Sharing Personal Content Online: Exploring Channel Choice and Multi-Channel Behaviors

Manya Sleeper*, William Melicher*, Hana Habib*, Lujo Bauer*, Lorrie Faith Cranor*, Michelle L. Mazurek†

*Carnegie Mellon University
{msleeper, billy, hana007, lbauer, lorrie}@cmu.edu

†University of Maryland
mmazurek@cs.umd.edu

ABSTRACT

People share personal content online with varied audiences, as part of tasks ranging from conversational-style content sharing to collaborative activities. We use an interview- and diary-based study to explore: 1) what factors impact channel choice for sharing with particular audiences; and 2) what behavioral patterns emerge from the ability to combine or switch between channels. We find that in the context of different tasks, participants match channel features to selective-sharing and other task-based needs, shaped by recipient attributes and communication dynamics. Participants also combine multiple channels to create composite sharing features or reach broader audiences when one channel is insufficient. We discuss design implications of these channel dynamics.

Author Keywords

file sharing; personal content sharing; access control; selective sharing; social networking sites; channel choice

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

INTRODUCTION

People often want to share personal content (e.g., photos, videos, documents) online with particular audiences. Online services and platforms, referred to in this paper as *channels*, offer mechanisms that allow users to target desired audiences, ranging from the ability to set file access-control rules in Google Drive or Dropbox, to the ability to manually create a list of people to whom to send email, to the ability to share with known friends or followers on social networking sites (SNSs) like Facebook or Twitter.

Prior work examined use patterns for online selective-sharing mechanisms. This work tended to explore dynamics for individual types of communication or systems, focusing, for example, on social communication patterns [9, 10, 19, 24, 26], traditional or cloud-based file systems [1, 3, 4, 30, 31, 32], or SNSs [11, 13, 28, 29, 33].

However, in today's multi-device and multi-application environment, users are typically not limited to a single site's sharing mechanisms [16, 21, 22, 32]. Instead, when sharing options on one channel don't meet a user's needs, the user can move to another channel, or can combine channels to usably share content with their desired audience. In this study we focus on *personal content sharing*, defined as content shared for non-work purposes. In this context, institutional guidance is largely absent, and users can draw on both traditional file-sharing and more socially focused services, such as texting applications or SNSs. This allows *personal-sharing ecosystems*: combinations of channels that together approximate a user's desired features and audiences better than any one channel's sharing options.

For example, a user might take photos on a trip with friends. She might want to share most of the photos privately with those friends, but a few photos more publicly. She might typically share photos using Instagram, but wouldn't be able to share privately using the service. So, instead of not sharing, she might share publicly visible photos on Instagram and the remainder just with the group of friends, using Google Drive.

We document the dynamics that emerge from the ability to choose between and combine different channels, focusing on two research questions: 1) What factors impact channel choice for sharing with particular audiences? and 2) What sharing behavioral patterns emerge from the ability to combine or switch between channels?

To address these questions we performed a three-part, qualitative study (n=17) that consisted of a preliminary interview focused on general sharing practices, a weeklong diary study tracking self-reported shared and accessed content, and a final interview following up on the diary entries.

We found that the task during which sharing took place, for example collaboration or conversation, combined with the type of content being shared, tended to shape the use of different services' features, both specifically related to selective sharing as well as to other task-driven needs. Audience attributes, such as access to different services or social dynamics, also shaped channel choice. In some cases, participants could meet sharing needs with one service; in other cases they shared across multiple channels to create compos-

CHI'16, May 07–12, 2016, San Jose, CA, USA
ACM 978-1-4503-3362-7/16/05.
http://dx.doi.org/10.1145/2858036.2858170

ite sharing features unavailable on any one service, such as the ability to share at multiple access levels, or to express urgency on a service that lacked notification capacity. Participants also shared across multiple channels to target composite audiences unavailable on any one service. We document these ecosystem-level dynamics and discuss the design implications of these observed behaviors for creating selective-sharing mechanisms that account for broader task and audience dynamics.

RELATED WORK

People often want to share content online with particular audiences. They limit access explicitly with access-control tools or use ad hoc, informal methods of access control. The desire to limit access may also interact with available access-control- and other task-related features. Prior work primarily focused on these dynamics for individual types of systems or communication, including information management tools, social communication, and social networking sites (SNSs), or focused on content sharing in primarily organizational contexts. We expand on this prior work by exploring content sharing at the "ecosystem" level, with a focus on personal content sharing, to document the emergent interactions of these dynamics across different types of content and systems.

Information management

Personal content sharing may be embedded in activities or applications used for two, often interrelated, tasks: personal information management, or "personally organizing" one's files, for example for synchronization across devices, and group information management, managing files in a collaborative setting such as a repository system (e.g., Dropbox, Google Drive) [1]. To choose channels for information management, users tend to consider content size, privacy and security, institutional policy, service accessibility and usability, and group familiarity with systems [4, 30, 32]. For example, when choosing between cloud storage and email for file management, people tended to choose email for its perceived reliability, simplicity, broad access, and level of control. They chose cloud systems because of organizational policy, broad reach, novelty, and the ability to collaborate and share large files [1, 25].

People may also use multiple information management services in combination or move between services for different tasks [32]. For example, they may combine multiple services because not everyone has access to one service [30].

Voida et al. found that users, broadly, try to match one or more services' features with sharing needs based on the type of content they want to share, and who they want to share with. Considerations may include level of notification (push versus pull), level of access control, and ability to redistribute content. At the time Voida et al. explored the issue, sharing was primarily desktop-based, and took place on email or traditional file-sharing systems (e.g., peer-to-peer networks, document repository systems, etc.) [31]. We draw on this work to ground our methodology, but also reflect modern sharing by focusing on personal content and including mobile devices and socially-oriented services such as SNSs.

Social networks and selective sharing

People share personal content on SNSs such as Facebook, Twitter, Google+, or Instagram as well as on more traditional file-sharing platforms [16]. These services allow sharing with friends or followers, or, on platforms such as Facebook or Google+, explicitly defined groups or individuals.

Users can sort social-network-site friends into a variety of pre-defined groups for sharing. Some users create groups using features such as Google+ Circles or Facebook's Friend Lists. For example, Facebook users used Friend Lists to target specific audiences either to "recreate some of their offline contexts" or to target relevant people in their networks [29]. Users can also share content more publicly on these platforms with friends or followers, often with intended audiences in mind. However, these "imagined" audiences may not match the content's actual reach [2].

