Attached to "The Algorithm": Making Sense of Algorithmic Precarity on Instagram

Yim Register
yreg@uw.edu
University of Washington
Seattle, WA, USA

Lucy Qin
lq@brown.edu
Brown University
Providence, RI, USA

Amanda Baughan
baughan@cs.washington.edu
University of Washington CSE
Seattle, WA, USA

Emma S. Spiro
espiro@uw.edu
University of Washington
Seattle, WA, USA

ABSTRACT

This work explores how users navigate the opaque and ever-changing algorithmic processes that dictate visibility on Instagram through the lens of Attachment Theory. We conducted thematic analysis on 1,100 posts and comments on r/Instagram to understand how users engage in collective sensemaking with regards to Instagram's algorithms, user-perceived punishments, and strategies to counteract algorithmic precarity. We found that the unpredictability in how Instagram rewards or punishes a user can lead to distress, hypervigilance, and a need to appease "the algorithm". We therefore frame these findings through Attachment Theory, drawing upon the metaphor of Instagram as an unreliable paternalistic figure that inconsistently rewards users [74]. User experiences are then contextualized through the lens of anxious, avoidant, disorganized, and secure attachment. We conclude by making suggestions for fostering secure attachment towards the Instagram algorithm, by suggesting potential strategies to help users successfully cope with uncertainty.

CCS CONCEPTS

• **Human-centered computing** → **Collaborative and social computing**; • **Applied computing** → *Psychology*.

KEYWORDS

Instagram, social media algorithms, algorithmic transparency, thematic analysis, social media and mental health, Attachment Theory, algorithmic precarity, content moderation, folk theorization

ACM Reference Format:
Yim Register, Lucy Qin, Amanda Baughan, and Emma S. Spiro. 2023. Attached to "The Algorithm": Making Sense of Algorithmic Precarity on Instagram. In *CHI Conference on Human Factors in Computing Systems (CHI '23), April 23-28, 2023, Hamburg, Germany*. ACM, New York, NY, USA, 15 pages. https://doi.org/10.1145/3544548.3581257

CHI '23, April 23-28, 2023, Hamburg, Germany

ACM ISBN 978-1-4503-9421-5/23/04.
https://doi.org/10.1145/3544548.3581257

1 INTRODUCTION

For the approximately 2 billion active users on Instagram, the possibilities for connection and learning are seemingly endless. One can engage with friends, share memes, learn how to care for chickens, start a band, or even amass 4.5 million followers for their cat [1]. An estimated 71% of U.S. businesses rely on Instagram to promote their products [50], and many artists, photographers, and models utilize the platform as a gallery for their work. Instagram is also a tool for political and social advocacy, with marginalized creators dedicating their pages to education, activism, and peer support [19, 67]. Instagram serves as a tool for self-expression, creativity, promotion, and solidarity. For many, it is simply a place to find joy.

For many content creators, an Instagram presence is directly tied to personal financial benefits and income, the ability to raise awareness on social and political issues, and the capacity to effectively help someone get needed resources. However, visibility and engagement are often unpredictable, sometimes skyrocketing individuals into the spotlight and other times resulting in lack of access or sudden disconnection from community. Prior work has shown the significant and destabilizing impact on creators that accompany these dynamics [23, 43, 68]. By both the nature of machine learning-based algorithms and company decisions, social media platform features and experiences are constantly subject to change. Research has shown how disorienting, frustrating, and unclear this is for both consumers and creators [9]. As a result, the process of sensemaking is continual and persistent—and the consequences of not keeping up can be far reaching. Users fear long-lasting impacts from lack of initial success and algorithmic punishment (algorithmically determined penalties or consequences on one's account, feature access, or visibility). Inspired by Chen et al. [21]'s model of trauma-informed computing and Petre et al. [74]'s description of *platform paternalism*, we posit that this constantly changing algorithm mimics an unreliable relational dynamic and therefore can be interpreted through the lens of insecure attachment. When the arbiter of punishment and reward is unreliable and uncertain, such as is the case with the Instagram algorithm, we observe that users respond in ways that mimic insecure attachment styles (distressing and hypervigilant responses to uncertainty that impact the user's sense of safety, trust, and stability).

While typically used to describe parent-child and adult relationship dynamics, theories of attachment style have also been productively applied to people's relationships to social media, which is

referred to as Attachment to Social Media (ASM) [92]. ASM has previously focused solely on users' relationships to others within their social network [12, 48, 56, 87]. However, Attachment Theory has not been explored in the context of how users relate to the *algorithms* that underlie social media platforms, as we do here. We can use Attachment Theory not only to *characterize* the impacts that uncertain algorithms have on users, but to *draw from* in ideating around how to foster more security, trust, and overall wellbeing for users of social media.

Before delving in to the different manifestations of insecure attachment, we first need to address the perceived threats, harms, uncertainties, questions, and punishments that users are responding insecurely *to*. Researchers, platforms, policy makers, and the public are only just beginning to understand both the short- and long-term effects of doing online creative labor. As Duffy et al. [31] stresses, we need further work to offer "insight into the allocations and rewards of visibility in platformized creative labor." Our work aims to contribute to some of these pressing questions.

Insight into how users perceive algorithmic precarity can be found in their sensemaking and folk theorization. To manage access and opportunity, as well as avoid punishment, users rely on algorithmic folk theories and collective sensemaking to theorize about how to "thrive", or perhaps more accurately "survive", on a particular platform [10, 29]. Knowing how a platform "works"—such as understanding what algorithms underlie how content is made (in)visible, how algorithms give priority to content, and why specific kinds of content tend to get banned—is crucial for success in online creative labor. Users turn to other platforms, marketing courses, and peer support to better understand the algorithmic systems that control their social media experiences [24]. Increasing knowledge of algorithmic processes may allow for a greater sense of control over self-presentation and platform experiences [27], though algorithms still behave in unpredictable ways even when mechanisms are more understood [16, 17].

To engage in community sensemaking around the Instagram algorithm, Instagram users often rely on Reddit forums such as r/Instagram to seek support, compare strategies, resolve uncertainties, and vent about algorithmic harms. Aiming to better understand how these individuals perceive algorithmic precarity, experience distress, and accordingly adapt their behavior, we employed thematic analysis on 1,100 comments and posts from r/Instagram. Our work first seeks to address the following research question:

RQ1: How do Instagram users perceive the effects of algorithmic precarity?

Describing the landscape of algorithmic precarity provides a foundation on which we can increase our understanding of the wide range of impacts on users. Prior work suggests that social media users describe their relationship to "the algorithm" as anxiety-inducing, confusing, and violating their expectations—a back and forth battle they must 'win' [9, 27]. This vigilance demonstrates the charged nature of user-platform interaction. After exploring the ways in which users perceive algorithmic precarity, we delve deeper into the manifestation of insecure attachment styles in response to unpredictable algorithmic behaviors. We ask:

RQ2: How might users' concerns about, and explanations of, algorithmic precarity on Instagram be interpreted through the lens of Attachment Theory, and what are the implications?

Using prior frameworks for ASM, as well as trauma-informed computing, we demonstrate in our findings how users show patterns of insecure attachment, taking form of *anxious, avoidant,* and *disorganized* manifestations in response to the Instagram algorithm. These responses lead to overvaluing the modifying of oneself to appease the algorithm, abandoning attempts for visibility on Instagram, or an inconsistent blend of the two strategies. All are marked by stress, frustration, and complaints, as seen on r/Instagram.

We also observe advice given in r/Instagram comments that demonstrates *secure* attachment and an increased ability to handle uncertainty. Secure attachment helps self-esteem, connection with others, independence, and overall well-being [7, 8, 26, 85, 86, 88]. There is an abundance of knowledge regarding how to help people achieve "earned secure attachment" in social relationships [26, 42, 73, 81], which we contend can be translated to people's relationships to social media and algorithms as well. We conclude this work with recommendations on how knowledge about attachment styles and algorithmic precarity could be used to promote earned secure attachment in the realm of social media, including suggestions for supporting more intentional social media use. We argue that this perspective may assist designers, policymakers, researchers, and users themselves in fostering secure attachment, and thus well-being, in the face of algorithmic precarity [31].

2 RELATED WORK

First, we provide background on the history of Attachment Theory and how it has been applied to social media use. Prior work has not explored user relationships to uncertain *algorithms*, so next we cover the ways in which these algorithms are opaque and precarious—either by design or by the nature of fluctuating machine learning models or societal trends. We provide background on what is known about the impacts of algorithmic precarity on users, as well as the ways in which users come together to sensemake around such uncertainty. Our work aims to further characterize this sensemaking as exhibiting behaviors consistent with attachment responses.

2.1 Attachment Theory

Prior work demonstrates the utility of bringing a lens of Attachment Theory to studies of social media and we use this frame to describe and interpret the effects of precarious algorithms on user mental health (see, e.g. [32]). We posit that users demonstrate insecure attachment when attempting to understand, reason with, or combat social media algorithms. In this section, we review the foundations of Attachment Theory as well as how it has been applied to the study of social media.

Attachment Theory, largely credited to the combined work of psychologists Bowlby and Ainsworth, focuses on human relationships and bonds, and evolved to explain how early childhood experiences later affect adult relationships and dynamics [7, 13, 62, 93]. The key takeaways of modern Attachment Theory revolve around how nurturing, supportive, and reliable environments can lead to a more securely attached adult—one who is able to balance their own needs with the needs of others in stable and reliable adult relationships [85, 88]. Alternatively, less reliable or responsive environments can lead to insecure attachment in adulthood, which is associated with difficulty creating secure bonds, relationships, and a healthy sense of self [41, 66, 72, 78, 79]. The attachment system is directly tied to the nervous system, including sensory experiences, vagus nerve activation, and regulatory processes that control affect and arousal [30]. These mechanisms are related to how individuals respond to stress, fear, safety, and security.

Four types of attachment styles have been identified and largely accepted by the research and clinical practice communities: 1) anxious, 2) avoidant, 3) disorganized, and 4) secure, further described in Table 2 [71, 85, 86]. *Anxious attachment* is characterized by fear of abandonment, high emotional investment in partners, hypervigilance to any changes in stability, and high distress activation when changes do occur [65, 86]. *Avoidant attachment* is characterized by hyperindependence, distancing, emotional suppression and high resentment, as well as deactivated nervous systems that are more prone to dissociation and resistant to social connection [86]. *Disorganized attachment*, the last of the styles to be identified, is a complex and confusing mix of both anxious and avoidant behaviors. It is characterized by higher hostility, anger, frustration, and aggression in addition to a combination of anxious and avoidant tendencies [71]. Finally, *Secure attachment* is characterized by an ability to maintain autonomy while also connecting with others when appropriate. A securely attached individual can manage their own needs while also seeking support and community. They can more easily regulate their attachment system when conflict occurs [85]. It is crucial to note that Attachment Theory research has predominantly focused on western, educated, industrialized, rich, democratic (WEIRD) populations [45]. Manifestations of (in)secure attachment are likely different in marginalized populations [58].

