

# From Ambient to Adaptation: Interpersonal Attention Management Among Young Adults

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## ABSTRACT

Ubiquitous mobile usage provides more opportunities to interact with more people than ever, but with the constraint that people's capacity for attention to others is limited. People manage demands on their attention by limiting their availability to others, and this may cause failure in attempts to reach others. In today's always-connected world, we know very little about how people manage their own availability, maintain awareness of others, and adapt their strategies for reaching others in the face of failure. This paper draws on results from a qualitative field study to present an integrative, joint action approach to attention management. Results suggest that mobile devices play a large part in assessing ambient awareness of others and signaling availability, but are rarely used in isolation. Attention is a continuum that spans multiple devices and channels involving actions and choices learned over time.

## Author Keywords

Attention; awareness; CMC; channel sequencing; ambient attention

## ACM Classification Keywords

H.5.2 [Information Interfaces and Presentation]: User Interfaces - Interaction styles.

## INTRODUCTION

There can be little doubt that the ubiquity of mobile devices and connectivity provides people with more opportunities to interact with more people than ever before [9,10]. Teens and young adults, on average, exchange around 100 text messages per day [37], and a wide range of communication apps have gained significant recent popularity. This means that people are not just always connected [10], but can also use many different ways, or channels [26], to connect.

These increasing opportunities for interaction, however, also mean increased demands on attention, a finite and scarce

resource [1,34,36]. To manage increased demands on their attention, people may choose to limit their availability to others using a range of strategies, which means that attempts to reach others sometimes fail [5]. We know little, however, about how people in today's always-connected world manage their own availability, maintain awareness of others, and adapt their strategies for reaching others in the face of these failures. We refer to this entire process as interpersonal attention management.

To better capture interpersonal attention management at all levels – from ambient awareness to active engagement or adaptation in the face of a failure to connect – we take an integrative, joint-action approach. By joint action we mean that we treat the initiation of interaction as a negotiation of attention [5,6]. Compared to prior approaches that focus primarily on how an individual's attention shifts between tasks [34] or earlier CSCW systems that relied on prescribed sequences (e.g., virtually “glancing” at somebody prior to starting a conversation) [38] or reciprocal steps (e.g., requiring both users to “glance” before talking) [12], our approach more fully captures the ways people adapt and negotiate in response to each other. This is particularly relevant when people may employ multiple methods to get somebody's attention.

We present results from an interview study of how young adults allocate and manage attention in their daily interactions. We saw evidence that they 1) maintained awareness of others, even when not directly engaged; 2) that responding to messages from others was affected not just by contextual constraints, but also being conscious of setting future expectations, and 3) that participants used a range of channels, often in sequence and sometimes including third parties, to get the attention of others.

## BACKGROUND

We use “attention” broadly, to include what prior work has referred to as “awareness” (e.g., [35]), which we would characterize as a low level of attention; and also to refer to active engagement with others, which we would characterize as a higher level of attention. We take a cognitive view of attention as a finite resource that can be allocated and varied in degree [36]. We use this term because we believe it more accurately captures the continuum of engagement with and attention to others, and eliminates the need to identify a discrete transition point from awareness to engagement. This transition point can be difficult to identify as, for example,

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when one is texting with one person and talking face-to-face with another.

The joint action element of our approach is rooted in Clark's [11] work on grounding and collaboration. We refer to attention-related acts as "gathering" (i.e., getting information about what others are attending to, such as walking by them or looking at a contact list) or "displaying" (i.e., indicating to others what one is attending to, such as via a "busy" indicator) [4,6]. These need not be mutually exclusive. Some displays (e.g., walking closer to somebody) can also serve to gather, and vice versa. It is assumed, moreover, that each act is performed with an understanding of how the other party is likely to respond, based on shared notions of appropriate behavior and expectations from prior interactions [11].

Our joint action approach is unique in that prior work has tended to focus *either* on gathering (e.g., how people attend to and use awareness information [16] or sensors to track interruptability [25]) *or* display (e.g., systems to show the status of others [38]). There has been a limited amount of work that examines the interplay of these behaviors, though some experimental evidence [4] suggests that they are interdependent. It is further importantly distinct from literature on multi-tasking [34], which has tended to focus on how one individual's attention is split across different activities (e.g., driving and talking) and how people respond to interruptions and then resume their original activity [15]. While recent work by Salvucci [34] and others does, as we aim to, incorporate attention at multiple levels, it does not treat attention between individuals as a negotiated process that factors in cognitive resources from both individuals.

