Automatically Generating Online Social Network Messages to Combat Social Isolation of People with Disabilities

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Abstract. We investigate the use of social networks for people with disabilities and their family and caregivers. Loneliness and isolation are problems people with limited communication abilities may experience. Online social networks may help overcome such communication barriers, but there are still many challenges. One challenge encountered by users of assistive technology is a learning curve not only of the user, but of family and caregivers. Our system automatically generates messages that would help answer the question "What did I do today?" and posts some of the user's daily activities with the software to online social networks. The users of our software would be able to post these messages to social networking websites to better enhance their communication with family and caregivers. We report qualitative feedback from a small preliminary user study.

1 Introduction

Information for people with physical disabilities is provided by websites developed and maintained by the government, hospitals, professional caregivers, not-for-profit organizations, and software developers donating their expertise. Some online forums have emerged where people with certain disorders can discuss their experiences. The American and German Multiple Sclerosis societies, the Myotonic Dystrophy Foundation, the ALS Association, and the Paralyzed Veterans of America organization have communities on Facebook, YouTube, LinkedIn, and Twitter, among others. An online community is desirable that cuts across disorders and diseases and focuses on the functional interface needs of individuals with severe movement abilities.

Online social networks can help alleviate problems of loneliness and isolation, but only if the technology works for the individual [1, 2]. Some of the challenges people with movement disabilities face when they attempt to use existing online networks are slow communication rates, inaccessible elements on web pages such as small links or buttons, inability to personalize interfaces, low literacy, lack of privacy (the caregiver is always present), lack of autonomy, and inadequate computer literacy of caregivers [1–3].

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We investigate the use of online social networks for people with disabilities and their families and caregivers. One challenge encountered by users of assistive technology is the learning curve not only of the user, but of family and caregivers. Family and caregivers who are not engaged with a new technology may not be interested in using it. Caregivers may not have time or knowledge to assist or facilitate with structuring the environment for communication with adapted communication technology.

We propose to generate messages automatically that would help answer the question "What did I do today?" The software can keep a log of the user's activities, e.g. what applications they use, what web pages they visit, what stories they read. The user can optionally annotate an activity or item to express their opinion about it (by applying a rating: like/dislike, thumbs up/thumbs down). At the end of the session, the user can update their social network with information and statistics about the session. This posting can include how much time the person used the computer and specific applications, what they liked or didn't like. This allows the user with disabilities to participate in social media and connect with family and caregivers without having to enter a lengthy message with an alternative text entry method.

The use of computers to help people with disabilities communicate has been studied for some time, including the conflicting approaches of message *construction* versus message *storage and retrieval*, and the cyber-liberation aspect of assistive and augmentative communication (e.g., [4]).

Many existing software platforms are integrating built-in social networking features. For example, some online video game platforms incorporate "friends lists" and "achievements" which allow gamers to share their accomplishments of specific feats within video games with their friends. In a sense, this is also a form of automatically generated social networking message.

We work with people who use a mouse replacement interface called the Camera Mouse [5]. This interface tracks head motion to move a mouse pointer on the screen. We have used it with a variety of accessible software. For example, the HAIL: Hierarchical Adaptive Interface Layout [6] provides interfaces that can change and adapt to a user's abilities while employing various applications. The Camera Canvas [7] is an image editing program with large configurable buttons. Preliminary evaluation of this system have been previously reported [8, 9]. Our middle school, high school, and remote users provided qualitative feedback on the proposed system.

2 Preliminary Field Research to Investigate Social Networking for Users with Motion Disabilities

The goal of our preliminary user study was to explore whether automatically generated social networking messages would be welcomed by people with motion disabilities. Our first group of users was students with physical disabilities in a public middle school.

Every student in the school is issued a laptop computer. The technology helps students express themselves since they can more easily convey what they know

if the sometimes exhausting fine motor skills can be removed from written communication. For some students, typing helps them self-monitor syntax by using grammar feedback built into word processing software. For others, text-to-speech features allow them to play back their writing and hear what they have written. Many students often re-read and re-check their written work without seeing errors, but on hearing an error they can instantly recognize it.

The school also uses several online instructional systems to support classroom learning. These systems supply additional assignments, leveled reading activities, and other support. The school features a *points economy* where students can earn "ribbons" for completing tasks or for high scores.

Students are quite engaged with the points economy. Moderately to severely language-impaired students would benefit greatly from having the ability to automatically post messages on social networks relating to their in-school achievements. It would reduce the physical demands and avoid losing messages to errors of syntax and grammar. Instead, it would enable these students to focus on the task at hand and share their ideas, perspectives, and experiences. Possibly even more important, automatic message posting would enable many students to interact normally with the social network. In the school, many special needs students work within the same isolated classroom the entire day. Interacting with a social network, whether that interaction is largely automatically generated or not, could allow them to escape their substantially separate classroom and mingle freely.

