13 NEW COMMUNICATIONS OPTIONS:
A Renaissance in Videoconference Use

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Abstract

Distance education has changed over the decades from a largely isolated, paper-based learning experience to one where rich visual and aural interactions with peers and teachers are now possible. Mitigating the effects of distance has been at the forefront of many who manage, design, teach, or learn with distance education. Video communications can in many ways address these effects. Internet Protocol (IP) video communications have become more relevant than ever as students and their teachers seek to interact with one another as they go about their learning. Renewed interest in communication tools has predominantly arisen due to increased access to the Internet, and on one level represents a renaissance. Further, there are environmental, technological, and economic drivers that will increase the use of internal-based video communications. However, many who teach or manage distance education do not have access to the knowledge and skills that make for effective and efficient use of video communications. A starting point is the discussion of issues and factors key to the scalability, sustainability, and pedagogical considerations of video communication in distance education contexts.

Introduction

It has been argued that the history of distance learning in higher education can be described as a series of generations, and that each new generation is defined by changes in practice and/or changes in

technologies (Caladine, 2008a; Nipper, 1989; Taylor, 2001). In the first generation, known as the correspondence model, students received largely text-based materials via mail and had little, if any, interaction with one another or the teacher. In some cases, interactions with their peers and teachers were provided through blocks of intensive residential experiences, but these were not available for all courses and could not always be attended by all students. Perhaps some of the blame for the high attrition rates that characterized correspondence courses could be ascribed to this lack of opportunity to interact. Later generations of distance education were characterized by technologies that provided opportunities for interaction with content, in the form of audiotapes and videotapes, and later, learning management systems. Subsequently, possibilities for person-to-person interaction increased. Initially these technologies were audio technologies, such as two-way radios, audio-conferences, and audiographics. It is generally known that early experiences with videoconference were often characterized by users' dislike of being "seen" by a camera, and the experience of e-mail and other computer-mediated communications has been that being able to see participants is not a necessary prerequisite for effective and efficient communications. However, being able to see the reactions of others is an important aspect of interaction, and over the past twenty years or so, videoconferences have become increasingly popular for mediating distance. As the technology improves, there is a renaissance or renewed interest in using IP for videoconferences. Higher education has thus far been the biggest user of video communications worldwide, and this is predicted to continue and spread across the increasing variety of software solutions (Greenberg, 2008).

Drivers for the Uptake of Video Communications

Synchronous communications technologies, whether for personal use or for use in organizations or education, are at a watershed. While audio has been the default for many years, the use of video for two-way communications is increasing for several disparate, coincident, and substantive reasons.

Costs

A common form of visual communications, videoconference, became popular in distance education in the late 1980s even though the high costs of ISDN[1] often kept the bandwidth low, resulting in poor picture quality. However, many factors have caused a continued increase in videoconference use (Greenberg, 2008). In particular, these include the savings due to the change from ISDN to the Internet. Around the turn of the millennium, connections to the Internet became fast enough to support high-quality videoconferences, and the last few years have seen higher speeds that afford further increases in picture and sound quality. Today, high-definition cameras and screens are becoming the standard in videoconference technology, primarily due to the small price difference between standard and high-definition videoconference appliances. The change from ISDN to the Internet for video communications changed the cost structure with particular implications for education providers. ISDN lines were, in the main, owned by telecommunications companies that typically charged on the basis of cost per line and cost per kilometre or mile. Thus, the cost of ISDN videoconferences increased with the distance between the connected locations as well as the number of lines used to improve quality, often making it prohibitive for everyday teaching and learning activities. The cost structure of the Internet is independent of the distance between locations. Thus, for the same quality, a conference between adjacent buildings will typically incur the same network costs as one that connects countries on opposite sides of the world. Testing[2] in 2002 showed that a videoconference from Australia to the UK cost in the order of $1,200 AUD per hour using three ISDN lines and about $1.50 AUD per hour using IP. Further cost advantages are achieved by multi-campus institutions that own their networks. In these cases, once the infrastructure is in place, the network costs are those of maintenance.