Drawing from prior work on channel blending [26], which characterizes the use of multiple media streams to direct attention within the scope of a single interaction episode, we use the word "channel" to refer to a specific conduit for interaction, such as a service or app. We use channel in a manner similar to Haythornthwaite's [23] use of "media." In order to understand and better support how people manage and negotiate attention through devices and tools, we focus on how people attend to each other in other contexts, how they respond to others' attention, and how they seek the attention of others.

### **Awareness, Attention and Channels**

Some early work on awareness in initiating interaction aimed to quantify the extent to which any individual was aware of the presence or activities of others [3,33]. This was expanded on to reflect that interaction requires mutual awareness, via notions such as reciprocity (e.g., [12]) or the focus-nimbus model [29]. In our joint action approach, building on Birnholtz and colleagues [4,6], we argue that interpersonal attention is often negotiated as each action is taken conscious of the other party's likely response.

If people act in expectation of another's response, they must have some (possibly incorrect) understanding of who they can reach, how aware others are of them, and how the other

person may to respond [11]. Just as some systems [29,33] track the level of awareness between users, a joint action approach suggests that people use similar heuristics.

This basic idea is reinforced by aspects of how we attend to others face-to-face. Goffman [20] refers to the act of noticing – but not engaging or interacting with – others in a public place as "civil inattention." This is similar to the notion of "ambient" awareness in online interactions [14] in that both reflect a low level of attention and, in contrast to Clark, are not interactive in an immediate, synchronous sense. As degree of attention increases in face-to-face attention, Kendon [27] notes how people use body language, positioning and other cues to attempt to get others' attention. Frischen [18], moreover, notes that people are attentive to others' eyes and gaze direction in discerning their focus of attention. All of this suggests that, within a single physical space, people are aware of who is around them and what those others are paying attention to.

We know less, however, about how people allocate or regulate their attention to the various channels and devices available to them for interaction at any time, particularly when they are not directly engaged with others. In this regard, we can view media multiplexity [23] and channel blending [26] as examining fundamental questions of attention allocation across multiple available channels within specific relational or conversational contexts. These perspectives do not, however, consider how people attend to particular channels *outside* of a particular interaction or relational context. We therefore asked:

*RQ1: How do people allocate and regulate their attention to interaction channels and devices when they are not directly engaged with others?*

### **Responding to Displays of Attention**

At times, one desires to escalate the level of attention paid to another (i.e., starting a conversation). In joint action terms, this is achieved by the initiator displaying attention in a salient manner likely to be gathered by the target [6]. The target would then display their own attention (or not) in a manner likely to be gathered by the initiator.

In face-to-face contexts, attention can be displayed in ways such as eye gaze [18], physical proximity [27], or language (e.g., shouting somebody's name). Responding to these requests often follows a similar pattern, such as returning eye contact, moving closer, or answering. Mobile devices also enable ways to display attention but interaction can become more complicated, arguably because, in Clark's [11] terms, there may be less shared understanding about the salience of particular displays or even whether or not they were seen at all. For example, if Alex wishes to talk with Bob, he could display attention by calling Bob's phone, which would presumably draw Bob's attention by ringing or vibrating, and Bob could display his attention to Alex by answering the phone. If Alex is concerned about disturbing Bob, however, he could instead display his attention via a text message

reading “Hey – have time to talk?” Bob could then display his attention either via a text message (“no, sorry” or “yeah, call me”) or by calling Alex.

As this example highlights, mobile devices provide many ways to respond to requests for attention. Moreover, given the transportability of mobile devices, there is a range of contexts in which displays could occur. Some work has focused on settings that are inappropriate [41] or may be perceived as an interference [8]. Other factors such as who is initiating, and contextual knowledge, also affect whether somebody makes themselves immediately available [39]. This reflects Ames’ [1] pecking order in which certain individuals or activities are privileged over others by students who are multitasking on mobile phones.