In fact, the main critique of the original Attachment Theory is that it did not account for the effects of a child's social class, marginalized identities, access to resources, or reliability of environment [44, 84]. Critics argue that the original theory put too much stake in the mother's bond, and did not account for environmental factors [37]. Goodwin [41] outlines how the applicability of Attachment Theory must be adapted for relationships outside the child/parent dynamic of the original theory. They conclude ways in which Attachment Theory is useful for adult mental health care and intimate relationships, by heavily considering the roles of mental health staff, group therapy, and other institutional factors. A post-modern view of Attachment Theory demonstrates how too much stake is put on maternal actions, and a "new, ecological model of attachment is needed that will accurately and equitably describe the important but not deterministic mother/infant relationship" [57]. Modern uses of Attachment Theory must imply reversibility of an attachment style, consider multiple dyads beyond just the child and a parent, and must account for the stability and security of one's entire environment, including institutional factors and marginalization [82]. Our work takes this view of Attachment Theory, considering Instagram as a sociotechnical environment in which attachment wounds can be heightened.

Since the 1960s, Attachment Theory has been refined in psychology, clinical practice, as well as applied to other fields like social work [49], social media marketing [48], organizational practice [85], and education [38]. Unsurprisingly, Attachment Theory has been applied to study how users connect with others on social media [92]. As social media has become an integral way of interacting with others and the world, researchers have investigated how attachment styles manifest in social media settings. VanMeter et al. [92] defines attachment to social media (ASM) "as the strength of a bond between a person and social media." This is a departure from the traditional theory as the parties involved are not both humans, but rather human and technology. Attachment Theory has been applied to investigate social media addiction and problematic social media use. Several studies present evidence that a more anxious attachment style correlates with more addictive, compulsive, or problematic use of social media [56, 91], as well as fear of missing out and of consequences for disengaging [12]. Some studies specifically explore how attachment interacts with users' social connections online, arguing that some may use "like seeking behavior" to get social feedback and interaction that they are missing outside of the digital world. Others may fill needs for intimacy by consuming or observing content, without actually interacting—furthering avoidance of intimacy outside of social media [87]. D'Arienzo et al. [32]investigate the relationship between attachment style and social media addiction, concluding that "those with insecure attachment appear to use the social media sites as a way of replacing and compensating affection that is missing from those around the individual."

Attachment Theory has proved a productive lens through which to study social media behaviors, including addiction and harmful engagement. We extend its applicability here, examining behaviors and attitudes expressed by Instagram users in relation to their experiences with platform algorithms. We explore the ways in which an unreliable and precarious algorithm sets the stage for insecure attachment and hypervigilant responses to algorithmic precarity, and observe how these responses manifest in user discussions online. However, we must first ask: What makes an algorithm so uncertain?

2.2 Algorithmic Uncertainty: Opacity and Precarity

Prior work has demonstrated that people want to know more about social media algorithms, but that algorithms are difficult to fully understand [33, 34]. In many cases this difficulty can be traced to various levels of algorithmic opacity and precarity. Algorithms are *opaque*—meaning their innerworkings are unclear to the user, e.g. we often refer to them as a 'black box' that we cannot see into. We know something is going on within the box, but we only see the input and output, not how the input is transformed into the output. Burrell [16] points to three different dimensions of opacity, helping to explain the origins of these traits: "(1) opacity as intentional corporate or state secrecy, (2) opacity as technical

illiteracy, and (3) an opacity that arises from the characteristics of machine learning algorithms and the scale required to apply them usefully." The platform studied here, Instagram, is likely to have algorithmic opacity that results from a combination of all three of these aspects. Instagram's algorithms are intellectual property protected by the company. Its users, on average, lack understanding about how general algorithms tend to function. Instagram must also continually process billions of inputs from constantly evolving societal trends, events, and community behavior to keep its platform engaging. Over the past few years, Instagram has tried to address growing concerns of lack of transparency. A 2021 blog post by the Head of Instagram, for example, attempted to shed light on what the ranking algorithm favors, as well as address concerns about the infamous 'shadowban' [2]. However, as may be expected, the post does not disclose specific details of how different kinds of content are weighted, moderated, or processed. While explanations shared by companies have improved over the last few years, users must still grapple with algorithmic changes and unexpected or unfair behavior every day.

Algorithms are also *precarious*—meaning they are often subject to change (sometimes without notification). Advances in technology allow Instagram to constantly update their software, such as changing how images get processed or tuning personalized recommender systems. This affects both consumers and creators; it is likely that the most detrimental consequences fall on creators. Creators rely on visibility, engagement, and loyalty to increase their financial prospects, and changes in the algorithms are directly tied to such metrics and therefore business success [6]. Duffy et al. [31] refers to the tumultuous nature of algorithmic reward and punishment as "nested precarities", providing a framework to "assess the volatile nature of visibility in platformized creative labor". They find that users can more readily deal with *feature changes* as opposed to more opaque underlying *algorithmic changes*. Instagram, for example, stopped using a chronological feed in 2016, the same year Twitter announced they would also be relying on a new algorithmic feed instead of a chronological list of posts. Both platforms noted that algorithmic curation of visible content would be more personalized and therefore likely to engage the user [20, 51]. However, understanding the hidden engine powering these changes (the ranking algorithm) requires a lot of additional (and technical) knowledge, and may not even translate to greater control over outcomes. For users, these changes lead to numerous questions: *What will the algorithm prioritize? Will it depend on what I like or what other people like? How can I make sure I see my friend's content? Is it analyzing my images? Does it make mistakes?*

Social media algorithms are demonstrably opaque and precarious due to lack of clarity around how they actually work, continual advances in technology, and because they are learning and responding to real-time events and trends. Operating within this kind of highly uncertain and dynamic environment has specific effects on social media users and inspires in both behavioral and emotional responses. The following section explores what we already know about the emotional impacts of this uncertainty.

2.3 Effects of Algorithmic Uncertainty

Uncertainty and resistance arise from changes in algorithmic behavior. The introduction of a non-chronological, algorithmically driven newsfeed was shown to be distressing for many Twitter users who wanted the certainty and structure of the chronological feed [28]. Bishop [9] discusses the anxiety, panic, and self-optimization that dominates how beauty vloggers are beholden to Youtube's recommendation algorithm as they try to stay afloat in the eyes of the algorithm. They may even be pushed into altering self-presentation to be more hyperfeminine in order to occupy a more clear niche for advertisers [9, 10, 60, 77]. Research has also detailed the algorithmic anxiety Airbnb hosts experience as a result of the algorithmic uncertainty in how they are evaluated and recommended to future guests. Hosts were simultaneously unsure of what behaviors may lead to penalization by Airbnb and afraid to exhibit any negative behaviors, which led to frustration and a perceived unfairness in how hosts were rewarded or punished [22, 53]. Karizat et al. [54] explore how algorithmic decisions are entangled with one's own identities, privileges, and marginalization, which shows how algorithmic folk theories can dramatically impact users' sense of belonging and worth. Cotter [23] likens social media use to "playing the visibility game," where entrepreneurs, micro-celebrities, and influencers must contend with opaque algorithmic processes in order to succeed.

On social media platforms, algorithms govern visibility and content presentation; they have also been woven into content moderation decisions. Automated content moderation is an unreliable and distressing experience for many creators [94]. Content moderation is a necessarily element of social media at scale; it is used to combat hate speech, cyberbullying, stalking, misinformation, graphic and violent content, illegal activity, and to enforce a platform's rules around nudity, self-harm, and copyright terms of service. Unsurprisingly, there is now a growing body of evidence to suggest that automated content moderation may sometimes act in discriminatory ways [36, 43, 68], such as mistaking queer discourse as hate speech [70] or perpetuating double standards in how Black womens' content is evaluated and removed [63]. It is unrealistic to think automated content moderation is without error. Yet, we still do not know enough about when and where mistakes are made, not to mention the consequences and harms of these mistakes.

The precarious nature of algorithms can also affect user privacy[18]. For example, a newly out queer person may not want their profile discoverable by or highlighted for non-accepting family members [27]. Sex workers or activists may not want their work easily discovered by family or those who will harass or bully them [3]. Recommended ads that are particularly 'spot on' can feel invasive and creepy, directly leading to user anxiety [46]. There is a notable tension between visibility and vulnerability [90].

2.4 Algorithmic Sensemaking and Folk Theorization

We are able to gain insight into how users perceive and respond to algorithmic precarity due to the phenomena of algorithmic sensemaking online. Users engage in a process of collective sensemaking to figure out how the algorithms on social media platforms work

[34]. For example, Airbnb hosts [22, 53], Instagram users [25], ride-sharing platform drivers [59], and Youtubers [10] have all been shown to leverage online community forums as spaces for sharing algorithmic experiences to collectively sensemake around opaque algorithmic processes. A growing body of cross-disciplinary work explores how and why social media users theorize about algorithms. In the face of limited information and lack of transparency, users engage in algorithmic 'gossip' [10], folk theorization [27, 52] and even selling of algorithmic knowledge[11]. The reasons for doing so span several motivations, such as: to better manage self-presentation to be desirable to advertisers [60], to circumvent content moderation [40], to spread awareness for a social cause [54], and to increase financial success through increased visibility [14].

Folk theories develop as individuals experience and share stories of their engagements with social media. Often, notable experiences are anchored in cases where expectations are met or unmet [33]. There are levels of complexity of an algorithmic folk theory, ranging from basic awareness to mechanistic theories of how an algorithm actually operates [27]. Folk theories need not be accurate descriptions of how algorithms are designed and implemented to assist users in explaining personal experiences and structuring their behavior—folk theories are internal models of how the world works. In today's technological ecosystem, folk theories about algorithms must be constantly adapted as algorithmic behavior changes.

Different from, but related to, algorithmic folk theories is the concept of *the algorithmic imaginary* [15]—described as "the way in which people imagine, perceive and experience algorithms and what these imaginations make possible"—which is tied to the *lived reality* of those interacting with algorithms. As researchers, we can further explore opportunities to improve user wellbeing, safety, and social connection within algorithmic systems by recognizing that algorithms have a very real impact on the everyday lives of their subjects. And that impact may not be the same for everyone; Duffy et al. [31]'s framework of nested precarities suggests that inequalities are intensified for those whose financial opportunity is linked to visibility, as well as marginalized individuals who can be further disenfranchised by unreliable visibility or moderation. We further explore these impacts through the lens of Attachment Theory, demonstrating how users respond to these nested precarities in ways that mimic insecure attachment to an unreliable environment. We then explore the potential for fostering secure attachment despite inherent uncertainties of the Instagram algorithm.

