Chirp: The Impact of Private Online Self-Disclosure on Perceived Social Support

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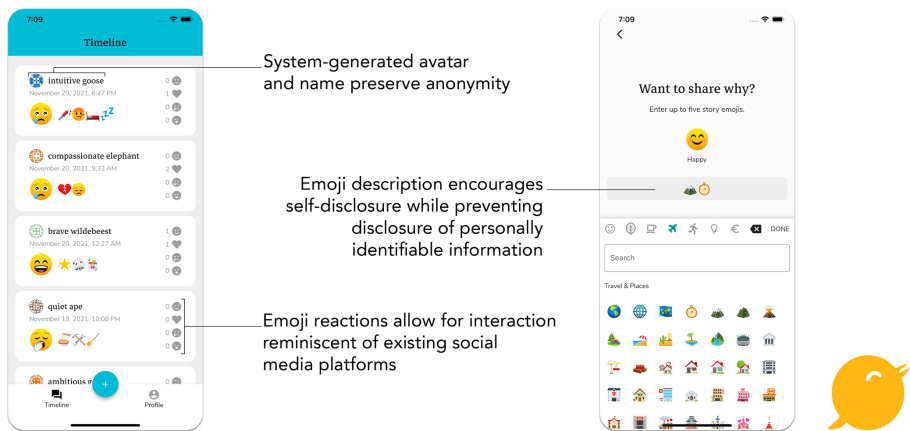JEFF HUANG, Brown University, USA

Fig. 1. The Chirp application is semi-private, sandboxed platform in which anonymous cohorts are prompted to emotionally self-disclose. The application uses emoji-based mood tracking posts, allowing users to self-disclose while still maintaining participant privacy. Shown here are the main timeline (left) where users can see and react to posts by other users, and the mood-posting interface (right).

As social media continues to grow as a space for emotional self-disclosure, it is important to understand whether self-disclosure acts as a causal factor impacting positive outcomes for users. Thus we developed Chirp, an anonymous social media sandbox space designed to explore the underlying effects of disclosure within online spaces. Users in Chirp are prompted to self-disclose moods and emotions using emojis. Through a between-subjects study among a cohort of first-year undergraduate student users on Chirp, we evaluate the effect of self-disclosure within semi-private online spaces on social support. While Chirp use does not show a significant increase in measured feelings of social support, user responses suggest that self-disclosure in Chirp may provide more

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social support than typical social media use or simple mood tracking over a two-week period. Our findings indicate that even in pseudo-anonymous, low-bandwidth communication platforms, self-disclosure may cause increased feelings of social support. This work highlights the impact of communication in semi-private online spaces on perceived social support.

CCS Concepts: • **Human-centered computing** → **Empirical studies in HCI**; *Empirical studies in collaborative and social computing*; Interactive systems and tools.

Additional Key Words and Phrases: social media, online communication, mental health, social support, emotion, sharing, disclosure, mood, tracking, emoji, reflection

1 Introduction

Social media is a common space for communication among undergraduate students—a group known to be at high risk for negative mental health outcomes. While it is generally acknowledged that social media use has a strong impact on mental health and well-being, it is still an open question whether that impact is positive or negative. Social media use has been associated with adverse outcomes such as negative body image [20], loneliness [41], and internet addiction. However, prior studies also show that using social media can reduce rates of depression [18], encourage emotional self-disclosure [2], and provide a space for users to find camaraderie and support [4].

Several theories try to explain the factors that influence these contrasting results. For example, Self Determination Theory (SDT) suggests that people use social media to cover psychological needs that are unmet offline [22, 32, 41]. Social Comparison Theory suggests that comparison of oneself to the online personas of others can lead to negative effects [35]. The Interpersonal-Connection-Behaviors (ICB) Framework also notably proposes that *active* versus *passive* engagement leads to positive and negative outcomes respectively [13]. Across these theories, we see a trend where intent and outside context are the primary mediating factors for expected outcomes. This was similarly observed by Yang et al. among online cancer support communities, where they report support-seeking *intent* through self-disclosure leading to received support through reciprocated disclosure [50].

However, even without accounting for user intent, social media platforms incorporate various design elements that can influence user interactions and subsequently impact outcomes [9, 22, 50]. Many analyses of semi-public and semi-private online support groups show that these groups contain significant self-disclosure and socially-supportive communication (e.g., [1, 4, 21, 24, 51]). While observing cancer support communities, Yang et al. found that users were more likely to self-disclose in *public* spaces; however, self-disclosure in *private* (one-on-one) channels was more strongly correlated to higher levels of actual social support than self-disclosure in public channels [50]. This contrasts previous literature that suggests users are more likely to share emotional content (i.e., emotionally self-disclose) in private spaces [9].

Thus, we first aim to better understand the impact of emotional self-disclosure in *private* and *semi-private* online platforms. We measure perceived social support as the main positive outcome as it is known as a strong protective factor against negative mental health outcomes. This leads to our first research question:

RQ1) How does the addition of regular emotional self-disclosure in a semi-private online space impact perceived social support among undergraduate students?

While Yang et al. attribute social support gains in public and private spaces to supportive responses and reciprocal self-disclosure [50], the same trend has not occurred in other prior work.

One longitudinal study measured the impact of increased posting frequency in a semi-public space (Facebook posts) [18]. While this study found that increased posting frequency did lead to lower levels of loneliness, loneliness was not impacted by response or engagement rates on posts [18]. Thus we question how reciprocity and responses to emotional self-disclosure in semi-private online spaces impact perceived social support among students:

RQ2) How do responses and reciprocal emotional self-disclosures from other students impact perceived social support among students who regularly emotionally self-disclose in private or semi-private online spaces?

To test our research questions, we build a sandboxed platform called Chirp: a semi-private space that prompts cohorts of anonymous users to emotionally self-disclose through emoji-based mood tracking posts (See Figures 1 and 2). Chirp is structured as a mobile application whose primary intention is to act as a safe and controlled space where we can study cohorts of users without the need to compromise participant privacy.

2 Background and Related Work

Work on self-disclosure and social support in online spaces exists within the fields of HCI and psychology. Here we discuss the importance of social support, as well as standard measures of social support used in this study. We further describe previous work that touches on the impact of self-disclosure on social support. Finally, we discuss existing apps, both commercial and in the CSCW and CHI community, that have been used to address questions around the impact of disclosure or support on mental health, well-being, or feelings of connection.

2.1 The Benefits of Online Social Support

Literature in psychology and social science has long shown the benefits of social support. Defined as "an exchange of resources between two individuals perceived by the provider or the recipient to be intended to enhance the well-being of the recipient" by Shumaker and Brownell [42], social support, and specifically *perceived* social support (one's perception of the social support available to oneself), has been tied to many metrics of mental, emotional, and physical well-being [45]. This includes acting as a protective factor that improves emotional resilience in response to trauma [43]. Research has shown that feelings of social support reduce rates of depression and anxiety [45], and are tied to decreased feelings of loneliness [30].

The rise of social media and other online platforms as popular venues for interpersonal communication has led researchers to question the impact of these online communication platforms on feelings of support and other well-being outcomes. Numerous studies have shown the positive effects of online support groups on users (e.g., [14, 21, 29, 46]), including the creation of social support networks over social media platforms (e.g., [4, 21]). Studies have also shown strong correlations between direct online communication with friends or family and feelings of social support [10, 26].

Studies on social support in social media settings have been primarily descriptive, either describing or finding correlations between actions on existing platforms and users' feelings [32, 44]. Thus, in this study we focus on causal impacts that may lead to increases in perceived social support.

2.1.1 Measures of Social Support. Traditionally, perceived social support is measured by the Multidimensional Scale of Perceived Social Support (MSPSS) [52, 53] (shown in Appendix A). However, the questions included in the MSPSS imply in-person and strong-tie interaction and support (i.e., family, close friends, and significant others). To account for the kinds of interaction and connections we see online, Nick et al. developed the Online Social Support Scale (OSSS), a 40-point scale that specifically asks about perceptions of social support in relation to online communities [39] (shown

in Appendix C). Both scales are scored as a sum of all responses, where a higher score indicates increased feelings of social support.

In this study, we use the MSPSS as a measurement of offline levels of social support, and the OSSS as a main measure of changes in online social support.