Furthermore, as in any mediated interactions, there is often more ambiguity using mobile devices about whether a person has gathered or is likely to gather a particular display of attention [5]. This means that people have more latitude in selecting whether and how to respond to requests for attention. From a joint action standpoint, moreover, we would expect that targets of attention in these scenarios would adapt their behavior according to incoming information from and expectations of the initiator. While substantial work has examined the impact of and response to interruptions [2,25,28], this has largely not focused on the mobile context and has not taken a joint action approach to understanding these behaviors. We therefore asked:

*RQ2: What do people consider as they decide how or whether to respond to others’ requests for attention?*

### **Getting Others’ Attention**

Another key issue concerns initiators of interaction, and how they choose to display attention to increase likelihood of response. Early work on media selection focused less on the salience of channels and more on their features and bandwidth [17]. Subsequent work argued that bandwidth matter less than the time invested in the interaction [40] and that people’s communication goals are important in this process [22]. Selecting among channels becomes even more important today given the array of apps and tools available.

Moreover, we noted earlier that a key aspect of our joint action approach is that people act in anticipation of others’ actions, based on a shared understanding of appropriateness [7] and the likelihood of particular responses. With attention, people anticipate responses to their acts of display based on both implicit and explicit cues gathered from the environment. Explicit cues include things like tools that signal availability (e.g., [29,38]). For example, an “available” status indicator next to Bob’s name could lead Alex to expect a fast response from Bob.

Implicit cues from the environment include information that does not directly display the status or availability of another, but that can be used to infer this. For example, if Bob does not respond to Alex’s chat message, Bob’s non-response might be an implicit cue that he is not actually available (or

not available to Alex). One problem with implicit cues, of course, is that they can easily be misinterpreted, particularly when seemingly in conflict with explicit cues (e.g., availability indicators). Implicit cues, such as non-response, sometimes require explanation to avoid negative interpretations and relational harm [5].

Often, however, the number of cues immediately available for gathering from the environment is limited. In these cases, Clark [11] would argue that people must rely on “contextual common ground.” That is, people rely on their perceived shared understanding of what is appropriate and likely, based on past experience and other knowledge.

While research has examined the use of explicit awareness cues in assessing others’ availability (see [38] for review), we know less about how people develop and draw on an understanding of others’ likely availability and response to interactions using various media. Some evidence [5] shows that people do consider others’ reactions, especially when unavailable, but this work did not focus on initiators of interaction. O’hara et al. [30] draw on the rhythms and expectations around interaction that they refer to as “dwelling,” but focus on interaction within a single channel. We wondered how people decide what channels to use in contacting others, and the extent to which these draw on shared understandings of channel usage and features of the channels relative to communication goals. We asked:

*RQ3: How do people decide what channel(s) to use in getting others’ attention?*

## **METHODS**

### **Data Collection**

Data for this study come from semi-structured interviews with 31 young adults. We recruited participants via flyers posted on campus at a Midwestern US University and through the research lab’s social media accounts.

Interviews were conducted in the lab and lasted 45 to 60 minutes. Two interviewers conducted all of the interviews based on a detailed protocol. The protocol employed a narrative-based inquiry method [13] which involves having participants describe specific episodes. This method enabled us to understand how participants remembered personal stories from their own perspectives.

Participants were asked to think of a particular episode in which they tried to get ahold of a specific person. They then walked us through details of the story. This was repeated for multiple people and scenarios. For each episode, we also asked about the nature of participants’ relationship with the other person and their communication patterns with the other person more generally.

We wanted to ask participants about as many and as diverse relationships as possible, based on factors such as physical proximity, frequency of mediated and in-person communication, romantic interest, and professional dynamic. Specific relationships also were brought up in the

flow of conversation when asking participants about their background (e.g., “Where did you spend most of your childhood?”) and the types of communication technologies and applications they used (e.g., “You said you used Snapchat in the past week. Who was the most recent person you’ve communicated with using that app?”).

### **Participants**

Participants’ ages ranged from 19 to 28 (mean = 22). All were students at the university where recruitment took place. There were 8 first-year students, three sophomores, three juniors, 11 seniors, 5 graduate students and one exchange student. Ten were male and 21 were female. We aimed to recruit for gender balance and gave preference to males in recruiting but for unknown reasons more females volunteered. Fourteen participants were white, 12 were Asian, four were black, and one was multiracial. Twenty-five participants were U.S. students; the other six were from India (3), France (1), Croatia (1), and South Korea (1).

### **Data Analysis**

Interview recordings were transcribed by two researchers or a transcription service. All transcripts were verbatim; with those by the transcription service checked by a researcher for consistency and accuracy. Data was analyzed using an iterative, qualitative coding process. We first assigned basic codes pertaining to our three research questions to sections of transcripts, and then developed new codes through discussion, as described by Huberman and Miles [24].

