Hallway

An application to promote social presence via asynchronous video

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ABSTRACT
Online education is expanding quickly and has proven to deliver content on par with traditional institutions. However, a significant portion of the value of the educational experience comes from developing social connections among peers and mentors. These connections help criticism to be delivered constructively, students to feel comfortable sharing new ideas, and to build a student's professional network. A proof of concept application was developed to demonstrate the feasibility of increasing social presence in an online classroom. The prototype shows that current technologies can deliver a web-based application which encourages the exchange of asynchronous video messages in a professional environment, thereby increasing social presence in groups working in distributed configurations.

Author Keywords
online classroom, social presence, asynchronous video, community of inquiry, transactional distance

INTRODUCTION
One of the largest differences between traditional and online education is how student-student and student-instructor interaction is mediated. Whereas most interaction in residential programs occurs face-to-face, the majority of interaction online takes place in text based formats. This change in communication mechanism can influence both the content and effect of interactions. While text based methods can promote benefits that are difficult to achieve in person, such as asynchronous interaction, basic non-verbal communication cues are lost when messages are delivered via text [19]. Communicating with the same richness that in-person conversation achieves has been difficult to facilitate online.

High speed internet connections no longer constrain online communication to just text. There have been a proliferation of video conferencing applications which enable synchronous face-to-face communication. Unfortunately, these types of applications remove one of the most valued qualities of online education–the ability to work when it is convenient. And while some asynchronous video messaging platforms exist, none seek to enable professional communication in the educational context.

The goal of this project is to develop a proof of concept application which delivers asynchronous video messages and thus promotes the development of social presence among students and instructors. The application, called *Hallway*, is available to demo at `https://hallway.andrewjesaitis.com`.

RELATED WORK
A great deal of study has focused on the role of social relationships in online and distance education. These relationships can be viewed through two different models: Transactional Distance [15] and the more recent Community of Inquiry [8] Model. Both models arise out of Social Learning Theory proposed by Bandura [1]. The theory states that students process new information by experiencing the consequences of their behavior both directly and vicariously. Furthermore, social support structures are central to developing critical thinking skills [4].

Transactional Distance
The Transactional Distance Model proposed by Moore states that students need to interact with the material, instructors, and each other to decrease the feeling of distance between the student and the content [15]. The author describes that the interaction with the content is similar to the interaction with one's self, as arguing and wrestling with material takes place as an internal discussion. This discussion is also valuable when it takes place externally with an instructor or especially with peers. Interactions with fellow students not only help students to understand the material but also help to develop other soft skills that are critical to future success.

Community of Inquiry
The Community of Inquiry Model proposed by Garrison helps to explain the differences between traditional correspondence courses and the online classroom [8]. It can be seen as a three-legged stool to describe a successful educational experience. First, students must participate in sustained discussion to construct meaning and solidify what Garrison terms *Cognitive Presence*. Next, *Teaching Presence* must be developed by instructors by providing a framework for students through course structure and guidance. Finally, students must develop *Social Presence* by projecting their personality into the community.

Garrison notes that *Cognitive Presence* can be easily fulfilled through text based communication and *Teaching Presence* depends on course construction and perceived instructor involvement [8]. While, students can attempt to build *Social Presence* through written messages, a great deal of meaning

is lost in this mode of communication when compared with in-person discussion. For example, Borup found that many instructors refrain from using humor online for fear of being misunderstood [3].

Vesely et al. attempted to determine the most important aspects of the Community of Inquiry Model [22]. They found that different groups prioritized different elements of the framework. Instructors tended to view *Social Presence* as the most important aspect, while students most valued *Teaching Presence*. The authors posit that students measure the educational experience based on interactions with instructors, while teachers evaluate their own performance based on how students explain the material when they interact with each other. Crucially, online, this interaction is often limited to discussion boards so it is the only informal evaluation measure that instructors have.