Task completion messages would be equally as valuable. For example, many of the classrooms require students to read 25 books per grade level. If an automated message were triggered at the completion of each book, it would not only help keep record of the accomplishment but would additionally serve as a connection with other readers school-wide, beyond the isolated classroom, who are progressing toward the same goal and perhaps reading the same book.

It would also beneficial if the messages could be updated based on the students' daily schedules. For example, a message could state, "Today I had art class," then parents could check the profile and be prepared to talk to their children at home. Providing this prompt would allow parents to interact with their child about the specifics of his or her day.

3 Prototype System Design

The prototype system can integrate with several online social networks to post messages. Such integration is accomplished via publicly available Application Programming Interfaces (API). In order to generate messages, the software must also interface with other software that is being used on the computer. There are several ways this integration can be accomplished depending on the ability to modify the software.

Assistive software designed with integrated social networking features can create the most detailed messages. Other software may either be easily modified or configured to produce logs that can be analyzed to create messages. Proprietary software can be monitored to measure how long it is used.

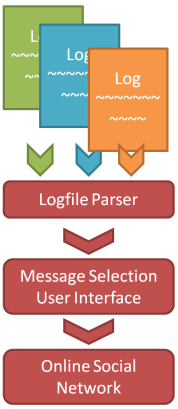

Fig. 1. System flowchart. Each application produces logfiles, which are then parsed to present message options to the user. The selected message is then sent to the online social networking site.

A flowchart of the proposed system is shown in Fig. 1. In the prototype system, the system is more limited: only one log file can be processed and the user interface (UI) presents the user with a choice of sending the message or not. Future work will expand the functionality of software to offer the user more options and more complex messages.

3.1 Custom Software

Software that is designed from start with social features can create the most detailed messages. All that is required is to add logging of interesting events within the software, or to keep track of how long a user uses a specific feature.

Magee and Betke previously presented HAIL: Hierarchical Adaptive Interface Layout [6] (Fig. 2). The software can keep a log of the user's activities, apply a user annotated opinion to the activity, and post it to the online social network.

3.2 Existing Software

Other software may be either easily modified or configured to produce logs that can be analyzed to create messages.

The BlockEscape [10] (Fig. 3) game was created to evaluate a human-computer interaction system. In the game, the user moves a block left and right so that it falls through holes in rising walls. The software stores detailed logging information which can be used to generate a social networking message about the user's gaming session. The level of detail of the message can vary, from general information about amount of time played, to more detailed information such as wins or losses, or how many correct and incorrect movements were made.

Propriety software presents a challenge; one that must be addressed if users want to post messages about any software they use that was not customized

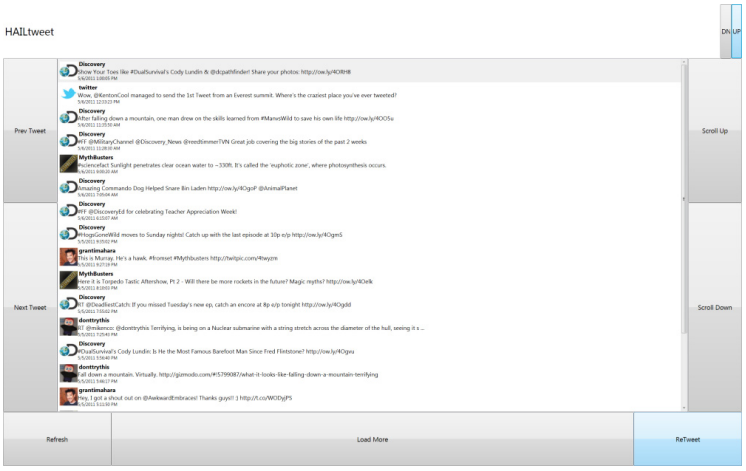

Fig. 2. Screenshot of HAIL twitter client. The large buttons around the edge are used to interact with the social networking site. The middle of the screen is a non-interactive display area. We integrated posting of automatically generated social networking messages within this program.

for this purpose. Without logging functionality, or the ability to modify the programs themselves, there is only a limited amount of information that an automatic message generator can access. One option is to log the active application window title. Another option is to take screenshots at certain times, and then present those screenshots as options to include in the online social networking message. In either case, users would likely be concerned about privacy issues.