In these discussions, we first identified three high-level properties related to individuals’ channel choice: technological, contextual, and relational. Technological properties were the lowest-level factors that affected people’s attention management strategies before they began to consider relationship or contextual matters. These included infrastructure (accessibility of the channel) and financial costs. Contextual properties were factors related with communication goals, urgency, and location. Relational properties were factors associated with characteristics of the person that the individual was trying to reach and the dynamic of their relationship. For each of these properties, we considered what types of explicit and implicit cues people used for both gather and display.

## **FINDINGS**

### **Ambient Attention**

RQ1 asked about how people allocate attention to communication channels when they are not actively engaged with others. One clear theme in our results was that participants displayed their own availability to others in different ways. This ambient state of attention could then be perturbed by others’ displays of attention toward them (if someone wanted to interact) or the participant’s desire for someone else’s attention. Participants said that their availability was based on many factors, often including their level of engagement in other activities as well as behavioral norms in different contexts. Aditi explained, “If I’m in class, I prefer not to reply at the time. When I’m at home during

night, I reply right away. While studying I prefer not to respond. I just ignore the phone.”

A social norm that came up frequently for a variety of locations related to the physical presence of others. In these cases, many participants felt the face-to-face conversation took precedence over interaction with those not present, but acknowledged the possibility that an incoming interruption might be more important. Participants had several strategies for displaying their availability to others at any given time, and these seemed to vary with the affordances and norms of each channel. Some messaging applications allow participants to display availability status in an explicit, granular manner. Padma said that she “goes invisible” on Skype unless she is “totally free” to avoid incoming calls. However, when using WhatsApp, she sets her status to “available” because text messages are asynchronous so she feels less obliged to answer messages right away on that particular app. Similarly, Sara described different ambient attention display behaviors for Facebook and Gchat:

*“If I’m just opening up Facebook for a couple minutes, but I’m in the middle of something, maybe I’m studying for a final, and I don’t really want anyone to contact me, then I’ll go invisible or turn my messenger off or whatever. I don’t tend to do it on Gchat as much, because people don’t contact me as much on Gchat.”*

Participants also differed in how they made themselves available to and/or aware of others. Some people described trying to be highly available and relied on technical features like push notifications to gather who was trying to reach out to them. Others, like Regina, were very careful about keeping notifications to a minimum because she described getting alerts for new messages as annoying.

### **Responding to Others**

RQ2 asked about factors people consider in deciding how and whether to respond to others. One key theme in our data was that participants felt they had to decide whether to respond immediately or delay response to a later or more convenient time. In many cases, the decision to respond immediately depended on the perceived time sensitivity or urgency of the request. According to Jack, “Sometimes I’ll hear it and I’ll just look at the screen to see if it’s something urgent. If it’s not, then sometimes it’ll just stay on my screen for a few hours until I get around to it.”

Immediacy of response also depended on the relationship with the initiator, and not always in expected ways. Lydia distinguished between her texting behaviors with acquaintances and close friends. “If they are really close, I will text them whenever I want—like a day or two later—but if they are not close, I don’t want to offend them so I am more quick to reply,” she said.

Sometimes, participants said they did not respond to requests for attention right away due to physical constraints, such as driving or a work task that occupies their hands. This particular distinction is interesting as it highlights the

ambiguity inherent in mediated interaction about whether a particular display of attention has been gathered by the other party. People may see an incoming message, but cannot respond until their hands are unoccupied, though the sender does not know this. As David explained:

*“My being a chemist, sometimes I might be inside of a glove box and my hands are gonna be busy, and I can’t reach down and get my phone, so that would delay things.”*

Even when people are not physically restrained from responding, some participants described deliberately delaying response to convey partial availability. Kara, for example, said she sometimes delays response to messages in order to lower others’ expectations of future responses. In another unusual but interesting case, one woman who was from India had two phones—a non-smart one with an Indian SIM card and a smart phone with a US carrier. She said that when she received calls on her Indian phone, she purposefully ignored them. She used that device only for receiving text messages. “If I send a text message it is two dollars, but it’s free for receiving,” she explained. If someone sends her a text, she will then call them back from her smartphone, which has lower international calling costs.

These examples illustrate how contextual elements such as the urgency of the message, as well as relationship factors and logistics such as costs, all play a part in shaping how people respond to others’ requests for attention.

