Theoretical Computation Simulation

The Implementation of Read Receipts and Social Anxiety

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Megan Bishop, Computer Science

Technical Project Team Members:
Megan Bishop

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Signature _____ _____ Date _ 11/2/2020___

Approved _____ _____ Date _11/2/2020___
Aaron Bloomfield, Department of Computer Science

Introduction

The technical topic focuses on a hypothetical software tool used to teach about the theory of computation, using principles of user experience design to make it more intuitive to the user. Users should be able to simulate various theoretical computation machines in order to enhance their understanding of early computers as well as how these developed into the complex machines we use today. The technical subject of the STS prospectus and the technical topic for the Dept. of Computer Science is not related.

The STS prospectus is an examination of read receipts in mobile messaging, and how they affect a user's level of stress and anxiety in a virtual conversation. An increasingly digital world takes away many of the constraints of in person communication, but in turn can create new pressures that were not necessarily intended with the original invention of communication platforms. Read receipts, notifications, or indicators are signals provided to a user of a messaging platform that the recipient of their message has read it. While an instantaneous response is generally to be expected in face to face or verbal communications, text messaging initially took away this pressure by allowing users time to formulate responses. The introduction of read receipts reintroduced this feature to the digital messaging platform, and furthermore contributes to a new culture of anytime/anyplace availability that expects an average person to be instantly available to anyone who needs them, regardless of what they are currently doing. The prospectus aims to analyze this new culture of constant availability, and examine whether read receipts are a truly beneficial technology, or if the detrimental culture effects make them more stressful than they are worth.

Technical Topic

The technical topic will be completed in the spring, however the hypothetical topic of this discussion will be a tool which combines user experience design and theory of computation as a way to teach basic computation models such as state machines and turing machines. Users should be able to create and test out their own basic computational models, as well as find summaries of the important details/components of each model in order to better understand their construction. With proper implementation, users will learn about theoretical computation and even potentially use the tool to test out complex ideas and algorithms from a theoretical standpoint.

The most important component of this tool is the machine builder, which allows the user to create either a deterministic state machine, a nondeterministic state machine, or a Turing machine of their own design. In order to create the best possible learning experience, users will see an intuitive layout of the different components of each machine type, and be able to directly move around the different visible parts. For state machines, they may create states and transitions, and each new component added will be programmable to determine what each portion of the machine will do. Once complete, they may press a button to execute the machine by providing an input and watching as it iterates through the various stages and transitions they have created. If they wish to create a nondeterministic machine, they may also indicate which states and transitions can be taken simultaneously in an input, and the different iterations of a specific input will be shown in the running of the machine. In the case of Turing machines, they may click and drag along the memory boxes to see what is stored, as well as manipulate each cell's initial value. They may then add their instructions as to how the machine runs and interacts

with memory. In execution, they will see a step by step walkthrough of how the machine runs with their given input and instructions.

Alongside the machine creation will be a help section of the tool, which gives an overview of both what each component should do in theory, as well as how to specifically interact with or add that component to their machine in the tool. This will help users to create their machine exactly the way they want, as well as gain a better understanding of why their machines should be built in a specific way.

With these features, hopefully students and just those who seek to learn more about the theory of computation and how computers were developed can use the tool to enhance their learning. The features will be built intuitively so the tool is easy to use, and the only learning curve is the material itself, not how to use the different parts of the software to create exactly what they want.

Introduction

Imagine you've sent a text to a close friend and twenty minutes have gone by. Usually this friend responds within minutes, so you go to check the status of the message, and the indicator underneath has changed from "delivered" to "read", with a timestamp from ten minutes ago. How do you interpret this? Or, imagine that you've received a text from a new friend that you're trying to get to know, but you have something else that requires your attention at the moment. Do you leave them with the read receipt indicating to them that you've seen it, or do you pause your more important task to avoid seeming like you're ignoring them. How might they interpret your response?