3 METHODS

We collected data from the subreddit r/Instagram, as many people use it as a digital gathering place to discuss the Instagram algorithm and engage in community support and collective sensemaking [25]. We analyzed these discussions using thematic analysis. The details of our approach are discussed below.

3.1 Data Collection

r/Instagram is a community self-described as *"The un-official (and unaffiliated) subreddit for Instagram.com - Learn tips and tricks, ask questions and get feedback on your account. Come join our great community of over 230,000 users!"* The subreddit has been available since 2011. We collected posts and comments using the PushShift API [76], filtering for those that contained any of the following keywords: *algorithm, data, ban, shadowban, machine learning, artificial intelligence*. This query yielded 13,076 items from the years 2012-2021. For the purposes of this work, we utilized 1,100 randomly sampled items for in-depth qualitative analysis. Items (posts or comments) ranged from a single word to a few paragraphs (max word count = 885), with an overall average of 67 words in length, and 80% of the data falling below 100 words. Qualitative analysis yielded no compelling differences between posts or comments, as many comments contained commenter's personal experiences instead of direct responses to the original poster. We also conducted a false negative test [61] of 50 items that did not contain any of our searched keywords. These items tend to be introduction posts, questions about specific features (i.e. *"I'm curious what fonts are used by Instagram in the Instagram story (classic, typewriter, comic, strong, etc) on the iOS platform. Because the fonts looks different from android. can someone tell me?"* or asking about issues logging in or using audio trends). While some posts may have been relevant to our analysis, such as posts asking about content moderation, these threads often eventually contain one of our keywords. Our focused search yielded more specific data related to the *algorithm* itself; our particular area of study. Temporally, the data is distributed exponentially with the growth of both Instagram and r/Instagram subreddit. However, we take care to include quotes ranging from 2012-2021, with qualitative comments on this temporal shift. Further temporal analysis is outside the scope of this paper. Due to the growth of both r/Instagram and Instagram itself, this sample is more heavily representative of 2016 onwards, with 62% of the data in 2019 onwards. This is reasonable as Instagram introduced 'the algorithm' as opposed to the 'chronological feed' in July 2016. Early mentions of 'the algorithm' in our data refer to image compression or filtering algorithms, such as *"the instagram algorithm has a time-from-image-capture variable calculated into the yellow filter amount, so yes those images will fade with time" (2012).*

3.2 Reddit as a Data Source

This paper investigates algorithmic sensemaking and user experiences with algorithmic processes on Instagram, utilizing data from the platform Reddit. This choice of research site and data source was informed by issues of access and type. Instagram permanently disabled its Application Programming Interface (API) in 2020, which was likely a positive step for users as it increased privacy protections, but with notable consequences for social media research [64]. Instagram prohibits the use of third-party applications to "scrape" or "crawl" in order to collect data from the platform, and use of the CrowdTangle API must be approved by Meta.

However, lack of Instagram data is not the sole motivation for using Reddit data in this work. r/Instagram represents cross-platform algorithmic sensemaking and community support. Several users seek out help on Reddit when their Instagram accounts are deactivated, shadowbanned, or action blocked. r/Instagram provides a space that allows creators and users, as well as non-users, to collectively learn about effective algorithmic strategies (and do so without being visible to the Instagram platform itself). Other research, e.g. [24] and [25], also use r/Instagram for similar reasons,

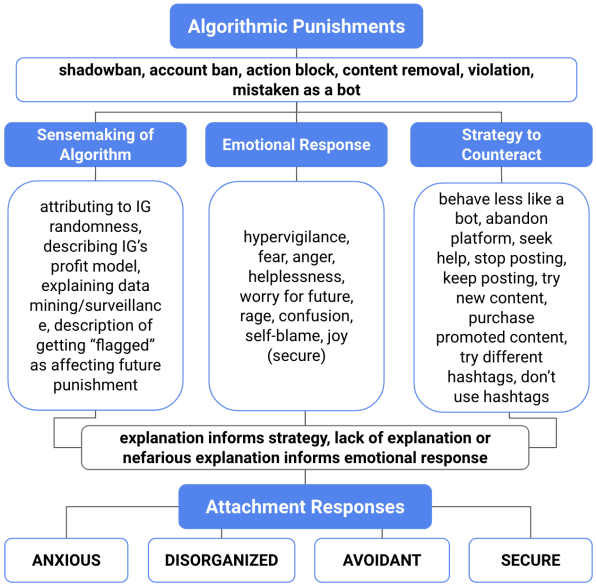

Figure 1: Schema of codes used to label 1,100 comments. Users describe an algorithmic punishment, then typically demonstrate an emotional response and their strategy to counteract punishment. Explanations inform the emotional response and subsequent strategy, and can be characterized into attachment responses, as further denoted in Table 2.

demonstrating the ability of Reddit data to shed light on user experiences. Because our aim is to investigate how users speak about their relationship to the platform and the platform's algorithms, as well as engage with others in these discussions, r/Instagram is an appropriate source of data. It offers insight on how users conceptualize their success and strategies on Instagram, and it also gives visibility into the social processes involved in these efforts. Our sample is primarily made up of users seeking to grow their accounts, either for financial or community-building goals, as evidenced by their concerns in the data. However, we also see evidence of users trying to connect with their more localized communities—and facing challenges due to algorithmic precarity. We further discuss the generalization of our findings in the Discussion.

3.3 Thematic Analysis

We randomly sampled 1,100 posts and comments to select a tractable sample for conducting thematic analysis according to the steps of Nowell et al. [69]. The first phase of analysis consisted of familiarization with the data. Two independent coders read over the same 100 items, documenting both reflexive notes and potential themes to look for in the next phase. This initial exposure to the data served as a prerequisite to phase two, where the two coders collaboratively labeled items into a large set of potential themes, trying to be as generative as possible with the categories. The third phase involved each of the coders independently labeling 500 items *(Total N = 1,100)*. While this was independent work, it was not without negotiation and discussion; this occurred asynchronously. Within 1,100 items, coders determined saturation as many items were repetitive and no longer adding information, generating discussion between coders, or contributing any novel themes [39]. Next, the coders came together for a collaborative distillation of the various themes, with evidence of insecure attachment coming out of this process. They compared codes and managed any discrepancies, re-coding where necessary after a process of adjudication. They looked for overarching themes of underlying phenomena, or themes that seemed to be approaching the same concepts. They employed thematic networks to group themes together and describe the broader topics that emerged. The process of aggregating and organizing codes was careful to identify what had already been found in prior literature, corroborating past findings. Over the course of a year, the first two authors discussed and collapsed themes, developing the schema in Figure 1. Not all items were relevant to the attachment themes, but touched on other themes that were collapsed under the larger umbrella of hypervigilance and anxiety. Finally, the first three authors worked on an iterative process to generate design solutions and research recommendations in alignment with both the data and scholarship on secure attachment. These recommendations are provided in the Discussion.

4 RESULTS

Our results indicate that users primarily perceive algorithmic precarity through a paradigm of punishment and reward. We outline these punishments, their impacts, and how users respond to the unpredictability of algorithmic behavior. We demonstrate how users' concerns can be interpreted though the lens of Attachment Theory, with the aim of characterizing and supporting secure attachment amidst algorithmic precarity.

4.1 User Perception of Algorithmic Precarity

RQ1: How do Instagram users perceive the effects of algorithmic precarity?

Across the Reddit data we collected, we found users engage in sensemaking around the algorithmic precarity that they experience. This precarity takes the form of a spectrum of algorithmic punishments, pressure that users feel to not take any breaks, and confusion and frustration around a lack of clear rules to follow to increase engagement. In their attempts to make sense of algorithmic precarity, community members create, use, and shape folk theories, sharing specific anecdotes based on personal Instagram activity. Of the 1,100 Reddit comments we analyzed, very few contain qualifications or mentions of the specific *type* of algorithm or even the algorithm's specific role or purpose. Instead, the phrase "Instagram algorithm" was used to refer to newsfeed organization, suggested/recommended content, post visibility, and content moderation. Some posts made it clear which segment of algorithmic behavior they were referring to, but most expressed frustration or desperation under an undefined, singular "algorithm".

4.1.1 Algorithmic Punishment and Reward. Overwhelmingly, users on r/instagram identify several different ways that accounts can be "punished" (See Table 1). We use the language of punishment and

Algorithmic Punishments	
Term	*Definition*
"action block"	A temporary inability to interact with a specific feature on the platform. For example, a user may not be able to comment on or like posts. [35]
"account ban"	Any type of suspension in which a user is not able to use their account, whether temporarily or permanently. [89]
"bot removal"	A bot removal is when an account is removed by Instagram when suspected of being a bot account. [4, 80]
"content removal"	The removal of posts, hashtags, stories, reels, comments, or any other content as determined by a process of deciding whether user-generated content adheres to the platform's community guidelines (policies) by both humans and automated systems [89]
"shadowban"	A form of light censorship targeting "vaguely inappropriate content" that is hidden from the Explore page. It may involve abnormal drops in engagement, deprioritizing your stories, and/or not appearing under hashtag search. It is a functionality intended to reduce the reach of content that is deemed 'borderline' by the content moderation process. [5, 24]
"violation"	A notification to an Instagram user when they have been deemed as going against Community Guidelines, either through having content removed or receiving a warning. These violations go in the "Violations" tab that the user has access to. [89]

Table 1: Common punishments on IG and their definitions

reward not only to mirror prior literature [31] and to draw parallels to platform paternalism [74], but also because it is the language of users:

> "So I know the algorithm is constantly learning and updating but I am under the impression that they did a big update last week (I know they implanted pinned comments, etc). Before the update, I felt like I had a pretty solid grasp on what **the algorithm rewarded and punished**, so I was getting solid reach on my posts. Since the update, my reach has halved." (2020)

The algorithmic punishments discussed within Reddit posts often result from automated content moderation practices where platforms monitor activity and compare against platform policies for suspected violation of guidelines. Users in our data discuss the common forms of algorithmic punishment that result from content moderation practices: action blocks, account bans, bot removals, content removals, shadowbans, and violations. For each of these punishments, users typically try to sensemake why they occurred, with explanations ranging from basic awareness of an "algorithm" to more specific folk theories of what happened.