2.2 Self-Disclosure in Private Online Communication

Many studies have shown that online platforms and social media spaces facilitate self-disclosure in between-user communication features (e.g., [4, 16, 21]). Studies have shown that key qualities of self-disclosure differ over private platforms compared to public platforms. When looking at communication over Facebook, Bazarova et al. found that users were more likely to self-disclose with more intense and less positive disclosures in private spaces than in public spaces [9]. However, in their study of a cancer support community, Yang et al. found the opposite—self-disclosure was more common in public spaces—though this may be a factor of the platform inherently having a cohort of users impacted by cancer [50]. Bazarova and Choi found that users primarily self-disclosed in private messaging over Facebook platforms with a goal of relationship development, as opposed to self-disclosure in public status updates where the main goal was social validation, self-expression, and relief [8].

Self-disclosure in private spaces has notably been shown to have positive impacts on social support. In their study, Yang et al. found that while users were more likely to self-disclose in public communication spaces, when users did self-disclose in private messages they received more socially supportive responses [50]. In a study of college students during the COVID-19 pandemic, Hoefer et al. similarly found increased self-disclosure in private messaging to be strongly correlated with perceived social support [26].

2.3 The Impact of Audience Reciprocation in Online Spaces on Social Support

Given that social media and online communication are implicitly social, it is intuitive that reciprocation or back-and-forth communication is a necessary factor when leading to positive outcomes such as perceived social support. Indeed, some previous work has shown a relationship between reciprocal actions and positive outcomes.

For example, when looking at the relationship between Facebook poster satisfaction and quantity and quality of responses (i.e., likes and comments), Bazarova et al. find that users feel "more satisfied overall when they receive more likes and gratifying comments (i.e., reply satisfaction), while number of comments influences overall satisfaction indirectly by enhancing reply satisfaction" [9]. In contrast, in a between-subjects longitudinal study investigating the impact of increased Facebook posting on feelings of loneliness, Deters and Mehl found that participants who posted on Facebook more frequently showed lower levels of loneliness, *regardless of whether those posts were interacted with or responded to by their network* [18]. The authors suggest a few potential reasons for this pattern, including that "the act of writing itself...might create a feeling of connectedness" as users have their social network in mind while writing their posts. While Deters and Mehl investigate loneliness and here we study perceived social support, this finding raises the question of whether in-platform reciprocal actions are necessary to see positive impacts.

We question the actual impact of these reciprocal actions in semi-private spaces in RQ2. In this study, we compare the impact of non-social emotional self-disclosure (similar to a diary) to social emotional self-disclosure in a semi-private space.

2.4 Existing Disclosure Systems

As Chirp is intended as a social media space in which to study self-disclosure by way of mood tracking, here we discuss existing alternatives. There are many commercial journaling and mood tracking apps that aim to improve users' daily routines and well-being (e.g., Daylio [12]). This also includes

well-being apps with mood tracking features, such as Headspace[1] or Calm[2] [48]. These apps primarily intend to act as spaces for self-reflection and self-improvement, and generally do not include public or social spaces.

Previous work in CSCW has also included tracking systems similar to Chirp. The app Opico, developed by Khandekar et al., uses emojis as the basis of communication, much like we do in Chirp [33]. In the Opico app, users can select a location on a public map and leave a string of emojis as a "reaction" to it. While Opico has more similarity to public social media spaces and Chirp is more reflective of private spaces, reactions in Opico can also encompass emotional or mood-related responses to certain locations. These reactions therefore show similarity to our "Chirp posts". Through the Opico app, the authors find that, given context, user interpretations of emojis can be accurate to the original intent.

Significant Otter [36], and IntimaSea [28] were both created as ways to communicate users' current emotional state to partners or friends that are already close with the user. Significant Otter uses biosignals detected through a smartwatch to suggest animated otter characters that users can send from their own smart watch to that of a partner [36]. By sending these animated characters, users can communicate without the use of text. Similarly, IntimaSea uses automatic stress tracking to share stress levels within a group of friends [28]. However, unlike Significant Otter and Chirp, IntimaSea allows users to share additional content (i.e., text, images, drawings) with others in their group.

While these systems each touch on aspects we address in Chirp, none specifically focus on emotional and mood disclosure and social support in semi-private social media settings. Additionally, popular social media platforms (such as Facebook and Twitter) have existing norms and relationships built between current users, which can impact the outcomes of users engaging with the platforms.

In this paper, we aim to isolate the impact of self-disclosure and reciprocation in semi-private spaces on perceived social support while avoiding confounding factors such as pre-existing relationships (such as those that exist in popular social media platforms). Doing so will allow us to better understand the individual factors in online communication that impact well-being, informing future development of systems that support user mental health. By leveraging Chirp, we can isolate individual factors while investigating their effects in a manner that would be difficult or impossible in existing systems.

3 Developing The Chirp Application To Study Self-Disclosure in Online Spaces

Chirp is an open source[3] mood tracker[4] and social media mobile application that uses emojis as the only form of user expression. It is built as a space to explore a simplified social media system that may allow users to build social support through emotional self-disclosure. The system does not require users to share any personally identifiable information. Moreover, every user must explicitly agree to an information privacy and consent form before using the app. The app is publicly available on the Apple and Google app stores under the name "Chirp Social Mood Tracker".

3.1 Design Considerations

Based on previous work around emotional self-disclosure and feelings of social support (e.g., [26, 34]), Chirp is built to **encourage emotional self-disclosure**. Furthermore, in order to keep our results as generalizable as possible, we **incorporate common social media platform design choices**.

As researchers, we are obligated to protect our participants as much as possible. However, the social nature of the app means we cannot guarantee the interactions participants will encounter

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[1]https://www.headspace.com/
[2]https://www.calm.com/
[3]https://chirp.cs.brown.edu
[4]We note that Chirp asks users the question "how are you feeling?", and includes main emojis that may more accurately be labeled as emotions rather than moods. However, by convention, we use the term "mood tracker" to describe the form of the system.

within the app. Thus, we **preserve participant privacy as much as possible**. This includes preventing users from voluntarily sharing identifiable information. This makes it substantially more difficult for negative interactions to occur during the use of the app, particularly the forms of negative interactions seen in cyberbullying on other social media platforms [6].

During the design phase of app development, we ran four separate user studies to refine the design and test the viability and interest in the platform.

3.1.1 Mood Tracking. Chirp uses the underlying functionality of a mood tracker to encourage emotional self-disclosure. Although we considered alternatives such as messaging apps and online forums, we concluded that an anonymous social mood tracker would offer the best opportunity to safely study the impacts on social support. By including both a traditional mood tracker "profile page" and a semi-public social "timeline" where users can "post", we allow for a non-social version of the app (sans the timeline feature) to look and feel like a completed app for control cases. This simultaneously allows us to provide one of the most common shared characteristics between social media sites, a profile page [23].

Across two separate phases of early user testing, testers were placed into a Discord server[5] and asked to post about their emotional state daily using only emojis (testers were prevented from posting text via an automated Discord bot). While testers reported it was an interesting experience, they complained that the variety of emoji options made it hard to choose an initial emoji to use as a general descriptor. For this reason, along with ease of analysis for research purposes, we implemented the concept of a "main" emoji for mood tracking (See Figure 2).

We restricted users to choosing their "main" emoji from 9 options:

- Happy
- Satisfied
- Excited

- Tired
- Bored
- Stressed

- Angry
- Sad
- Scared

This subset was based on the six universal emotions as defined by Ekman: happiness, sadness, anger, fear, disgust, and confusion [19]; as well as the six moods tested in the Profile of Mood States (POMS): tension, depression, anger, vigor, fatigue, and confusion [37]. To select which main emotions and moods to include, we released a pilot survey asking student responders to report which emotions or moods they had felt that day (from POMS and Ekman), as well as each of the terms rephrased into layman's terms. We additionally added some neutral options, such as bored and content, and asked for any final thoughts. Based on this survey, we included the most referenced options from POMS (fatigue, tension), Ekman's list (happiness, sadness, anger, fear), and our added options or rephrasings (excited, bored, content). We rephrased these nine selected states to make sense as a response to the question "How are you feeling?" as shown in the app (Figure 2). Finally, user testing reports showed that testers were confused by the term "content" (as a state of satisfaction) as opposed to "content" (as the things that are held or included in something); thus, we used the term "satisfied" in our final study design.