In the modern world, where smartphones have become almost mandatory to daily life, the majority of people have had experience with read receipts. With the rise of digital messaging, it is important to figure out how their implementations can harm or help relationships in the absence of in person interaction. Simply put, remote communication is only valuable insofar as it can help relationships to progress as close to naturally as possible. The digital age has created an environment where people are expected and expect others to be available to them in some form at all times, which can be exhausting, particularly for those who are more inclined to social anxiety. It seems that the use of read receipts could potentially exacerbate this problem even more, as the knowledge that a conversation partner is notified of their message being read amplifies the pressure to reply in a timely manner, therefore forcing the recipient to be more available than they might be comfortable with. On the other hand, sending someone a message and knowing that they have viewed it without replying can cause the sender more stress and make them more likely to misunderstand the lack of communication, which can be overall harmful to both the sender personally and their relationship as a whole.This phenomenon has

potential to be quite pervasive with its widespread application, so it seems to be worth examining to see whether these read receipts truly have a place in modern society or if they are more harmful than they are worth.

Research Question

The proposed research seeks to answer the questions "How does social anxiety affect a user's perception of read receipts?", "How does anxiety increase or decrease when a person's texting partner uses read receipts?", "Are socially anxious people more or less likely to use read receipts themselves?", "How does the initial introduction of read receipts compare to their current usage?" and using these responses to answer the more general question "Are read receipts beneficial enough to a user to outweigh potential insecurities they may introduce into social relationships?"

Literature Review

One of the first instances of the introduction of read receipts was the implementation on Japanese messaging platform Line, in response to the Great East Japan Earthquake in 2011. The intention was for users to ensure that family members were alive and safe by providing instant notification when a message was read by the recipient, thus providing confirmation they had survived. This initial intention was certainly beneficial, and served to maximize connectivity in a time and place where it was crucial to the health of users (Kato, 2017). However, with the subsequent popularization of this feature in mobile communication technologies, connectivity between individuals and relationship building was changed in two important ways: availability anytime and anyplace, and instantaneous connectivity. Researchers used the anytime/anyplace

availability in a 2016 study focused on an affordance study of adolescent relationships (Abeele, Schouten, & Antheunis, 2016). Abeele et. al conducted a survey-based study of teenage students asking how they felt about various aspects of mobile communication, and found that students have both a generally positive view of the constant availability and a higher appreciation of this aspect, correlated with a reported higher companionship with their friends. This makes sense as the increase in availability for communication leads to overall higher rates of communication, and therefore faster relationship building. However, can communication taking place solely over digital messages really equate to time spent face to face? According to another study, this depends on a user's level of social anxiety (Lundy & Drouin, 2016). Researchers in this study found that among three different methods of first-time communication with a stranger, the only method that showed any significant difference in reported connectedness with the stranger was text messaging. Namely, those who had a low score on a social anxiety measure reported lower connection with their partner via text than those with high social anxiety. Overall, there are different and redefined boundaries when communication is moved virtually, as reported by Hertlein (2012), which may partially explain the difference in the perceptions of texting. Between these studies, current research establishes that while personally meaningful connections can be built and grow through solely text-based messaging, there is a distinct split on whether a user considers this to be more or less meaningful as compared to more direct communication, which may prove to be similar to how read receipts are perceived to affect relationships by users.

While certain users report more agreeable relationships built via text, further studies suggest many potential problems in the growing use of text messaging over direct communication, which could be either exacerbated or eased by the presence of read receipts. A study performed in 2007 agreed in its conclusion that more socially anxious people prefer text

messaging to voice calling, but subsequently found that those who score higher on a loneliness index are more likely to prefer calling (Reid & Reid, 2007). It stands to reason that the increased usage of texting versus voice calls can lead to more feelings of isolation, as texting involves much less of the comfort of human interaction. Furthermore, Reid & Reid (2007) found that more socially anxious users reported cell phone use in general was likely to be used as a distraction from feelings of anxiety. This feeds directly into the logic of a 2018 examination of "problematic" cell phone use, which defines this problematic use as treating the cell phone as a means for escape from reality to a detrimental extent (Velthoven, Powell, & Powell, 2018). Interestingly, this study pointed out read receipts specifically as a contributor to problematic use, reporting that users who knew a read notification would be sent felt more pressure to immediately respond to notifications, leading to greater overall use. A similar conclusion was drawn by Mascheroni & Vincent (2016) in an adolescent interview-based study focused on teenagers' perpetual availability via cell phones. A common theme in the interviews was the participants' fear of missing out when they were not able to use their phones, and several reported that this anxiety was amplified both when they are reading messages and receiving read notifications. A subsequent study which sought to examine possible solutions to this problem of anytime, anywhere availability by examining means of disengagement came to a troubling conclusion (Mannell, 2018). Of the possible aspects of messaging or cell phones which could be used to reduce availability (particularly disentanglement and suggestiveness), implementation - while allowing for disengagement - tended to discourage disengagement in their use. For example, Mannell (2018) cited platforms for group chains/text messages as a wide source of perpetual availability for users, and pointed out that many such platforms allow the user to suppress notifications from or leave the group entirely, but in most (if not all), the other users of