Ad hoc methods of access control

Beyond technical access-control features, users may also draw on ad hoc methods to limit access to content. On SNSs users may self-censor, or choose not to share [5,14,20,29,33]. They may also limit the people in their network (e.g., Facebook friends) by ignoring or blocking others [29, 33]. Users may also draw on discussion, or group norms and trust, to decide what is appropriate to post when others are involved [14, 33].

Similar ad hoc methods of controlling access can occur in other everyday sharing environments. For example, Mazurek et al. found that people hid files by deleting the files or by giving them misleading names [15].

Social communication dynamics

Users may also share content on services primarily used or intended for social communication or conversation. For example, an individual might share a photo as part of a text-message-conversation. In this context, factors that impact broader social-communication channel choices may also impact personal-content-sharing channels. Communication channel choice can vary based on personal and household characteristics, including education and gender. Geographic distance, social closeness, and technical expertise can also impact channel dynamics [9, 26]. Channel choice can also depend on network characteristics, such as number of ties, and the geographic or social diversity of the network [3].

People also use communication technologies, in combination, to maintain social relationships [8]. They may *channel switch* or move between channels to use different types of channels for different purposes. For example, in the workplace, they might use instant messenger to set up a phone call [10]. People may also combine varied, quick interactions in a *communication chain*, for example, to multitask in a work environment [24]. We expand on prior work by considering how these social factors interact with content sharing.

Accounts and boundary management

When choosing channels for personal content, people may also use account management to regulate identity-driven boundaries online [7, 23, 30]. People draw on the varying

levels of control offered by different technologies to "facet" their identities online for a variety of reasons, including privacy and access control, a desire to separate the personal and professional, and task separation [6, 7, 23].

METHODOLOGY

We focused on how and why participants use different channels to share and access content with different people, for personal ("non-work-related") purposes. Our goal was to elicit both high-level reasons for channel choice and reasons for channel choices during specific activities. The study took place in three parts. In an initial semi-structured interview participants explained, at a general level, how and why they choose different services to share and access content. We then used a diary study to ask participants to report their actual content-sharing and access behaviors over a week. We finished with a semi-structured interview in which participants explained how and why they used different services during the reported activities.

Recruitment and demographics

Participants were recruited by posting a link to a screening survey on Pittsburgh and Washington DC-area Craigslist sites, as well as on Carnegie Mellon University's experiment recruitment board. We screened for English proficiency and to include a mix of genders, ages, and occupations. We also screened for participants who regularly used the Internet for non-work purposes and had a personal smartphone they accessed regularly, so they could participate in the diary portion (Table 1). Participants were compensated with a $50-65 Amazon gift card based on level of participation in the diary-study portion.

Interviews and diary study

Initial interview

The initial interview focused on services participants used to share and access personal content. The structure was based on Voida et al.'s work on file sharing [31], expanded to reflect modern services and devices. Participants were interviewed in the lab (7 participants) or remotely with video chat (10). Interviews were audio-recorded and transcribed.

Participants first described the devices they "used to connect to the Internet." Next, we introduced them to personal content sharing: "any time you create content and share it" or "times when other people you know or interact with create content and then share it with you," limited to "content you typically share for personal use...outside of work."

As an initial probe we used a predetermined list of services developed from pilots and asked participants whether they used each to share or access content for non-work purposes. The list included: Google Drive, Dropbox, email attachments, Instagram, other photo sharing services, text messaging, Facebook Groups, Facebook Messenger, Facebook (general), Twitter, Google+, instant messaging, Snapchat, repository services, physical devices, and showing someone a device. If participants mentioned other services we asked about those as well. We then asked participants if there were any services we hadn't talked about that they used for a variety of types of content (e.g., music, videos, genealogy data). Finally, we asked participants if we'd missed any services. By cueing both services and content types, we tried to prompt a relatively comprehensive set of services. For each service participants used we asked probing questions, including:

- What they typically used the service for; why and how they used the service
- Who they shared content with or accessed content from using the service; whether/how they shared with specific people/groups
- What types of content they shared using the service
- What their typical sharing/access pattern was; whether they typically looked at the content once or multiple times
- What their typical notification activities were (e.g., how they knew content was available/how they told others content was available)
- Why they used that service versus others (for types of content, people, etc.)

Diary study

We next asked participants to fill out a diary of personal content sharing and access activities over a 6- to 7-day period (exact length depended on interview timing). We used the Paco smartphone-based experience-sampling application[1] to send five brief surveys at random intervals each day. Each survey asked the participant if they had shared or accessed content since the previous response. The participant described the service they used to share or access the content, who they shared the content with or received the content from, and the type of content. Each participant's survey contained personalized multiple choice options, created based on the initial interview. They also provided a brief free-response description of activities. Participants had to complete at least ten surveys to participate in the final interview.

Final interview

We reviewed the reported sharing activities with the participant during a final, approximately half-hour-long, semi-structured interview within a few days of the diary study. For each activity we asked the participant for more details about who they shared with or received content from, the type of content, and the dynamics of the activity. We also asked about why they chose specific services for specific activities, and, where applicable, why they chose between different services for handling similar people or content.

Data analysis

The initial interviews resulted in high-level descriptions of how and why participants used services. The diaries and final interviews resulted in 223 content-sharing activities for which participants described how and why they shared or accessed specific items.