4 Case Studies

4.1 Three Middle School Students

We visited a public middle school in Boston, Massachusetts over a 5 month period. Three female students, all age 13, participated in our study. Participant T has spastic cerebral palsy with severe dysarthria. She has limited movement in her limbs and no dexterity in her fingers. She is able to use head-actuated switches, hand switches, and adapted joysticks with her hands. Participant G has cerebral palsy and is nonverbal due to medication side effects. Participant L has cerebral palsy caused by traumatic brain injury. L is verbal and has fair dexterity with her fingers.

Students T and G use a Dynavox [11]. For G, as a primary mode of communication, the Dynavox is becoming the major functional form of communication both in school and out of school. While gestures and vocalizations can convey basic communication needs, the Dynavox help fill this student's need to communicate more advanced concepts. It is an academic tool used for spelling tasks

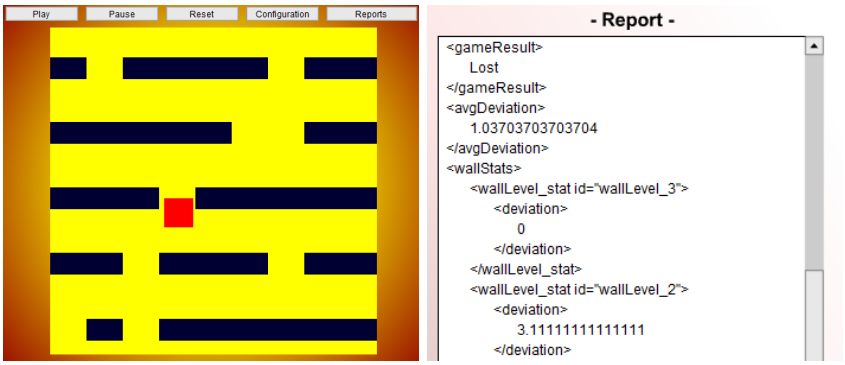

Fig. 3. Screenshots of the BlockEscape game. Left: game screen. Right: report screen.

and participating during class discussion. It also serves as a communication tool in school and in the home, and between the two.

For T, the Dynavox is supplemental and serves as a social tool. As a supplemental mode of communication for the student's limited intelligibility and motor skills, the Dynavox supports social interaction without which the student would likely remain unengaged. This student will not likely use Dynavox as a primary mode of communication because listeners familiar with the speech can understand it and lack of fine motor skills complicates access of the device. Still, the device enables the student to engage others in limited, albeit prepared conversation.

We first conducted evaluation of HCI software usage with the Camera Mouse with participant T. Participants L and G, having seen T use the Camera Mouse and associated software, began asking to try it themselves. This positive social feedback cycle increased their engagement and desire to use the technology. L said "I saw [T] using it and thought 'this looks like fun' so I wanted to try it". It is this social engagement we aim to foster in an online social network.

We observed L using the Camera Mouse to play the game EagleAliens, and then we showed her a potential social network posting (Fig. 4) and asked for her reactions. L does not use the internet at home and was not sure if she liked the idea or not. We asked if she would want to share her score on the game or her work in class with her family or friends, and she replied affirmatively, adding "I think that would be cool, because then they would know how much work I did".

We talked with T and L together. T had been out of school for 5 weeks for medical reasons and had used the Camera Mouse on her own during that time. She indicated that it would have been good to share what she was doing with her classmates while she was away. L said that if they could share their scores, "...she would know what I got, and I would know what she got..." and that would be good "...because we might have something in common." T indicated that if she saw online that her classmates had tried something new, she would be inspired to try it herself.

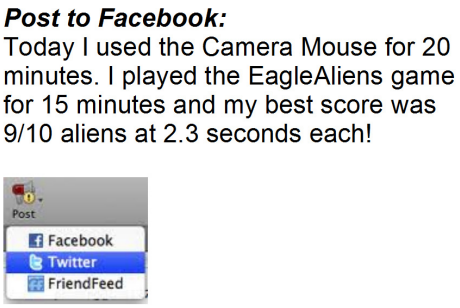

Fig. 4. We showed our study participants this simulated online social network posting and asked them for their reactions

All three participants expressed interest in sharing what they had done at school with family members who do not live with them. *G* also indicated that she would try something new if she saw online that her classmates had tried it.

Lastly, we asked all three subjects how likely they are to use such a feature if it was available in software that they already use. We utilized a 5-point Likert scale, where 1 is not at all likely, and 5 is very likely. Their mean response was 4.6.

4.2 A High School Student

Participant *C* is a 16 year-old male high school student with cerebral palsy. *C* is verbal and has high mobility in his arms and hands. He is very technology literate and enjoys playing video games and using his computer. His typical computer interface involves a touchpad and voice recognition software. He also uses gaming pads to play video games. He said he uses Facebook to keep in touch with his friends from his old high school. We visited *C* in his home to evaluate human-computer interaction software and to receive his feedback.