the group would be notified of the attempt to disengage, therefore discouraging it. Thus, we continue to circle back to this problem of perpetual availability and resulting anxiety, which is pointed out in multiple cases as being magnified by the presence of read receipts.

As far as studies which examine read receipts specifically, research is scarce, but a few interesting conclusions have been drawn which open to further study. One researcher found that there are correlations between whether users would prefer to receive read receipts or not based on their relationship to the conversation partner (Alhddad, 2015). In general, participants indicated that they would most prefer to have read receipts on from their romantic partners, followed by close friends. Furthermore, participants tended to report that they would specifically prefer not to send read receipts to friends, while they would most like to receive them from new acquaintances. Alhddad's (2015) results seem to indicate that many users relate the use of read receipts to a form of trust, or as a way of gaining information about a new person, given that they were most preferred to be used in very close or more distant relationships, rather than just average friendships. Therefore, in using read receipts with a communication partner, some emotional vulnerability is entrusted or expected from the extra information provided. This is further backed up by a more general study on correlations of emotional reactions to read receipts (Lynden & Rasmussen, 2017). It was found that while some participants in this interview study reported slight positive emotions associated with read receipts, only in that they provide useful information, a range of negative emotions were evoked from both the sender and receiver side. Receivers reported a pressure to respond quickly when read receipts were turned on, knowing that the sender might draw conclusions about being ignored if they read without responding. Meanwhile, senders reported higher anxiety about receiving a reply when their message had been read, as well as increased app checking due to the fact that read receipts do not provide a

notification outside of the app when read. These negative reactions can potentially be explained by the results of yet another study, which examined 3 different indicators of text information: read receipts, delivery receipts, and ellipsis/typing indicator (Earle, 2018). Results indicated that of the 3, the one most likely to be perceived as intentional nonresponse was the read receipt, while delivery could indicate not opening the message and typing could be perceived as accidental. Negative emotional responses seem to make even more sense given this context of perceived intent to ignore. One interesting point to be made, however, is the disagreement between Alhddad (2015) and Lynden & Rasmussen (2017) on how many participants were aware of their read receipts messaging feature or not. The former reported that around a third of survey participants had not even noticed them, while the latter reported that all interviewees were aware of them, though some prompted an explanation prior to agreeing. This may prompt further study of this awareness in future research to resolve the discrepancy.

Studies on the effects of read receipts specifically are severely lacking, but they are an important feature of messaging that can change the experience of communicating virtually. While the feature is critical in emergency situations and useful on a more casual surface level, providing a helpful indicator of message receipt that can help a user determine whether or not a follow up is necessary, there does seem to be evidence that their presence can increase already present social anxieties and social pressure that can already be felt in messaging. Through examination of the existing literature, it is clear that many sources indicate a changed relationship to communication when it takes place over text messaging. The lack of instantaneous response, or pressure to provide one, could in particular bring about extra feelings of anxiety that may not exist in a face to face or voice call communication. Though it may to an extent solve problems for those who have higher levels of social anxiety, the potential additional

problems introduced may not be worth the relief the lack of live communication may provide, particularly when it comes to anxiety caused by read receipts. As such, there is a clear gap in studying the direct relationship of social anxiety and the perception of read receipts in texting. Furthermore, it seems that the majority of relevant studies seem to have been performed on adolescents, so there is room to explore these topics in the context of university students, who have been familiar with the technology much longer. The proposed research aims to bridge this gap by directly examining the interpretations and effects of read receipts in relation to social anxiety in university students.