#### *Channel Exclusivity*

In some cases it was very easy for participants to decide what channel to use in displaying attention to a contact, because they used only one channel to communicate with that person (and used this channel only for that person). We refer to this as “channel exclusivity.” Although there were some instances where this was because of technological constraints—like one participant’s mother who only communicates through phone calls—there were some cases where a single channel was deliberately allocated and made it easier for the participant to selectively attend to, or ignore, communication with that individual.

For example, Joon, an international student from South Korea, set up an exclusive channel with his long-distance girlfriend. He used a messaging app called Line and explained that he used it because it had both video and text messaging functions; he did not use video with anyone else. In contrast to Joon’s case, Lydia created an isolated channel with her mother so that she could limit communication to specific times to avoid her mother’s frequent phone calls. She explained that she had a non-smart phone that she used exclusively for talking with her mother:

*“I made the mistake of giving her my real phone number one time and she called a lot. So I disconnected the phone and gave her a new number for my cheap phone. I have this rule where I keep the phone off all week, and then on Saturday night I turn it on, and she can call me on Sunday, at 10am, and then after she calls me I turn it off.”*

While having two phones was unusual among our participants, it was common for participants to designate a single channel for a particular family member. Many were older adults who had limited technological skills, and thus were confined to a particular channel. Helen used an application called WeChat exclusively with her grandmother. Her grandmother doesn’t text but knows how to exchange short voicemails through WeChat.

As these examples show, dedicating a particular channel to an individual can facilitate increases or decreases in attention to that person by altering the salience of that person’s display behaviors. Using an app like Line makes displays from Joon’s girlfriend especially salient, while Lydia’s mom-only phone essentially suppresses her mom’s display behavior until Lydia is ready to talk with her.

#### **Getting Others’ Attention**

RQ3 asked how people decide what channels to use in getting others’ attention. Participants described a negotiated process that involved gathering cues to discern the other person’s availability, reaching out to them, and then perhaps trying again if the first attempt was unsuccessful.

#### *Explicit Cues*

One way that people reported getting information about others’ availability is via explicit awareness features, though they had mixed reactions to technical features that let them see others’ availability. Emily, who used Snapchat, a photo-sharing application, complained that Snapchat notifies users when a photo has been seen by the recipient. This made her more sensitive when waiting for a response:

*“Back then when you were sending letters, the postman wouldn’t tell you, ‘They read your letter already.’ It would get there when it would get there, and you’d get a response when they could send a response. But I think since the availability of telling you that somebody’s read your message or just seen your Snapchat changes the whole dynamic of the interaction between the two individuals. So it makes people think, ‘They read it 10 minutes ago. Why haven’t they texted me? Do they not like me? Am I being too pushy?’ So you start thinking too much about it, which I guess, it’s a downfall of social media.”*

Consistent with what participants said above about using response time to display their own availability, they also reported gathering cues about availability from others’ response times. Victoria said she gets impatient when she is texting and the other person’s responses slow down:

*“If you’re having an ongoing conversation with someone, and it’s a quick back and forth, once they stop answering or take a long time, you’re like, ‘That’s weird,’ because you have been going back and forth.”*

#### *Options and Goals*

For our participants, one of the most salient factors in deciding how to get ahold of others was the participant’s interaction goal. They typically said they chose synchronous

communication methods if the goal was urgent. Aditi described an incomplete group project where one of the members could not be reached before the deadline. To get a fast response, she switched to a synchronous channel by calling on the phone. Aditi further distinguished between time-sensitivity and general urgency, an idea that was reflected by several participants, including Nico:

*“My suite mate and a few other girls like a group from last year were going out to dinner somewhere and we were on our way to the restaurant and there was no sign of her, so I gave her a call to say like ‘Hey were you planning to come?’ Again if I’d like just sent her a text and waited for an hour, then the dinner would have been done by then.”*

Having access (or lack thereof) to a particular channel influenced people’s choices in initiating communication. Stevie, a masters student working in a basement lab, said that lack of cell phone reception underground affects her tactics. For colleagues who are also in the basement, she will either use a landline phone or physically go talk to them. For others outside of the building, however, she mostly uses email. “I don’t turn my phone on at work because I don’t get cell phone reception. People can Facebook or email me,” she said.