After using the Camera Mouse with various software programs, we showed *C* the social networking posting message (Fig. 4) and asked for his reactions. When asked if he would use this feature, he responded: "I would like it". We also asked what types of messages he would like to share when he uses his computer, he said that he personally would not want to share his own computer activities but he thought that it would be a good idea for others.

We asked him if he would like sharing capabilities in a program like Camera Canvas and he said that it would be a good idea. We discussed different places to post and he thought Facebook or Flickr would be good. He thought that this share feature coupled with Camera Mouse and the other programs he tried would be especially good for young children with disabilities so that they could show their friends and family what they are doing.

C thought that it was important for users with disabilities to have an easy way to communicate their thoughts online. He said that people with disabilities have things to share and say, communicate and express.

4.3 A Remote Assessment

The mother of a Camera Mouse user told us that her quadriplegic teenage son (D) is very social and would immensely enjoy being able to play a game with his three younger sisters. We engaged in a remote assessment of using assistive technology with this family via several telephone conference calls. Our goal was to tailor our user interface software for the needs of this user.

We developed a customized game called Picture Click Game (Fig. 5). This game displays a user's photographs in a configurable grid layout. In the simplest layout, one picture is displayed on each half of the screen. The picture changes to a new picture when the mouse pointer moves over the picture. In more complex layouts, one target picture is highlighted - the highlighted picture changes when the mouse pointer reaches it. The caregiver can adjust the settings to provide a customized level of complexity tailored for the needs of the user.

This game records mouse pointer trajectories and events within the program. Our software can analyze the log to generate an online social network message describing what the participant did with the game.

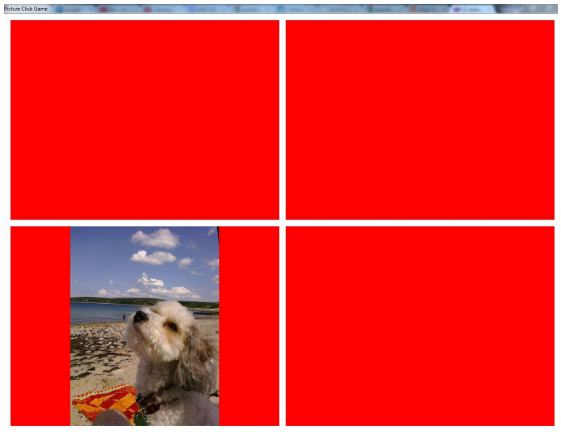

Fig. 5. Screen shot of the Picture Click Game with a 2 × 2 grid layout

5 Discussion of the Use of Automatically-Generated Online Social Network Messages

Home language diversity can be an issue between home and school. There may be a desire to communicate in multiple languages via an online social network. All three middle school students expressed interest in sharing their daily activities with family outside of the country who may not speak English.

Perhaps a bigger challenge than language barrier is the home environment. Students need a proactive and engaged environment, but introducing new technology may be difficult if the family feels overwhelmed. Another challenge is

around access and connectivity: Not all students can use the internet at home. As for in-school log-ins, sites like Facebook are blocked at the middle school we visited, preventing testing of posting actual messages from the school environment. One possible in-school solution would be the use of an online social network dedicated to people with disabilities (e.g., [12, 13]).

An important feature of many of the social networking APIs is that messages are tagged with the name of the software that submitted the message. Such tagging can raise awareness about the availability of different assistive technology software. This may help family members to learn about them and integrate them into their environment.

Privacy concerns could be a roadblock to adopting automatically-generated messages. Our high school participant, for instance, would not want all of his computer activities to be broadcast for the world to see.

We did not address literacy issues with other potential users. Users with literacy issues could benefit from automatically generating messages so that they can participate socially even if they do not have the ability to write messages themselves.

Our discussion with a special education director indicated that her students would benefit from enhancing social interactions through automatically-generated social network messages. She expressed a concern that her students may have problems communicating or travelling for social purposes; online social networking could address these challenges by keeping students engaged with their peers.

6 Conclusion and Future Direction

Automatically-generated social network messages have the potential to address loneliness and isolation challenges faced by people with various physical disabilities. Even then, there are many technological, language, and social challenges still to overcome. We present a system that can generate social networking messages from within assistive technology software. We report on qualitative feedback from our users that demonstrates the benefits of this approach to social networking for some users.

We plan to expand the implementation of our prototype software to provide a fully working system that people will be able to download and use on their own. Once this is done we would like to expand our user study to see if people would use this system in the long term. We would also ask people to opt-in anonymously to share certain log data so that we can collect statistics about the software's usage.

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