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22 of May of 2020
Research Proposal

Association between AI recommender systems in Email Communications and Self-esteem

**Introduction:**

Today, people communicate through text messages, emails, and social media. Using these tools people send and receive Artificial Intelligence (AI) generated messages. These messages are made after an AI algorithm reads people's incoming email and recommends them different sentences that they could use to respond. Companies such as Google and Facebook have been improving these predictive models to suit people's interests. Particularly, Google's writing assistant Smart Compose, uses Artificial Intelligence (AI) algorithms to make recommendations to users (Burke, 2002). Scholars have opened discussions about using recommendation systems and some highlight the effect that email communications have in people's self-esteem. However, minimum research has focused on how people perceptions and feelings about such recommendations. Surveys have been used to understand the self-esteem in email users and modeling of neural networks have been used to understand the context of an email to predict responses. Understanding the association between these two factors comes from the complexity of the unique psychologies behind each user. This proposal focuses on the association between the psychological effect that AI systems like Smart Compose have on its users. To obtain data that is relevant to the discussion I propose conducting a survey to examine the association of AI algorithms in email communication and the self-esteem of Smart Compose users.

**Literature Review:**

To explore how AI in self-esteem relate, the role of email communications on people's self-esteem, as well as the quality of recommender systems must established. In previous

research focused on people's media choices, Joinson (2004) asked 265 participants to rank their preferred medium of communication between Face-to-Face (FtF), email, letter, and telephone. Results demonstrated that low self-esteem users preferred communicating via email whereas high self-esteem users preferred FtF interactions. A recent study by Elhai et al. (2017) illustrated a significant association between technological devices and lower self-esteem. This study suggested that young people showed mild levels of self-esteem as a result of smartphone use (Elhai et al., 2017). Overall, the literature suggests that the email sender and recipient interacted solely through a computer or smartphone. Today, AI stands as an additional intermediary. Email relationships have been fundamentally altered, as now users must also manage a relationship with the AI algorithm recommending the message.

Recommendation systems help users make decisions based on knowledge-based data or learned behaviors (Yang, 2006). In their research about recommender systems, Zhang, Yao, Sun, and Tay (2019) suggested machine learning advances allow deep learning-based recommenders to overcome obstacles of conventional models, achieving high recommendation accuracy and popularity. There are three main categories of recommender systems: collaborative filtering, content based, and hybrid recommender system. Only collaborative filtering offers suggestions by first building a user's profile and learning from the user's historical interactions with products, either explicitly (e.g., from previous user rating) or implicitly (e.g., from browser history) (Kherad and Bidgoly, 2020). Latest developments using these technologies is Smart Compose (SC).

This state-of-the-art writing assistant created Google's engineers, raises the question on how the user's self-esteem is involved in the process of responding to emails. SC is a powerful neural networks language model trained on a large amount of e-mail data (Chen, et al., 2019). As

the user attempts to reply to an email, SC provides high quality message predictions and a smooth user experience (Chen, et al., 2019). However, Kherard and Bidgoly (2020) suggested that to improve the quality of the recommendations, explicit feedback about the recommendation is required. A system will use these characteristics unique to each user, to optimize the recommendations made by the recommender systems (Kherad and Bidgoly, 2020). These discussions are based on quality of the recommender systems instead of the user's perspective about the recommendation. Knowing the self-esteem level of SC users will help examine the usefulness of recommender systems by highlighting the user's decision-making process. The number of times one chooses to use SC is relevant because it will optimize systems' prediction.

Research about decision making and recommender systems indicated that having too much choice can lead to consequences that extend beyond increased demands on consumers to process information (Stone, Yates, and Caruthers, 2002). In turn, this could create a dependency to SC systems on users with low self-esteem. More research about self-esteem and decision making suggested that people act to reduce threats to the self when deciding for others as well as for themselves (Wray and Stone, 2005). People with low self-esteem lack willingness to make decisions, resulting in a high potential to avoid making risky decisions (Wray and Stone, 2005). Most of the studies about self-esteem presented in this review used the Rosenberg's Self-Esteem Scale (RSES) (Rosenberg, 1965) to assess the levels of self-esteem of their population. The RSES is widely used in the Social Sciences (Donnellan, Ackerman, & Brecheen, 2016) and consists of 10-item self-reported questions that measures the user's cognitive and affective regard to the self. With that in mind, users of SC who have low self-esteem could be more vulnerable to accepting recommendations that they do not think are useful.