3.1.2 Anonymity. Interactions over social media and other online communication are not solely positive [6]. Sharing personal information can lead to negative online interactions or bullying, for example, doxxing [5]. Given the potentially sensitive nature of the posts shared in the app, we keep Chirp anonymous. To maintain anonymity, we: 1) do not collect or display any personal information about users, and 2) do not allow users the opportunity to voluntarily share personal information through the app (for example, posting "my name is <name> I live in <location>"). The latter case is discussed further below.

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[5]https://discord.com/

While we wanted to keep users anonymous, we still wanted to maintain popular elements of social media platforms. This meant including usernames and profile images (i.e., avatars) [23]. To avoid personal information such as names or images of users in the app, we assign automatically generated usernames and avatar images for each user. Avatars were generated using Gravatar[6]. A random combination of an adjective and an animal provided a potentially memorable username and has been used in past studies to identify participants (e.g., [47]).

3.1.3 Emoji Only Communication. To preserve anonymity, we prevent users from sharing personal information in the app. This means that we cannot allow free text in social spaces. We chose emojis as an alternative form of communication since they have been shown to be very understandable given context [33]. In our case, shared context is provided in two ways: all posts in the app are in a specific format describing mood; and, in the study, all participants are first year undergraduate students at the same institution.

Including restrictions on user content is also a trend seen on many social media platforms. For example, Twitter's character limit, or Instagram's requirement that every post includes an image or video. We additionally note that not every social network relies on text, for example, the social networks Yo[7] or Emojli[8]. During user testing, testers expressed that they found the emoji-only requirement to be a fun exercise. We hope this gamified experience felt reminiscent of other social media applications.

We note that to avoid confusion or ambiguity due to different art for Unicode emojis on Android versus iOS platforms, we used emojis from a third-party library called JoyPixels[9]. Thus, all emojis appeared identical for all app users.

3.1.4 Limiting Responses to Reactions. The ICB framework describes how active social media use involves connection promoting behaviors [13]. As Chirp was intended as a social media platform where active use is possible, it needed some form of connection promoting– or interactive– features. As mentioned previously, we do not allow users to enter text in the app to preserve anonymity. Thus we cannot include text comments or responses. Furthermore, comments are an easy way to respond negatively, even without text (consider a user posting about a pet's death and the comment response "😂😂😛").

A different, very common feature in social media platforms is a system of reactions or likes [23]. Examples include reactions on Facebook or in Twitter DMs, likes/favorites on Instagram posts or Tweets, and upvotes/points systems such as on Reddit. Studies have shown that reacts across different platforms can have a positive effect on online communities and interpersonal relationships, and can be socially supportive [11, 25, 29]. Thus we included reacts as a form of interaction and support-showing in the Chirp app.

We chose to include four reaction types: a smiling face, a crying face, a gasping face, and a heart. For these, we chose common reactions among Facebook, Twitter, Instagram, TikTok, and LinkedIn. The exception to this is the "angry react", which is included in both the Facebook and Twitter DM reaction options, but we do not include it in the Chirp app. We identified that the angry react could be used as a negative response, and thus, it was not included as an option. Borrowing conventions from these popular social media apps, users may select only one reaction to a post.

3.2 App Interface Design

When users first log into Chirp, it presents them with our user privacy and consent form. This privacy and consent form informs users that "[their] anonymized data may be used or shared for future research." All users read this form before they are given the option to continue to use Chirp. After

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[6]https://en.gravatar.com/
[7]https://en.wikipedia.org/wiki/Yo_(app)
[8]https://emoj.li/
[9]https://joypixels.com/

(a) Onboarding Screen

(b) Main User Timeline (Social Group Only)

(c) User Profile (Social Group Only)

(d) Main Emoji Selection

(e) Story Emoji Selection

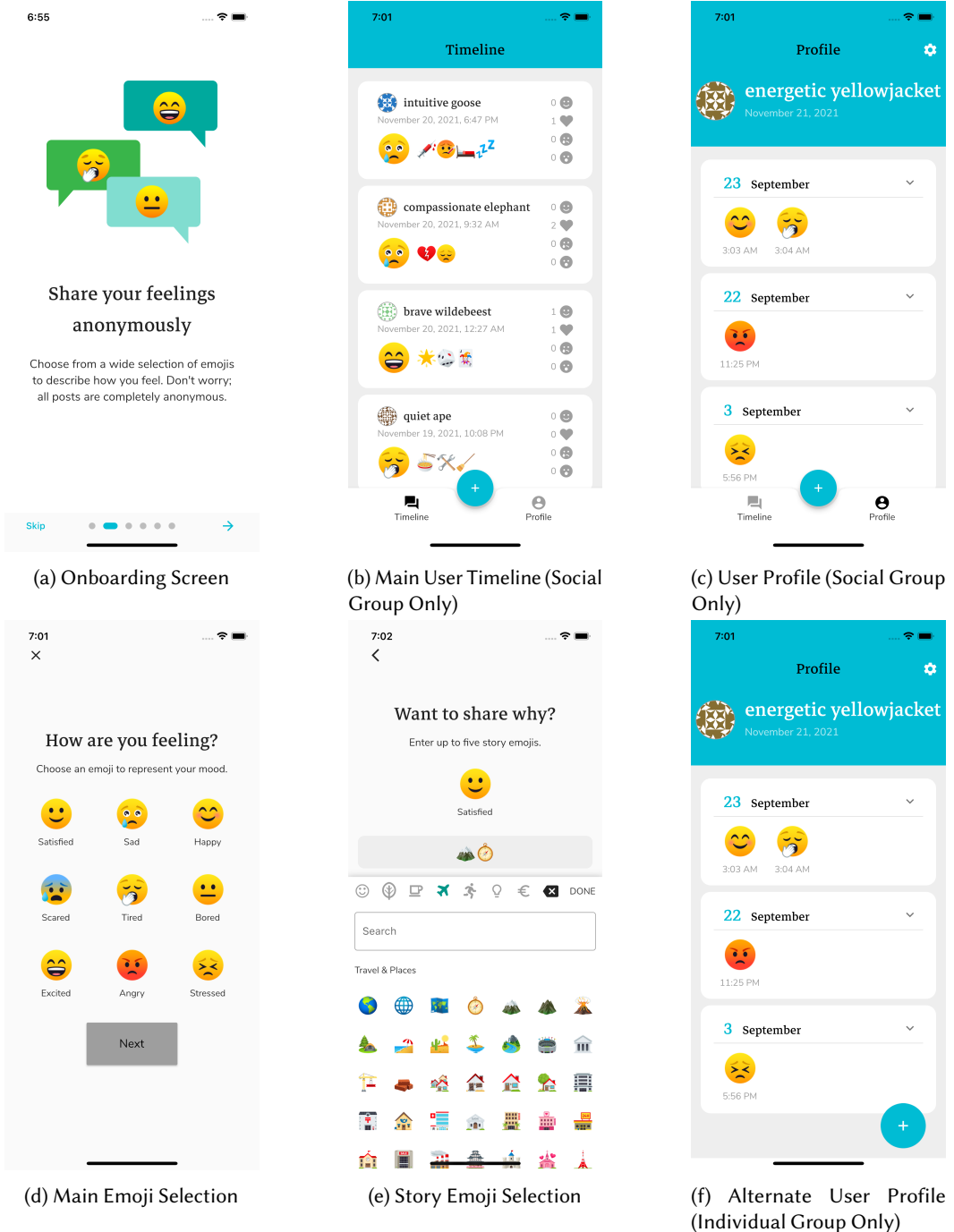(f) Alternate User Profile (Individual Group Only)

Fig. 2. Chirp application main pages as shown to study participants. Note that the main user timeline (b) is the default home page of the app for general users and participants in the Social group in this study. Participants in the Individual group in this study are unable to view (b), instead are presented with (f) as a replacement for (c) and as the default home page of the app.

a series of short onboarding screens, Chirp shows users a timeline where they can see posts made by other users and add their reactions to their posts (as described in Section 3.1.4; see also Figure 2).

While users can see reactions to their posts on the timeline page (Figure 2b), they cannot view reactions to their posts on their profile page (Figure 2c). This is because the primary function of the profile page is as a mood-tracking log, somewhat separate from the social aspects of Chirp.

