How People Form Folk Theories of Social Media Feeds and What It Means for How We Study Self-Presentation

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ABSTRACT
Self-presentation is a process that is significantly complicated by the rise of algorithmic social media feeds, which obscure information about one's audience and environment. User understandings of these systems, and therefore user ability to adapt to them, are limited, and have recently been explored through the lens of folk theories. To date, little is understood of how these theories are formed, and how they tie to the self-presentation process in social media. This paper presents an exploratory look at the folk theory formation process and the interplay between folk theories and self-presentation via a 28-participant interview study. Results suggest that people draw from diverse sources of information when forming folk theories, and that folk theories are more complex, multifaceted and malleable than previously assumed. This highlights the need to integrate folk theories into both social media systems and theories of self-presentation.

Author Keywords
Algorithms; algorithm awareness; folk theories; social media; algorithmic curation; grounded theory; user understandings; theory formation; social feeds

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI)

INTRODUCTION
Every day, social media users around the world share stories and photos chronicling their lives, livestreams, and commentary on their world [17]. This content may be visible to multiple audiences – likely the poster's friends, but potentially millions of others as well [29, 34]. The content will affect others' impressions of the poster [16, 27, 33], possibly in ways consistent with their self-presentation goals or desired self-image, but potentially in negative ways with consequences ranging from embarrassment [33] and bullying [52] to social stigma [2] and job loss [19]. With

this in mind, there is substantial evidence that social media users wish to understand and control who sees their content [20, 29, 30]. Nonetheless, their actual understanding of these systems is often tenuous and in flux [11, 12, 31, 32].

One reason users struggle to understand their social media audience is that content visibility is often controlled by proprietary, algorithmic social media feeds, such as the Facebook news feed or Instagram feed [4, 8, 15]. These algorithms take the content available to each user and curate it, resulting in a more manageable feed [15, 50]. From the perspective of an individual posting content, these feeds take self-presentation behavior (e.g., status updates or photos) and make it visible to some audience members but not others. These systems play an increasingly central role in people's everyday lives [15, 37, 38, 43, 50], and therefore in their everyday presentation of self.

While valuable, these algorithms are often complex, difficult to understand and opaque [15]. They provide users with little information about how they work, and operate unpredictably [37, 38]. As such, most users understand them poorly [11, 12], which can exacerbate common online self-presentation problems (e.g., context collapse [34] and difficulty with fine-tuned self-presentation [6]).

Users' strategies for understanding these systems have been explored through what cognitive scientists call folk theories. Recent work in HCI (e.g., [7, 11, 12, 14, 42]) has focused on eliciting these theories, which are defined as "intuitive, informal theories that individuals develop to explain the outcomes, effects, or consequences of technological systems" [7 p. 3165]. This work has shown, for example, that many people have high-level folk theories that affect their perceptions of how algorithms like Facebook and Twitter's feeds work [7, 11].

Given the potential consequences, negative and positive, of users' online social media content, we must update our theories of self-presentation to account for the role of algorithmic social media feeds in this process, and how users understand them [6]. Two key open questions remain in this endeavor. First, others have examined how users think about audiences (e.g, [29, 31, 32]), and how they reason about why content is selected for consumption in their feeds (e.g., [11, 12, 42]), but we know little about how users form folk theories about how content they produce will be seen by others. More examination is needed of folk theory formation for self-presentation in algorithmic social

feeds, including how users seek and integrate new information.

Second, we need to update our existing theories of self-presentation to account for the new role of algorithmic curation, and how folk theories about such systems are used in fine-tuning one's self-presentation behavior. More investigation is needed to build a conceptual toolkit for linking folk theories to self-presentation.

In this paper we present an interview study of how users seek information about and form folk theories of algorithmic social media feeds as they try to achieve their self-presentation goals. Our analytic approach is inspired by information foraging theory, a classic paradigm for understanding information seeking in environments where information is scarce and problems are poorly defined [40, 41]. We further consider how individual-level factors, such as web skills and self-monitoring, play a role in folk theory development. Results suggest that important information driving the formation of folk theories can come from sources both endogenous and exogenous to the platform; that most folk theories include multiple sources of information or inference about the platform's operation; and that the malleability of folk theories vary considerably.

BACKGROUND
To understand how folk theories of algorithmic social media feeds play into social media self-presentation, we must first examine how folk theories are created and used, and understand the challenges and opportunities users face.

Information foraging theory [40, 41] has proven useful for understanding how users seek and make sense of information in situations where goals are ill-specified and necessary information is scarce or difficult to find. In many ways, the social media environment exhibits these properties. Users have high-level self-presentation goals, but may not know exactly how to achieve them or find information necessary to understand the environment, as information about the operation of the social media platforms themselves is scarce [15, 37]. As such, we draw on information foraging and the larger process of contextual sensemaking in which it is embedded as a theoretical sensitizing construct that guides our qualitative analysis [3].

Fundamentally, information foraging is about how people find useful information. Navigating to the wrong information incurs costs, in lost time and utility [40, 41]. In this way, constructing folk theories is similar to foraging in that less useful information could result in folk theories with little or negative utility. In our context, this could mean lost or botched opportunities to present oneself well, or even embarrassment or humiliation. To understand how and why people select the information that comprises their folk theories, and thus help people avoid negative outcomes, we must understand their information sources and how this information is gathered.