STS Framework

The problem of read receipts was analyzed from the framework of technological politics by Langdon Winner, as their introduction truly re-framed the social expectations of digital messaging. With such widespread use among varied communities, it's much harder to break down the user base into groups for analysis, so it was more helpful to consider their impact on sociopolitical views and expectations as a whole than specific user categories.

Relatively simple in concept, read receipts were created as an indicator that the person to whom you have sent a message received and read that message. There are many situations where this can prove helpful, such as when you are trying to get in contact with someone for an urgent matter, and are unsure whether to follow up on the message with another form of communication, or just as simple as confirming that your messages are reaching their intended recipient. However, generally the most common interpretation of read receipts is determining whether or not a person is ignoring a message or simply hasn't gotten a chance to read it yet, and this was no doubt part of the design intention. This in turn functions as a way to make virtual

communication more instantly gratifying to users - in other words, it creates a pressure on your recipient to reply as soon as the message is received when they're aware you can see the read status. Generally, this technology is managed by developers of these messaging platforms, becoming available only to those affluent enough to obtain cell phones and other devices capable of distance communication.

The decision making of read receipts is heavily dependent on the platform where they're implemented. On many of the most common platforms (such as SMS or iMessage), it is up to the individual user whether they'd like to indicate when they've read a message or not, and can even tailor this choice to the specific person they are communicating with: for example, turning the feature on for a romantic partner but off for a work acquaintance. Other platforms (such as Snapchat), however, make this choice for the user and implement read receipts into the platform's base concept, with no way to disable the feature. Some even take this concept outside of private communication, going so far as to show users exactly which of their contacts have viewed public posts without leaving users a choice to send or receive this indication. In nearly all cases, the user's choice - if one exists at all - is restricted to whether they will send indicators on messages they've received, not whether they will get them on messages they've sent.

The rise of read receipts and other indicators of a person's status outside of direct communication (e.g. indicators of whether or not a person is online and actively using a platform), have contributed to a decline in an individual's expectation of privacy. When others can always see exactly what you're doing and how you're interacting with nonverbal communications, it creates the expectation that you should always be available to other people, whether you have the time or energy to devote to communicating or not. Though read receipts so far are most prevalent in casual communication, this has dangerous implications should this

feature begin working its way into professional contexts. Already email, phone, and other indirect forms of communication have forced people to take their work home so that fully catching a break from the work environment is near impossible, so migrating this expectation of constant instantaneous responses in non-emergency situations only makes this issue more pervasive. Allowing users the choice to engage is paramount in lessening this effect of the technology and keeping its implementation from altering the culture of virtual communication.

Method

The proposed study will collect primary data through the use of surveys given to undergraduate university students. Participants will be compared by their level of agreement on various statements of feelings on read receipts and their score on a social anxiety scale, such as the Leary Social Anxiousness scale, as used by Reid & Reid (2007). Students will be sampled from the University of Virginia, due to availability constraints, and a goal of at least 100 participants from various student groups - specifically varying club participation and majors - will be set in order to gain a varied sample of those with both high and low social anxiety scores for best results to avoid self-selection bias. Survey will be conducted via Google Forms.

Secondary data will be collected through direct informational interviews with a small number of students from these groups in order to determine in more detail how read receipts affect their virtual communications. These students will be asked about specific scenarios in which they have chosen to use or refrain from using read receipts, and determine their motivations in this choice. This additional data should hopefully provide more context to the primary data collected and identify any possible nuance in the results.

Timeline

The questionnaire will be developed over the coming months, with hopes to be ready for distribution in February. Responses will be collected over the remaining weeks of February as well as the month of March, and data will be organized for analysis in April, leading to completion of the project in early May.

Conclusion

The proposed project will analyze read receipts in mobile messaging platforms, and how various users with different levels of social anxiety react to them. Prior research on the topic has found that read receipts and other pressures that come with digital messaging have come with increased stress for the user, as well as the preference of texting to other forms of communication for those with social anxiety, so this project seeks to fill in the gaps of how specifically college students with varying levels of social anxiety react to their implementation. The survey research is expected to find that the stress caused by read receipts will be even more prevalent in those with higher anxiety. With these results, hopefully a contribution will be made to the question of whether read receipts help or hurt a digital platform, and whether their implementation is worth the potential extra stress they may cause in communication.

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