Users discuss cases and draw specific connection to factors theorized to underlie algorithmic decisions. For example, this is a user-generated explanation of being mistaken as a bot and then action blocked: *"If Instagram finds that you are liking and/or commenting too much in an hour, they recognize you as a bot and will 'action block' you from continuing to like and/or comment." (2020).* We observe that users articulate strategies to resist being seen as bot-like, and to "prove" that one is a human to the algorithm. In an attempt to prevent unfair moderation, users described the need to consciously monitor their behavior for activity perceived to be too bot-like; this included liking or commenting on too many posts, liking or commenting too quickly, avoiding the use of banned hashtags, repeatedly using the same hashtags, or sending direct messages too quickly. [1]

> "...I answer all my messages at once, not throughout the day, so it could easily look like I'm a bot I guess? Plus I'm not on every single hour, I visit it in like the morning & at night, and sometimes don't post for days, so I guess another possible sign to IG that I could be a bot... though I'm legit not, I'm a human." (2020)

However, despite sensemaking of the algorithms, there is still a sense of randomness and unpredictability when it comes to algorithmic behavior, which may even be directly tied to the user's perception of their worth:

> "I believe that's Instagrams shit algorithm, sometimes it'll promote your content, and most times it'll tell you to fuck off and you're worthless (unless you pay for advertising)" (2017).

Users also express frustration with the precarity and inaccuracy of the content moderation process: *"They even banned my account for violating community standards due to nudity when all I did was post a pic of my baby bump (I was wearing a sports bra) from waist up. There are literal porn videos on facebook yet they choose to ban me LMAO." (2020).* Stories of high-stakes moderation such as account bans in response to a faulty moderation decision adds to the exasperation that people feel around algorithmic punishments. The comments also demonstrated the confusion surrounding algorithmic punishment; users often call out the fact that algorithmic behavior is not consistent and instead varies across cases:

> "It's a toss up really. Since they don't admit shadowbanning is really happening, anything goes. It's also common for them to lift the shadowban after a certain period of time, but leave the page in a lower state of engagement than before." (2019)

The idea that an account is left in an algorithmically-determined state of low visibility brings us to the idea that algorithmic punishments have lasting effects on users' accounts.

4.1.2 Residual Effects of Punishment. Many users noted that any punishment in the form of content moderation may lead to increased susceptibility to and likelihood of future sanctions. As one user wrote: *"The issue is that as you get more and more reported, and has more and more content removed, the bias against your account increases. (2019)*" Users try to preemptively protect themselves, their accounts and communities by building knowledge of these challenges, ideating around how the algorithmic punishments might occur and their lasting effects. As seen below, users expressed beliefs that multiple punishments would result in a permanent ban, but with unclear boundaries on how this might happen:

> "I have been shadow banned a few times noticeably though, and it was due to my hashtags and using too many similar ones I believe.. which again is annoying but whatever. How many times can you get shadow banned before you get permanently banned? Because if there's an actual limit then I will never use hashtags again in fear of becoming permanently banned. (I have a wonderful community

[1] Fear around being mistaken as a bot is in stark contrast with this hopeful 2014 comment about Instagram's spam removal initiatives: *"Instagram has set their sights on locating and removing all spam accounts... This coming especially in a time where the other platform competitors are ramping up their services to increase the trust from their users. Also, by getting rid of the spam accounts this could in turn be an asset to gaining more business opportunities for Instagram in the forthcoming years."* (2014).

> on there that I would be devastated if I lost connection with them all)" (2020)

Many users employ the language of "recovery" or "account health", again noting that punishments against your account may set you back indefinitely: *"Once your account is tied to any suspicious activity its hard to recover" (2019)* and *"[it] takes some time to recover from the shadowban to get the numbers where they used to be. (2019)"*

Users that had personally experienced an action block, account ban, or shadowban expressed fears surrounding the lasting effects of such a punishment. Specifically, users conjectured that their account may carry an invisible mark or "flag" that leads them to be further targeted, demonetized, and deprioritized after a single violation or watched more closely for future violations. In particular, many users mentioned being unable to achieve prior levels of visibility: *"Now, yes I think shadowbanned accounts are in general blocked from ever reaching the top hashtags category, EVEN when said shadowban expires. Again, this is my personal experience." (2018)* or *"...my main concern is that I know that my shadowban is over because my posts appear in hashtags now—but my engagement still hasn't returned to pre-shadowban levels." (2020)*. In response to another user who had experienced an action block, a user commented: *"You have to get that red flag off your head. Until then this will keep occuring." (2019)* Similarly, a different user commented, *"Once your account is tied to any suspicious activity its hard to recover - thus these common instructions above rarely work. Not only that - they will infect your other devices with a 'flag'." (2019)*

Users describe a sense of helplessness following algorithmic punishment. While Instagram does have a Help Center, many users note that appeals and reports are never resolved, and that it is impossible to actually speak to someone about their case. This user sums up the unpredictable nature of algorithmic punishment:

> "So is all this really a matter of luck then? You may get unbanned and you may be stuck with it for good? I've had it for over a week now and I'm honestly not sure why I got banned. I had a photo reported and taken down which I really didn't deem to be offensive although it was weeks after that my account ban came about.... Is there really nothing we can do other than sit tight and hope for a miracle?" (2017)

Given the uncertainty, lack of control, and sometimes unjustified punishment, users may be pushed to a state of hypervigilance—constantly assessing potential threats—in order to protect one's access to connection, financial stability, and/or community.

4.1.3 Hypervigilant Responses to Algorithmic Punishment. In response to fear of being unfairly moderated, and potentially suffering long term effects because of it, we observe indications of hypervigilant behavior. As one user posted, purposeful modification of one's behavior to keep up with the algorithm can lead to feelings of exhaustion and defeat. In their comment below, they also highlight the effort, as well as sophistication of strategy and tactics, needed to keep up and promote their business, linking it to a game of chess.

> "I have no idea if I have been shadow-banned because I use the same hashtags over and over (which I am now afraid of using ones like "fairywings" or "potionbottle" because I have used it too often even though that is literally what my product is and should be hashtagged as such) or if my views have dropped from the algorithm changing AGAIN. social media shouldn't have to be like chess, I shouldn't have to work THIS HARD to get just the people who follow me to see my stuff. Out of 700 people how are only 20 of them veiwing my stuff? I really don't have the time in the day to obsess over this. Instagram is killing my small businesses and MANY others." (2020)

Users express burnout, exhaustion, pointlessness, and helplessness in trying to keep up with the algorithm.

> "It's not worth it at all, I regret spending so much time over the years growing my art account on instagram and spending money boosting posts. The algorithm has destroyed my reach to the point that I feel all the work I put in was for nothing." (2019)

Users describe their adversarial relationship to algorithm. It is common for users to employ language of fighting, battling, or playing games, such as *"All accounts are in a constant battle with the algorithm." (2018)*. They also attribute omniscient or all-powerful qualities to the algorithm they are up against: *"It seems to help if you just play along with the Instagram overlords' control system" (2019)*. Not only do users feel they are in a battle against the algorithm, but they describe the algorithm as something they cannot possibly win against, an authority which uses unclear rules to dole out punishments and rewards.

> "to me it sounds ridiculous. why not just tell the user if a post is inappropriate and FOR WHAT REASON and preferably before posting? so that the user can correct mistakes and create more valuable content? why not publish the rules? so that people talk about it like it's voodoo and about "the algorithm" like it's some internet god? who you have to please for her to like you and approve your posts?" (2020)

Another characteristic of hypervigilance is the unrelenting assessment of potential threats, and the inability to take a break. Users apply this to recommending post consistency, posting every day, and not taking a break from social media as it may hurt your account in the long run. However, users also believe that they are at risk for additional punishment if they post consistently after or during any kind of ban. As one user expressed, *"When I got out of shadowban, I was using about 20 hashtags in the first comment. A couple of days later I got shadowbanned again, although it only lasted for 1 day. I got scared so I posted without any hashtags for a while and now only include in caption." (2019)* More drastically, users may refrain from posting altogether for an extended period of time such as exhibited in this comment, *"Nope, I've have not posted in 2 months. Hopefully the shadow ban is uplifted. Its so annoying, the action block threshold is so low for me" (2020)*. However, this is in direct contrast with the other fear that taking a break will permanently reduce an account's visibility. Users feel caught between multiple, and sometimes conflicting, pressures to manage their account success.

While Instagram may not explicitly punish a user for lack of activity, beliefs surrounding the potential for algorithmic deprioritization may cause users to feel pressure to continue producing content in order to preserve their visibility. As one user expressed, *"I post twice a week and it seems to be the sweet spot for me. Taking a break is tempting, especially since the engagement drop, but I think you're right - you get forgotten pretty fast if you're not keeping up and feeding the algorithm." (2020)* Aside from losing engagement, others expressed that taking a break from posting may put the user

at risk of algorithmic punishment, *"I'd hazard a guess that returning after an extended break could trigger a shadow ban." (2019)*

In order to avoid a negative outcome for their account, such as deprioritization, lower engagement, or shadowbanning, we observed that users may establish a regimented posting routine or self-impose quotas. However, these quotas are unrealistic for many: *"...because I don't post everyday I also lose followers quickly, which always annoyed me. I solely post videos, so to pump out a video a day is nearly impossible." (2017)*

Overall, the narratives observed within the data suggest that there is a common fear that lack of activity on Instagram can lead to implicit punishments. This may incentivize some users to create content on a regular basis simply to avoid punishment. Hypervigilance can take many forms, and here we note the trends of hypervigilant behavior in response to what users *believe* about the algorithms. We explore this hypervigilance further by drawing parallels to insecure attachment [78], which are often characterized by a perpetual state of hypervigilance and nervous system activation [83]. We see signals of anxious, avoidant, and disorganized behavior as reactions to precarious and unclear algorithmic punishment.

4.2 Interpreting User Sensemaking Through the Lens of Attachment Theory

RQ2: How might users' concerns about, and explanations of, algorithmic precarity on Instagram be interpreted through the lens of Attachment Theory, and what are the implications?

We explore user hypervigilance through the lens of Attachment Theory, with particular focus on how the uncertainty involved in algorithmic precarity contributes to an insecure dynamic between user and platform. When the authority on punishment and reward is inconsistent, the receiver of those consequences may respond in alignment with the three insecure attachment styles: avoidant, anxious, and disorganized. Users each have their own attachment predispositions, unique goals, and isolated experiences with algorithmic behavior, all affecting these outcomes. However, it would be unreasonable to diagnose, pathologize, or *prove* attachment styles from our sample; instead we use Attachment Theory [13] and platform paternalism [74] as lenses to explore how users experience algorithmic precarity, with a focus on community, financial stability, and self-presentation expectations. While a user may demonstrate an insecure attachment to Instagram with regards to their comments on Reddit, this does not say anything about that individual's relational attachment style. Instead, we use the lens of insecure attachment to describe the patterns of behavior that result from instability that users experience on Instagram, with the aims of both gaining insight into this dynamic as well as exploring the potential for fostering security. Table 2 summarizes these characterizations for how each of the attachment styles manifest in user behavior. Figure 2 adapts Shaver and Mikulincer [83]'s model of the mechanism of hyperactivation for the different attachment styles, but uses the algorithm as the source of threat. To answer RQ2, we demonstrate the various ways in which user's concerns align with the attachment styles, further discussing the implications in the Discussion.