In considering folk theories for social media self-presentation, utility is a key criterion. Folk theories are more focused on utility than empirically-provable correctness. If a folk theory helps a user achieve their goals, it is a "good enough" folk theory for that user [24]. This is further supported by evidence from developmental psychology suggesting that people adapt their folk theories in dynamic environments to maintain the theories' utility, by replacing or reformulating them as utility varies [47]. As such, our analysis is guided by the utility of folk theories.

Importantly, foraging is only one step in achieving one's goals. Foraging is typically followed by a sensemaking phase, in which new information is integrated into a usable "knowledge product" [40, 41]. Guided by this template, we consider people's self-presentation goals, how information about platforms is gathered and selected (i.e., "foraged"), and then how this information is brought together to create a usable knowledge product, or a "folk theory" in our terms, for understanding algorithmic social media feeds in service of social media self-presentation.

Self-Presentation Goals
Information foraging occurs embedded within the context of a larger task to which the assumptions of foraging are indexed [40, 41]. We take successful self-presentation to be the embedding context, with "success" defined as fulfilling of one's own high-level strategic self-presentation goals [27, 46]. This definition is reinforced by work suggesting one's overall desired impression to be a primary goal and motivator [44].

Social psychology research shows that these goals vary between individuals, and, depending on personality and orientation towards others, can take different overall forms (e.g., acquisitive vs. protective presentation), with very different tactics needed for fulfillment [1]. We define goals in terms of the overall impression the individual is trying to project. For example, we are interested in whether somebody seeks to create a more polished image rather than a more candid one, but are less interested here in exactly how they do that. As goals play an important role in self-presentation, our first task is to identify them. We asked:

RQ1: What self-presentation goals do participants have when producing content in algorithmic social media feeds?

Potential Sources of Folk Theory Information
Having identified users' goals, we must understand how people seek the information that will help achieve them. Research on folk theories in HCI has yielded a detailed understanding of how people become aware of algorithmic social media feeds. This is often via violations of expected behavior (e.g., a close friend posts something you do not see on your feed) [12]. People adjust their behavior once they are aware an algorithm is in play, including closely comparing who is shown in their feeds to their prior expectations, among other tactics [7, 11, 12, 42].

However, these approaches only capture people's general responses to algorithmic curation. Self-presentation is a complex, strategic, and ongoing process that is responsive to the environment [16, 27]. It would be difficult to make effective decisions in this process based only on awareness that an algorithm exists. What other sources of information are used for developing folk theories in social media?

In describing how individuals locate specific sources of information, information foraging theory posits that decisions on what information to rely on, or forage, are evaluated based on the potential utility of the information in achieving one's goal [40, 41]. Here, this can be seen as evaluating information for utility in effectively fulfilling self-presentation goals.

In information foraging this interplay between goals and utility is constrained by the foraging environment [40, 41]. The key environmental constraints here are on the availability of information about algorithmic social media feeds. However, as Pirolli notes, foraging models must consider both "the constraints of the environment and the psychological machinery available" to the user [40 p. 8]; similarly, self-presentation behavior has been linked to this psychological machinery as well (e.g., [6, 33]). In our analysis, we will be attuned to psychological factors that may further constrain foraging.

The folk theories literature in cognitive science suggests that people consistently tend to use knowledge in the world, gained from artifacts or systems directly, to supplement existing knowledge of that artifact or system [45]. This tendency is stronger when there is an accessible "top layer" of mechanism plainly visible to users, and hidden layers underneath. This is often the situation on social media platforms, where content is visible as a top layer but the underlying mechanisms of curation are hidden. Additionally, cognitive science also suggests that socially obtained information (e.g., talking to friends about how a system works) can also be valuable, such that these conversations work as an information source [13, 24].

We need to better understand how and where users source folk theory information in order to understand the role folk theories play in self-presentation. As such, we asked:

RQ2: *What are the sources of information for folk theories of algorithmic social media feeds?*

Forming Folk Theories from Information Sources
Continuing to use information foraging as a guide, we would next expect a sensemaking step [41, 51] in which foraged information is turned into a usable knowledge product, what we call a folk theory. Prior HCI literature has mostly focused on what might be called single-issue folk theories. For example, a user notices that they only see posts from people whose posts they often comment on, so they operate with a folk theory that commenting behavior drives curation. A single-issue folk theory could be a usable knowledge product; as noted above, if the theory has utility,

it can be a "good" theory, regardless of its complexity. However, with the increasing complexity of these systems [15, 43], it is unlikely that single-issue theories will be useful. We know of no work in HCI, however, that explores the process of how folk theories are formed from raw information beyond single-issue theories, particularly the development of folk theories that are sufficiently sophisticated to have utility for self-presentation.

Here, we again look to cognitive science for guidance. Extensive experiments in that literature show that folk theories are formed intuitively, represent minimal concern for internal consistency, and are often fragmentary. They generally aim towards causality but do not always fully achieve this [24, 25, 47]. It is also possible for nascent theories to coexist or be combined [47], suggesting that we can expect some mechanism by which multiple sources of information can be used to form folk theories (e.g. a sensemaking process), potentially leading to different folk theories that exist side by side, or complex, aggregate theories that constitute new knowledge. This suggests that multiple pieces of information are often necessary to even start building a folk theory.