The Importance of Social Interaction

When communication occurs solely via text many of the non-verbal cues conversation participants use vanish. Researchers have found that subtleties like humor [9], self-disclosure [6], and non-verbal recognition like smiling [7] are key elements of communication. Studies have estimated that more than two-thirds of communication is non-verbal [12, 14]. Even if this percentage is an over-estimate, a significant amount of data is lost in the translation of a discussion from a spoken to a written mode.

As mentioned above, participants are reticent to use humor in contexts where the cost of misunderstandings are high. This reluctance harms group formation because humor is a building block for relationships [7]. Richardson and Swan found that students in groups with a high degree of cohesion learned more [17]. Therefore, facilitating natural interaction is critical to student success.

Perhaps, an element even more important than humor in the classroom is trust. Garrison argues that *Social Presence* is important for precisely this reason. Without strong social bonds students are afraid to take risks when expressing new ideas and are less inclined to collaborate with other students [8]. Cutler discusses that one basis for the development of trust is the reciprocal disclosure of personal information [6]. This disclosure is more likely to occur in an environment where students see each other as people rather than as forum posts.

Tu and McIsaac found that increasing *Social Presence* increased online interaction among students [21]. Thus, the establishment of *Social Presence* can lead to a virtuous cycle where students interact and share more online further developing their online personality.

Developing *Social Presence* benefits the student-instructor relationship as well. In a qualitative study, Borup found that using video helped to increase positive feelings between students and instructors [3]. Griffiths additionally found that video helped students feel more connected with their instructors [10]. This increase in *Social Presence* can support *Teaching Presence* since students will be more comfortable asking for help if they have a better relationship with their instructor.

Asynchronous Video in the Online Classroom

Researchers have sought to increase *Social Presence* within the online classroom by incorporating video. Griffiths found that students enrolled in an online version of an educational technology class that used asynchronous video, rated the course significantly better than the on campus version [11]. The negative comments for the online course focused on the poor usability of the employed technologies (Windows Movie Maker and email) and not on feelings of disconnect or a lack student interaction. Additionally, he found that using asynchronous video encouraged a collaborative learning environment and student motivation, while allowing students to get to know their instructors and receive individualized feedback.

Asynchronous interaction has been shown to allow students to be more reflective in their work. Hrastinski found that students reported that the ability to consider the material before responding helped them to learn the content [13]. Stein reported similar findings that having enough time to reflect on course content drove students to explore the material more deeply than they otherwise would have [20].

Asynchronous video has additional advantages over synchronous interaction especially when examined with respect to different student personas. Borup found that introverted students valued the ability to carefully construct their thoughts and not have to compete with vocal students for speaking time [2]. Additionally, for students whose first language is not English, they found that it helped them develop English speaking skills. These advantages occurred while still gaining the benefits that a synchronous video service provides. For example, Borup notes that extroverts often find it difficult to express themselves effectively online in writing and prefer a spoken communication medium [3]. Finally, procrastinators benefit from seeing their instructor as a real person who will hold them accountable [2].

Moridani found no significant difference in student performance between sections of a pharmacogenetic pharmacotherapy course taught using synchronous video-conferencing and asynchronous video streaming [16]. Students in the asynchronous section reported feeling that the organization of the course was better, despite having a lower overall satisfaction with the course. The overall preferred delivery mechanism for both sections consisted of a mix of pre-recorded lectures followed by live question and answer sections. Additionally the response rate to the survey was nearly double for those in the asynchronous section, which might suggest a higher degree of engagement with the material. The authors suggest that one reason for the satisfaction disparity may have been that the technology was more difficult to use in the asynchronous section. This interpretation is consistent with the usability findings that Griffiths noted [11].

PROBLEM DESCRIPTION

Given the previous work in the field, it seems that increasing *Social Presence* would benefit online education. Furthermore, research has shown that video can enable students to build their online personality and help students and instructors see each other as people rather than as a username. Mixed evidence exists if synchronous or asynchronous video is best

at achieving this goal. However, students generally value the flexibility that online education provides [18], suggesting that holding all else equal asynchronous video would be more helpful to students.

Therefore, the problem that remains consists of two main elements: context and usability.