In the app, users can create their own posts. They first start by reading the prompt: "How are you feeling?" and accordingly choose from 9 different "main emojis" (as described in Section 3.1.1). After users choose a main emoji, they are presented with a page asking them to "… share why" by creating a story: a string of at least 1, but up to 5 emojis describing the main emoji they initially inputted (as shown in Figure 2e). We provide a broad yet limited library of emojis to use in the story.

To ensure that the app appears as similarly across user devices as possible, we used Google's Flutter app framework, which does not use native iOS or Android components and instead renders the app pixel by pixel. Furthermore, as mentioned previously, we use the JoyPixels emoji font to ensure that all emojis appear identically for iOS and Android users.

3.3 Privacy and Consent

We designed Chirp to ensure the privacy of our participants, as discussed in Section 3.1. Instead of personally identifiable information like email addresses or phone numbers, Chirp relies on the hashed identification code of our participants' mobile devices to identify individual accounts. A user's client device hashes their device ID before being securely sent over HTTPS to our web server. Users must agree to our terms of service about how our study will use their data before any data is stored.

3.4 Data Flow for Account Creation and Recording Data

As mentioned in Section 3.1.2, users are assigned a random avatar and username. We give users these anonymous identifiers to create a system that feels similar to major social media applications while providing memorable anonymous tokens to identify users. When creating an account, users are also placed in a "group" and assigned a group ID. They can only see and share posts within their group. Our university-managed server stores the user's salted and hashed private device ID, group ID, and anonymous public information in a database.

Chirp records a user's posts and reactions within a centralized database using a RESTful API. When a user creates a post, their device sends this data to the server, which uses the cookies sent along with the request body to identify an authenticated session. When users react to a post, their device first updates their reaction status and then sends this data to the server to store in the database. When a user queries a post, Chirp will retrieve aggregated reaction counts and the latest reaction from the user making the query.

4 Method

4.1 Participants

We recruited participants from a pool of first-year undergraduate students at the author's university. Physical posters were placed around our institution's campus, including in and around first-year dormitories, and in popular areas of congregation near campus. We also posted advertisements online in social media groups created as conversational spaces for first-year undergraduates from the authors' institution (i.e., Facebook groups, Instagram, Reddit). We required that all participants be 18 or older to be eligible to participate in the study.

While, in general, our research questions focus on university students, we limit to only first-year university students in this study as a control. Once they start college, many students are no longer physically near their primary social support network (e.g., parents, friends) and, therefore, are likely

to benefit from an online source of social support. This is particularly true in the first year before they are able to build strong new connections with other students at their institution [7]. We restricted recruitment to a single university to ensure that all participants were under the same university-mandated COVID safety policy. Furthermore, as previously mentioned, previous studies show that emojis are understandable *given a shared context* [33], for example, within a specific Facebook group, shared friend group, or known location. By using a cohort of students from the same university and class year, we can ensure an appropriate level of shared context that would ensure understandable communication between participants.

In total, we recruited 77 consenting participants (43 female, 32 male, and 2 non-binary) based on the eligibility criteria. All participants were over the age of 18. This study was approved by our institution's IRB as a human subjects study.

4.2   Study Procedure

The study lasted two weeks in March 2022. Participants were randomly separated into one of three groups, each with differing levels of access and features within Chirp.

(1) **Social (27 total participants)**: using the fully-featured version of Chirp as described above (Figure 2(a-e)). Participants were in an isolated study-only group. These participants only shared posts and interacted with users in this group.

(2) **Individual (25 total participants)**: using only Chirp's profile page as a mood tracker. These participants had no access to the social timeline or other social features (Figure 2(a,d-f)).

(3) **Control (25 total participants)**: did not use Chirp at all.

Our three-group study design allows us to individually test our two research questions. We can test the overall impact of emotional self-disclosure in a semi-private online space on perceived social support, as described in RQ1, by comparing the Social and Control groups. We can also isolate the impact of the potential for reciprocal interactions (i.e. emoji reactions) described in RQ2 by comparing the Social and Individual groups.

Since Chirp is a relatively unknown system that is not broadly used outside of this study, we use a between-subjects study design. This allows us to avoid the influence of familiarity with the platform over time on our study conditions. A between-subjects study also allows us to collect data on all three groups over the *same period of time*, which prevents temporal influences on participant feelings of social support. As we are studying students, there are common outside factors that are likely to impact feelings of social support, for example, changes to university COVID policy, school breaks, or (as we encountered in this study) periods of mid-terms or finals.

4.2.1   Pre-Study Eligibility and Onboarding. Before the study period began, all participants completed an eligibility survey as well as an onboarding survey containing a consent form and setup instructions and informing them of the study start date (as all participants across groups started and ended the study on the same days). Participants in the Social and Individual groups were additionally asked to install and join the correct versions of the Chirp app as part of the survey. They were asked not to begin posting in the app until the study start date and were instructed to post in the Chirp app at least once a day once the study began. Participants in the Social group were also informed that all users posting in the app were first-year undergraduates at their institution. This information was intended to create a natural "cohort" for the participants in the Social group, similar to a Facebook group or a subreddit community.

4.2.2   Study Surveys. During the two-week study, all participants were sent three study surveys—on the start date, one week after the start date, and two weeks after the start date. Weekly surveys allowed us to test *trends* in feelings of social support and outside factors rather than just a start and
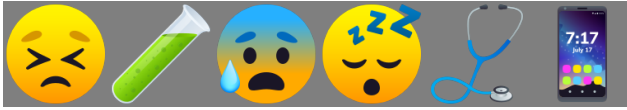
Fig. 3. An example of a post made in Chirp. The first emoji shown is the "main" emoji, and all following emojis are the "story" emojis. This image was shown to participants as part of the final study survey, and participants were asked the following question: What do you think the author of the following post meant to convey about their mood? The first of these emojis was chosen in response to the prompt "How are you feeling", while the others were chosen in response to a follow-up prompt "Want to share why?"

end point. The participants were asked to fill out the surveys to the best of their ability within two days of receiving the email request to complete the relevant survey.

We sent emails containing personalized survey links to participants at around 10 am local time every week for three weeks. All participants were contacted at the same times on the same days. Up to three additional reminder emails were sent over the following two days reminding participants to complete the surveys until they did so.

All three study surveys asked participants to report on their general social media and messaging time ("On average, how many hours per day do you spend [reading social media/posting on social media/messaging]"). The surveys also included psychological scales for participants to fill out, including the MSPSS and the OSSS. The MSPSS was included as a baseline measure of offline social support, as changes in outside factors related to social support networks could impact participant use or relationship to online social support. The OSSS is therefore used as our comparative measure to detect changes in perceived social support. Finally, all surveys asked participants what emotions they felt each of the 9 main emojis from the Chirp app represented.

In both follow-up surveys, participants were also asked if they had gone to someone for support in the past week, and if so who and when. These surveys also asked participants in the Social and Individual groups whether they had shared their Chirp username with anyone else, and to explain their intended message from a provided recent post they had made in the Chirp app. Additionally, two of these provided posts were chosen and presented to all participants in the Social and Individual groups during the second (mid-experiment) survey and to all participants in the final survey. Participants were asked to describe what they thought the original poster meant to express in the given post. An example of one of these chosen posts can be seen in Figure 3.

The final survey additionally asked whether participants in the Social group felt that they connected particularly well or poorly with any other users of the app, and asked participants in the Individual and Social groups about their feelings on the emoji-only communication within the app. Finally, all participants were given a space for any final thoughts. In this final survey, Control group participants were also shown the same two selected posts as the other participants and asked to describe what they thought the original poster meant to express. See Appendix B for survey questions.

4.2.3 Compensation. Participants were paid $10 for each survey completed as part of this study. Participants in the Social and Individual groups were additionally paid $1 for each day during the two week study in which they posted, if these participants posted in the app every day of the study and completed all surveys then they were paid a $7 bonus (equaling a maximum of $50 in compensation). This incentive structure was chosen to make sure that participants were consistently engaging with the app, with the option to engage more often than we required.

4.2.4 Data Cleaning for Analysis. Following data collection, we removed a total of 12 participants from our analysis. These 12 participants were removed for the following reasons: 7 participants were

removed for failing to complete at least one survey, one participant in the Individual group failed to use the app at any time during the study, 3 participants had unusually low MSPSS scores outside the normal distribution computed using the interquartile range method (IQR), and one participant was removed as they had responded 2 to all questions of a 40-question Likert scale, and thus were likely answering at random. This left 65 total participants in the study, with 25, 22, and 18 participants in the final Social, Individual, and Control groups respectively.

