments, and the view count. How many views equal the value of one citation? Does a video that garners extensive debate and discussion in the comments area receive equal impact rating as a video that garners no discussion? Will view count be a new measure of scholar impact alongside citation-count? For example, when the tenure and promotion committee judges the impact of a faculty member, will the fact that this faculty member's videos have been viewed 100,000+ times play any role in deciding whether they are an influential scholar? Additionally, citations may better reflect the impact of some types of submissions, while views may better reflect the impact of others. For example, research notes, commentaries, dialogues, and briefs may be highly citable, while tutorials and teaching materials are likely to garner relatively more views but perhaps fewer citations. Scholars and publishers make strategic decisions based on the way they calculate impact. Thus, it is an absolute necessity to evaluate early on the potential of these additional measures.

8 Conclusion

The current academic publishing process disseminates only one form of scholarly contribution: print-style papers. As a result, the current tenure and promotion process recognizes only this one form of contribution. Further, science at large advances only by this single type of contribution. As a scientific community, we are doing ourselves a great disservice by ignoring the insights, artifacts, discoveries, and conversations that naturally occur in the scientific process of advancing knowledge but that do not fit into the narrowly defined form of print-style papers. By failing to recognize, reward, and publish the wide variety of scholarly contributions that do not suit the print-style paper, we hinder scientific progress, devalue important and necessary contributions to science, and demotivate these types of vital contributions. In this issues and opinions paper, we propose a viable model for disseminating all meaningful scholarly contributions through multimedia delivered in video format. For the welfare of the scientific community, we intentionally rock the boat with regards to the way we conduct, recognize, and disseminate scholarly contributions. Sustainability into the digital age necessitates our reevaluating current practices.

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Appendix A: Audiovisual Resources

Making screen-captured videos has never been easier than it is nowadays. In this appendix, we briefly explain five examples of easy-to-use resources for making video presentations. To demonstrate the relative ease of creating one of these videos, we have created a simple tutorial demonstrating Prezi as the presentation software and Screencast-o-matic as the video capture software. One can view the video at http://www.youtube.com/watch?v=ZrGewwTAUEY.

Screencast-o-matic

Screencast-o-matic is screen-capturing software that records everything that happens on one's screen, microphone, and webcam. One can switch off the microphone and webcam separately. The tool allows for dummy-proof video editing, including the option to overlay annotations, insert a new video or audio, clip video or audio, speed up, slow down, or fade out (among other functions). The tool records in 1080p high definition and allows for online storage and automatic uploading to YouTube, Vimeo, and other popular video sites. Screencast-o-matic costs only US$15 per year. Here are some examples of videos made using Screencast-o-matic:

- Intro to Screencast-o-matic: http://screencast-o-matic.com/u/h/start-recording
- Multigroup moderation in SmartPLS: http://www.youtube.com/watch?v=-BI8VweLQPc

PowerPoint video capture

One of the best-kept secrets of Microsoft PowerPoint is that can record full HD video presentations. By selecting the "record slide show" option in the "slide show" tab, users can record a full presentation, including all slide transitions, animations, and audio narrations. The user can then save the recordings as a video file using the "save and send" option. Here is an example of the use of this feature:

- Variables and Factor Analysis: http://www.youtube.com/watch?v=R-jg026t0F8

Prezi

Prezi is a PowerPoint alternative that enables the user to create "zooming" presentations. The entire presentation exists on a single canvas (instead of on a set of slides). The presentation follows a zoom-in, zoom-out sequence to focus on different parts of the canvas. One can turn a Prezi into video by using screen-capturing software, such as Screencast-o-matic. Here is an example of a Prezi video:

- Summary of Lowry et al. (2013): http://youtu.be/LZQIDkA-ke0

PowToons

PowToons is an animated version of PowerPoint. It provides a video and audio timeline for easy editing. Its creators designed PowToons specifically for animated PowerPoint presentations. However, the learning curve for PowToons is a bit steeper than for PowerPoint. Here is an example of a video created using PowToons:

- Intro to PowToons: http://www.youtube.com/watch?v=XokhlijAAI0

VideoScribe

The animated white-board videos popularized by RSA Animate have become common. One can create these videos painstakingly by hand or use VideoScribe. Here is an example of a VideoScribe video presentation:

- Intro to VideoScribe: http://www.youtube.com/watch?v=tK0qhy3Np_Q

Appendix B

Based on our experience of developing multimedia instructional materials[15], we contend that it is not reasonable to expect academic researchers to develop the skills of aesthetic design, instructional design, and multimedia technology development just as it is not reasonable to expect multimedia experts to develop the skills of an accomplished academic researcher. Instead, the challenge (and opportunity) is to harmonize those two sets of specialized skills, which one can do in a cost-effective and efficient manner by following an asynchronous, remote process of content development. In that process, a "media expert" (ME) (i.e., one who has the requisite skills in aesthetic design and instructional design, and an ability to grasp complex academic content) collaborates with the author (i.e., the subject matter expert (SME)) to shape the content into a form that emphasizes coherent cognitive processing as supported by visuals. This process benefits from using content development models. Table 4 summarizes an effective and largely asynchronous process of developing multimedia materials that uses a story-centered design to convey complex content:

Table B1. Process for Developing Story-centered Multimedia Materials Remotely and Asynchronously

Step #	Description
1	**Interview the subject-matter expert:** the ME interviews the SME via Skype or a similar technology. This communication may be the only synchronous communication throughout the entire process. To avoid the distraction of taking notes, the ME audio-records the interview and immediately thereafter creates a transcript.
2	**Create a first draft of the story-centered content:** in a few days, the ME reorganizes the contents of the transcript into a story that is faithful to the SME's telling but that follows a narrative arc in ways that a conversation typically does not.
3	**Iterate to a near-final story draft:** the SME and the ME iterate by email to create a "near-final draft" in two or three days. The objective is to settle on the arc and outcomes of the story while (in the interest of speed) letting the final script emerge from step four of the process.
4	**Develop the video animations**: this process requires complex knowledge about storyboarding (i.e., using images and concept maps and to support the explanation of the complex content and the telling of the story that conveys the SME's process of scientific discovery), instructional design, aesthetic design, and more.
5	**Develop the soundtrack**: once the animations are finished, the ME sends the final script to the SME for recording. This process has mechanical, content-management, and aesthetic considerations.
6	**Edit the audio; develop the videos:** a mechanical process of combining the edited audio with the animations to create the animated video. The most laborious piece of this step is synchronizing the audio with the animations.

[15] The third author designed such a process and has used it successfully for three years in developing multimedia instructional materials for a globally ranked blended learning MBA program. The first coauthor has uploaded over 175 scholarly videos to YouTube and has a large online presence and following.

About the Authors

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