We qualitatively coded the initial interviews. Personal sharing activities are embedded in information management [1, 3,

[1] pacoapp.com

Code	*Age*	*Gender*	*Occupation*	*Hrs/wk*	*Services used*
P01	31-40	F	Art/writing	10-20	Drive, Dropbox, Email, Text, Google Hangouts, NextDoor, Soundcloud, Physical device
P02	18-25	F	Admin. support	20+	Drive, Email, FB, FB Groups, Text, Physical device
P03	26-30	F	Fitness instructor	5-10	Drive, Dropbox, Email, FB, FB Groups, Instagram, Text, YouTube, Soundcloud, Other sites/blogs/discussion boards
P04	31-40	F	Science/engineering/IT	20+	Drive, Dropbox, Email, Flickr, Text, Pandora, Steam
P05	51-60	M	Unemployed	20+	Drive, Dropbox, Email, FB, FB Messenger, FB Groups, Text
P06	26-30	F	Admin. support	10-20	Drive, Email, FB, FB Groups, Twitter, Text, Physical device
P07	18-25	F	Americorps	20+	Drive, Dropbox, Email, FB, FB Groups, FB Messenger, Instagram, GroupMe, Text
P08	26-30	F	Business/management	10-20	Drive, Dropbox, Email, FB, FB Groups, FB Messenger, Instagram, Text, Wedpics, WhatsApp, Google Hangouts
P09	31-40	M	Student (medicine)	20+	Dropbox, Email, FB, FB Groups, Snapchat, Text, Google Hangouts
P10	31-40	M	Legal	5-10	Drive, Dropbox, Email, FB, Twitter, Google+, Text, Google Hangouts, Soundcloud, Bandcamp, YouTube, GitHub, Other sites/blogs/discussion boards
P11	31-40	M	Service	20+	Drive, Email, FB, FB Groups, FB Messenger, Instagram, Tumblr, Twitter, Text, Bandcamp, YouTube, Physical device, Other sites/blogs/discussion boards
P12	31-40	F	Other professional	5-10	Dropbox, Email, FB, Pinterest, Text
P13	18-25	F	Unemployed	20+	Drive, Dropbox, Email, FB, FB Groups, FB Messenger, Flickr, Instagram, Pinterest, Tumblr, Twitter, Snapchat, Text, YouTube, Physical device
P14	41-50	M	Skilled Labor	1-5	Drive, Email, Text, Physical device, Other sites/blogs/discussion boards
P15	26-30	F	Student (management)	20+	Drive, Email, FB, FB Groups, FB Messenger, Pinterest, Text, WhatsApp, Physical device
P16	18-25	M	Student (management)	20+	Drive, Dropbox, Email, FB, FB Groups, FB Messenger, WhatsApp, Physical device, Other sites/blogs/discussion boards
P17	18-25	F	Student (comp. science)	1-5	Drive, Dropbox, Email, FB, FB Groups, FB Messenger, Instagram, WhatsApp

Table 1. Participant demographics: participant code, self-reported age range, gender, occupational category, typical hours per week online for non-work purposes, and services described in the initial interview (most participants also described showing someone content on a device)

4,17,30,31,32], SNS [11,13,28,29,33], and communication-related activities [9, 10, 19, 24, 26], so the two interviewers first drew themes from prior work to affinity diagram their interview notes and create an initial codebook. One coder then coded the initial interview transcripts, iteratively updating the codebook. This resulted in three codebooks, related to tasks, behaviors, and reasons for channel choices, which were used to create Tables 3, 4, and 5. A second coder coded a random set of 50 items from each codebook, resulting in Kappa values >0.65 for each (>0.6 indicates "substantial agreement" [27]). One coder used a subset of the codes to code the diary items. We report themes seen in the initial interviews and reflected in the diaries. Participant counts from the initial interviews are sometimes included for illustrative purposes.

RESULTS

Participants shared personal content during a variety of *tasks*. Accomplishing these tasks, with different *types* of content, required *features* supplied by varied services. For example, collaborating on content may require a user to be able to both share with a particular audience and edit collaboratively. To choose channels for sharing, participants, therefore, sought desired attributes in features of available services. However, participants also wanted their audiences to have access to the content in a timely manner. Thus, choices were also constrained and shaped by *audience attributes*, such as access to services or tech-savviness. One service sometimes provided the features necessary for sharing in the desired manner while performing a task and accessing the desired audience. However, participants also sometimes combined multiple services to achieve these goals.

We describe *tasks* and *types of content* that tended to shape participant consideration of services' *features*, as well as how *audience attributes* tended to constrain choices within the available feature space. We then discuss participants' strategies for combining multiple services to reach *composite audiences* or to create *composite sharing features*.

Personal content sharing in an ecosystem of services

Participants chose between, and combined, varied services for personal content sharing (Table 2). Overall, participants described using between five (P12) and fifteen (P13) services (Table 1). They typically shared on some combination of a personal computer and phone. Some services were primarily used on a computer (e.g., Google Drive), others primarily on phones (e.g., texting), and some were used across devices (e.g., email) (Figure 1). Most participants also described sharing content by showing it to others.

Content-sharing decisions are embedded in tasks

Participants chose channels based on how service features met their sharing needs. They focused both on ensuring content reached desired audiences and accomplishing broader activities not directly related to sharing. For example, when planning events some participants sought tools that would allow them to share content with fellow planners and perform collaborative editing. Thus, channel choices often relied on matching services' features to both selective-sharing and broader, activity-based needs. Table 3 outlines types of tasks

Channel type (Participant count)	*Examples*
Email (17)	Gmail, school email systems
Text/instant messaging (17)	Google Hangouts, Facebook Messenger, texting, GroupMe
Social networking or photo sharing sites (15)	Facebook, Twitter, Instagram, Tumblr, Google+, Flickr, Pinterest
Discussion boards/platforms (15)	Facebook Groups, Slack, NextDoor, Ancestry.com
Music/video sharing (6)	YouTube, Bandcamp, Soundcloud
Physical devices (6)	USB/thumbdrive, personal hard drive
Repository (1)	GitHub
Showing someone (15)	Showing content on a laptop or phone

Table 2. Types of services participants described using to share personal content during the initial interviews

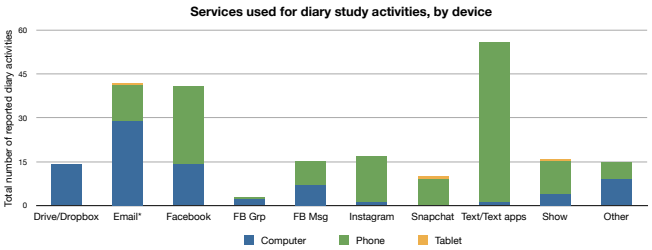

Figure 1. During the diary study portion of the study participants reported sharing and accessing content on a number of services, across devices including personal computers, phones, other computers (work, library), and tablets (*one email activity is excluded because the participant didn't remember the device)

participants described as interacting with personal-content-sharing channel choice. The role the sharing component of the task played in shaping channel choice varied.

Many participants (13) described personal content sharing as interacting with *archival or synchronization* tasks. Here, the ability to share tended to shape channel decisions by defining content location. P07 shared content through Dropbox because "a lot of my like pictures and stuff that are on my Mac go straight to Dropbox."