5 Results

This study primarily asks two research questions:

RQ1) How does the addition of regular emotional self-disclosure in a semi-private online space impact perceived social support among undergraduate students?

RQ2) How do responses and reciprocal emotional self-disclosures from other students impact perceived social support among students who regularly emotionally self-disclose in private or semi-private online spaces?

Here we look to answer these questions through a comparison in OSSS scores between our three study groups. We then investigate potential confounding factors that may have an influence on the results. As this study investigates multiple participant groups each with measurements at three equally spaced time points, we use mixed repeated measures ANOVA.

Metrics for Social Support: Using OSSS Over MSPSS

The MSPSS is an older measure of social support, first developed in 1988 [52]. As a result, it primarily focuses on in-person interaction and social support, which is reflected in the questions it asks (See Appendix A). As this study focuses on online interactions and specifically tries to exclude in-person interaction, we use a more recently developed measure, the Online Social Support Scale (OSSS) [39], to measure perceived social support from online sources (See Appendix C).

We further note that OSSS is a particularly long questionnaire, with 40 individual items that sum to a single score. With 40 Likert scale questions in a row, a participant is likely to skip a response accidentally. Since the scale is summed, a missing response can significantly impact scores between weeks. To account for this, we normalize it in two ways to account for between-participant and question ordering biases.

First, for each participant, we find any questions they skipped across the three surveys (observed min: 0, max: 2). These questions were removed from the scale across all weeks for that participant. This ensures that for each participant, the set of measured and responded questions is consistent across all weeks of the study. However, this means the maximum OSSS scores *between* different participants are inconsistent. We account for this in the next step.

Second, we measure the *change* in each participant's OSSS over time. This allows us to fairly compare participants across different groups, despite the used OSSS scale being slightly different per participant due to skipped questions.

5.1 OSSS scores Decline, With the Exception of Social Users

As we measure perceived social support in this study using the OSSS, we first check if the Social group shows a positive change in OSSS over the course of the study when compared to the Social and Individual groups. By comparing OSSS changes between the Social and Control groups we can see the overall impact of regular emotional self-disclosure in a semi-private space among undergraduate students (RQ1), and by comparing OSSS changes between the Social and Individual groups we can see the impact of response and potential for reciprocation (RQ2). The results are not statistically significant
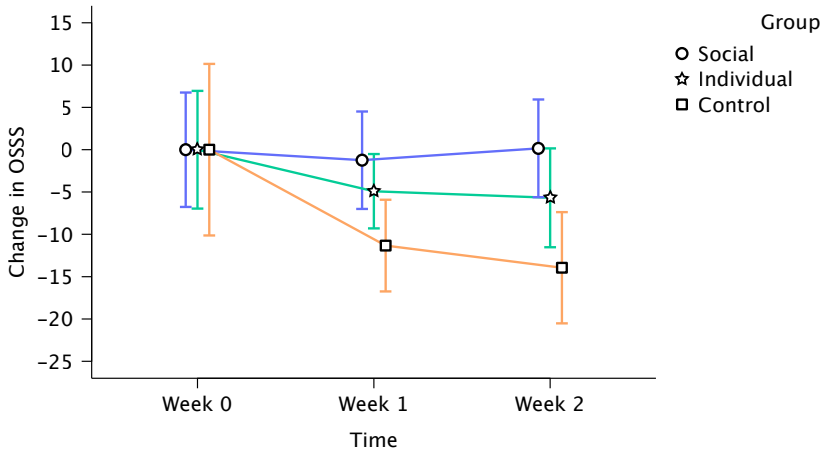
Fig. 4. Mean change in OSSS scores over the course of the study. Error bars denote 95% confidence intervals. Note that while the Social group stays approximately constant, the Individual and Control groups show a decrease in OSSS over the course of the study. The Control group shows a faster and more pronounced decrease than the Individual group. Two weeks after the study start indicates the end of the study.

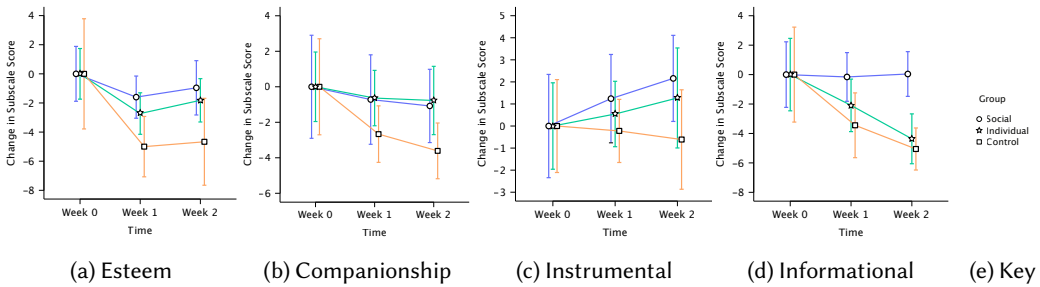| (a) Esteem | (b) Companionship | (c) Instrumental | (d) Informational | (e) Key |

Fig. 5. Mean change in OSSS subscale scores (Esteem, Companionship, Instrumental, Informational) over the course of the study. Error bars denote 95% confidence intervals. Note that all subscales show similar trends to the full scale (Figure 4). In all cases, the Social group shows approximately constant or increasing scores. With the exception of the companionship subscale, where the Individual group matches Social, in all cases the Individual group shows less positive results than the Social group, and the Control group shows the most pronounced decrease in scores. Two weeks after the study start indicates the end of the study.

(2-way repeated measures ANOVA Time × Group interaction effect[10], $F(3.3, 102.3) = 1.3$, $p = 0.27$, $\eta_p^2 = 0.06$), indicating no provable difference between study groups. We do see a moderate effect size where participants in the Social group seem to have maintained a consistent level of perceived social support, while OSSS scores for the Individual and Control groups dropped (See Figure 4).

5.1.1 OSSS Subscales Are Consistent With Full Scale. As mentioned previously, the OSSS as a measure is built from four subscales, each corresponding to a different "type" of social support (i.e., esteem, companionship, informational, and instrumental) [39]. If the trend we see in the OSSS scores is a result of random variation, we might expect to see more variance in results among the subscales.

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[10]This test violates the assumption of sphericity and therefore in reported with Greenhouse-Geisser correction
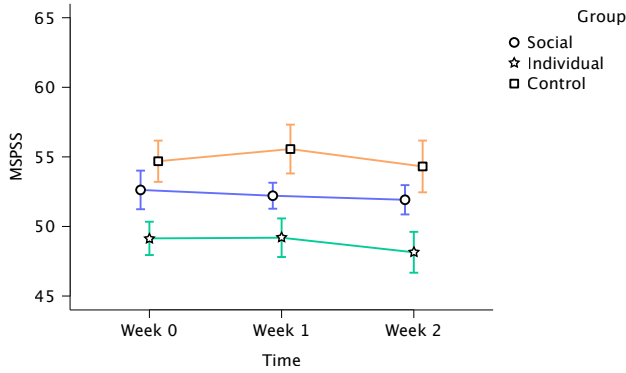
Fig. 6. Mean MSPSS scores over the course of the study. Error bars denote 95% confidence interval. Note that each group stays at a consistent MSPSS over the course of the study. Two weeks after the study start indicates the end of the study.

Alternatively, if the pattern we see is only impacted by one specific subscale, then we would expect to see random variance among some subscales and a very strong relationship in one specific subscale.

As shown in Figure 5, we see a continued trend among all subscales of non-significance, yet with a consistent drop in scores in the Control group. The consistency of this same pattern across all subscales of the OSSS may increase the likelihood that these are true trends. However, again we do not find statistically significant differences when we perform a two-way repeated measures ANOVA for each case, for the interaction effect between Time and Group: esteem[10] ($F(3.4,104.0) = 1.1$, $p = 0.36$), companionship[10] ($F(3.5,108.6) = 0.5$, $p = 0.7$), informational[10] ($F(2.9,91.0) = 2.2$, $p = 0.10$), and instrumental ($F(3.7,115.6) = 0.5$, $p = 0.73$)

5.1.2 MSPSS Impact on OSSS. There is also the possibility that factors outside of the Chirp app had an impact on the results. To test this, we check for changes or differences in MSPSS scores between participant groups over the course of the study.