Similarly, a woman from rural India said that she mostly calls her family via cellular call rather than video, because her contacts lack Internet service at home. Not surprisingly, financial costs were also a concern for individuals who had limited texting and data plans, or were trying to communicate with people in different countries. Using Internet-based applications to communicate with friends in other countries or international friends who lacked US phones was common. For example, Amanda said she used WhatsApp to talk to her brother in Bosnia:

*“I’m not friends with him on Facebook and I can’t text message him because it’s really expensive, so I use WhatsApp because I always have my phone and he always has his phone, and we both have Internet.”*

#### **Channel Sequences**

While we have focused so far on the selection of a single channel for reaching somebody, many participants described sequences of channels, especially in situations where their first attempt to get somebody’s attention failed. While prior research has found that people use a variety of different channels [26] we found that the switching back and forth between these channels was most often not a random process, and that people relied on a set of patterns, or a sequence, to obtain others’ attention.

When asked, many participants already had a channel sequence in mind for specific individuals. For contacting peer collaborators on class projects, Ashley said she would first email, then Facebook, then use the university directory to get their phone number. “It’s kind of weird because sometimes the phone number is their home phone, so I’d probably do Facebook, then the directory,” she said.

Margaux, an exchange student from France, explained that if she needed to reach her parents immediately, she would first see if they were on Skype, but if not, would send her father an email. “I am sure he will answer if I send him an email to his professional email,” she said.

Sometimes alternative channels for getting attention were other individuals. Participants said they contacted third parties people for more information about the person they were trying to reach, or because they thought another person might be more likely to reply or better able to get the target’s attention. For example, David, a PhD student in chemistry, did this to reach his adviser:

*“Typically, if I’m having trouble getting a hold of him, I’d start off with an email, and then maybe I just don’t hear anything back. And then I’ll go to our program assistant, look through his schedule, find a time around where he’ll be in his office, and just kind of force my way in there.”*

In a similar example, Dorothy described how she chose people based on likely physical proximity to the person she aimed to reach, and the hope that others’ acts of display might be more salient to the target than her own:

*“Sometimes when it’s hard for me to get ahold of someone I ask the person they’re living with. Like my friend Zeba, I couldn’t get ahold of her so I Snapchat, texted and Facebooked her and called her and then when she didn’t respond I asked mutual friends, like her roommates, to get ahold of her for me through word of mouth.”*

Sequences tended to move from asynchronous, text-based channels (e.g., texting) to synchronous channels (e.g., phone calls), especially when the goal was to coordinate an in-person meeting. Working as a part-time food writer, Victoria often has to coordinate with a photographer to take pictures of food. Explaining this coordination, she said:

*“I would email her first ‘cause that’s where you set the baseline, and then as it gets closer, I’d be like, ‘Hey, I’m at Whole Foods. Where are you?’ to see if she was there to take the pictures. I would set up everything through email, and then texting is at the time.”*

#### **Learning Others’ Habits, Rhythms, and Routines**

Many participants described developing intuition over time of their contacts’ daily rhythms and routines. Rhythms and routines reflected media usage and more general patterns, and participants’ intuitions influenced their attention-seeking strategies as well as their expectations for response. Victoria, a senior who lives with several roommates, said that—if she needs to reach somebody at their apartment -- she contacts one roommate in particular because she knows she will get a quick answer:

*“She’s always by her phone... if I ever needed something and I’m not home, I would text her rather than any of my other roommates. I know she’ll respond very quickly.”*

Similarly, Regina talked about how she waits for specific times when trying to reach out to her sister because she has a good sense of her sister's routine:

*"She's a teacher; I kinda know her school schedule. I'll save my texts for when I know she's out of class... and then there's a good chance she'll respond to me within a half hour or something."*

Charlotte, whose brother sometimes works night shifts, is careful about how she gets ahold of him so that she does not interrupt his sleep. "He has a crazy work schedule so it's usually text first," she explained, "I would text him like, 'Are you sleeping?' 'cause I don't wanna wake him up."

Some participants, who may have lacked direct knowledge of schedule attributes like busy times or sleep schedules for contacts, had to learn the "hard" way about others' response habits. Aiden described how he had trouble communicating with his roommate and had to consult with mutual friends if the roommate's failure to respond was specific to Aiden:

*"He's not good at responding. I talked to his girlfriend and our other roommate, and they were like, 'Don't take it personally, he's just not good at communicating.'"*

## **DISCUSSION**

We began with the premise that there is utility in considering points of intersection between historically disparate literatures on awareness of others [29,33,38] and how people use multiple media [23] and channels [26] to interact in their everyday lives, especially given the ubiquity of mobile devices, interaction channels and connectivity today. Our findings, summarized in Table 1, have several implications for this literature and for the designing interaction tools.