Other tasks required sharing in combination with other task-related activities, which together shaped desired features. While the task might not primarily be focused on making content viewable by others, sharing tended to play a role in accomplishing the activity. For example, participants (12) integrated sharing into *collaborative* activities. They shared content during ongoing projects or to allow editing or feedback. P01 used email to edit "a book cover" with collaborators, and P10 used Google Drive with "script ideas that would be passed back and forth" with friends.

Similarly, content sharing played a role in event-*planning* for some participants (8). They described using Google Docs to plan events, for example coordinating a party by "getting everyone to fill out a form for their availability" (P08) or using a shared document to "see what other people are bringing" (P06). A few participants also used interest-driven Facebook Groups for planning. For example, P02's college club

Types of tasks	
Archival or synchronization	Use a service for storage, backup, archival
Browsing	Browse posted content (e.g., on a newsfeed)
Collaboration	Ongoing project collaboration, feedback, review
Connect w/friends or family	Connect, stay in touch with friends or family
Conversational sharing	Use content to facilitate or as part of a conversation; brief, conversational-style sharing
Documentary sharing	Document a life event (e.g., with photos or videos)
Resources	Receive or provide information or a resource
Planning or logistics	Plan an event; organize logistics in real time
Publicity	Publicize events or promote oneself

Table 3. Tasks that shaped participants' desired channel features for personal content sharing

sports team coordinated "serious business, schedules, practices" through a Facebook Group.

A few participants also shared content, using text messaging, to facilitate real-time logistics. P01 described coordinating with a friend to find each other at a baseball game by sending "a picture of what she's standing next to."

Other tasks that shaped channel choices were more directly focused on content sharing. These tasks, and sharing needs, tended to vary by type of content and audience. A few participants focused on *documenting* events. They tended to want to share large amounts of content with limited audiences to fully document events, and described using Dropbox, or specialized applications like WedPics that allowed them to upload large amounts of content while controlling the audience. P03 explained, "We were at my brother's graduation and there were like 500 pictures, and my mom really wanted to see them...so we thought she should just start using Dropbox."

Participants (6) also sometimes shared in a more *publicity*-focused manner to promote events or self-promote. They focused on reaching more public audiences, often by broadcasting. P07 explained that she'd publicize content on Facebook: "if there's an event on campus I want everybody to go to."

Many participants (10) also performed more ambient, *conversational*-style, content sharing. They tended to use small amounts of content, like photos or videos, to supplement ongoing conversations, for example, showing a picture on a phone to demonstrate something that's "too hard to explain" (P13). Participants also used services like texting or IM to send brief pieces. P10 explained how he and his friend would "send photographs of things kinda throughout our day, if we're walking around and something seems relevant." They also included content in ongoing conversations on services like email. For example, P08 used email for conversations with her mother-in-law: "that's like our primary mode of communication...have a whole conversation with her on e-mail back and forth and then send a picture of something."

Features of services	
Access to content	Content is available on that platform
Ability to edit	Support for editing or collaborative editing
Additional content	Ability to add additional information to the content
Broadcast	Whether the service will make the content public; level of reach
Connectivity requirements	Whether the service is dependent on an Internet connection or requires data
Control over file hierarchy and structure	Ability to control how a file hierarchy and structure are created and maintained
Recipient contact information	What information is needed to reach a recipient
Selective sharing	Available selective-sharing features
Simplicity	Number of steps required to access the service; convenience
Size/number	Ability to manage large files/number of files
Speed/notifications	Speed of receipt; whether the service provides notification
Support for file type	Support for different types of files or content
Trust	General level of security, privacy, trust in the service

Table 4. Available features of services were matched to both the desire to target particular audiences and accomplish broader tasks.

Similarly, participants (13) described *browsing* content friends or people they followed posted on SNSs like Facebook or Instagram. P09 explained, for Facebook, "I just log on, every, every other day or every day just to read through the News Feed."

Matching features of services to content for a given task

Participants sought services with features that met both the sharing and broader, task-based needs required to perform tasks-at-hand, tending to draw on different services for different types of tasks. Features participants wanted were also shaped by the type of content shared in the task (Table 4).

Selective-sharing features/affordances

Participants often wanted to target desired audience(s) at particular levels of access. Services provide different *selective-sharing* mechanisms that afford varied levels of control over content sharing, including the ability to:

- Share one-on-one with specific individuals (e.g., email, text, instant messenger)
- Create pre-defined groups for ongoing sharing (e.g., mailing lists, Facebook grouping tools, traditional access-control lists, Google+ Circles, texting applications like WhatsApp or GroupMe)
- Create on-the-spot groups by filling in names or contact information (e.g., email, texting)
- Send a link or share an ID with others to share content, sometimes with the option of additional privacy control (e.g., Google Drive, Dropbox, WedPics)
- Broadcast content to known friends, followers, or contacts (e.g., Facebook, Twitter, Instagram, Snapchat Stories)

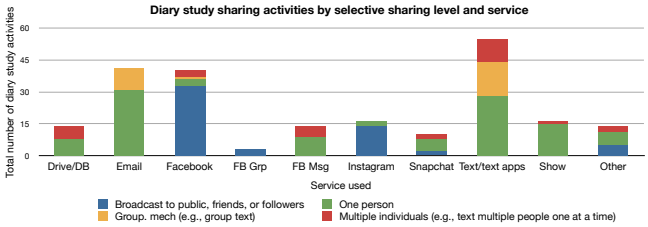

Figure 2. During the diary, participants used services to share with audiences at different levels. They tended to use some services to broadcast to friends, followers, or the general public (e.g., Facebook or Instagram), and others primarily to share with individuals, for example sending an email to one person. They also used group sharing mechanisms on some services, such as group texts, or sending email to a group. On other services they shared with multiple people, one at a time, for example texting several people individually.

Participants used these mechanisms to achieve desired control over their content (Figure 2). Most participants wanted *explicit control* for some content and used services that allowed them to set access-control rules or explicitly limit who could view content. Some participants used access-control mechanisms paired with predefined groups or sent access-controlled content to a group using a link. P12 started using Dropbox, for example, "when my son was born...because we could allow who we wanted to, like, view it, and give them like access to everything...we didn't want them publicly shared."