Since the MSPSS is a separate measure of (in-person) social support, we expect to observe one of two patterns if it has an impact on OSSS scores. 1) If OSSS scores reflect online conversations that participants are having with in-person friends then we would expect the MSPSS to have a similar pattern to what we see in OSSS; that is, that participants in the Social group have the highest scores or increase and those in the Control group have the lowest or decrease. 2) If OSSS scores reflect that participants with weak offline ties build stronger online support networks, as predicted by Self Determination Theory, then we would expect the MSPSS to have an opposite pattern to the OSSS; that is, participants in the Control group have the highest or increasing MSPSS scores and those in the Social group have the lowest or decreasing.

While we find a significant difference between the three groups, we do not see either of these patterns reflected (as shown in Figure 6). Furthermore, we do not see a change over time in MSPSS scores in any group, thus we would not expect a change in outside social support to have an impact on OSSS scores. A two-way repeated measures ANOVA shows no statistically significant interaction effect on MSPSS score between time and study group ($F(4,116) = 0.29$, $p = 0.88$). Simple main effects analysis also shows that time did not have a significant effect on MSPSS ($F(2,116) = 1.44$, $p = 0.24$), though the study group did ($F(2,58) = 5.17$, $p = 0.01$).

5.2 Social Group Participants Posted More Consistently, but with Similar Timing and Emotional Valence as Individual Group Participants

As we determined that MSPSS scores are likely not the cause of the trends we see in OSSS scores, we next question whether differences in frequency, timing, or emotional valence (positivity/negativity) of Chirp posts between the Social and Individual groups had an impact on OSSS scores. In both groups, participants are asked to post at least once a day in the same format.

As suggested by Deters and Mehl, it is possible that the act of posting about oneself is enough for positive outcomes. Thus, we question whether participants in the Social group simply posted in the Chirp app more than those in the Individual group. While we find that the Social and Individual groups of Chirp users posted in similar quantities and at similar times of day, we also find that Social users post much more consistently than Individual users. This suggests that the results were unlikely to be impacted by one group posting significantly *more* than the other, but that Social participants might be more motivated to post or engage regularly. 356 posts were made in the Social group over the study period, with each participant posting at minimum 8 and at maximum 18 times throughout the 14 day study (mean: 14.1, median: 15). Individual group participants made a total of 290 posts throughout the study, with each participant posting a minimum of 2 and a maximum of 27 times throughout the study (mean: 13, median: 14). Users in both Social and Individual groups posted once per day a majority of the time (84.8% and 70.3% of the time, respectively), however *users in the Individual group were twice as likely to skip posting on a given day than Social users* ($\chi^2(1, N = 702) = 20.6452, p < 0.001$, 22.1% and 10.4% of the time, respectively). This may indicate that the presence of other users in the Social group motivated users to post more regularly. Most posts across both participant groups were made between 6–7 PM local time (Social: 24%, Individual: 23%), while the vast majority were made between 10AM and 9PM (Social: 79%, Individual: 83%). This emphasis on the 6–7 PM time period is likely because Chirp sent a daily push notification at 6:05 PM to those who had not posted yet that day.

Yang et al. suggest that the valence of shared posts may have an impact on reciprocation and support [50], leading us to the question of whether posts in the Social group were more negative than those in the Individual group. Here we mark each of the nine "main emojis" in Chirp as either positive (satisfied, happy, excited), negative (sad, scared, angry, stressed), or neutral (tired, bored)[11] and compare the frequency of positive or negative emoji choices in the Social and Individual groups. We find the Social and Individual groups to have similar levels of positive valence main emojis over the study period (45.5% of Social posts and 49.7% of Individual posts). We also find the Social and Individual groups to have similar levels of negative valence main emojis (27.5% of Social posts and 26.5% of Individual posts). This suggests that differences in post valence did not lead to the differences in perceived social support between the Social and Individual groups.

5.2.1 Interactions Beyond Posting in the Social Group. As described previously, the experience of a participant in the Individual group was similar to the Social group, with the removal of social features as the only difference (see Figure 2). We question whether simply posting in a social space versus non-social space accounts for the differences in OSSS between these groups or if interaction from other users, represented in this study by reactions left on posts, had an impact on OSSS (RQ2).

Most participants in the Social group (72%) did interact with another post at some point in the study. Excluding reactions that were later removed, 18 of 25 participants in the Social group reacted to at least one post during the study, with 16.7 reactions on average (total: 320, min: 1, max: 121, median: 5.5). Though not every participant in the Social group reacted to another post, every user received reactions on at least one of their own posts (number of reactions min: 4, max: 28, mean:

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[11]emoji labels as described in the Chirp app, shown in Figure 2d

12.6). This indicates that there was interaction and reciprocation between participants in the Social group, even though it was not incentivized in the study.

Based on previous work that suggests that interaction and reciprocation leads to more positive outcomes [9, 50], we would expect that reacts as visible indicators of support would lead to higher levels of perceived social support and that more reacts would lead to higher levels of perceived social support. However, we see no correlation between the number of reactions to a participant's posts and OSSS at the end of the study ($Pearson's\ r = 0.16$, $p = 0.46$).

5.3 Participants Were able to Connect Through Posting in Chirp

To better understand whether and how Social group participants built relationships through Chirp, in the final survey we asked Social users whether there was "any other user in Chirp that you felt particularly positive about or felt like you connected with?". Two participants pointed out specific other users by username that they felt close with (P170 mentioned P189, and P208 mentioned P201). Other participants expressed that focusing on posts by specific users was less impactful than general trends in posts. For example, P145 mentioned that seeing other posts helped them feel less isolated:

> I honestly did not pay much attention to usernames so I can't say that a specific user connected with me but there were a few posts that I remember resonating with and it helped me feel a little less isolated knowing that other people aren't constantly joyful and happy 24/7. - P145 (Social)

Other participants noted that common shared experiences among Social group users led to reassurance and supportive responses. A few participants noted a chemistry midterm that seemed to be a common thread among posts:

> Whenever anyone posted the chemistry test tube with green liquid inside, I knew they were talking about the upcoming chemistry exams, so I felt a bit reassured knowing that there were some individuals out there stressed about the exam as well. - P197 (Social)

While not a shared experience in the moment, common experiences such as relationship struggles also elicited support. One participant noted an effort to support another user who they believe posted about a breakup:

> I remember specifically one post with a crying emoji and a heartbroken/teddy bear emoji, which instantly read as a breakup or a fight in a relationship. It had a lot of sad reacts from people empathizing with the original poster. - P147 (Social)

Overall, survey responses seemed to indicate that users were able to and actively did build connections and attempt to provide support over the Chirp app.

5.4 Participants Understood Emoji Posts

As the Chirp platform uses emoji-only communication, there is a possibility that participants were unable to interpret others' posts. If this were the case, then participants may assume that their own posts are not understandable and the "social" aspect of the app would be irrelevant. Given evidence that users felt supported in the Social group, we expect there to be a high level of understanding or perceived understanding on the part of the participants.

5.4.1 Participants Were Divided on Perceived Interpretability of Emoji Posts. We first find common themes of participants' perceptions of their understanding of emojis through a thematic analysis conducted by the first author. The analysis focused on participants' perceptions of emoji communication and understanding, thus we used open coding and focused on responses to the following questions from the survey (as shown in Appendix B):

- In general, how did you feel when using emoji-only communication?

- Were there any specific times where you felt you had a very good understanding of what a post on Chirp was trying to convey? Can you give an example and how you interpreted it?
- Were there any specific times where you felt you had a very bad understanding of what a post on Chirp was trying to convey? Can you give an example and your best guess at interpreting it?
- This is the end of the survey, is there anything else you would like to tell us?

Some example codes include: "deciding which emojis to choose is a creative outlet", "unsure if others understood intended meaning", "knowledge of popular courses informs post interpretation". These codes were then consolidated into broader themes, including "use as a space for self-reflection", "impact of anonymity on comfort", "ability to interpret given context of the cohort", and "emotional response to emoji-only restriction". Here we focus on the theme of "ability to interpret given context of the cohort". Overall we find that while some types of posts felt very difficult to interpret, there were many posts with a clear narrative or outside context that made them highly interpretable.