4.2.1 Anxious Attachment. A characteristic of the anxious attachment style is the molding of the self to please an authority—sacrificing one's own needs in order to seek approval through a variety of strategies. Due to a lack of trust and stability, the anxious individual fears being abandoned or punished at any moment. In order to prevent these negative consequences, they preemptively try to adapt to whatever they think the authority wants. The anxious individual is *sometimes* rewarded or has their needs met, resulting in a continued cycle of repeating their coping behaviors [78, 83].

Anxiety often manifests as fear, as well as exhausting all possibilities to reduce uncertainty as quickly as possible [79]. In the following example, a user notices a glitch, describing their fear and *eight* different strategies they attempted in order to remedy the problem.

> "The same thing happened to me! More than 2/3 of my posts were gone this morning after the two factor authentication. Given all of our similar experiences, it's likely a glitch. I'm afraid to even post though, for fear that that would somehow cement my feed into its reduced state (as weird as that sounds)! I've tried so many different things to see if they work: I deactivated and reactivated two factor authentication, changed my password, logged out of all my IG accounts, deleted the app, restarted my phone, redownloaded the app and logged back in again, but it's still there. Like a few of you, I've also submitted a comment on the "report a problem" section and requested the data download. I'm curious to see how long this takes to fix!" (2018)

Another characteristic of anxious attachment is preemptive anticipation of another's needs. In order to maintain good standing, an anxious individual will try to prepare ahead of time in order to avoid punishment and possibly gain reward [78]. This user describes the Instagram algorithm as the "bane of their existence" but also discusses their goals of gaining favor with the algorithm. They are following the "rules" (which are unclear) but also trying to preemptively gain favor.

> "The Instagram algorithm is the bane of my own (and probably all of our) existence. So beyond trying to adhere to the rules and play nice I'm interested in other ways that may make the algorithm favor my page more, which brings me to my question(s). Does watching the stories of people you follow and the sponsored stories between them help your standing in the eyes of the algorithm? Is there anything else I can be doing besides frequent content and adhering to the rules?" (2020)

Anxious attachment typically results in a lack of differentiation between self and others—the anxious individual becomes so focused on their partner or caregiver that they lose a healthy sense of individuality. This is reflected in how users talks about "molding" themselves to each incarnation of the Instagram algorithm: *"The algorithm is an always changing brain so that means we have to constantly be molding ourself to the newer algorithm." (2020)*

> "This damn Instagram algorithm has been IMPOSSIBLE to keep up with, especially for my business pages. What're you doing to stay on top of it? It feels like we go through week-long waves of mastering it and get a ton of engagement, then we hit rock bottom again the next week and don't

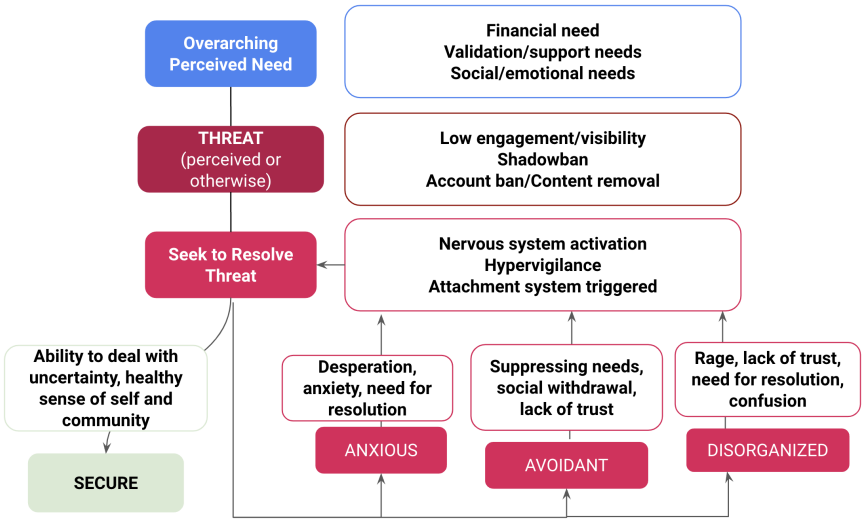

Figure 2: A proposed mechanism of insecure attachment responses in relation to social media algorithms. Adapted from Shaver and Mikulincer [83], a framework of the mechanism by which insecure attachments form. Key characteristics of the attachment styles are elaborated on in Table 2. Insecure attachment responses tend to stay in a perpetual activated state of nervous system activation and distress.

Attachment theory as applied to user reaction to algorithmic precarity on Instagram				
	Secure	*Anxious*	*Avoidant*	*Disorganized*
Key characteristics	ability to balance self and others, relies on community and also has ability to self-soothe, strong sense of self, authentic expression, emotional regulation [8, 73]	emotional activation, fear response, worry of losing connection, inauthentic expression to please others, high reliance on others for feedback [7, 8]	emotional suppression, disengagement, dissociation, distrust, lack of hope that needs will be met, loneliness, hyperindependence [7, 8]	combination of anxious and avoidant behaviors, aggression and rage, hatred mixed with desire for intimacy, dysregulation [71]
Manifestation on Instagram	seeks online community but not at the expense of their own authenticity or burnout, likely uses IG as a creative outlet, relies on other sources of connection or promotion, attempts to grow if in line with their personal boundaries, seeks compromise between user and platform	trying to follow all the unseen rules, attempting multiple courses of action, preemptive planning to avoid punishment, inauthentic expression to grow or be liked, worry and fear about the algorithm	leaving the platform, claiming it's "not worth it" to grow, stopping activity even if they express the desire to interact	anger at Instagram, aggressive language, continued attempts to reconnect and grow, desire to understand the rules despite frustration with them

Table 2: Characteristics of the different attachment styles and how they manifest with regards to the Instagram algorithm

even get 100 likes or a single comment. HELP!!!!!!" (2021)

It is important to remember that anxious attachment is a valid and expected response to an unpredictable environment; it is a coping mechanism and in this case, a response to algorithmic precarity.

4.2.2 Avoidant Attachment. Avoidant attachment typically manifests as hyperindependence and disengagement from the source of unreliability. Key characteristics of the avoidant style are a dismissive and negative view of the authority, with the avoidant individual preferring to abandon the relationship rather than seek getting their needs met [66]. On Instagram, many people acknowledge the necessity of a social media presence for businesses and connection. For a user who feels compelled to stay on the platform, but also feels angry and insignificant, this incongruence may deepen feelings of dissatisfaction with social media. We observe that many users feel compelled to stay on Instagram even if they believe it cannot meet their needs. It is also important to acknowledge that users who exhibit avoidant behaviors may be less likely to post on r/Instagram; our observations here may underestimate the prominence of these behavioral manifestations. One user described how algorithmic changes are pushing people off Instagram, likening it to a 'slow death'.

"There are a lot of assumptions here of foul play but I have A LOT of celebrity friends who basically abandoned Facebook last March due to their catastrophic algorithm changes. Now it appears the slow death is reaching Instagram. I even have a youtube watch partner who use to get 600k views a post that now completely left Facebook because now he sometimes get 100 likes on shit. Homie got 1.7 million followers... this is wild and dangerous." (2019)

When an avoidant individual's needs are continually not met, they tend to disengage and feel a sense of powerlessness. This is reflected in how users talk about their exasperation with Instagram and their intentions to leave:

> "Mine too, fuck Instagram I'm thinking about using other means - Facebook, YouTube. Instagrams algorithm and ghost banning is tiring me out " (2019)

> "This is something that really upset me about the feed sorting change. Before the change was implemented on my feed, which happened in mid-late march, I would scroll from the most recent post to the last post I remember viewing, which made it really easy to know when I was caught up. Since then I've almost stopped using Instagram altogether because I'm just not interested in viewing content the way they're telling me I should." (2016)

A key characteristic of avoidance is the perception that it is not worth the effort to get one's needs met—because the avoidant individual has observed enough evidence to discount that possibility [56]. Trust has been repeatedly broken and the only option for the avoidant individual is to disengage:

> "I ended up leaving Instagram for a while. Its been a couple months; that ban completely stripped me of all motivation." (2020)

> "It's as if the Instagram algorithm remembered everything I told it I *didn't* want to see and decided to show me just that :(I spent an entire weekend "hiding" (show me less of this) on every single one and it didn't "learn". It was never 100%, but it was nice to look at, now it's just memes, sports, makeup...whatever. At this point I've given up...I just completely ignore it. I don't think there's anything to do...they've done something to the algorithm :(" (2016)

Again, one must remember that displaying avoidant tendencies is not unreasonable. It suggests that the algorithm has consistently failed to show users how actions could change outcomes.

4.2.3 Disorganized. Disorganized attachment, unlike anxious and avoidant attachment, emphasizes a fear of authority figures in general [71]. In disorganized attachment, adults will employ a "confused approach and avoidance of the attachment figure for support and solace in times of need", as well as a higher degree of anger and hostility than is seen in anxious or avoidant attachment [71]:

> "Fuck instagram. They just deleted me without any warning. I censored all my pictures so they didnt show any nipples or anything. They don't respond to my appeals. It's not worth building a following on there when they just ban you so easily when youre making huge efforts to follow the rules." (2019)

> "Why does Instagram's algorithm fuck over talented creators while it somehow promotes people who lack talent? Why is it that every time I view the explore page, there are these annoying sexualized reels. The algorithm is going downhill for my art page no matter how hard I try. It seems like the only way to get the algorithm to work is through paying for promotions but I dont want to do that." (2020)

People with disorganized attachment have a lack of coherence in their mental representation of themselves, others, and relationships, which leads to confusion and conflict. One user recounts how their behavior on Instagram leads to a confusing reward and punishment cycle for their account:

> "Do you know what the weird thing is? I barely touch my IG account because of the drop in engagement, likes and followers. However, when I abandon it, the number of likes and followers starts growing faster than ever. However, as soon as I post to it again, the growth in likes, engagement and followers just stops. Once again, this adds credence to my theory that the IG algorithm is designed to act like drugs. They give you a taste, then when you want more, they cut you off and start demanding payment (promote). You end up paying more, getting back less and having to pay more and more to get less and less." (2020)

These users demonstrate a strong desire to follow the rules; they also highlight the ups and downs of their Instagram use as intense and seemingly intentional. However, they lack a coherent approach to their interactions, and incorporate both anxious and avoidant strategies.

4.2.4 Secure Attachment. Our data primarily showed signals of insecure attachment behaviors, but a minority of the comments responded in ways that aligned with securely attached tendencies. Secure attachment features a balance between self-reliance and community support, as well as a less activated response to external fluctuation. Secure attachment is also characterized by attunement to one's own goals and motivations that bolster a secure sense of self [88].