Climate and Economic Change

Issues around global warming and climate change have encouraged many institutional leaders in education and commerce to rethink the necessity of business travel. Videoconference and its higher-quality

counterpart, telepresence, provide more environmentally friendly alternatives that are also time-saving. As access to these technologies for students as well as academics and researchers is becoming easier, their uptake is set to rise. At almost the same time, the world has entered a period in which the economies of many countries are slowing or are in recession. It is reasonable to assume that resulting hard times will make many business personnel reconsider the costs of travelling to attend face-to-face meetings. Anecdotally, and at least in the authors' institutions, the trend is to cease or limit travel and opt for videoconference or telepresence.

Video is becoming the standard in interpersonal communications

For many years, telephony was the standard for synchronous communications between distant parties. However, the technology of traditional telephony is not as entrenched as once thought. Many organizations have made the change to Voice over Internet Protocol (VoIP), in which the Internet is used for telephonic communications. This has two distinct advantages. First, the cost structure of the Internet (as mentioned above) can deliver cheaper long-distance calls. Second, organizations can reduce their infrastructure costs by having only one network to install and maintain. Following immediately after Voice over IP is Video over IP, and the advertising material indicates that many VoIP providers are including video communications applications with VoIP solutions.

In addition to the use of Voice and Video over IP by organizations, the past five years have seen a marked rise in the use of VoIP and Video over IP for personal communications. A recent survey of university students (Caladine, 2008b) showed the use of video communications applications gaining on audio. Popular communications tools such as Windows Messenger and Skype, as well as video communications embedded in social software, were becoming popular. For example, Tokbox and Friendvox are video communications applications that can be embedded in Facebook. Further, the survey indicated that nearly 80 percent of the surveyed students used the applications for an average of 8.6 hours per week.

The year 2008 marked the fifth anniversary of Skype, one of the world's most popular IP communications technologies. When Skype was first launched, it was audio only. In the ensuing years, video communications became an optional extra. The latest release of Skype reveals a change in emphasis to a video communications tool that has the option be used as an audio communications tool.

Other recent changes that will create upward pressure on the usage levels of video communications are the proliferation of 3G mobile telephones and the transition of communications applications from audio to video. The recent release of the Apple iPhone in Australia was met with extremely high levels of uptake (as in other countries), and as 3G mobile phones are also Web browsers, they can be used as Video over IP devices. In Australia the number of mobile phones (or cell phones) has exceeded the total of the population, and 3G mobile phones outnumber older generations of this technology. Combinations of tools such as Personal Digital Assistants (PDAs) with 3G mobile capacity and installed applications are becoming attractive to university departments (e.g., medicine, education, engineering) where students are regularly on remote practicums and need to engage with fellow students and staff to complete required learning activities. The convenience of these tools will create additional pressure for high-speed wireless/mobile networking across Australia and elsewhere in the next five to ten years.

Challenges for Distance Education

These three categories of drivers indicate that video communications for organizational and personal use will increase, and is predicted to increase in higher education by 24 percent over the next few years to 2013 (Greenberg, 2008, p. 90). While this is good news for the suppliers of the technology and for the environment, it poses challenges for those engaged in distance education. These challenges will be economical, technical, and pedagogical. Economical and technical challenges will relate to the sustainability, scalability, and interoperability of applications and appliances. Pedagogical challenges will arise from the need to develop appropriate teaching and learning

practices. A repeating dilemma will arise with each new wave of technology: should this be used for formal education or is it a personal/social tool better left in the realm of informal communication? From a practitioner's point of view, the challenge will come from the need to be flexible, adaptive, and innovative. In other words, the need is to rapidly develop new understandings of pedagogies to best utilize the person-to-person interactivity of emerging technologies (chapters 2 and 6). Some commentators go further and argue that new pedagogies are required. These pedagogies will respond in new, innovative, and pragmatic ways to disciplinary and contextual needs (chapter 5; Smyth, forthcoming).

In the past, videoconference appliances were technologically fairly similar. Although the brands differed, they basically transmitted and received audio, pictures of participants, and computer images. The move to Video over IP adds opportunities and complexity to this by

(a) permitting connections from webcams as well as from videoconference appliances,
(b) providing other functions such as collaboration through the use of digital canvasses, and
(c) providing applications that integrate video communications with telephony, text, computer applications, and social networking solutions using Presence.[3] These are often referred to as Unified Communications (UC).