### **Implications for Theory**

We saw substantial evidence of people behaving in ways that are not well captured or explained by existing theories.

#### *Attention as Continuum*

First, we saw clear evidence that people saw interpersonal attention as a continuum in which they had several channels at their disposal with varying degrees of salience, and could be engaged with people at different levels of intensity. This stands in contrast to prior approaches to awareness (e.g., [35]), which historically focused on users' persistent sense of the presence, availability or activities of others with an eye toward interaction (see [38]). Once active interaction has commenced, awareness becomes less necessary.

One problem with this approach is that, while it worked well for early CSCW tools like instant messaging or video within a closed system, it is much more difficult to apply to today's multi-channel, mobile, always-on environment. We suggested earlier that identifying a transition point between awareness and active engagement might be difficult, and our demonstrated this. When participants saw the content of a push notification for an incoming text message, for example, it is not clear if they were "aware of" or "engaged with" the other party. For this reason, we prefer the concept of

"attention," which can occur along a continuum of intensity and does not require a transition point. We believe this to be more consistent with our participants' experience.

In many ways, in fact, we found it interesting that participants described experiences that resonated more strongly with theories of face-to-face interaction (e.g., [18,27,36]) than theories of online awareness and interaction. Kendon [27], for example, suggests that people strategically use physical positioning to make their presence more or less salient. Our participants, when using mobile devices, could not use their bodies to make their acts of display more salient, but they did describe display tactics such as texting or calling somebody who was likely to be physically near or otherwise more visible to their target, or using particular channels to convey urgency. In some ways, this approach may seem similar to Grinter and Eldridge's [21] observation of teens using texting to query availability for a phone call, but it is also distinct in that the intent there was to use texting so as not to draw immediate attention, where our participants goal was to get attention.

We do not claim credit for the idea of attention occurring along a continuum. Rather, our contribution here is to expand this continuum to include states of mutual attention. This builds on prior work, such as Salvucci et al.'s [34] continuum of multitasking, in which they describe attentional characteristics of tasks that occur at different levels of focus and with varied time between task switches. Our joint approach begins to show how people's actions of gathering and display extend beyond allocating their own attention and become a joint effort involving others. Our data do not allow us to make claims at the detailed level of some multitasking research (e.g., [15]), but we urge additional work using logs and trace data from dyads and groups to improve our understanding of these processes at lower levels of analysis as they play out in interaction.

#### *Interaction, Channel Norms, & Adaptation*

Consistent with a joint action perspective in which attention is negotiated, our participants described reserving highly salient display tactics for times when a first attempt at getting attention failed. This stands in stark contrast to notions of reciprocity (e.g., [12]), in which the other party would be required to respond at the same level of salience before either could escalate the interaction to a more salient channel. It also serves to supplement ideas about channel blending [26], in which channels are combined strategically to shift attention (i.e., to a video stream) within an ongoing interaction, but escalation of salience is not used strategically to command attention as we saw here.

With regard to perceived salience of channels, Goffman's [20] work on face-to-face interaction in public places suggests further that people attend to others in ways that are cognizant of social norms and relationships. We saw some evidence that our participants tried to do this, in that many described times when they felt they normatively should but could not attend to others due to aspects of the context (e.g.,

physical restraint) or relationship. At the same time, though, their experiences also suggest that they struggled with this somewhat, especially when they felt too available to another person, and took steps to reduce this availability (e.g., delaying response, using a separate phone).

These struggles and people’s perceptions of the norms around interactions raise another key issue we saw that a joint action approach can help illuminate. Participants did not always report a shared understanding about the salience of particular channels, and this varied with different individuals and in different contexts. This stands in contrast to face-to-face interaction, where salience is typically rendered obvious by physical proximity or audibility and feedback is immediate, or single-system online interaction where salience is controlled and often symmetrical (i.e., features and notifications appear similarly for all users).

Rather, our participants used many channels or notification configurations for different purposes, but these often seemed to be asymmetric as evidenced by participants also describing the need to learn the habits or patterns of their contacts through experience or consulting with others. With shared understanding of how salient particular channels were or what the norms of interaction were, such steps would be less necessary. Our results suggest that existing conceptions of media as low vs. high bandwidth [17], having particular features [22] or supporting particular aspects of interaction (e.g., [7]) are insufficient. Given that individuals have control over the salience of their incoming notifications, we must also account for perceived salience and configuration of particular channels.