Overall, the cognitive science literature suggests that our current understanding in HCI of single-issue theories without complex construction may be limiting in terms of understanding how folk theories relate to complex behaviors such as self-presentation. Accordingly, we asked:

RQ3: *How is information integrated to form folk theories of algorithmic social media feeds in self-presentation?*

METHOD
To answer these questions, we conducted 28 semi-structured interviews with social media users, focusing on the platform each participant indicated they most frequently posted to: Facebook (n=12), Twitter (n=6), or Instagram (n=10). We chose to focus on these three platforms due to their wide user bases [9], varying levels of algorithmic influence on user content, and focus on these platforms in prior work (e.g., [4, 7, 11, 12, 42, 48]).

Participants
Participants were recruited via flyers on the campus and surrounding area of a large Midwestern research university. They were compensated with $25 for a 60-90 minute in-person interview at our laboratory. Participants were undergraduate and graduate students, as well as non-student members of the university community. Ages ranged from 19 to 25 years (M=20.8), and gender skewed female (N female = 19). The sample was racially diverse, including individuals who identified as white, African American, Asian, Hispanic, and multiracial. We recruited participants until we reached theoretical saturation [5].

To gauge participants' prior knowledge of and engagement with social media and the internet, we administered two scales after the interview. For general internet skill, we used Hargittai's web skills index [18], a measure of how
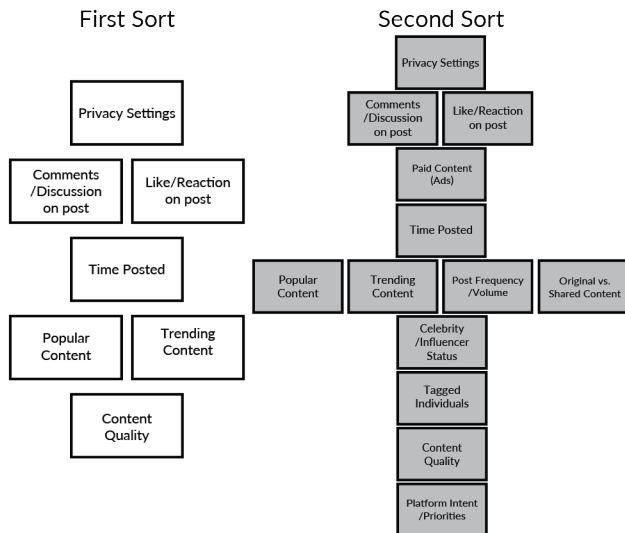
First Sort   Second Sort

Figure 1. Example card-sort results showing P29's perception of how Facebook's news feed determines the audience for one's own posts. Factors on higher-placed cards are believed to be prioritized over those on lower-placed cards. Factors on the same row (within each sort) are equal priorities.

effectively a user can use the internet. Participants had moderate web skills (M=3.2 on a 5-point scale; SD=0.54). Platform usage was measured via a self-report usage scale from [6]. Participants were low to moderate users of the social media platforms they discussed in their interviews (M=2.1 on a 6-point scale anchored by 1 = weekly or less, 6 = multiple times per hour; SD=0.48), suggesting that our sample was not likely biased by power users who may be working from expert knowledge instead of folk theories.

Procedure
After consenting to participate, participants underwent a two-phase interview process meant to elicit their understanding of information flow on their chosen platform.

The first part of the interview was designed to make the participant's existing knowledge about how the platform works more salient. We prompted them to reflect on current and past posting behavior (especially instances of poor or unexpected behavior) and their understanding of imagined and actual audiences for that content. The interview protocol was informed by prior work showing audience awareness and expectation violation to be helpful in revealing and exploring user folk theories (e.g., [7, 12, 42]).

Throughout the interviews, interviewers listened for indications of folk theories or other asserted knowledge of the platform. They then followed up on these with questions about the sources of these ideas and requests for deeper explanations, following [45]. Throughout, interviewers were careful to indicate that the probes were motivated by our interest in the participant's perception, and not by our own more accurate model. When participants asked if their ideas were accurate, they were told we did not know.

The second interview phase was a card sorting task inspired by work on mental models (e.g., [21, 22]), a close cousin of folk theories[1]. For sample task results, see Figure 1. Throughout the first interview phase, the interviewer had kept a list of the decision criteria the participant had said might influence algorithmic curation. In part two, these criteria were presented individually on small index cards. The participant was asked to arrange the cards to represent how they thought the platform would curate their content. Participants were told they could use any structure that expressed how they thought the platform worked and that they could use as many or as few cards as they wanted. In practice, most participants either presented a ranked list of factors or a rudimentary flowchart. Interviewers made clear to participants that this task was about their ideas; there were no wrong answers, and we had no "accurate" model of the platform for comparison. Once the participant's card sorting model was complete, the interviewer and participant stepped through the model card by card. The interviewer probed on reasoning for each card's position and sources of information, if any, that supported their reasoning.

After all cards were probed, the participant was given additional cards with factors mentioned in prior work (e.g., trending content, celebrity/influencer status, location proximity, time posted, likes/reactions, comments, etc.) (e.g., [7, 11, 12]) that had not been mentioned in the interview, and asked to adjust the model to incorporate the new factors. These new cards were presented to participants as factors frequently mentioned in discussions of this issue, and were not given privileged status (e.g., relative to what Facebook/Twitter/Instagram actually does). Participants were again told to use as many or as few of the new cards as they wanted. Once this second model was complete, we repeated the step-through and probe process.

Finally, participants were asked to create an algorithmic curation model they would prefer to see on their chosen platform. This model was also stepped through and probed, but we do not report here on data regarding this final model.