Although videoconference has been used for some years, in many cases the use has not been informed by rigorous research leading to sound pedagogical practices. Videoconference has frequently copied typical lecture-hall formats of didactic information delivery rather than exploring approaches that are interactive and oriented towards knowledge construction. When considered alongside the combination of factors outlined above, the importance of social constructivist (Vygotsky, 1978) approaches to learning in higher education, which recommend such activities as peer collaboration, reciprocal teaching, and people learning from the experience of others (Schunk, 2000),

should prompt much rethinking about the place of interaction in distance education. A key aspect of this is the consideration of approaches to capitalizing on the capacity of video communications to reduce isolation and increase the personalization of learning experiences for distance students. Indeed, there is now scope for the empowerment of distance learners and an opportunity to offer a much wider choice of strategies intended to enhance and support learning (Smyth, 2005; Smyth & Zanetis, 2007). Indications from the research literature are exciting. Many practitioners are beginning to explore the possibilities that video communications create, especially where connectivity is widely accessible by the vast majority of students.

Signal strength (or bandwidth) and picture quality will remain a challenge for those reliant on shared networks or satellite connectivity, such as in developing nations where internal mobile networks are proliferating rapidly on increasingly congested networks where bandwidth cannot be guaranteed. The personal experience of one of the authors in the Royal Kingdom of Bhutan indicates that connectivity is possible, but satellite up/download lag and poor signal strength result in ephemeral, small-sized images appearing without audio.

Further, in many cases, the management of videoconference installations has not been characterized by scalable and sustainable business models. Data from a current project investigating the use of video communications/rich media technologies across the university sector in Australia[4] confirms that many institutions are being left behind as video communications technologies proliferate outside the sector and are increasingly demanded by students and staff for use in learning and teaching. There are two aspects to this trend. First, institutions have generally acquired video communications technologies for particular projects or purposes and are just beginning to integrate them into institutional planning strategies, facilities, and teaching practice. Thus, cost-benefit analyses, business plans, and funding models are in their infancy and are often characterized by a lack of clear information about what is being used or planned for use across institutions. Second, policy support is similarly lagging alongside the lack of coherent operationalization and management strategies. Among many issues,

readiness factors—including staff awareness of the potential for the technology as a pedagogical tool—are now becoming a focus for institutional planners.

Videoconference in Teaching and Learning

Videoconference has traditionally been seen as a tool for one-way transmission: lecturer to many students (Laurillard, 2002), although proponents of videoconferencing have long argued for its use on the basis of encouraging interactivity and interaction between participants (e.g., Andrews & Klease, 2002). This perception of transmission has been and remains a limiting factor for videoconferencing for teaching and learning activities even though there is a solid pedagogical basis for using it for guest lectures and other enhancement activities in distance learning. As the scope of videoconference grows beyond stand-alone rich media technology and into the realm of unified communications, preconceptions need to be shed in order to embrace the new capacity for engaging two-way video communication. Lecturers recognize the benefits of videoconferencing for a variety of purposes (Smyth, Stein, Shanahan, & Bossu, 2007), including higher degree research supervision, teaching to students on international campuses (Macadam, 2005), and research. Many are anxious for network connectivity and institutional infrastructures to enable seamless connections to remote students so that they can encourage student-to-student interaction. Internet connectivity has increased the potential for innovative pedagogy, signalling an opportunity for new rather than amended approaches (Smyth, forthcoming). Importantly, cost structures that bring connectivity within the reach of most distance students should further enable new pedagogies to emerge.

The place of video communications as tools for social constructivist approaches to teaching and learning is expanding as the reach of technologies extends via broadband, mobile, and wireless connectivity. As these tools increasingly extend to 3G phones and other mobile devices as outlined above, and the expectation for video and audio communication as part of the teaching and learning process increases, the demand for including mobile technologies in the learning process is growing.

This is creating the need for institutions to extend and strengthen wireless networks and to create learning and teaching spaces that are flexible enough to include the integration of these new technologies into teaching and learning activities.

Data[5] also show that videoconferencing is successfully used in situations where universities have established networked sites across multi-campus locations both nationally and internationally or for remote students to access university services from study centres. Videoconference is an important component of multi-location teaching in some institutions, such as the University of Wollongong, which has campuses on the south coast of New South Wales, and Central Queensland University, which has campuses in several central Queensland centres. Metropolitan institutions have been less enthusiastic adopters of videoconference despite the rapid uptake of learning management systems to enable off-campus study. However, there are some examples of metropolitan institutions using videoconferencing to teach to international campuses, either to provide a particular learning experience (e.g., indigenous law at the University of Queensland) or to engage in twinning or other offshore teaching and learning agreements.