With respect to context, a problem existing messaging solutions face is the reluctance of users to intermingle personal and professional communication. In other online areas users have dealt with these differing contexts by maintaining analogous services for both parts of their life. For example, many users have distinct work and personal email addresses or professional and personal social networks. Thus, any messaging service for education needs to focus on serving the more formal communications market.

As previous studies have noted, the biggest hurdle to effective adoption is usability [8, 16]. With the advent of the smartphone which provides seamless video recording and sharing capabilities, it is simply unacceptable to require users to find tools and develop work-flows that allow them to interact over video. However, the smartphone or tablet is a poor primary interface for educational work since much of student's and instructor's time is spent at a desktop or laptop computer completing and reviewing assignments. This distinction does not preclude the possibility of mobile interaction with a video messaging service, but in a professional context it is unlikely to be the main device that is used for interaction.

PROPOSED SOLUTION
In order to address the usability and context concerns, a web application was developed. The application was developed using the Django Web Framework [23] and the React JavaScript Framework [24]. These frameworks were chosen for their ability to develop rapid prototypes.

Since usability is a primary concern for this application, development focused on providing users with a natural interface for interaction. The first concern that had to be overcome is the technological burden that users suffered from in previous implementations. For example, in Griffiths and Graham's trial [11], users were required to record their message in one program, transcode the video into an acceptable format, attach the file to an email, and then send the message. This process is fraught with difficulty and users are likely the experience problems with camera drivers, video formats, and attachment size all before even viewing another student's message. Then when opening messages students would need to contend with video codecs, video storage, organization of emails, and the possibility of receiving viruses when opening large files. Even when using web-based video hosting solutions like YouTube (https://www.youtube.com), users still need to figure out how to record a video and encode it in a format that the service accepts.

All of these issues can now be overcome by using a modern web application. The recent release of the Media Capture and Streams API [5] enabled the implementation of a completely browser based application. Moreover, this API and
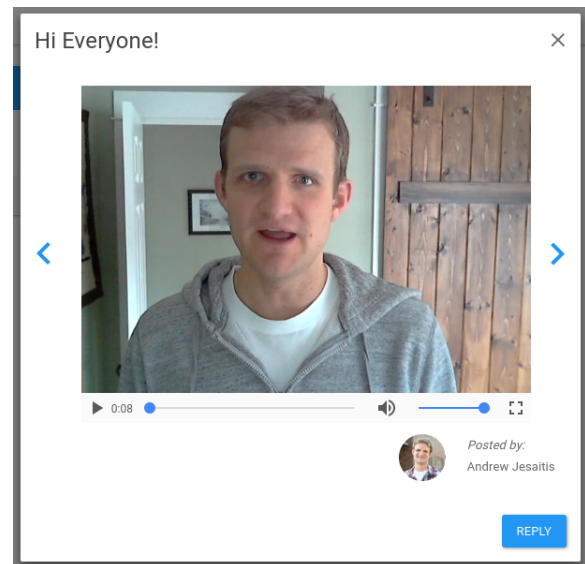

Figure 1. The player interface provides controls to view previous and next messages and to reply to a discussion. By default the player will play all of the messages in a discussion automatically in succession. This design allows the user to listen, rather than navigate the interface, when interacting.

associated standards eliminates the need for additional plug-ins when recording and viewing videos, further reducing the burden on the user.

The user experience of the application is equally important as the production experience. The goal of the the application's interface is to provide a simple set of controls to allow users to record a video and not distract from the viewing of other student's messages.

A single "camera" button floats in the lower right portion of the screen and clicking it brings up the recorder interface. The user is prompted to input a title for their message and then can record their video by clicking the "record" button. Once they click "stop," the user can either choose to re-record or upload the clip. Finally, removing the ability to edit videos promotes the creation of imperfect clips, which serves to further humanize the participants.