Analysis
We approached our data guided by past work, but with goals of discovering new insights about how users form and use folk theories relevant to self-presentation. We used a constructivist grounded theory approach, allowing themes to emerge through close reading of transcripts, memo-ing, and constant comparison [5]. All transcripts were read by the first author and two research assistants, who regularly compared themes and iteratively developed an open coding scheme, per [35]. This coding scheme was then refined into axial codes through discussion and iteration by the lead author and two research assistants, with consultation from a

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[1] Mental models are seen as a functional blueprint of how a user thinks a system works [36, 39], while folk theories are less formal, less mechanistic, and more expansive, representing guiding beliefs about a whole system [23, 24]. For further discussion see [14].

senior researcher. (Among these axial codes were key correlates for self-presentation, described below.) Finally, the lead author, the original two research assistants, and an additional research assistant, performed a final set of comparisons and discussions as part of a selective coding round, including re-coding when needed.

The card sorting exercise, which is not native to grounded theory methodology, was analyzed as a companion to the corresponding parts of the interview transcripts. We did not quantify the card-sort data here, and instead used the visual representation of the user's model to enhance our understanding of the user's explanations.

Emergent Self-Presentation Factors
During open coding, all coders noticed recurring patterns in the data that closely matched psychological correlates of self-presentation identified in prior work (e.g., [6, 10, 33]). We accounted for these emergent self-presentation factors during coding, operationalizing them as follows:

Self-monitoring, or the ability to observe cues in one's surroundings and appropriately adapt self-presentation [49], has been repeatedly shown to be a key factor in self-presentation (e.g., [6, 33]). Following [1, 28], we separate self-monitoring into protective self-monitoring, which concerns sensing cues from others as to what behavior is considered unacceptable and will damage one's presentation, and acquisitive self-monitoring, which concerns sensing cues about what kinds of behavior will gain praise and approval from others.

Audience understanding style speaks to how a user understands their imagined audience. We adopt Litt and Hargittai's terminology, including *abstract understanding* as a broadly imagined, nonspecific audience, and *targeted understanding* as an understanding that is linked to specific potential audience members or groups [31].

Tool use concerns whether or not a platform user uses available audience management tools (including privacy features). We include both *audience-reaching tools* which build audiences (e.g., tagging, hashtags, post timing) and *audience-limiting tools*, which constrain visibility (e.g., audience lists, privacy settings) [32].

We also used a validated and commonly-used (e.g., [6, 33]) web skills [18] measure alongside these emergent factors.

RESULTS
Overall, our analyses suggest that, while users' self-presentation tactics vary, there are clear trends around our research questions that lend insight into both how folk theories are formed and the relationship between individual differences and folk theories. We first discuss our participants' self-presentation goals and then consider how these goals relate to the sources and content of folk theory information, folk theory construction, and the malleability of folk theories.

Goals: Why Do You Present?
RQ1 asked about participants' self-presentation goals. Our analyses surfaced four distinct, mutually exclusive goals.

The most common goal (42.9% of participants) is *authenticity*, where the participants say they are attempting to present in a way that accurately reflects how they see themselves, with a minimum of artifice or performativity. As P28 recounts, this often reflects a desire to be genuine:

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"I'm like the kind of person who wants to be
perceived as who I think I am, and so I try to be
like honest and genuine, when I like put myself
out there."
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The next most common goal (32.1% of participants) is *polished presentation*, where participants say they aim to craft a specific, consistent image for themselves. This may aim to portray a desired image or aesthetic, fulfill the preferences of one's audience, project a new or desired social image of oneself, or mask imperfections to create an image one can be proud of, as P14 quite literally recounts:

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"I like to be proud of my Instagram. I feel like
if you look at [just any photos] you could see
flaws, and why would I post it if I could post
something that is perfect?"
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The third most common goal (17.9% of participants) is *peacekeeping*, where participants see themselves as working to stay within a desirable range that will not "rock the boat" with any of their audiences. Peacekeeping goals are not tied to the desire to push or achieve a distinct, desired image, but rather to stay within a range that will offend as few people as possible. A major motivator here is avoidance of arguments, as recounted by P23:

```
"Yeah, I definitely stay away from controversy in
my permanent social media image… I just want
people to, you know, I don't want there to be
arguments."
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Finally, a small minority (7.1%) of participants were coded as having *goal-neutral self-presentation*. These participants claim to not actively pursue any self-presentation goal. They described no criteria for what content should or should not be linked to themselves. Of course, it is unlikely that these individuals literally have no goal; however, this is what they told us, with examples that at least suggest a haphazard style of self-presentation.

Having identified these four goals, we now examine the origins of information used to achieve these goals.

Sources: How Do You Know?
RQ2 asked about sources of information for folk theories of algorithmic social media feeds. We identified two broad sources of information: *endogenous information*, which originates with the platform itself, and *exogenous information*, which originates outside the platform. In defining these, we consider the origin of the information from the user's point of view. Thus, even if shared on Facebook, a *Wired* article about the Facebook news feed

would be exogenous because the magazine, and not Facebook, is the source of the information.

Endogenous information was used by most participants (89%), suggesting that many folk theories arise from participants' experience with the platform itself. Participants reported several ways they became aware of endogenous information. Noticing repeated patterns of friends shown in a feed is a common tactic, as is picking up on patterns of content, as recounted by P22 when discussing their sense that that mixing content types "must be" a priority for the Facebook feed:

> "I feel like they must mix it up in terms of what they show you, for example statuses and then what people liked, if it was a picture and then they could show you videos… on my news feed at least it's always very mixed, so I don't feel like I'm reading status after status after status, so I feel like that might be high priority."

Observing the platform's reaction to one's own behavior can also be an endogenous cue, as recounted by P7 while discussing Instagram's curated "Explore" feed:

> "I think they already know from what you like and when you're exploring, because now on my explorer feed, all I have are lifting videos… My brother, he likes pictures of cats, so his explorer feed is just lot of pictures of cats but then, he randomly has videos of WWE and he doesn't know why, but I guess from a while back, he liked a post that had John Cena in it and now his feed feels like a mix of WWE and cats."

Direct observation of what comprises one's feed is not the only source of endogenous information. Participants also talked about what was not there. In the second round of card sorting, where common algorithm factors are introduced, P21 rejected the notion that current location is used to generate Instagram's feed:

> "Because I'm an exchange student, so most of my friends are in Singapore and I do have some friends here who use Instagram in the States, but I don't see the States people's posts getting prioritized over people in Singapore, so I guess location doesn't really affect it."

In addition to observation, some participants felt that certain features or affordances reflected platform priorities. They said the mere presence of a feature "must" mean it is incorporated into the platform's algorithmic curation mechanism. When asked why "content" was listed as a key component of their card model of Facebook, for example, P11 said they had noticed the "don't show me content like this" button on each piece of content in their news feed as well as a feature to make certain ads "go away" based on their content. To P11, this meant the content of posts must be a key feature in how their news feed is aggregated.

Often, this endogenous information exists alongside exogenous information. Half of our participants reported using both kinds of information when considering the basis of their posting behavior on social media platforms. This exogenous information tends to come from outside media (e.g., magazines) or discussions with friends. The opinions of friends and, especially significant others, were particularly important, as recounted by P13:

> "I think it was that comment from [my] boyfriend that he hadn't seen that specific post… he said, 'Its filtered by like how often you like people's post and stuff like that.' I was like, 'Oh of course it is, and then everything is probably filtered that way.'"

Emergent Self-Presentation Factors

As noted above, both self-presentation theory and information foraging take relevant environmental and psychological constraints into account. This allows us to go beyond identifying sources of information and learn why individuals favor certain sources. Although half of our participants used both endogenous and exogenous sources, during open coding we noticed patterns among those who favored one source or the other. Based on prior literature, we coded for these (see above).

Our findings suggest that, for users skilled at using the internet, the platform provides all the information they need to make self-presentation decisions. Participants that report relying exclusively on endogenous information all have higher-than-mean web skills compared to other participants. This may reflect greater ability to understand and draw information from the platform, and, in turn, achieve self-presentation goals. For example, P6, a student who recently came to the US from India, noted that their primary goal in using social media is to authentically show friends back home the "journey" of life in America. Initially, their photo posts received little attention, but this changed when, while searching Instagram for information about a soccer tournament, P6 noticed that results seemed dependent on hashtags. Since then, P6 has believed that hashtags are the primary driver of distribution on Instagram, and reports that not only do their posts get more attention with their new hashtag strategy, but also attention from their desired audience. Here, observation alone informed P6's folk theory and, technically correct or not, the theory is "good enough" as it helps achieve presentation goals.

The opposite appears true of participants who favor exogenous information. All of them have lower-than-mean web skills, which could reflect difficulty in deciphering cues from the platform, or less inclination or ability to look "under the hood" of a platform. In fact, all exogenous-only participants described situations in which friends and family stepped in and informed the participant of lax privacy settings. These participants frequently recounted progress in learning how to use the platform as a series of interventions from friends plus new ideas seen in news articles. Additionally, these participants had goals focused on control, such as polished presentation or peacekeeping. They also all showed signs of employing complex social choreography in their self-presentation behavior, such as regularly engaging in protective self-monitoring behavior

and limiting tool use according to our coding criteria. Overall, this suggests the exogenous-dominant folk theorist is playing a primarily defensive game, based off the advice of others. They are aiming for a specific presentation, but with limited understanding of how to do so.

P8 is a good example of this. We coded their presentation goal as "peacekeeping," as they are aware that "there're people always willing to pick a fight on Facebook" and wish to avoid this type of conflict. However, this goal went unachieved initially. P8 described being excited to use Facebook's tagging feature but saw no information suggesting that a tag would not just be visible their friend, but also friends of friends, and wound up with an audience that was both much broader than expected and not eager to be tagged. In short order, a friend called and complained about P8's unrestrained tagging, explaining privacy and related settings along the way (and validating similar advice from P8's mother). With this new, exogenously-sourced information about how Facebook works, P8 turned to more restrictive privacy settings for all their content and tagged fewer posts, to a point where they now describe their peacekeeping goal as largely fulfilled. Where P8 was unable to gather endogenous information about how Facebook works, friends helped via exogenous information.

In sum, it appears that favored source of folk theory information varies with individual factors, suggesting that personality and skill attributes may affect the folk theories that guide self-presentation behavior.

Sensemaking: From Information to Theory
RQ3 asked how people aggregate information from these sources to form folk theories used in self-presentation via algorithmic social media feeds. Consistently, we found complex, aggregate folk theories generated from multiple, often disparate, pieces of information from different sources. Participants discussed a piecemeal path to their understanding of a platform.

In some cases, folk theory formation is purely additive, with multiple pieces of information from multiple sources believed to have a causal relationship with the final outcome (in this case, the constructed feed). For example, consider P32's ongoing attempt to understand how their use of privacy features and their liking behavior influence the composition of their audience (especially regarding parents and family). When asked how they had come to understand these aspects of Facebook over time, P32 recounted:

```
"I mean just growing up with it to be honest… kind
of through my own thing where you're trying to
make things… more or less private… and then you go
through Facebook's help manuals and stuff and it
helps you know how to do certain things. So I
guess sort of like tinkering with Facebook itself,
that's how I've gotten to know."
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From a combination of endogenous, observation-based information from the platform and reading documentation,

over a sustained period of time, P32 was able to additively develop a folk understanding of the news feed's dynamics.

Many participants, however, moved past this tinkering type of model to extrapolate more. For example, P14 combined knowledge gathered from sources with P14's own assumptions about the corporate goals of Instagram in justifying why they thought celebrity and verified status were major factors in generating a feed:

```
"They're getting money for it… they'd rather have
someone like that post than me post because
they're going to get money and that's really great
for them. Similarly, verified accounts and some of
the influencers, that's essentially marketing for
them too… People like to see what they're doing.
So, they're going to put that at the top."
```

For P14, this inference, initially based on both endogenous and exogenous information plus their own speculation, was then combined into a larger folk theory that goes beyond just this one causal relationship:

```
"If it's something that's happening that day or is
just a popular post [it moves to] the top…  Post
frequency and volume… I think maybe when you don't
post often and then you post, it goes the top
because they're like 'oh, this user's finally
using this platform…'  I feel like I get more
likes when I don't post in a while, then I post
something… Location proximity, I think when you
check in places and you have checked in there too,
it's good, it's a match."
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P14's overall folk theory includes elements based on endogenous observation mixed with inferentially-generated elements – not an uncommon combination in our interviews. In fact, all participants, especially during the card-sorting exercise, drew on multiple sources to create a larger model of how the entire system might work.

This kind of combinatory sensemaking appears to occur across presentation goals and psychological factors. However, a small subset of our participants with consistent self-presentation goals and attributes recounted *confirmatory combinations*, in which the participant compares and aggregates these multiple pieces/sources of information with each other to verify accuracy before acting on the information. For example, as noted above, P13 started actively believing that engagement was a key factor in the Facebook news feed when their partner asserted this. Really this functioned as confirmation of an earlier hunch based on observation:

```
"I already knew that [likes and comments] had
something to do with everything probably in junior
year of high school just by observation… stuff
from people that you don't know [shows up] because
someone has commented on it who is your friend. I
just observed that that was happening."
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As P13 then recounted, they had also gathered endogenous information by observing the results of their own liking and commenting behavior, plus additional discussions with friends, before final confirmation from their partner (who

had based their confirmation off a reddit post). To incorporate likes and comments as important parts of their folk theory of the news feed there was a multi-step, multi-sourced process of confirmation.

Like all other participants who recounted confirmatory combinations of information sources in their folk theory, P13 had a polished presentation goal, and reported behavior consistent with a targeted understanding of their audience, and high tool utilization (both to limit audiences and reach new audiences). Additionally, they drew on both endogenous and exogenous information, using the endogenous information to confirm exogenous information or vice versa. This suggests that, for those looking to maintain a tightly-controlled image on social media, both sources of information may be required, or at least useful, to ensure that their folk theory is as "good" as possible.

In sum, the majority of our participants did not hold single issue or static folk theories, a departure from prior HCI literature. Instead, we saw the construction of complex, multi-faceted folk theories from multiple sources of information, and we found that this variety of sources and the dynamic nature of folk theories interacted in important ways with self-presentation goals.

Malleability: How Rigid are Folk Theories?
Our analyses also yielded emergent findings regarding the utility of folk theories. As the sensemaking process described above consists largely of constantly modifying one's understanding to integrate new information, we explored the perceived utility of a participant's folk theory in terms of how malleable it is. To do so, we used our iterative process to code the apparent malleability of a participant's beliefs, based on distinct markers identified in earlier coding. Folk theories were coded as "malleable" or "rigid," by examining each participant's stated confidence in their understanding, their reported posting behavior, and the consistency of their choices and behavior in the card sort. For example, we coded P29's theory as malleable, based on their willingness to heavily modify their model of the platform during card sorting, as seen in Figure 1, and on their explicitly-stated lack of knowledge about how algorithmic social feeds work.

Overall, the majority (60.7%) of participant folk theories were malleable, suggesting that most folk theories are flexible, as opposed to closely-held, rigid beliefs. One example of a participant with a malleable theory, and how changeable such a theory can be, is P30, who estimates that they understand 10 to 20 percent of how the Facebook news feed operates, despite describing a complex theory that reflects substantial inference. P30 was willing to change their theory when presented with new information, in that their second-round card sort tripled the number of factors they included compared to the first-round sort.