Other successful uses of video communications in distance education include the growing number of collaborations between universities and other institutions to offer courses or programs that traditionally have small numbers and have become commercially unviable for offer by a single institution.[6] These collaborations also offer opportunities for distance students to engage with a wider variety of experts and peers. The use of video communications in this way is leading to a merging of physical and virtual teaching and learning spaces. This will create further challenges for institutions in the design and fit-out of learning spaces.

Videoconference Technology

The cost structure of videoconference (and to a smaller degree, video communications) costs can be predicted with some degree of accuracy. However, before a meaningful discussion of these installations can begin, a conceptual understanding of the technology involved in

videoconference is necessary. Videoconference appliances typically have:

> cameras to capture images of local participants,
> screens to display images of remote participants,
> microphones to capture local audio, and
> speakers to replay remote audio.

Videoconferences in their simplest form connect appliances at two locations. Such videoconferences are called *point-to-point* and may have one or more participants at each location, as shown in Figure 13.1. Often, however, more than two locations are connected to the same videoconference. In such cases, another device called a *bridge* or Multi-Conference Unit (MCU) is required to enable all participants to see and hear one another, as shown in Figure 13.2.

Figure 13.1
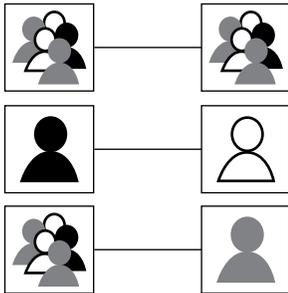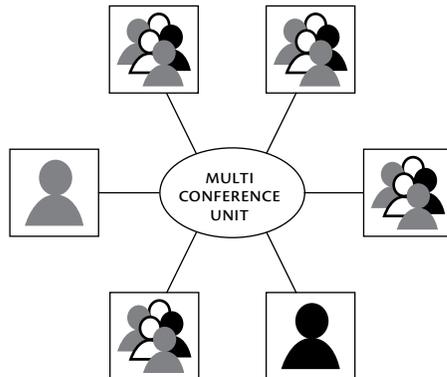Point-to-point videoconferences

Figure 13.2
A multi-point videoconference

As Internet applications such as Skype continue to evolve, the infrastructure required to send and receive signals in point-to-point and multi-site conferences will become less significant, however, there will be a need for standards, or some bridging mechanism, if the increasing variety of commercial applications is to enable seamless connectivity between dedicated videoconference networks and Web-based applications.

Management of Videoconference

Sound business practices need to be involved in the management of video communications if they are to meet higher levels of use in a financially sustainable manner. Further, to cope with the predicted growth, video communications installations must be designed and installed in such a way to scale up to future usage levels without the need for expensive re-installations. Preliminary analysis of data gathered to date in the Leading Rich Media Implementation Collaboratively Project (2007–2009) funded by the Australian Learning and Teaching Council (ALTC) indicates a trend towards the centralization of management into information communications technology directorates, and concerns with the lack of information about the proliferation of brands, forms of UC technology, and realistic plans for ongoing issues, such as the cost of maintenance contracts and the use of recurrent funding for technology purchases.

Cost and scalability

To effectively manage an expanding videoconference installation, a clear idea of costs is essential. The costs involved with owning a videoconference installation fall into several areas: videoconference equipment purchases, network or traffic costs, training, operation, and maintenance. Financial planning for videoconference installations can be reasonably straightforward as the costs of endpoints and Multiple Conference Units (MCUs) are relatively predictable.

Apart from deals that may be done — for example, for the supply of multiple units — videoconference endpoints have discrete costs that vary from brand to brand. So it is quite simple to budget for endpoints in an expanding videoconference system: the more endpoints the higher the cost. This is illustrated in Figure 13.3 as the cost of each additional endpoint is represented as a step in the graph. Scalability of MCUs is only slightly more complex than that of endpoints. MCUs generally have a fixed number of ports, which indicate the number of concurrent connections. That is, a twenty-port MCU can connect up to twenty endpoints in a number of discrete conferences. It can bridge one conference of up to twenty endpoints, four conferences of five

endpoints, or multiples of conferences and endpoints that are equal to or less than twenty. The first step in Figure 13.4 indicates the cost to purchase a MCU as a fixed amount for three connections up to twenty (for example). After that, another MCU is needed, and hence the costs step up once more. For applications with only a small number of connected endpoints (often less than five), endpoints can be supplied with a multi-point function built in.