Other participants sought control by sharing with *specific individuals* or small groups, using services like text or Facebook Messenger. P03 used text messaging, for example, to share with an individual when "it's something that I don't really want to be known public." Some participants, on the other hand, felt they had control when they shared with *smaller, known, friend or follower groups* on broadcast platforms: P13 explained that she used Snapchat because "I think it's a lot more private...you very definitely know who's gonna see it and who isn't, based on who's in your contact list."

In parallel to these methods, participants (7) also *trusted* different services to enforce selective sharing or provide general security. P08 moved the password information file she shared with her husband off Google Drive, because she "just stopped feeling like it was safe, and so now I keep it in Dropbox. I guess I perceive that as a little bit safer." Similarly, P03 shared a photo by text, because she wasn't "comfortable with putting pictures of my godson online."

For some tasks, like publicity, participants wanted content to reach broader audiences and tended to share on more public-facing platforms (e.g., Facebook, Instagram) that allowed them to *broadcast*. For example, P13 used Facebook for "stuff I want to have a general outreach rather than a private outreach." They sometimes tried to call specific audience-members' attention to the content, using mechanisms like tagging recipient(s), adding hashtags, or posting on walls.

Content-type-driven feature choice

Some tasks also required sharing or accessing different types of content. Channel decisions were, thus, partly driven by support for *content formats*. P03 explained, for example, switching from Google Drive to email to more easily open

a fillable PDF. For many participants (12), channel choice was also driven by services' support for content *size or number* of files. Some participants tended to move from services like email to cloud-based platforms such as Google Drive or Dropbox as the amount of content increased: "If I'm gonna share a lot, I'm gonna use something like Dropbox" (P04).

In line with work on boundary management [6, 23], some participants (5) also tended to associate different services with different *content tone* or levels of formality: P13 used Snapchat, for example, for "slightly goofier stuff than Instagram." This dynamic sometimes interacted with available access-control options: P08 shared "the more intimate photos [from her wedding] like pictures of me getting dressed or with my mom crying in the dressing room" on Dropbox, with family, while "the ones where I'm walking down the aisle and they're just more of the typical wedding pictures I shared on Facebook."

Some participants (6) also drew on services that provided fast *notification,* or that they perceived to deliver content more quickly when they wanted to share content they considered important or urgent, for example when planning or as part of an urgent conversation. Several participants, for example, used text messaging when they wanted content to reach others quickly, especially WhatsApp, because it provided notification of receipt. Or, P04 perceived Dropbox as faster than email and used it when her husband "went to go get a medical procedure done and he had forgotten to take a copy of his notice from his other doctor to say that this needs to be done. So I took a picture of it and I posted it to Dropbox and then when he was at the doctor's office he pulled it down."

Features to support other task-driven activities

Participants also considered needs related to activities required for the task-at-hand, but not directly related to selective sharing or access control. A few (4) considered services' *data or network connectivity* requirements, especially when they expected be in locations where they didn't know whether they would have good connectivity. P01 explained, for example, that she used a USB drive to bring content to an artist's studio for collaboration, because she didn't want to risk not having an Internet connection after traveling.

Participant channel choices were also impacted by how much *additional information* a service allowed users to add to the content (4 participants), and how easily *editable* or *accessible* the service made the content (8 participants). For tasks like collaboration, for example, participants tended to want to add information or edit: P03 used Google Drive for feedback on an essay because it gave recipients "access to edit because I prefer all the comments on, like, one document."

Participants also tended to use services because they were more convenient or required fewer steps to share or access content (the level of *simplicity*). P17 explained choosing Dropbox for sharing because, "I can store [content] in my laptop, I can add and edit right from my laptop."

Creating a usable group organization schema can also be challenging when sharing [18]. When sharing large amounts of content, for tasks like archival or collaboration, some participants (5) described choosing services they felt allowed them to create a file *hierarchy and folder structure,* organize content, and control or maintain the organization. P03 chose to use Dropbox instead of Google Drive for photo sharing, for example, because she felt it gave her more control over file structure: "I sorta like to keep everything organized...because I find that when people share photos with me in Google Drive, they just go anywhere, they don't go to like a specific folder."

Attributes of individuals/groups	
Access/ availability	Access to the service, availability on the service
Experience, tech-savviness	Experience with a service; general perceived tech-savviness
Proximity	Geographic location/proximity
Level of interaction	How often one interacts or expects to interact with the audience

Table 5. Audience attributes also shaped channel choice and dynamics.

Influence of audience characteristics on channel choice

Participants also tended to want to reach their audience(s) in a timely manner. They shared with varied types of individuals and groups, including friends, family, acquaintances, classmates, professional contacts, interest- or activity-based contacts (e.g., friends interested in fitness, people interested in finding coupons or deals, etc.), and the general public. Thus, while participants tended to draw on services for the features they offered for particular tasks, channel choices were constrained by the services desired recipients used, and were shaped by broader social dynamics.

Access to services

Most participants (16) described *audience access* as a factor in their choice of service. P08 used Google Drive, for example, because, "everyone's already on Gmail and most people that I share files with are, like, in one of my Hangout chats or something." Similarly, participants tended to want to use services that they knew audiences checked frequently, especially for urgent content. They tended to take audience experience or comfort with different technologies into account, or considered general levels of tech savviness. For example, P03 used text messaging "for communicating with my mom, that's the only service I can use where she can get it instantly."

Reflection of social dynamics

For more social tasks or services, for example conversational sharing or text messaging, channel considerations also tended to reflect broader social dynamics. Participants' service choices partially reflected geographic *proximity* or typical level of social *interaction*, in line with dynamics seen in work on communication patterns [3]. Many participants (11) used certain services with people who lived nearby or with whom they interacted regularly: P02 explained that she used text messaging to share content with "friends that I see in person, at least once a week."

Grouping tools and one-off or repeat interactions

Setting up a maintained sharing environment can also incur costs. Participants used channels that provided more or less permanent sharing mechanisms that, in some cases, partially

aligned with levels of interaction they expected to have with audiences: one-time, repeated but time-limited (e.g., for an event), or repeated and ongoing.

Participants sometimes used faster, lower-cost, sharing methods during expected one-off interactions. At an extreme, participants sometimes described showing someone content on a device when they didn't think the recipient would want repeat access. Some participants also sent quick, one-off messages on services like email; P10 used email "if it's not expecting a response necessarily, but just kinda like, oh, here's a picture I wanna share with you."