One user describes how they leveraged algorithmic knowledge to resist unrealistic beauty standards. Their sense of control, agency, and self-actualization is evidenced by their ability to cut out unwanted content and pursue their hobbies.

> "I actively stopped looking at beauty or fashion related posts on Instagram and unfollowed everyone that uses heavy Photoshop or facetune. Then I started to only focused on posts that had something to do with my hobbies. After a while the Instagram algorithm will stop showing you beauty related posts. I'm now starting a new art project because of a post I saw on insta :)" (2019)

Another user shows how they prioritize their own authenticity and fun, and resists what they think the algorithm expects from them, resulting in a discovery of a positive new hobby.

> "The algorithm was the reason I started collages. I was so annoyed by it that I decided to have some fun, instead of doing what they want me to do (which, I guess, is posting selfies and boring stuff)." (2019)

Another element of secure attachment is responding to uncertainty and precarity in a healthy way that prioritizes wellbeing. Below a user acknowledges frustrations, while also offering advice for growth. They mention trying to resist the pressure to grow, even though it can be a 'great tool'. They advise others to prioritize authenticity and happiness over growth, while still acknowledging the benefits of building a following.

> "Instagram algorithm is really messed up and even though your art is great, not many people may be able to see it. You can check some tips for growing on Instagram from other artist, try to engage with your followers and other fellow artist, or, if you want to, try some draw this in your style challenge for more exposure. Just don't feel so much pressured about this, social media is a great tool for knowing future clients and building a community, but never forget about your art and do what makes you happy ;) <3" (2020)

It is important to recognize that securely attached does not equate to happy. Securely attached individuals can and do navigate conflict and express displeasure with their circumstances. For example, users express frustrations while searching for a 'middle ground': *"I know I sound bitter and disgruntled. I know Instagram is providing a free service. I know I'm the product. But there has to be a middle ground, where Instagram can promote ads without *completely* ruining the feed." (2016)*

Secure attachment is also characterized by the ability to respond to uncertainty and discomfort with patience. Instead of a hypervigilant response to uncertainty, securely attached individuals can more easily self-regulate and weigh their options. We observe how users describe the importance of patience when dealing with fluctuations in the Instagram algorithm: *"First of all you should always check those things with multiple accounts and wait some time before jumping to conclusions, because there are fluctuations on IG." (2018)* or

> "Instagram algorithm treats you well as long as you keep people stay longer in the app. As long as you organically grow, youll see you get more engagement. It can take even 6 months or more of growth until you gain a nice amount of followers per day. Just keep on going, hope you the best" (2020)

Finally, we see how users can demonstrates a secure balance between authenticity and responding to algorithmic pressure. For example, *"I think the problem is probably algorithm. I'd love to fix the problem myself, but for now I'll just keep being genuine and hopefully will get the same in return :)"* (2018). As further illustrated, another user acknowledges the desire to grow, while also warning against sacrificing authenticity. They situate the center self-reflection and personal development. The author of this posts suggest using the decrease in engagement as motivation for self-discovery.

> "I'm not recommending you turn into a bandwagon artist or falsely adopt color palettes/painting styles you don't like but know is popular with mainstream consumers. What I'm saying is that a stagnation in activity could also be a sign to say that it might be time for new experimentation and personal development of your art. Algorithms are one thing but as artists, we should also consider that perhaps our activity might reflect our own feelings with our work." (2019)

These examples each demonstrate components of secure attachment that could be further explored by continued research, design interventions, community support, and discourse about social media and personal wellbeing.

5 DISCUSSION

Our investigation reveals a variety of distressed responses to user-perceived algorithmic precarity. As evident in the language of Reddit data, Instagram users overwhelmingly view platform engagement through a punishment and reward paradigm, seeking to 'be treated well' and 'not get in trouble'. They also describe a helplessness and lack of agency to control their success and desired outcome on the platform. In this study of (in)secure attachment to 'the Instagram algorithm', we highlight the dynamic of unreliability and coping responses that arises due to precarity, opacity, and user beliefs. Here in our discussion, we ideate on the possibility of fostering secure attachment and consider interventions for supporting a more transparent and reliable algorithmic experience. We focus on potential pathways for promising HCI research endeavors that can design systems and evaluate the possibilities of fostering secure attachment to social media.

5.1 Limitations

Our findings demonstrate the impacts that algorithmic precarity has on users, in a way that mimics and/or heightens insecure attachment. It is important to clarify that Attachment Theory has primarily been applied to human relationships. However, we know that one's attachment style and subsequent behavior is greatly affected by the reliability of an *environment* as well [55, 82, 84], and we view the algorithm as part of a precarious environment impacting its users. We caution against any literal interpretation of Instagram as a parental figure, and instead use the metaphor to characterize the impacts of algorithmic precarity on user hypervigilance. Users already personify the algorithm (e.g. *'algorithmic overlords'*), or place their blame on sole individuals such as Mark Zuckerberg. Instead, we encourage users to direct their demands for transparency towards the human elements of algorithmic systems. In other words, efforts to resist these algorithms should be focused on steering oversight boards, challenging machine learning biases, calling for more insight into how the algorithms make decisions, critiquing Community Guidelines, and championing an improved appeals process.

However, when the uncertainty and precarity *cannot* be changed, due to the nature of ever-evolving trends and randomness, fostering secure attachment is necessary. Given our sample, we suggest these findings are most applicable to creators on Instagram who already pay close attention to 'the algorithm', analytics, and trends—though the potential for fostering secure attachment may also serve teens [92], content consumers (those who do not post regularly or at all), and smaller accounts trying to connect with their in-person friends. More research is needed in specific populations of interest to explore the general applicability of our work.

5.2 Recommendations for Promoting Secure Attachment

We know that secure attachment represents a healthy balance between self and others, and the ability to more effectively handle uncertainty or fluctuation in relationships [88]. Secure attachment overlaps with trust, wellbeing, nervous system regulation, and self-worth. Insecure attachment can be transformed into "earned secure attachment" [26, 73, 81] and we draw from established interventions, as well as characteristics of secure attachment, to suggest possibilities for supporting earned secure attachment to precarious social media algorithms. We draw on both our empirical results and established elements of Attachment Theory to consider potential paths towards fostering secure attachment. For each recommendation, we outline how researchers could investigate and evaluate the efficacy of the approach.

However, we stress that social media alone is not responsible for manifestations of insecure attachment; nor can it be used in place of mental and physical health support. Larger systems of inequity must be deconstructed to fully support the wellbeing of

social media users [21, 67]. This work simply provides a path forward for those interested in scaffolding secure attachment to social media—creatively envisioning future systems that foster and promote empowered digital connection.

5.2.1 User Agency via Goal Setting and Reflection. We observed that users felt disconnected from their own reasons for using Instagram, simply trying to 'stay afloat' and not be 'punished' as opposed to guiding their own goals for growth, connection, advocacy, or expression. The helplessness we observed demonstrates the lack of user agency and feelings of control over their own experience. In order to support user agency, a sense of control, and a more empowered way of interacting with social media, researchers could experiment with pre- and post-social media use prompts, surveys or other interventions that allow the user to explore *why* they use Instagram and what they gain from connecting digitally. Given that secure attachment often involves self-regulation skills and personal reflection [26, 75], we ground these recommendations in our data where users share preferred self-soothing strategies. We observe users reminding others to reconnect with the 'why' of social media use as a critical component of their personal experiences. This reflective process may allow the user to identify the behaviors they *do* like, and to focus their attention on serving their own goals as opposed to the algorithm. Reflection may be useful for guiding actions, bringing them in alignment with goals when scrolling. Possible design interventions may be to introduce quick touch points (SMS messages or links to short surveys) that prompt users for the type of content they want to see and how it supports their goals for social media use. In other cases, for example, if a user's goals are to connect with others, research could explore the efficacy of priming the user with a template of behaviors that are known to be associated with more meaningful connections, as opposed to simply viewing. It may be worth studying how to help users plan their time and accounts around the content they prefer to see; for example if a user prefers to see nature content they may make a separate Instagram account simply for plants. Each of these interventions should be evaluated for whether or not they affect hypervigilance and other signals of (in)secure attachment.

5.2.2 Scheduling Support Frameworks and Tools. Another proponent of secure attachment is reliable routine in the face of unpredictability [26]. Given the fluctuating nature of algorithmic success, it may be beneficial for users to control their own posting schedules and boundaries, while also engaging in self-regulation strategies[75]. One can imagine frameworks for helping users identify boundaries, such as not responding to DMs in the morning, or only spending a certain amount of time creating content before they deem it good enough to post. Hiniker et al. [47]'s *MyTime*, for example, contributes a framework for planning out social media *non*-use while supporting user agency and personal goals. We posit that interventions like *MyTime*, when applied to social media in combination with scheduling tools and APIs that allow users to batch their content ahead of time, may prove beneficial. However, a theme that emerged in our study was fear of long-lasting consequences for taking time off or missing a day of posting. While batching content ahead of time may circumvent this, we are also interested in how users *cope* with these fears and how they can be alleviated. Research to evaluate how promoting other forms of secure attachment affects these negative beliefs and anxieties around lasting punishments, or if there are ways to avoid those punishments with less effort from the user, hold great promise.

5.2.3 Peer Support for Modeling Secure Attachment. Our results saw users engaging in collective sensemaking to grapple with algorithmic punishments. We also observe users modeling secure attachment for others, such as encouraging them to "be patient" or focus on personal goals as opposed to pleasing the algorithm. While not as prevalent as expressions of distress, these responses highlight opportunities for peer support. We know that secure attachment involves self-reliance in harmony with community support [81]. How might we catalyze and promote peer support and modeling of secure attachment strategies and behaviors? Interventions could be as simple as an automatic bot on r/Instagram that prompts users to think about strategies grounded in secure attachment when it identifies anxious language. Peer support could also be initiated as a focus group, design session, or in a specialized app for users interested in building a more secure relationship to social media use. There are also possibilities for peer mentorship and support systems. Further research by the HCI community is needed to identify how to best support these needs, and to evaluate the efficacy of the suggestions provided among peers.

5.2.4 Providing Additional Context on Trends. Another way to support secure attachment is lessen uncertainty within the environment [42]. Users expressed distress with the current level of transparency, such as when content is moderated with no explanation. Additional transparency could reduce uncertainty and promote user security. While we may be unable to affect in-app features on Instagram, researchers could develop more detailed analytics that demonstrate natural fluctuations in trending topics, Instagram use, or prioritized features of the app. Oftentimes, a post may perform poorly simply because other content is trending or a particular hashtag is being overused that day. Content moderation may also fluctuate given how many reports are coming in, how many moderators are working, and due to new changes occurring on the backend. While access to these details is Instagram's intellectual property, researchers might invest in ways to provide enough insight to the user to help them identify natural or expected variability in visibility. Explanations of how different the system may behave day to day could be distressing or comforting; further research is required. These efforts could parallel others to increase data science and machine learning education in the general public.