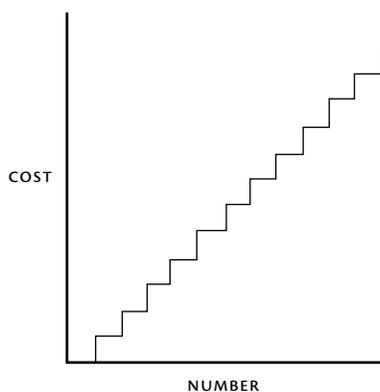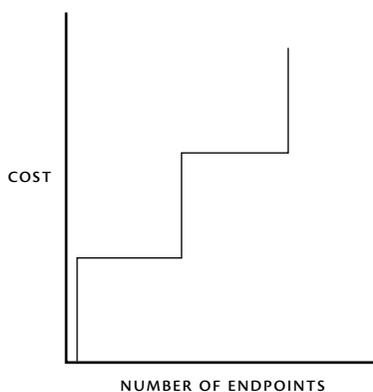**Figure 13.3** Scalability of endpoint costs   **Figure 13.4** Scalability of MCU capacity

While equipment costs can be easily predicted and planned, as shown, the costs of support can vary widely and depend on many factors. These factors include the operational skills of videoconference participants and the size of the installation. These factors do not operate in isolation, and often there can be efficiencies gained by training participants in basic operation skills and then adopting a centralized approach to support. Distributed support is defined as the presence of a technical or operational support person and replacement equipment at each endpoint. This is in contrast to centralized support, where the technical/operational support person or persons are in one location and communicate with the other locations via telephone, videoconference, or other means. Centralized or distributed support personnel can access the MCU and hence assist in all aspects of the videoconference.

A centralized support function usually requires the purchase of an additional endpoint and computer equipment to access the MCU. Thus, centralized support has a fixed associated cost. For small installations, the distributed support model can be cheaper than a centralized one, as the support person uses the local participants' endpoint. However, there is a point where distributed support becomes more expensive than centralized support. This is shown in Figure 13.5 where the two lines intersect.

Figure 13.5 Support costs
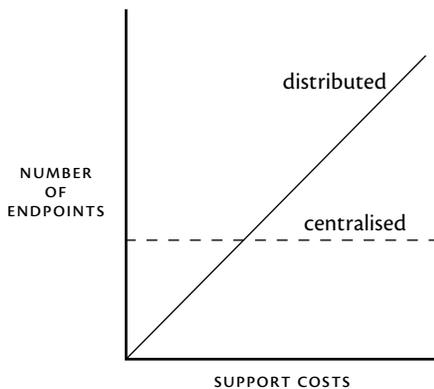
In distance education, videoconferences are often used repeatedly during a teaching semester. In such cases where the participants will be using the videoconference technology frequently, cost efficiencies can be attained by training participants in the operational aspects of the videoconference technology, as this will reduce the need for operational support. This approach has pedagogical benefits as well, as when students are confident with the technology, they are likely to use it more effectively. For example, newcomers to videoconference are often reluctant to use the controls to frame the image they are sending. This can result in small images of participants on a large screen of little or no communicative value. However, when students are comfortable with the technology, they are more likely to frame reasonable images of themselves, thus optimizing the communicative value of the videoconference.

Sustainability considerations

At first, videoconference was marketed to organizations as a way to reduce costs through the reduction or elimination of travel. In recent times this has been complemented by a marketing approach that touts videoconference as a means to reduce organizations' carbon footprints, and some videoconference manufacturers use this as a central sales point. For example, see the Green Manifesto published by Tandberg, a manufacturer of videoconference technology (Tandberg, 2008). For distance education or multi-campus institutions, the cost-benefit analysis is a relatively simple one in which the costs of travel to regional centres or the employment of academic staff at those centres is compared to the costs of videoconference equipment purchases, training, operation, and maintenance. However, little reliable data are available to aid decision-making. There is a need for work to be done to develop and disseminate viable and sustainable models for adopting video communications.