Some participants also described expecting time-limited interactions, for example when planning a game night or trip. They sometimes described using services that allowed them to set up temporary sharing environments with lower coordination costs and that could be easily closed after use, such as group emails or group messages on Facebook Messenger. For example, P11 described using Facebook Messenger to organize game nights: "you just start a new group and then add three or four people...when the event's coming up, and then, then that group will stop" after the game night occurs. Similarly, P08 used WedPics, a specialized photo application, at weddings. She sent out a private ID to everyone attending so they could consolidate photos for the event, with minimal overhead. She explained: "I've done that for every other wedding I've been at. They have some cute catchphrase or something and then that's the ID."

In other cases participants described groups for which they expected ongoing, longer-term interactions, such as project groups or friends and family. For these groups they tended to describe services that allowed them to set up pre-defined or ongoing groups with more archival structure, such as Facebook Groups (e.g., for school clubs or with classmates), mailing lists (e.g., for ongoing conversations with friends), Google Drive or Dropbox folders (e.g., for longterm collaborations), or WhatsApp or GroupMe groups. For example, P16 checked in with a group of office colleagues every three or four weeks, so he maintained an ongoing group chat.

Combining channels to meet needs

Sometimes one service met task-, content-, and audience-driven needs. However, participants also combined multiple services to create composite sharing features that allowed them to share with varying access levels or meet a task's selective-sharing and other activity-driven needs. They also combined audiences available on different services to target all desired recipients.

Composite features: indicating urgency

For some tasks participants wanted to make sure content reached recipients quickly, sometimes with acknowledgement of receipt. Voida et al. describe the use of "out of band" channels, like the phone, to speed up notification [31]. The current environment also provides synchronous tools like text messaging or IM that tended to be perceived as quickly delivering content and can provide explicit receipt notification. However, these services may lack functionality desirable for other task-driven activities, such as support for editing. Thus, to accomplish tasks (e.g., sending detailed information, collaborating on a document, etc.) and also indicate urgency, participants (11) sometimes described using text messaging or other secondary channels in parallel to more task-driven channels to alert recipients to the presence of the content. For example, P12 texts her husband to let him know "that I sent him an email instead, with more detailed information."

A few participants described similar dynamics for multitasking. They wanted to collaborate on projects and also have conversations. Some services, like Dropbox or Github, allow collaboration but not synchronous conversation. Participants, therefore, used one service to edit or share content while using another for discussion. For example, P10 worked on coding projects with friends. He would chat on email or Google Hangouts and share content from Github.

Composite features: redundant selective-sharing groups

Some participants also shared with the same groups of people using multiple services, because both services allowed them to reach the desired audience, but neither services met all other task-driven needs. For example, P12 shared with the same group of friends using email and text messaging. She chose between the services based on how much information she included in the content. Similarly, P13 used Snapchat with her friends, but switched to text message when the content had more substance.

Other participants switched between services based on content tone. For example, P07 shared with, and received content from, college friends and family on Facebook and Google Drive or Dropbox. The Facebook content was "less personal to me than whatever is on Dropbox or Google Drive."

Composite features: chaining services

Some participants (8) moved from one service to another to access desired features. For example, for some tasks, participants wanted to send content to people for whom they didn't have particular contact information (e.g., phone number, email). They lacked secondary channels for contact information present in organizational settings [31], so they sometimes fell back on channels that required less information to initiate contact. Then, they would move the communication to channels with additional features they wanted for tasks. For example, P16 described starting a conversation on Facebook Messenger and then moving to WhatsApp or email.

Participants also sometimes moved from one channel to another as task-related needs changed. P13 described sharing a document over Facebook Messenger. She then realized the recipient needed an editable version of the document, so she moved to Google Drive. Similarly, participants sometimes started interactions by showing someone a piece of content, for example in the midst of a conversation, when it was the fastest method. Then if the person wanted a copy of the content they moved to another channel to send it.

Targeting a composite audience through multiple channels

Desired audiences were also not always available on a single channel. All desired recipients might not use a single service, or participants might want to share content at varied levels of access for different portions of the audience. Participants

sometimes used multiple services, in combination, to create a *composite audience* by:

- Increasing broadcast reach of content by cross-posting it on multiple publicly facing services
- Sending pointers to publicly available content to specific people or groups to make sure it was available to non-overlapping audiences
- Sharing some content on a channel with more access control and a subset more publicly

This dynamic sometimes occurred when participants tried to broadcast content as widely as possible, for example when focused on publicity. Some participants had different followers, friends, or known audiences on different social networking sites or public platforms. For example, P13 shares content on a variety of broadcast services with different audiences on each. On Facebook she has "a lot more friends like I don't really interact with," on Instagram it's "more people that like I generally want to know what's happening in their life," and on Tumblr her audience is mostly people she doesn't know.

To increase the reach of content, some participants (10) described cross-posting on multiple platforms. Services provided features that supported this behavior, including the ability to embed content, and to allow pointers or links to content from or on another site. Participants used these features to create broader composite audiences, sometimes while taking advantage of an initial service's features. For example, P11 shared music-related content on Bandcamp, which allowed him to upload music, and then also posted a link on Facebook. Some participants also used Instagram for video and photo editing and then cross-posted the content. P03 explained, "usually what I'll do is have the video like go to Instagram and then, you know, having Instagram post it to Facebook." A few participants also described expanding an audience to include specific people they knew were unavailable on certain services. For example, P12 knew that her parents didn't use Facebook, so she shared with them separately after posting on Facebook.

Some participants also described using multiple services to selectively share content at mixed access-control levels. They sometimes wanted to share more content with a subset of a larger audience. For example, participants might share photos with a smaller group of people using a service that allowed more access control, such as texting, email, Drive, or Dropbox. Then they would share one or two photos more publicly, for example on a broadcast service like Facebook. P07 described sending her mother ten photos of her brother's graduation by text and then posting one to Instagram that she "wanted her friends to see."

LIMITATIONS

We focused on ecosystem-level behaviors, which limited deep insights into specific themes (e.g., specific channels or strategies, participant background knowledge, etc.). Our choice of interviews and diary studies also relied on self-reported behaviors and motivations. This allowed us to probe participants' reasons for their behaviors; however, the results may also reflect participant biases regarding their motivations, as well as potential unwillingness to discuss sensitive topics. Our use of a smartphone-based diary also means that participants were relatively tech-savvy, which may be reflected in the somewhat young sample. Additional work could include a broader sample, more focused scope, or more observational insights to expand on themes that emerged in this work. It could also explore how personal-content sharing varies for participants with different backgrounds (e.g., demographics, technical or privacy knowledge, etc.).