As mentioned previously, Social group participants were asked if "there [were] any specific times where [they] felt [they] had a very *bad* understanding of what a post on Chirp was trying to convey". Most participants pointed out that certain types of posts were hard to interpret, or "seemed random". As one participant shared,

> when individuals posted emojis that seemingly had no correlation, it was difficult to interpret what the user meant. For example, if someone posted an emoji of them being scared with random emojis of a fruit, a sun, a dolphin, and a chemistry test tube, I would probably misinterpret why they are scared. - P189 (Social)

However, many participants also noted that there were patterns and common cases that they felt were easy to interpret when asked if "there [were] any specific times where [they] felt [they] had a very *good* understanding of what a post on Chirp was trying to convey". One participant pointed out the importance of time to their interpretation,

> usually on Sundays most people posted the tired emoji with work related emojis so I usually figure people were tired and had lots of work after doing fun things the night before. - P208 (Social)

5.4.2 Participant Interpretations of Emoji Posts Were Accurate. With the inconsistent nature of participant perceptions of their ability to interpret posts, we investigate how consistently and accurately participants are actually able to interpret posts. We perform a content analysis on one post with a known "ground truth" meaning to see actual interpretation accuracy among participants. We further used content analysis to identify themes across all participants' interpretations of that same post, described in more detail below. We find that interpretations were often accurate to the author's intent, but even when not accurate, interpretations overlapped significantly between users.

As mentioned previously, participants were shown a Chirp post from the day before the survey was distributed, which was posted by another participant in the Social group (shown in Figure 3). We collected both the ground truth intent of what the original poster meant to convey in the post, as well as interpretations from all other participants. The original poster described their post,

> I was stressed because I had a chem exam, hadn't been getting much sleep, and had to do a CPR certification module - P189 (Social)

From this post, we extracted 5 topics that encompass the intended meaning of the post:

- Stress
- Lack of Sleep
- Chemistry
- Exam
- CPR

Topic Rate of Prediction per Group for Example Post										
Described by Author					Other Common Topics					
Stressed / Anxious / Worried	Lack of Sleep / Tired	Chemistry	Exam	CPR	Pre-Med / Med. Student	STEM	Lab	Phone Use	Doctor	Sick
Social 70.83%	41.67%	41.67%	29.17%	0%	41.67%	20.83%	16.67%	12.50%	12.50%	4.17%
Individual 77.27%	54.55%	31.82%	31.82%	0%	31.82%	22.73%	18.18%	27.27%	18.18%	18.18%
Control 22.22%	55.56%	11.11%	5.56%	0%	22.22%	5.56%	5.56%	11.11%	27.78%	44.44%

Table 1. Participants who had been using Chirp in any form (in either experimental group) were able to successfully identify that the post's author was communicating stress and a chemistry exam much more accurately than the Control group. However no participants were able to correctly interpret that the author had a CPR module. Despite it not being described by the author, many participants also said that the author was a pre-med or medical student, and nearly half of the Control group thought the author was sick.

After these topics were identified in the ground truth post, a codebook was created to code each topic across all participant interpretations of this post. A subset of participant interpretations was used to identify synonymous concepts and terms, which were used to update the codebook. Ending in the following, more generalized topics:

- Stress/Anxiety/Worry
- Lack of Sleep/Tired
- Chemistry
- Exam/Test/Midterm
- CPR

All participant interpretations were coded based on these topics. We then similarly identified and coded concepts from every participant's response to find common concepts between participants that were not included in the ground truth.

As shown in Table 1, participant interpretations from the Social group are at least 29% accurate across all concepts, with the exception of CPR, which no participants mentioned. Additionally, even for concepts not included in the ground truth, participants are consistent between themselves. This implies that there is a broader shared understanding of a post within the group, even if it is not true to the original poster's intent.

We, therefore, assume that the participants in the Social group are able to understand each other's posts and that the context provided within our chosen cohort is sufficient for successful interpretation, as is consistent with previous work [33]. This further implies that participants in the Social group were able to understand each other and connect in this space.

6 Discussion

Numerous studies have shown evidence of socially supportive actions over online platforms. These have included semi-public [21], semi-private [50], private [26, 50], and anonymous [3] online communities. Previous work has also shown evidence of communication and support through emoji and other non-textual communication [29, 33, 36]. In Chirp, we leverage these design choices in a sandbox space but fail to find a significant relationship between regular self-disclosure in a semi-private space among students and perceived social support (RQ1), nor do we find a significant difference between disclosure in a space with potential reciprocation versus one without (RQ2). Despite this, qualitative data in this study shows that participants in the Social group were able to build connections in the space and expressed that they felt they were able to relate to and felt comforted by posts made by other participants. This suggests that emotional self-disclosure in Chirp's semi-private social space did facilitate supportive behavior as has been seen in previous studies.

Here we discuss these findings and the potential reasons behind these discrepancies.

6.1 Participant Intent May Impact Outcomes

Qualitative responses from participants in this study show a diverse trend. While some participants felt the emoji posts were too random to interpret, others recalled specific instances and users with whom they either built connections or gave or received support. We propose that this may reflect user intent while using the system.

Previous work has pointed out intent as an important factor in receiving support. Yang et al. identify negative self-disclosure as support-seeking behavior, which then leads to support [50]. The Interpersonal-Connection-Behaviors (ICB) Framework similarly suggests that connection-promoting (or "active") behaviors lead to more positive outcomes [13]. As this study incentivizes daily posts containing emotional self-disclosure, the act of self-disclosing—whether negative or positive—is no longer on its own indicative of any specific intent or support-seeking behavior. This may lead to a separation between participants who posted in the app simply to fulfill the requirements of the study and those who were also genuinely interested in using the app—and therefore engaging with the intent to connect. This would align with previous work, and if this were the case, it could explain the variations in participant experiences observed in this study.

It would be prudent for future work to concurrently study both naturalistic user experiences as well as outcomes from direct experimental interventions like the study described here in order to disentangle this factor.

6.2 Differentiating Supportive Actions and Perceived Social Support

It is notable that previous work has primarily looked at the existence and frequency of supportive responses rather than the metric of perceived social support as in this study (e.g., [4, 9, 29, 50]). While these two metrics are closely related, they are different measures. There is a possibility that while online interactions do lead to socially supportive behavior, online platforms do not effectively facilitate perceived social support. This would align with Media Richness Theory, which proposes that the richer platforms, or platforms that provide more information to the user (e.g., tone, body language, facial expression), lead to more effective communication and, therefore, better outcomes [15]. Supporting this suggestion, recent work has found that the addition of richer information in messaging interfaces, such as more informative typing indicators, can increase feelings of connection [27].

However, both in previous work and the current study, participant responses in interviews and surveys indicate that users do feel socially supported by these online conversations (e.g., [2, 51]). This seems to support the idea that users can both provide and perceive support over online platforms.

We suggest that future studies look not only at metrics of actual social support but also include measurements of perceived social support. Particularly given evidence that received social support has less of an impact on mental health outcomes than perceived social support [40].

6.3 Ability to Relate May Be More Important than Direct Response

When discussing connection and support, participants in this study point out specific posts and users with whom they felt they were able to connect or empathize. Similarly, we note that Social group participants were significantly less likely to skip days posting in the Chirp app. This suggests that the social environment encouraged more regular posting, which may also be a result of feelings of similarity and empathy between users. Participants also point out cases where they or others used reactions in an attempt to provide support to others. However, participants make no mention of feeling supported based on reactions that they received. This may imply that responses made on posts are less important than feelings of similarity or empathy with independent posts made by other users.

This would align with previous work by Deters and Mehl, where the authors found that when participants were asked to post more frequently on Facebook, the number of received likes or comments

on posts did not significantly impact outcomes [18]. Deters and Mehl propose that the act of disclosure with a target audience in mind may act as a reminder of existing bonds, helping users maintain a positive emotional state without social interaction [18]. However, unlike the Facebook users studied by Deters and Mehl, participants in the current study are pseudo-anonymous. While participants were aware users visible to them in Chirp were all in a similar cohort (i.e., first-year students at the same institution), they were unaware of who the other users in the app were (when asked, only four Social group participants said they had shared their username with anyone in or out of the study group). This lack of previous connection means that disclosure in Chirp is not made with existing bonds in mind. Yet participants describe feeling supported based on posts made by other users in the app.

This may indicate that support is found in feelings of similarity and empathy between users. In their study of cancer support communities, Yang et al. describe that supportive users showed support through reciprocity to negative self-disclosures by the support-seeking user [50]. Viewed from a different perspective, this supportive reciprocal disclosure also provides an opportunity for the support-seeking user to build a feeling of similarity and empathy with the supportive user.