Not all theories coded as malleable were initially presented that way, however. P10, for example, confidently asserted
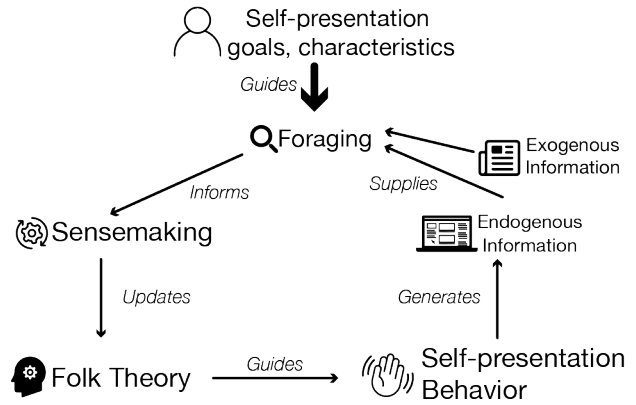

Figure 2. The folk theory formation process. Self-presentation goals and characteristics (top) influence the whole process. We start here at the foraging step, but the process is iterative with folk theories under constant revision.

their folk theory as fact, but when challenged downgraded their claims to guesses, and changed their model to include new information and additional structure during the card sort. This suggests that even when a user confidently deploys their folk theory, it is not necessarily ironclad and can be updated with new, and potentially even contradictory, information.

In contrast, 28.6% of participants held what we coded as rigid folk theories[2], speaking confidently about them, even to the point of asserting expertise in this area. During the second card sort, strong theory holders ignored additional cards or gave them low priority, preserving their initial structure. When challenged during the interview, they defended their theory. P5, for example, rejected all of the additional cards in the second sort, and repeatedly said they trusted their own observations. P12 did integrate new cards during the second sort, but only when it bolstered or at least did not disturb their original theory.

While folk theory malleability does not appear to have any direct relationships to self-presentation factors, we saw evidence of relationships to other elements of folk theory construction. Those with rigid folk theories tended to favor endogenous information, and also often made complex inferences as described above. In other words, those with rigid folk theories largely drew from the platform and extrapolated from there, without much outside influence, social or otherwise. This suggests that the rigid folk theories may be constructed largely in isolation, in an interplay between the platform and an individual user.

DISCUSSION
We have explicated how users form folk theories of algorithmic social media feeds, as illustrated in Figure 2 and explained below, and how this process relates to self-presentation, as illustrated in Figure 3.

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[2] An additional 10.7% of participants had a folk theory we could not assess on malleability from the data at hand.
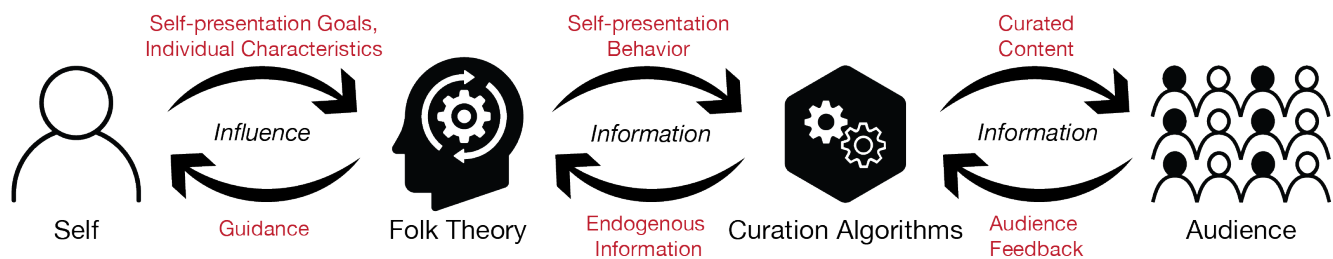
Figure 3. Cross-sectional view of how folk theories play into self-presentation processes on social media.
Note: not all aspects of the self-presentation process are represented here.

Our first research question (RQ1) asked about participants' goals in self-presentation. Prior literature suggests these goals should largely drive the rest of the self-presentation process [27, 44], so understanding goals was necessary in order for us to characterize how participants searched for and evaluated information relative to these goals. As Figure 2 shows, we found that these goals drive both the self-presentation and folk theory formation processes.

Unsurprisingly, participants expressed several discrete self-presentation goals that reflected varying degrees of curation, concern about audience and authenticity in self-presentation. The goals we found fit broadly with the goal types predicted by Arkin, with clearly acquisitive goals (e.g., polished), protective goals (e.g., peacekeeping), and a balance between the two (e.g., authentic) [1]. These goals, moreover, influenced the folk theory formation process, as we describe below.

Our second research question (RQ2) focused on information foraging and the formation of folk theories in this context. As Figure 2 shows, participants used a diverse set of information sources, including both endogenous information, which is sometimes generated by participants' own behavior, and exogenous information. Moreover, choices among information sources were related to the self-presentation goals articulated in RQ1, as well as self-presentation factors such as web skills and self-monitoring ability.

Our third research question (RQ3) asked how sensemaking processes led to the development of folk theories by integrating information from the foraging reported in RQ2, as guided by goals reported in RQ1. As Figure 2 further illustrates, our results point to an inferential and ongoing sensemaking process in which users develop their folk theories. For most participants, moreover, these folk theories were evolving and malleable. Most participants revised their folk theories when probed. This points to the potential ability to update and change theories, either naturally as new information surfaces or though targeted intervention. This evolving folk theory, which is complex, multi-sourced, and malleable, then guides self-presentation behavior as we describe below. The iterative structure of Figure 2 shows that participants' folk theories evolve over time. Behavior guided by a folk theory then generates endogenous information, supplies new information to be

foraged and may drive updating the folk theory with new information.