DISCUSSION

Participants used one or more channels to match features to personal-content-sharing needs in the context of task and audience dynamics. Designers should account for these task, feature, and audience dynamics, as well as the potential for multi-channel behaviors, to create selective-sharing mechanisms that account for realistic ecosystem-level behaviors.

Designing embedded selective-sharing mechanisms

When developing selective-sharing mechanisms for personal content, designers should account for the broader task and audience context in which mechanisms will be used. We observed three interacting factors that should be considered.

Designers should consider the *level of access control* users may want when sharing content; for example, a desire to broadcast to the public, share with known followers, or limit access to specific groups of people or individuals. They should also account for *costs users may be willing to incur* to set up and maintain the access control. These access-control needs also interact with *broader, task-related features* users may need, such as the ability to share files of different sizes or content types, the ability to collaborate, or the ability to share with limited network bandwidth.

The need to account for these factors, in context, is driven by task and audience dynamics we observed in this paper. Different tasks may require different levels of control over access and may necessitate activities that may not be tied directly to access control. Similarly, users may be more willing to incur costs for tasks or audiences for which they expect to have ongoing interactions and less willing to incur costs when they expect shorter interactions. Based on the degree to which designers expect these dynamics to be present in a given context, they can draw on design dimensions, such as those we observed, that address each factor (Table 6). Including design features that consider each of these factors may help designers create selective-sharing mechanisms that account for access control in the context of broader task and audience dynamics.

Facilitating multi-channel or single-channel strategies

Participants drew on multiple services when one channel was not sufficient to meet their needs; however, participants also relied on single channel strategies to maintain boundaries or control over content, or for simplicity. Designers of sharing mechanisms should, therefore, also consider when to add features on a single service to support tasks or audiences and

Design features

Factor	Sample design dimensions/affordances
Level of access control	One-on-one sharing, pre-defined or on-the-spot grouping tools, links to access-controlled content; ability to broadcast to a defined group of friends, a known group of followers, or the general public
Willingness to incur costs	Length of time access control will be supported (e.g., one-off link vs ongoing interaction environment), speed of setup/takedown of access-controlled environment, level of support for archival/organization, ability to control or delegate control of organizational schema or access
Task-related features	Support for editing, synchronous notification, bandwidth availability, types and sizes of content

Table 6. We observed a number of design features and affordances that could help designers account for task and audience dynamics when creating selective-sharing mechanisms.

when to instead facilitate multi-channel strategies to meet task and audience needs. We observed several dimensions designers can consider.

Including features to facilitate tasks

Participants drew on multiple services when one service was insufficient to complete a task or provided insufficient audience reach. Designers should, therefore, consider whether one service will provide the desired features and audience for tasks users may wish to perform, or whether users may reach out to additional services. In some cases it may reduce complexity for a service to facilitate multi-channel strategies rather than trying provide all features within one service. For example, a text messaging service might choose to facilitate content export to a service that provided broader editing features if its users wanted to use it during collaboration, rather than adding an editing tool. In these cases designers can draw on a number of design features that facilitate multi-channel strategies, including cross-posting, allowing content to be embedded across sites, and facilitating content export or download. However, in other cases, integrating features into one service may be simpler for users.

Clarifying boundaries

We also observed that, in line with prior work [6, 7, 23], participants used services to maintain boundaries between audiences or types of content. While users may draw on multi-channel strategies to achieve task- or audience-based needs, moving content across services may risk lowering boundaries, through potentially unintended audience access to content, or unclear or unintended data flow across platforms.

Designers should, therefore, consider when multi-channel strategies may lead to undesirable or unexpectedly lowered boundaries or leaked data. When the consequences of performing activities across sites may be unexpected, designers should seek to clarify, and limit the potential negative impacts of, the user's actions. For example, when data, or content, is cross-posted or linked across sites, the new audience and access-control policies should be clear. A number of design mechanisms could potentially facilitate this process, including notifications that clearly communicate when and how data leaves a platform, defaults that maintain access-control policies from the initiating service or the service with stricter policies (e.g., cross-posting a link to access-controlled content instead of automatically embedding content), and allowing users to limit metadata shared with content (e.g., not automatically including user identifiers specific to one service when sharing on another).

Understanding channel-based mental models of trust

We also observed that participants tended to choose channels partially based on trust in individual services or in their percieved abilities to provide control over content. Consistent with prior work [12], participants had variable mental models for deciding when to trust different platforms, ranging from considering paid platforms to be more secure to trusting services that provided clearer selective-sharing tools. These models may or may not be accurate in context, but, to encourage use of services' sharing features, designers should also seek to understand users' mental models for trust and control for individual channels and across channels. Further work is needed to explore factors that may drive these mental models of trust by channel, as well as how these factors may interact with task, audience, and multi-channel dynamics.

Evaluating sharing mechanisms

Researchers should also evaluate sharing mechanisms at the ecosystem-level when considering their ability to meet selective-sharing needs. Prior work has tended to assume the decision to share content occurs based on how well individual channels' selective-sharing mechanisms meet users' needs (e.g., [20]). However, we observed that participants move between and combine aspects of tools that are substitutable at the task- or audience-level to meet personal-content-sharing needs. Researchers should, therefore, consider that people may use tools that do not have all the features they need as long as the tools can be incorporated into multi-channel strategies. Or, users may exclude a tool that doesn't work well in their overall ecosystem. Thus, channels' selective-sharing tools should be evaluated based on their role in broader ecosystem context.

CONCLUSION

To share personal content, participants chose services based on a desire to share with audiences, while accomplishing tasks. This choice was shaped by audience attributes and social dynamics. Participants sometimes combined multiple services to fill gaps in available features or reach combined audiences. Designers should consider task and audience dynamics, as well as tradeoffs of multi-channel versus single channel sharing when designing for personal content sharing.

ACKNOWLEDGEMENTS

This material is based upon work supported by the National Science Foundation under Grants No. 0946825 and CNS-1012763, as well as the ARCS Foundation.

REFERENCES

1. Ofer Bergman, Steve Whittaker, and Noa Falk. 2014. Shared files: The retrieval perspective. *Journal of the*

Association for Information Science and Technology 65, 10 (2014), 1949–1963.