Future Research

It appears safe to assume that the use and uptake of videoconference technologies will grow in the near future. A further safe assumption is that other video communications tools will become mainstream mechanisms of communication in organizations. These tools include Unified Communications and in particular Collaboration. UC was referred to earlier as the bringing together of a range of existing and new communications applications, and the hype suggests that businesses can benefit from them. One vendor suggests that UC "combines all forms of business communications into a single, unified system that provides powerful new ways to collaborate" (Cisco, 2008). Another states that Unified Communications "will transform business in the coming decade" (Microsoft, 2008).

If UC has transformative advantages for business, the question must be asked: can UC deliver similar advantages for distance education? The recent Wainhouse Research Segment Report (Greenberg, 2008) indicates that "these technologies [are] uniquely suited to distance and e-learning" (p. 11). However, the following questions must be asked:

> Are these aspects of UC appropriate for distance education?
> What benefits do these aspects of UC bring to distance education?

Unified Communications typically include video communications that use webcams and computers, thus facilitating video communications from participants' desktops, and it is easy to imagine the efficiencies that are possible with this technology. The communications can be unified with collaboration tools that use digital canvasses, also on desktops. In the context of distance education, these questions must be asked:

> Will UC replace appliance-based videoconference?
> What is the role of online collaboration (with video communications)?

Perhaps one of the greatest technological challenges will be provided by the single-user model of UC; that is, one person to a computer or endpoint. While this is not a problem for small meetings of up to eight to ten participants (and hence eight to ten windows on each participant's screen), how will it work or indeed can it work in distance education? Preferably, the single-user model should become a tool for group work and few-to-few communications that enhance learning. The benefit of visual interaction is lost when participants cannot clearly see others' faces, so caution is encouraged when considering uses of such applications.

   Telepresence is yet another video communications technology that has not been fully explored for use in distance education. Telepresence installations are very expensive to purchase and operate, and generally cater to meetings of twelve or fewer participants. The experience of meeting in telepresence is very close to that of meeting face to face, as the pictures are of high quality. Further attention to furnishings and room layout creates images and sounds of the distant participants that are lifelike. In business, telepresence installations are effectively used for small meetings. As they cater to small numbers, the use of telepresence installations in distance education is probably limited and the cost benefit not as positive as that of videoconference. However, their

use in distance education should not be discounted without thorough investigation.

While there has been some limited investigation of the role of mobile technologies in distance learning, this is an area that is set to expand rapidly, particularly in relation to video communications. The expansion of wireless networks and the increasing flexibility and power of mobile devices means that these mobile technologies will become common in the distance education landscape. However, there are many challenges for institutions in adopting these technologies for teaching and learning, including managing potentially "disruptive" technologies and finding ways around the current lack of interoperability between mobile devices.

Clearly, significant levels of investigation are required if, in the future of video communications in distance education, these new communications technologies and their integration with computer applications are to be recognized and taken advantage of.

Conclusion

The use of video communications for distance education is experiencing a revival — perhaps a renaissance of sorts — as the growing availability and reliability of such technologies and improvements in cost structures enable the widespread use of the Internet to support such technologies. Mobile technologies, student expectations, and the increasing flexibility of teaching and learning activities within and between institutions is further driving the uptake of video communications for distance and other forms of teaching. However, to ensure the sustainability and scalability of the use of video communications, many factors need to be given thoughtful consideration, in particular the development of business models to thus support these technologies. The development and implementation of appropriate pedagogies that utilize the interactive and collaborative capabilities of video communications technologies is a vital aspect of the successful use and sustainability of these tools.

NOTES

1   ISDN is the Integrated Services Digital Network, a network of digital communications lines operated by telecommunications companies.

2   Data from UNE network administrator

3   Presence is an application in Unified Communications suites (and also found in many video communications applications such as Skype) that reports the availability status of individual users to the rest of the networked community. Typical Presence options are: available, away, and busy, but when a participant's presence indicator is linked to their diary the Presence can indicate when the participant is expected to be available.

4   Leading Rich Media Implementation Collaboratively: Mobilising International, National and Business Expertise funded by the Australian Learning and Teaching Council (survey data from 19/37 universities).

5   Ibid.

6   Ibid.

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