Integrating Folk Theories into Self-Presentation
Taken together, our findings strongly suggest that we consider folk theory development and use as components of behavioral models of self-presentation, such as Goffman's [16]. Here we return to concepts from information foraging [40, 41]. As noted above, new information is assessed according to its utility in achieving goals, as constrained by attributes of the environment [40, 41].

Goffman's model essentially describes an interplay whereby an identity is projected by the self, others respond to that projection, and behavior is adapted to achieve one's goals [16]. Where information is sought, it is largely in the form of feedback or attributes of the environment that guide behavior. Recent work has argued that social media and algorithmic curation have complicated self-presentation by mediating the relationship between self and audience [6].

Figure 3 shows the relationship between folk theories and self-presentation, highlighting that the relationship between audience and self is no longer direct. Information about the self can flow through multiple channels, and algorithmic social media feeds can obscure the actual audience, essentially introducing a new environmental constraint to the self-presentation process. Prior work highlights that people may be slow to recognize these changes, but have some basic folk theories about how they function [11, 14, 42].

As Figure 3 further illustrates, our findings build on this work by highlighting novel information dynamics in the self-presentation process. In addition to seeking feedback and basic attributes of the environment in achieving their goals, people must now also seek information about – and develop a functional understanding of – complex algorithmic social media feeds. This understanding, in the form of a folk theory, bridges the self (left side of Figure 3) and the feed (center of Figure 3), allowing people to reach and get information about their audience (right side of Figure 3).

Our data suggest that this process occurs very much as a part of the self-presentation processes described by Goffman. Moreover, it exhibits many of the properties of information foraging and its attendant sensemaking process:

people are constantly assessing the utility and plausibility of new information from multiple sources, relative to their goals, direct experiences and the perceived experiences of others [40, 41, 51]. Folk theories are malleable and evolving guides to coping with novel environmental elements that are difficult to understand, but significantly influence self-presentation. Thus, we argue that understanding self-presentation in this important context requires an understanding of how people forage for information and use it to update their folk theories.

With this mandate, our emergent results around information seeking tendencies of participants may offer useful directions for future work. For example, participants that favored exogenous information had more directed, performative goals, and they used more tools to define their audiences and engage in self-monitoring behavior. One interpretation of this is that users who are focused on maintaining a specific image in front of others form folk theories based on information from others and are guided by that folk theory to help them manage others' impressions of them. Thus, presentation goals inform folk theories, which in turn drive presentation behavior.

Notably, other individual attributes appeared related to participants' folk theories. Web skills, for example, which are a proxy for how well one can understand and effectively use internet technology in general [18], are related to information source preferences. Those that favor endogenous information have high web skills while those that favor exogenous information have low web skills. In general, those with higher web skills are simply better at using internet technology [18], and as such appear to have more facility acquiring the information they need from the platform itself. Individuals with lower web skills, though, may not be able to draw all of the information they need from the platform itself; they rely on external support in their foraging process, especially to perform complex social choreography and audience monitoring required to successfully achieve the more directed and privacy-minded self-presentation goals that our exogenous-dominant participants tended to favor. All of this highlights how integral the foraging process is to self-presentation itself, and how it must be accounted for in our theoretical models.

Challenges for Design
Our results also point to two important challenges for designers of complex, algorithm-driven systems. First, our results show that knowledge of a platform's operation is not simply helpful to users, but is in fact an integral part of the social process of self-presentation. This suggests that more accessible information about how social feeds themselves work could be key to helping users achieve their self-presentation goals, lending further support to calls for seamful design (e.g., [11]). This objective, however, must be balanced by limits on how much information is practically useful to users [26] and the risks of gaming and/or manipulation inherent in mechanism transparency.

Second, our folk theory formation findings suggest opportunities for platforms to employ folk theories to anticipate user goals and actively support them in systematic and scaleable ways. By identifying potential pitfalls and missed opportunities associated with certain folk theories via log data and machine learning techniques, platforms could potentially highlight features that may help specific users achieve their goals and avoid mistakes.

Limitations and Future Work
As with any study, we urge caution in interpreting our findings. Our sample was drawn primarily from undergraduate and graduate students, which may affect our results. Many of our emergent findings are preliminary and require larger-scale follow-up in order to assess their scale and robustness. Our focus on posting behavior here, rather than feedback, liking, retweeting, or other self-presentation behavior, also limits the results, though posting is clearly an important part of self-presentation. We urge future work that examines the role and evolution of folk theories in carrying out other elements of self-presentation.

Our analysis here is also limited to information source types (endogenous vs. exogenous), instead of the information itself or even individual sources of information. As noted in our results, endogenous information came from both simple observation of the platform as well as taking action and looking for the consequences of that action. Similarly, exogenous information came from friends, family, magazine articles, help manuals, and more. Each of these individual sources of information merit follow-up, as does the role of social norms, which were surprisingly absent from participant accounts of their platform use.

Finally, though we did not include power users in our sample, we also – inadvertently – excluded brand new users of social media; as such, our results may not apply to them. As the cognitive science literature around folk theories suggests that there is only a limited window in which incorrect initial theories of a system can be corrected [45], this population merits specific consideration.

CONCLUSION
In this paper, we have taken the first steps in understanding the folk theory formation process as it applies to algorithmic social media feeds, and provided a preliminary conceptual toolkit for integrating this important process into modern models of self-presentation. These contributions provide guidance to designers on how to aid social media users in fulfilling their presentation goals in a complex, algorithmic online world.

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