5.2.5 Beyond Design. Investigating collective sensemaking through expressions on Reddit, demonstrate the continued and persistent distress that many social media users experience. We encourage localized community support for creative laborers to discuss and contend with algorithmic fluctuations, as well as mental health support that engages with lack of access and stigma for non-white, non-Western, identities. For each community affected by algorithmic precarity, support will look different. We encourage further participatory research into supporting specific needs of creative laborers with regards to algorithmic precarity and managing their responses to uncertainty.

6 CONCLUSION

Instagram users contend with algorithmic precarity in order to manage their financial opportunities, protect their privacy, avoid content moderation, connect with their communities, and present themselves in alignment with their self-presentation goals. Users fear lasting effects of moderation or poorly performing content, and refuse to take breaks for fear of additional algorithmic punishment. We find that users' hypervigilance in response algorithmic precarity mirrors insecure attachment. We detail the ways in which users demonstrate insecure attachment to platform algorithms, characterizing each style's manifestations of social media use. We suggest possible interventions for fostering secure attachment in order to promote user safety, stability, agency, trust, and wellbeing.

REFERENCES

[1] [n.d.]. Nala Cat. https://www.instagram.com/nala_cat/?hl=en

[2] Adam Mosseri. 2021. Shedding More Light on How Instagram Works. https://about.instagram.com/blog/announcements/shedding-more-light-on-how-instagram-works

[3] Allison McDonald, Catherine Barwulor, Michelle L. Mazurek, Florian Schaub, and Elissa Redmiles. 2021. "It's stressful having all these phones": Investigating Sex Workers' Safety Goals, Risks, and Practices Online. In *Proceedings of the 30th USENIX Security Symposium (USENIX Security 21)*. USENIX Association. https://www.usenix.org/conference/usenixsecurity21/presentation/mcdonald

[4] Andrew Hutchinson. 2020. Instagram Looks to Crackdown on Bots with New Review and ID Process. *Social Media Today* (Aug. 2020). https://www.socialmediatoday.com/news/instagram-looks-to-crackdown-on-bots-with-new-review-and-id-process/583491/

[5] Carolina Are. 2021. The Shadowban Cycle: an autoethnography of pole dancing, nudity and censorship on Instagram. *Feminist Media Studies* (2021), 1–18.

[6] Christy Ashley and Tracy Tuten. 2015. Creative strategies in social media marketing: An exploratory study of branded social content and consumer engagement. *Psychology & Marketing* 32, 1 (2015), 15–27.

[7] Kim Bartholomew. 1993. From childhood to adult relationships: Attachment theory and research. (1993).

[8] Kim Bartholomew and Leonard M Horowitz. 1991. Attachment styles among young adults: a test of a four-category model. *Journal of personality and social psychology* 61, 2 (1991), 226.

[9] Sophie Bishop. 2018. Anxiety, panic and self-optimization: Inequalities and the YouTube algorithm. *Convergence* 24, 1 (2018), 69–84.

[10] Sophie Bishop. 2019. Managing visibility on YouTube through algorithmic gossip. *New media & society* 21, 11-12 (2019), 2589–2606.

[11] Sophie Bishop. 2020. Algorithmic experts: Selling algorithmic lore on YouTube. *Social Media+ Society* 6, 1 (2020), 2056305119897323.

[12] Roz Boustead and Mal Flack. 2021. Moderated-mediation analysis of problematic social networking use: The role of anxious attachment orientation, fear of missing out and satisfaction with life. *Addictive Behaviors* 119 (2021), 106938.

[13] Inge Bretherton. 1985. Attachment theory: Retrospect and prospect. *Monographs of the society for research in child development* (1985), 3–35.

[14] Taina Bucher. 2012. Want to be on the top? Algorithmic power and the threat of invisibility on Facebook. *New media & society* 14, 7 (2012), 1164–1180.

[15] Taina Bucher. 2017. The algorithmic imaginary: exploring the ordinary affects of Facebook algorithms. *Information, communication & society* 20, 1 (2017), 30–44.

[16] Jenna Burrell. 2016. How the machine 'thinks': Understanding opacity in machine learning algorithms. *Big Data & Society* 3, 1 (2016), 2053951715622512.

[17] Jenna Burrell, Zoe Kahn, Anne Jonas, and Daniel Griffin. 2019. When Users Control the Algorithms: Values Expressed in Practices on Twitter. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–20.

[18] Joseph A Calandrino, Ann Kilzer, Arvind Narayanan, Edward W Felten, and Vitaly Shmatikov. 2011. " You might also like:" Privacy risks of collaborative filtering. In *2011 IEEE symposium on security and privacy*. IEEE, 231–246.

[19] Matthew Carrasco and Andruid Kerne. 2018. Queer Visibility: Supporting LGBT+ Selective Visibility on Social Media. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. ACM, Montreal QC Canada, 1–12. https://doi.org/10.1145/3173574.3173824

[20] Casey Newton. 2016. Here's how Twitter's new algorithmic timeline is going to work. *The Verge* (Feb. 2016). https://www.theverge.com/2016/2/6/10927874/twitter-algorithmic-timeline

[21] Janet X Chen, Allison McDonald, Yixin Zou, Emily Tseng, Kevin A Roundy, Acar Tamersoy, Florian Schaub, Thomas Ristenpart, and Nicola Dell. 2022. Trauma-Informed Computing: Towards Safer Technology Experiences for All. In *CHI Conference on Human Factors in Computing Systems*. 1–20.

[22] Mingming Cheng and Carmel Foley. 2019. Algorithmic management: The case of Airbnb. *International Journal of Hospitality Management* 83 (Oct. 2019), 33–36. https://doi.org/10.1016/j.ijhm.2019.04.009

[23] Kelley Cotter. 2019. Playing the visibility game: How digital influencers and algorithms negotiate influence on Instagram. *New Media & Society* 21, 4 (2019), 895–913.

[24] Kelley Cotter. 2021. "Shadowbanning is not a thing": black box gaslighting and the power to independently know and credibly critique algorithms. *Information, Communication & Society* (2021), 1–18.

[25] Kelley Marie Cotter. 2020. *Critical Algorithmic Literacy: Power, Epistemology, and Platforms*. Michigan State University.

[26] Rachael A Dansby Olufowote, Stephen T Fife, Cydney Schleiden, and Jason B Whiting. 2020. How can I become more secure?: A grounded theory of earning secure attachment. *Journal of Marital and Family Therapy* 46, 3 (2020), 489–506.

[27] Michael Ann DeVito. 2021. Adaptive folk theorization as a path to algorithmic literacy on changing platforms. (2021).

[28] Michael A DeVito, Darren Gergle, and Jeremy Birnholtz. 2017. " Algorithms ruin everything" # RIPTwitter, Folk Theories, and Resistance to Algorithmic Change in Social Media. In *Proceedings of the 2017 CHI conference on human factors in computing systems*. 3163–3174.

[29] Alicia DeVos, Aditi Dhabalia, Hong Shen, Kenneth Holstein, and Motahhare Eslami. 2022. Toward User-Driven Algorithm Auditing: Investigating users' strategies for uncovering harmful algorithmic behavior. In *CHI Conference on Human Factors in Computing Systems*. ACM, New Orleans LA USA, 1–19. https://doi.org/10.1145/3491102.3517441

[30] Lisa M Diamond. 2001. Contributions of psychophysiology to research on adult attachment: Review and recommendations. *Personality and Social Psychology Review* 5, 4 (2001), 276–295.

[31] Brooke Erin Duffy, Annika Pinch, Shruti Sannon, and Megan Sawey. 2021. The nested precarities of creative labor on social media. *Social Media+ Society* 7, 2 (2021), 20563051211021368.

[32] Maria Chiara D'Arienzo, Valentina Boursier, and Mark D Griffiths. 2019. Addiction to social media and attachment styles: a systematic literature review. *International Journal of Mental Health and Addiction* 17, 4 (2019), 1094–1118.

[33] Motahhare Eslami, Aimee Rickman, Kristen Vaccaro, Amirhossein Aleyasen, Andy Vuong, Karrie Karahalios, Kevin Hamilton, and Christian Sandvig. 2015. " I always assumed that I wasn't really that close to [her]" Reasoning about Invisible Algorithms in News Feeds. In *Proceedings of the 33rd annual ACM conference on human factors in computing systems*. 153–162.

[34] Motahhare Eslami, Kristen Vaccaro, Min Kyung Lee, Amit Elazari Bar On, Eric Gilbert, and Karrie Karahalios. 2019. User attitudes towards algorithmic opacity and transparency in online reviewing platforms. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. 1–14.

[35] Fatemeh Alizadeh and Gunnar Stevens. 2020. Think like a Human, Act like a Bot: Explaining Instagram's Automatic Ban Decisions. In *Conference on Human Factors in Computing Systems Extended Abstracts 2020*. ACM, Honolulu, Hawaii.

[36] Gretchen Faust. 2017. Hair, blood and the nipple. In *Digital Environments*. transcript-Verlag, 159–170.

[37] RM Pasco Fearon and Glenn I Roisman. 2017. Attachment theory: progress and future directions. *Current Opinion in Psychology* 15 (2017), 131–136.

[38] Ted Fleming. 2008. A Secure Base for Adult Learning: Attachment Theory and Adult Education. *adult learner: the Irish journal of adult and community education* 33 (2008), 53.

[39] Patricia I Fusch Ph D and Lawrence R Ness. 2015. Are we there yet? Data saturation in qualitative research. (2015).

[40] Ysabel Gerrard. 2018. Beyond the hashtag: Circumventing content moderation on social media. *New Media & Society* 20, 12 (2018), 4492–4511.

[41] Isabel Goodwin. 2003. The relevance of attachment theory to the philosophy, organization, and practice of adult mental health care. *Clinical Psychology Review* 23, 1 (2003), 35–56.

[42] Jami Grich. 2001. *Earned secure attachment in young adulthood: Adjustment and relationship satisfaction*. Texas A&M University.

[43] Oliver L Haimson, Daniel Delmonaco, Peipei Nie, and Andrea Wegner. 2021. Disproportionate Removals and Differing Content Moderation Experiences for Conservative, Transgender, and Black Social Media Users: Marginalization and Moderation Gray Areas. *Proceedings of the ACM on Human-Computer Interaction* 5, CSCW2 (2021), 1–35.

[44] Elizabeth Harlow. 2021. Attachment theory: Developments, debates and recent applications in social work, social care and education. *Journal of Social Work Practice* 35, 1 (2021), 79–91.