7 Limitations

Due to the nature of the study design, we caution against generalizing the findings from this study, but rather treat them as insights that may be transferred in relevant settings. Our study population was somewhat small for a between-subjects experiment, where 65 participants were split over the three conditions in our study. With this study population size, the data is susceptible to outside influences and individual variance among the participants, especially across measures where there is substantial individual difference.

Furthermore, our study population consisted solely of first-year undergraduates, over the age of 18, at a single academic institution. Using a more homogeneous cohort was intentional to achieve more consistent and controlled lifestyle conditions. As a trade-off, it limits our study results from being generalized to broader populations. This is a trade-off that is difficult to avoid for cohort-based studies, and we believe that triangulating multiple studies with different methods will be needed to make broader claims about online social support in society.

The recruitment of first-year undergraduates at the same institution also means that participants may have communicated with each other outside of the study platform. Though we ask whether and to whom participants disclosed their Chirp usernames, our results may still be impacted by participants connecting outside of the study.

We also note that compensation between study groups was not equal. Participants in the Social and Individual groups were compensated at a higher rate than the Control group. This is because daily posting was incentivized for Social and Individual group participants—something that was not required of the Control group. However, we acknowledge that differences in payment structure may have impacted participant responses.

As we recruited participants only through physical posters on or around campus and over a few social media networks, we also may have specific under-represented populations even within our selected cohort. Students who were remote and were not connected over social media or who had limited internet access would be under-represented in this study.

Survey question responses were self-reported and sparse over the course of the study, with only three measurement points over 14 days. It is possible that individual outside factors such as emotional state could be affecting participant MSPSS and OSSS scores. While we acknowledge this possibility, the MSPSS is a long-standing and well-validated measure shown to have high internal consistency and reliability— both in the original English form (used in this study) and in translations to other languages [31, 38, 49, 52, 53]. Notably, the MSPSS does vary significantly with feelings of depression and anxiety [31]. While we do not test for depressive symptoms, our data shows no significant

difference between the Social, Individual, and Control groups in level of anxiety (tested with GAD7; $F(2, 62) = 0.207$, $p = 0.813$, $\eta^2 = 0.007$) or loneliness (tested with ULS8; $F(2, 62) = 2.439$, $p = 0.096$, $\eta^2 = 0.073$). As a newer measure, the OSSS has been less thoroughly tested for validity and reliability, but its similarity to the MSPSS, as well as original testing of validity and reliability, suggest that outside impacts on the OSSS would be similar to those on the MSPSS [39].

Finally, responses to our survey questions were self-reported, and it was likely that participants knew that we were the app developers. This knowledge could lead to biases in survey responses [17]. Compounded with the longer nature of the emotional state scales we used, which could lead to fatigue and random responses, participants may have exaggerated or randomly filled out survey responses. We filter for obvious instances of insincere or random responses, but some may persist in the data.

8 Conclusion

Simple mood trackers can be converted to social mood apps where users can safely reflect while sharing only the context they wish to reveal through emojis. In this paper, we presented Chirp, an anonymous, low-bandwidth social mood tracker that uses emojis to encourage users to share their emotions. Even in this extreme scenario of complete privacy and safety from harmful messages, we see the potential for online self-disclosure over private social media to offer social support. We investigate how such a system can build feelings of social support and connection through emotional and mood disclosure. As social media continues to grow into an online commons, there is a space for safety-focused platforms to help build resilience through self-reflection and disclosure.

9 Acknowledgments

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A MSPSS

Table 2. The MSPSS as it was presented in this study. Note that MSPSS score is calculated as a sum of all responses, where a "Strongly disagree" is coded as a 1 up to "Strongly agree" which is coded as a 5. Thus a higher MSPSS indicates more perceived social support.

Please rate how much you agree with the following statements with regard to **this current point in time**.					
	Strongly Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
There is a special person who is around when I am in need.					
There is a special person with whom I can share my joys and sorrows.					
My family really tries to help me.					
I get the emotional help and support I need from my family.					
I have a special person who is a real source of comfort to me.					
My friends really try to help me.					
I can count on my friends when things go wrong.					
I can talk about my problems with my family.					
I have friends with whom I can share my joys and sorrows.					
There is a special person in my life who cares about my feelings.					
My family is willing to help me make decisions.					
I can talk about my problems with my friends.					

B Relevant Survey Questions

- In the past week, was there a point where you felt like you needed to go to someone for support? If so, who did you go to, and when was it?
- MSPSS (See Appendix A)
- OSSS (See Appendix C)
- What kinds of feelings does the following emoji represent?: 🙂
- What kinds of feelings does the following emoji represent?: 🥺
- What kinds of feelings does the following emoji represent?: 😊
- What kinds of feelings does the following emoji represent?: 😰
- What kinds of feelings does the following emoji represent?: 🤭
- What kinds of feelings does the following emoji represent?: 😐
- What kinds of feelings does the following emoji represent?: 😁
- What kinds of feelings does the following emoji represent?: 😡
- What kinds of feelings does the following emoji represent?: 😣
- What do you think the author of the following post in Chirp meant to convey?
  As a reminder, the first of these emojis was chosen in response to the prompt "How are you feeling?", while the others were chosen in response to followup prompt "Want to share why?"
- This is the end of the survey, is there anything else you would like to tell us?
  Included only for Social and Individual groups:
- Did you share your Chirp username with anyone? If so, who? (ex. a friend, parent, spouse)
- You made the following post in Chirp. Please explain below what you meant to convey in this post.
  As a reminder, the first of these emojis was chosen in response to the prompt "How are you feeling?", while the others were chosen in response to followup prompt "Want to share why?"
- In general, how did you feel when using emoji-only communication?
- At any point during your use of Chirp, did you use the Profile page as a mood tracking log? If so, what did you use it for?
  Included only for Social group:
- Were there any specific times where you felt you had a very good understanding of what a post on Chirp was trying to convey? Can you give an example and how you interpreted it?

- Were there any specific times where you felt you had a very bad understanding of what a post on Chirp was trying to convey? Can you give an example and your best guess at interpreting it?
- Is there any other user in Chirp that you felt particularly positive about or felt like you connected with? If so, what is their username?
- Is there any other user in Chirp that you felt particularly negative about? If so, what is their username?

C OSSS

Table 3. The OSSS as it was presented in this study. Note that OSSS score is calculated as a sum of all responses, where a "Never" is coded as a 0 up to "A lot" which is coded as a 4. Thus a higher OSSS indicates more perceived social support.

Please rate **how often** the following things have happened for you **while you interacted with others** online over the last week. Use the following scale:

	Never	Rarely	Sometimes	Pretty Often	A lot
People show that they care about me online.					
Online, people say or do things that make me feel good about myself.					
People encourage me when I'm online.					
People pay attention to me online.					
I get likes, favorites, upvotes, views, etc. online.					
I get positive comments online.					
When I'm online, people tell me they like the things I say or do.					
Online, people are interested in me as a person.					
People support me online.					
When I'm online, people make me feel good about myself.					
When I'm online, I talk or do things with other people.					
People spend time with me online.					
People hang out and do fun things with me online.					
Online, I belong to groups of people with similar interests.					
People talk with me online about things we have in common.					
Online, I connect with people who like the same things I do.					
I am part of groups online.					
When I'm online, people joke and kid around with me.					
People relate to me through things I say or do online.					
Online, people make me feel like I belong.					
When I'm online, people give me useful advice.					
Online, people provide me with helpful information.					
If I had a problem, people would help me online by saying what they would do.					
Online, people would tell me where to find help if I needed it.					
People help me learn new things when I'm online.					
People offer suggestions to me online.					
People tell me things I want to know online.					
When I'm online, people help me understand my situation better.					
If I had a problem, people would share their point of view online.					
People help me see things in new ways when I'm online.					
People online would help me with money or other things if I needed it.					
When I'm online, people help me with school or work.					
Online, people help me get things done.					
If I needed a hand doing something, I go online to find people who will help out.					
Online, people offer to do things for me.					
Online, people help me with causes or events that I think are important.					
When I'm online, people have offered me things I need.					
When I need something, I go online to find someone who might lend it to me.					
When I need a hand with school or work things, I get help from others online.					
I contact people online to get help or raise money for things I think are important.					