### Implications for Design

From a design standpoint, our results have several implications. First, our participants did not use channels and applications in isolation. While these tools are often designed

and evaluated on their own, our results show that people are strategic about how they use the channels available to them, with whom they use which channels, and how they configure the salience of notifications and other interruptions from these channels and tools. So designers of interaction channels should consider how their tools will be used within this ecology of attention negotiation.

One general way to do this would be to consider the perceived salience of particular tools and channels, and how this particular level of salience is used by particular users within the context of negotiating, avoiding or attracting attention. Just as, with the OpenMessenger framework, researchers [6] advocated displays of attention at multiple levels of salience, designers of tools should consider how a specific tool might provide multiple levels of salience, how a suite of tools can combine to provide multiple levels of salience, and how the operating system of the device itself both mediates and complicates these processes. The device or specific applications, for example, could serve as a mediator when two people’s perceptions of a similar channel differ significantly (e.g., if somebody thinks Facebook messages are highly salient, but their partner has push notifications turned off for Facebook).

At the same time, we saw many appropriations and workarounds for design features likely missing from current interactions. We saw that people had difficulty using the same application for different types of relationships, and in extreme cases, had to use separate applications for different people. It would be useful if devices or applications could be configured to allow salient notifications from a particular contact via any channel, rather than on an application-by-application basis. Such status could be granted to a contact on an expiring (e.g., show me messages from the friend I’m meeting for coffee, but only for the next 2 hours), scheduled

State	Activity	Based on cues related to	Gather or Display?
<b>Ambient attention</b>	Signaling availability	Level of engagement in other activities Behavioral norms of context Affordances of channel	Gather/ Display
<b>Responding to others</b>	Decision to respond immediately	Urgency Time sensitivity Relationship Physical constraints	Gather
	Actual response	Dedicating special channel for someone	Display
<b>Getting attention</b>	Gathering cues	Features that explicitly display others’ availability Response	Gather
	Reaching out	Goals / urgency Access to channel Financial costs Physical proximity	Display
	Failure to contact => reaching out again	Learning others’ routines Employing multiple channels / channel sequences	Gather Display

Table 1. Summary of Results

(only show calls from mom call from 10 to 2), or permanent (e.g., always show calls from my boyfriend) basis. This would make it easier to get attention in known cases.

We also noticed that many participants chose to use more subtle forms of notification or turn off push notifications altogether because they were too disruptive or overwhelming. Part of this annoyance was due to the perceived randomness or high frequency of some disruptions. Having a general phone setting that enabled people to control the frequency and timing of receiving such notifications (e.g., having a setting for delaying notifications so that they only arrive at certain times) may give people a stronger sense of autonomy and control over their app use rather than feeling like a slave to constant requests for attention. There are also opportunities to have the system learn about an individual's communication habits; for example, Poppinga et al. [32] found that using the phone's sensors to infer mobile context was able to improve delivery of notifications. At the same time, our findings show that there is high variability in individual preferences, and that even within the individual, preferences differ by relationship and context. This suggests that a one-size-fits-all strategy may not succeed, but giving people more options for customization could help.

#### Limitations and Future Work

As with any study, this work has limitations that urge interpretation with caution. While a qualitative interview study allows for rich detail and reflection, these specific findings may not generalize to the larger population of mobile phone users. Our participants were young adults and students at a major university, so vary in both age and education from the broader population. Future studies should examine other populations that are more diverse in factors like age, race, and socio-economic status.

We strongly encourage additional work to overcome these limitations and extend our initial findings. In particular, we urge more systematic examination of mobile phone usage, such as via phone log data [19,31] and other digital traces that could be used to find quantitative evidence of attention negotiation via various communication tools available to people. In addition, we urge additional qualitative work looking at the population more broadly, and the strategies that additional populations people use to manage their own and others' attention in their everyday interactions.

#### CONCLUSION

In this study, we took a joint action approach to understand how people manage interpersonal attention in everyday communication. Through interviews with young adults, we found support for a joint action approach to attention management in which individuals were negotiating how to display their availability and get ahold of others based on others' response as well as additional cues that they gathered on their own. Results imply that theories of mediated communication could more accurately capture today's interaction by considering awareness and interaction as a

continuum of attentional states; and further that these attentional states are negotiated using channels and notifications that vary in perceived salience. We also found, however, that there are few norms or agreements on the salience of channels or how notifications are configured or executed. This complicates attention negotiation and challenges existing designs and theoretical perspectives.

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