Current literature suggests that recommendation systems like Smart Compose are not tailored to suit people's personalities. The study of Prabhumoye, Quirk, and Galley (2019) verifies this idea suggesting that technologies such as Smart Compose are currently limited to grammar, spelling, word choice, and wordiness. Another recent study talks about how recommendation systems have reacted to explicit user feedback while using a model for rating predictions made by the recommender systems (Shi, Wand, and Qin, 2020). Their method's performance increased but despite their efforts there are still some areas that need improvement. Even with these advancements, what the user perceives about email recommendations is still unknown.

**Methodology and Design:**

AI is becoming so immersed in our day to day email communications that some people tend to overlook to what extent they interact with each other or if it is the AI interacting instead. Due to Elhai et al. (2017), the association between the use of technological devices and lower self-esteem is significant. Therefore, this research will use a pure research approach. As a result of selecting this approach, I will explore if AI algorithms, such as neural networks used in Gmail's Smart Compose impact the self-esteem of college student users of ages between 18 and 25 years old. The method will be the correlational analysis strategy and because I am choosing a quantitative mode of inquiry, a sample size of 1000 college students seems reasonable.

Ehrenberg et al. (2008) studied young people in their 20's with increased levels of low self-esteem. This population reported a preference in communications using technology. Therefore, a population of age between 18 and 25 years old will be chosen for this study. To collect a diverse range of sample population, flyers and post in community colleges and 4-year universities across the Northern Bay Area, Eastern Bay Area, and San Francisco will be created. To increase the sample size, the research will also be advertised through posts on these

educational institutions' social media. Both the flyers and social media post will state the research's abstract question and will be requesting people to participate by indicating their email address, gender, and their age. With the submission of this information the person will be contacted and informed about the research. Then if they are interested in being part of the study, they will be requested to give consent. Once the consent is received, they will receive information about how the survey will be administered. This preliminary data will be categorized based gender (i.e. Female, Male, Non-binary, other) and age. Posteriorly, these emails addresses will be used to communicate the necessary information and tools regarding the design.

In order to administer the survey, data will be collected from the people that use a plug in previously created. This browser extension can be added to all internet browsers (Barth, et. All, 2010) and it will evaluate if the SC system is being used and record the frequency of use of SC. Before the user sends out an email it will prompt them the RSES questionnaire to assess the self-esteem level of people using SC. In order to discover if there is a significant correlation, a quantitative statistical analysis will be performed. The hypothesis is that people with lower self-esteem is expected to use SC relatively more than people with high self-esteem. To discover if there is a significant correlation, a random selection of the data will be used to make a comparison between the self-esteem levels users with low self-esteem and high self-esteem versus the frequency of use of Smart Compose. This will highlight if recommender systems using AI algorithms, such as neural networks, used in Gmail's Smart Compose impact the self-esteem of college student users in the United States with ages between 18 and 25 years old.

For research communities the outcome of the collected data will establish whether people's self-esteem is being accounted for in the development of such tools. The findings of this research will motivate further research as well as the development of systems that take in

consideration how people feel about these new communication systems. For humans to continue to interact with each other, computers should be an accurate medium of communication instead of a filter of information.

**Conclusion:**

Gmail has become, arguably, the email provider that people use the most, and as users of Gmail today, their voice and tone are predicted by AI algorithms. Whether they want to use these predictions is up to their own self-esteem and decision-making process. To analyze the data, a correlational strategy will be used, which will allow to examine how AI and the way we communicate today, relates to people's self-esteem. Because the association between AI recommender systems and its effect on self-esteem are the focus of this research, the mode of inquiry that would help validate the correlation will be the quantitative analysis through surveys. Therefore, the Rosenberg's Self-Esteem Scale will be used to assess the level of Self Esteem in Smart Compose users. This proposal highlights how AI algorithms, such as neural networks, used in Gmail's Smart Compose impact the self-esteem of college student users in the United States with ages between 18 and 25 years old. In doing so, this would highlight the user's perception and thoughts about the suggestions from the automated reply system powered by Google, Smart Compose. Finally, the results will allow scholars to continue the discussion on how email communications using AI recommender systems impact self-esteem and inspire further research in this topic.

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