2. Michael S Bernstein, Eytan Bakshy, Moira Burke, and Brian Karrer. 2013. Quantifying the invisible audience in social networks. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 21–30.
3. Jeffrey Boase. 2008. Personal networks and the personal communication system: Using multiple media to connect. *Information, Communication & Society* 11, 4 (2008), 490–508.
4. Robert Capra, Emily Vardell, and Kathy Brennan. 2014. File synchronization and sharing: User practices and challenges. *Proceedings of the American Society for Information Science and Technology* 51, 1 (2014), 1–10.
5. Sauvik Das and Adam Kramer. 2013. Self-Censorship on Facebook. In *Seventh International AAAI Conference on Weblogs and Social Media*.
6. Shelly D Farnham and Elizabeth F Churchill. 2011. Faceted identity, faceted lives: Social and technical issues with being yourself online. In *Proceedings of the ACM 2011 Conference on Computer Supported Cooperative Work*. ACM, 359–368.
7. Benjamin M Gross and Elizabeth F. Churchill. 2007. Addressing constraints: Multiple usernames, task spillage and notions of identity. In *CHI'07 Extended Abstracts on Human Factors in Computing Systems*. ACM, 2393–2398.
8. Caroline Haythornthwaite. 2001. Exploring multiplexity: Social network structures in a computer-supported distance learning class. *The Information Society* 17, 3 (2001), 211–226.
9. Yuli Patrick Hsieh. 2012. Online social networking skills: The social affordances approach to digital inequality. *First Monday* 17, 4 (2012).
10. Ellen Isaacs, Alan Walendowski, Steve Whittaker, Diane J. Schiano, and Candace Kamm. 2002. The character, functions, and styles of instant messaging in the workplace. In *Proceedings of the 2002 ACM Conference on Computer Supported Cooperative Work*. ACM, 11–20.
11. Sanjay Kairam, Mike Brzozowski, David Huffaker, and Ed Chi. 2012. Talking in circles: Selective sharing in Google+. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 1065–1074.
12. Ruogu Kang, Laura Dabbish, Nathaniel Fruchter, and Sara Kiesler. 2015. "My data just goes everywhere:" User mental models of the internet and implications for privacy and security. In *Eleventh Symposium On Usable Privacy and Security*. 39–52.
13. Airi Lampinen, Vilma Lehtinen, Asko Lehmuskallio, and Sakari Tamminen. 2011. We're in it together: Interpersonal management of disclosure in social network services. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 3217–3226.
14. Airi Lampinen, Sakari Tamminen, and Antti Oulasvirta. 2009. All my people right here, right now: Management of group co-presence on a social networking site. In *Proceedings of the ACM 2009 International Conference on Supporting Group Work*. ACM, 281–290.
15. Michelle L Mazurek, JP Arsenault, Joanna Bresee, Nitin Gupta, Iulia Ion, Christina Johns, Daniel Lee, Yuan Liang, Jenny Olsen, Brandon Salmon, and others. 2010. Access control for home data sharing: Attitudes, needs and practices. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 645–654.
16. Andrew Perrin. 2015. Social Media Usage: 2005-2015. *Pew Internet & American Life Project* (2015).
17. Emilee Rader. 2007. Just email it to me!: Why things get lost in shared file repositories. In *GROUP'07 Doctoral Consortium Papers*. ACM, 9.
18. Emilee Rader. 2010. The effect of audience design on labeling, organizing, and finding shared files. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 777–786.
19. Lauren E. Scissors and Darren Gergle. 2013. Back and forth, back and forth: Channel switching in romantic couple conflict. In *Proceedings of the 2013 Conference on Computer Supported Cooperative Work*. ACM, 237–248.
20. Manya Sleeper, Rebecca Balebako, Sauvik Das, Amber Lynn McConahy, Jason Wiese, and Lorrie Faith Cranor. 2013. The post that wasn't: Exploring self-censorship on Facebook. In *Proceedings of the 2013 Conference on Computer Supported Cooperative Work*. ACM, 793–802.
21. Aaron Smith. 2010. Americans and their gadgets. *Pew Internet Research* (2010).
22. Aaron Smith. 2015. US Smartphone Use in 2015. *Pew Research Center* (2015).
23. Frederic Stutzman and Woodrow Hartzog. 2012. Boundary regulation in social media. In *Proceedings of the ACM 2012 Conference on Computer Supported Cooperative Work*. ACM, 769–778.
24. Norman Makoto Su and Gloria Mark. 2008. Communication chains and multitasking. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 83–92.
25. John C Tang, Jed R Brubaker, and Catherine C Marshall. 2013. What do you see in the cloud? Understanding the cloud-based user experience through practices. In *Human-Computer Interaction–INTERACT 2013*. Springer, 678–695.

26. Pauline EW Van den Berg, Theo A. Arentze, and Harry JP Timmermans. 2012. New ICTs and social interaction: Modelling communication frequency and communication mode choice. *New Media & Society* 14, 6 (2012), 987–1003.

27. Anthony J Viera, Joanne M Garrett, and others. 2005. Understanding interobserver agreement: The Kappa statistic. *Fam Med* 37, 5 (2005), 360–363.

28. Jessica Vitak. 2012. The impact of context collapse and privacy on social network site disclosures. *Journal of Broadcasting & Electronic Media* 56, 4 (2012), 451–470.

29. Jessica Vitak and Jinyoung Kim. 2014. You can't block people offline: Examining how Facebook's affordances shape the disclosure process. In *Proceedings of the 17th ACM Conference on Computer Supported Cooperative work & Social computing*. ACM, 461–474.

30. Amy Voida, Judith S Olson, and Gary M Olson. 2013. Turbulence in the clouds: Challenges of cloud-based information work. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 2273–2282.

31. Stephen Voida, W. Keith Edwards, Mark W. Newman, Rebecca E. Grinter, and Nicolas Ducheneaut. 2006. Share and share alike: Exploring the user interface affordances of file sharing. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 221–230.

32. Tara Whalen, Elaine Toms, and James Blustein. 2008. File sharing and group information management. *Personal Information Management: PIM* 2008 (2008).

33. Pamela Wisniewski, Heather Lipford, and David Wilson. 2012. Fighting for my space: Coping mechanisms for SNS boundary regulation. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 609–618.