[45] Joseph Henrich, Steven J Heine, and Ara Norenzayan. 2010. Most people are not WEIRD. *Nature* 466, 7302 (2010), 29–29.

[46] Eelco Herder and Boping Zhang. 2019. Unexpected and unpredictable: Factors that make personalized advertisements creepy. In *Proceedings of the 23rd International Workshop on Personalization and Recommendation on the Web and Beyond*. 1–6.

[47] Alexis Hiniker, Sungsoo Hong, Tadayoshi Kohno, and Julie A Kientz. 2016. MyTime: designing and evaluating an intervention for smartphone non-use. In

Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems. 4746–4757.

[48] Robert Hinson, Henry Boateng, Anne Renner, and John Paul Basewe Kosiba. 2019. Antecedents and consequences of customer engagement on Facebook: An attachment theory perspective. *Journal of Research in Interactive Marketing* (2019).

[49] David Howe. 1995. *Attachment theory for social work practice*. Macmillan International Higher Education.

[50] Hubspot. 2022. Instagram Marketing. https://www.hubspot.com/instagram-marketing

[51] Instagram. 2016. See Posts you Care About First in your Feed. https://about.instagram.com/blog/announcements/see-posts-you-care-about-first-in-your-feed

[52] Shagun Jhaver, Darren Scott Appling, Eric Gilbert, and Amy Bruckman. 2019. "Did You Suspect the Post Would be Removed?": Understanding User Reactions to Content Removals on Reddit. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (Nov. 2019), 1–33. https://doi.org/10.1145/3359294

[53] Shagun Jhaver, Yoni Karpfen, and Judd Antin. 2018. Algorithmic Anxiety and Coping Strategies of Airbnb Hosts. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. ACM, Montreal QC Canada, 1–12. https://doi.org/10.1145/3173574.3173995

[54] Nadia Karizat, Dan Delmonaco, Motahhare Eslami, and Nazanin Andalibi. 2021. Algorithmic Folk Theories and Identity: How TikTok Users Co-Produce Knowledge of Identity and Engage in Algorithmic Resistance. *Proceedings of the ACM on Human-Computer Interaction* 5, CSCW2 (Oct. 2021), 1–44. https://doi.org/10.1145/3476046

[55] Celeste Kidd, Holly Palmeri, and Richard N Aslin. 2013. Rational snacking: Young children's decision-making on the marshmallow task is moderated by beliefs about environmental reliability. *Cognition* 126, 1 (2013), 109–114.

[56] Eunhyang Kim and Eunyoung Koh. 2018. Avoidant attachment and smartphone addiction in college students: The mediating effects of anxiety and self-esteem. *Computers in Human Behavior* 84 (2018), 264–271.

[57] Thomas David Knestrict. 2002. *A post-modern critique of attachment theory: Moving towards a socially just ecological framework*. University of Cincinnati.

[58] Vladimir J Konečni. 2010. Responsible behavioral science generalizations and applications require much more than non-WEIRD samples. *Behavioral and Brain Sciences* 33, 2-3 (2010), 98–99.

[59] Min Kyung Lee, Daniel Kusbit, Evan Metsky, and Laura Dabbish. 2015. Working with Machines: The Impact of Algorithmic and Data-Driven Management on Human Workers. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. ACM, Seoul Republic of Korea, 1603–1612. https://doi.org/10.1145/2702123.2702548

[60] Renkai Ma and Yubo Kou. 2021. " How advertiser-friendly is my video?": YouTuber's Socioeconomic Interactions with Algorithmic Content Moderation. *Proceedings of the ACM on Human-Computer Interaction* 5, CSCW2 (2021), 1–25.

[61] Kelly Mack, Emma McDonnell, Dhruv Jain, Lucy Lu Wang, Jon E. Froehlich, and Leah Findlater. 2021. What do we mean by "accessibility research"? A literature survey of accessibility papers in CHI and ASSETS from 1994 to 2019. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. 1–18.

[62] Mary Main, Judith Solomon, et al. 1990. Procedures for identifying infants as disorganized/disoriented during the Ainsworth Strange Situation. *Attachment in the preschool years: Theory, research, and intervention* 1 (1990), 121–160.

[63] Brandeis Marshall. 2021. *Algorithmic misogynoir in content moderation practice*. Technical Report. Technical Report. Heinrich-Böll-Stiftung.

[64] Ally McCrow-Young. 2021. Approaching Instagram data: reflections on accessing, archiving and anonymising visual social media. *Communication Research and Practice* 7, 1 (2021), 21–34.

[65] Lachlan A McWilliams and Gordon JG Asmundson. 2007. The relationship of adult attachment dimensions to pain-related fear, hypervigilance, and catastrophizing. *Pain* 127, 1-2 (2007), 27–34.

[66] Robert T Muller. 2009. Trauma and dismissing (avoidant) attachment: Intervention strategies in individual psychotherapy. *Psychotherapy: Theory, Research, Practice, Training* 46, 1 (2009), 68.

[67] Tyler Musgrave, Alia Cummings, and Sarita Schoenebeck. 2022. Experiences of Harm, Healing, and Joy among Black Women and Femmes on Social Media. In *CHI Conference on Human Factors in Computing Systems*. ACM, New Orleans LA USA, 1–17. https://doi.org/10.1145/3491102.3517608

[68] Sarah Myers West. 2018. Censored, suspended, shadowbanned: User interpretations of content moderation on social media platforms. *New Media & Society* 20, 11 (2018), 4366–4383.

[69] Lorelli S Nowell, Jill M Norris, Deborah E White, and Nancy J Moules. 2017. Thematic analysis: Striving to meet the trustworthiness criteria. *International journal of qualitative methods* 16, 1 (2017), 1609406917733847.

[70] Thiago Dias Oliva, Dennys Marcelo Antonialli, and Alessandra Gomes. 2021. Fighting hate speech, silencing drag queens? artificial intelligence in content moderation and risks to lgbtq voices online. *Sexuality & Culture* 25, 2 (2021), 700–732.

[71] Ramona L Paetzold, W Steven Rholes, and Jamie L Kohn. 2015. Disorganized attachment in adulthood: Theory, measurement, and implications for romantic relationships. *Review of General Psychology* 19, 2 (2015), 146–156.

[72] Laurie Anne Pearlman and Christine A Courtois. 2005. Clinical applications of the attachment framework: Relational treatment of complex trauma. *Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies* 18, 5 (2005), 449–459.

[73] Jane L Pearson, Deborah A Cohn, Philip A Cowan, and Carolyn Pape Cowan. 1994. Earned-and continuous-security in adult attachment: Relation to depressive symptomatology and parenting style. *Development and psychopathology* 6, 2 (1994), 359–373.

[74] Caitlin Petre, Brooke Erin Duffy, and Emily Hund. 2019. "Gaming the system": Platform paternalism and the politics of algorithmic visibility. *Social Media+ Society* 5, 4 (2019), 2056305119879995.

[75] Michael I Posner and Mary K Rothbart. 2000. Developing mechanisms of self-regulation. *Development and psychopathology* 12, 3 (2000), 427–441.

[76] Pushshift. 2019. Pushshift. https://github.com/pushshift/api

[77] Lauren Rouse and Anastasia Salter. 2021. Cosplay on demand? Instagram, OnlyFans, and the gendered fantrepreneur. *Social Media+ Society* 7, 3 (2021), 20563051211042397.

[78] Pat Sable. 1994. Anxious attachment in adulthood: Therapeutic implications. *Journal of Analytic Social Work* 2, 1 (1994), 5–24.

[79] Pat Sable. 1995. Attachment theory and post-traumatic stress disorder. *Journal of Analytic Social Work* 2, 4 (1995), 89–109.

[80] Sapna Maheshwari. 2018. Uncovering Instagram Bots With a New Kind of Detective Work. *The New York Times* (March 2018). https://www.nytimes.com/2018/03/12/business/media/instagram-bots.html?searchResultPosition=1

[81] Rachel Saunders, Deborah Jacobvitz, Maria Zaccagnino, Lauren M Beverung, and Nancy Hazen. 2011. Pathways to earned-security: The role of alternative support figures. *Attachment & human development* 13, 4 (2011), 403–420.

[82] Ilene Schecter. 2013. A secure place: Attachment patterns and socioeconomic status. (2013).

[83] Phillip R Shaver and Mario Mikulincer. 2002. Attachment-related psychodynamics. *Attachment & human development* 4, 2 (2002), 133–161.

[84] Jack P Shonkoff. 2003. From neurons to neighborhoods: old and new challenges for developmental and behavioral pediatrics. *Journal of Developmental & Behavioral Pediatrics* 24, 1 (2003), 70–76.

[85] Bret L Simmons, Janaki Gooty, Debra L Nelson, and Laura M Little. 2009. Secure attachment: Implications for hope, trust, burnout, and performance. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior* 30, 2 (2009), 233–247.

[86] Jeffry A Simpson and W Steven Rholes. 2017. Adult attachment, stress, and romantic relationships. *Current opinion in psychology* 13 (2017), 19–24.

[87] Lynne Marie Stöven and Philipp Yorck Herzberg. 2021. Relationship 2.0: A systematic review of associations between the use of social network sites and attachment style. *Journal of Social and Personal Relationships* 38, 3 (2021), 1103–1128.

[88] PO Svanberg, Lisa Mennet, and Susan Spieker. 2010. Promoting a secure attachment: A primary prevention practice model. *Clinical Child Psychology and Psychiatry* 15, 3 (2010), 363–378.

[89] The Instagram Team. [n.d.]. Community Guidelines. https://help.instagram.com/477434105621119

[90] Kim Toffoletti, Holly Thorpe, Adele Pavlidis, Rebecca Olive, and Claire Moran. 2021. Visibility and vulnerability on Instagram: negotiating safety in women's online-offline fitness spaces. *Leisure Sciences* (2021), 1–19.

[91] M-P Vaillancourt-Morel, M-È Daspe, Y Lussier, and C Giroux-Benoît. 2020. For the love of being liked: a moderated mediation model of attachment, likes-seeking behaviors, and problematic Facebook use. *Addiction Research & Theory* 28, 5 (2020), 397–405.

[92] Rebecca A VanMeter, Douglas B Grisaffe, and Lawrence B Chonko. 2015. Of "likes" and "pins": The effects of consumers' attachment to social media. *Journal of Interactive Marketing* 32 (2015), 70–88.

[93] Robert J Waldinger, Marc S Schulz, Arthur J Barsky, and David K Ahern. 2006. Mapping the road from childhood trauma to adult somatization: the role of attachment. *Psychosomatic medicine* 68, 1 (2006), 129–135.

[94] Jing Zeng and D Bondy Valdovinos Kaye. 2022. From content moderation to visibility moderation: A case study of platform governance on TikTok. *Policy & Internet* 14, 1 (2022), 79–95.