Videos are organized into topics provided by the original poster and sorted in reverse chronological order. To view a discussion, users click a topic and the corresponding message begins to play instantly. Following the original clip, replies are played automatically as shown in *Figure 1*. This auto-play presentation style is meant to mimic how discussions naturally progress. At anytime the user can reply to the discussion by pressing a single button to record their response. Once the user is happy with the recording they can upload it and it is appended to the current discussion.

The concern for the user's context was addressed in two ways. First, the tool is a standalone service and is not built on top of another platform the user might use for a different purpose. Second, all communication is private to the discussion group in which the user is posting. Sharing posts by other users is explicitly not supported to further build a foundation

of privacy and trust within the application. This foundation is crucial because, as acting as a technological middle man, the application itself has the ability to undermine the development of *Social Presence* outlined previously.

Finally, the application was not designed to be an all encompassing replacement for interaction in online classrooms. Instead, as Moridani reported, students prefer to use a mix of tools based on the activity [16]. Thus, the application would be very useful for initial introductions or conducting office hours asynchronously, but might not be the best choice to ask about assignment deadlines or post topics for the upcoming exam. Effective *Teaching Presence* still requires the judicious application of any technology.

FUTURE WORK
While *Hallway* shows the potential for what an asynchronous video messaging service can look like, it still has many opportunities for improvement.

First, the on-boarding and invitation process could be improved. Currently, a user must create a discussion group and share a code with other users to allow them to join. This process could be simplified by allowing users to be invited via a link which would automatically add them to the group. This change would encourage users to create more ad-hoc groups to be used in situations where a visual medium would be helpful, such as in group projects.

Second, it would be interesting to explore non-linear replies. Instead of every reply being appended to the end of the discussion, each reply maintains a parent. Each discussion would be then be structured as a tree. A simple depth-first search traversal could be used to play replies, however, care would be needed to ensure that the viewer is not confused by where they are in the the conversation.

An outstanding problem in the field of video is providing a good way to search for information contained in the clips. Natural language processing and machine learning provide methods that could help to classify content. Using the terms produced by this classification, an interface to search for information contained within clips could be created. This search would allow the tool to be used in cases where the value of the discussion comes mainly from the information it contains, rather than the interaction itself.

Providing more targeted communication could be useful, as well. It is easy to imagine scenarios where a viewer would like to respond to the original poster in private, for example in a peer feedback scenario. Additionally, a specific mode for two-way messaging could be useful, especially in the case of instructor-student communication.

Another feature of face-to-face conversations that can be both valuable and detrimental depending on the situation is their ephemeral nature. Personal video messaging services like SnapChat (http://snapchat.com) have taken advantage of this idea. Allowing users to choose if they want their conversation to be automatically deleted after a specified period of time or an event like an exam might allow students to speak more freely by removing the fear that the message will exist for the rest of the semester.

Finally, it could be useful to attach documents to posts. This attachment feature would both enable the peer feedback idea mentioned above and allow verbal discussions surrounding an object like a video or link.

CONCLUSION
Fundamentally, education is a complex activity. It requires a community to be successful. Any solution that promises to eliminate the other participants in the community is doomed to fail as it will knock out one of the legs of the legs of the Community of Inquiry Model that Garrison describes [8]. Instead, tools need to be created to leverage the impact that each community member can have in order to support the enterprise.

Distributed classrooms are a challenging environment in which to maintain and even grow the amount of support each student feels from their peers and instructor. It is especially difficult because the current iteration of distributed learning emphasizes educating large numbers of students. This development can easy lead to a depersonalization of education which only increases the transactional distance between students and the material [15].

This challenge can be met by developing tools, such as *Hallway*, which allow students to interact with their peers and instructors using the full amount of communication bandwidth available. Through rich interactions students can build their *Social Presence* which in turn strengthens both *Teaching Presence* and *Cognitive Presence*. Moreover, technology allows participants to interact asynchronously further strengthening one of online education's key assets – flexibility. In fact, this flexibility allows for discussions to occur in a more efficient manner; a unlimited number of students can listen, if not participate, and students are no longer constrained either by time or geography in their participation.

Technology can be a great asset in the progression of education. But, it must be employed to strengthen education's number one most important element: the community.

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