

EXHIBIT 2

**IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA**

PEOPLE OF THE STATE OF CALIFORNIA,
et al.,
Plaintiffs,

v.

META PLATFORMS, INC, Instagram, LLC,
Meta Payments, Inc., Meta Platforms
Technologies, LLC., et al.,
Defendants

IN RE: SOCIAL MEDIA ADOLESCENT
ADDICTION/PERSONAL INJURY
PRODUCTS LIABILITY LITIGATION

THIS DOCUMENT RELATES TO:
4:23-cv-05448

MDL No. 3047

Case No. 4:23-cv-05448-YGR

Judge: Hon. Yvonne Gonzalez Rogers

Magistrate Judge: Hon. Peter H. Kang

TRIAL REPORT OF RAVI IYER, PHD
August 1, 2025

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I. Introduction

I.A. Summary of opinions

- (1) Based on the assumptions of harm set forth in Section I.E as well as my research and experience, it is my opinion that the following design changes for young users, subject to effective age verification, will mitigate the unwanted, negative, and harmful experiences, including excessive and unhealthy usage, associated with young users' use of Instagram and Facebook (collectively "the Platforms"):
 - Verifiable removal of all "engagement" signals within algorithms used for young users, including any optimizations for comments, reshares, or time spent viewing content, and replacement of engagement signals with optimizations for explicit user preference or content that Meta determines to be "quality" (Section II).
 - Removal of Meta's extended use design features for young users, including infinite scroll and autoplay, quantification of engagement, and ephemeral content, and restriction of notifications to those that are truly time sensitive (Section III).
- (2) It is also my opinion that each of these design changes is feasible, including because they have been implemented previously, either by Meta in temporary, limited settings or by other peer companies.
- (3) Finally, it is my opinion that Meta's safety tools and features, including Teen Accounts—settings for young users aged 13–17 that Meta recently implemented—are insufficient to mitigate the unwanted, negative, and harmful experiences, including excessive and unhealthy usage, associated with young users' use of the Platforms. Many changes within Teen Accounts, such as increased parental supervision options or time limit reminders, rely on (1) knowledge of and willingness to use control settings and (2) the willpower of teens in the face of temptation. Meta, and the broader industry, acknowledge that controls are rarely used and that defaults are essential to drive uptake. The uptake of non-defaulted settings is typically well under 10%. It is also widely known amongst both scientists and parents that teens are still developing their self-control, such that expecting them to exercise such control over their usage in the face of technologically facilitated temptation is unlikely to succeed.
- (4) For these reasons and others described in the remainder of this report, Teen Accounts are not an adequate replacement for the design changes described in this report.

I.B. Qualifications and expertise

- (5) I am the Managing Director of University of Southern California's Neely Center for Ethical Leadership and Decision Making. The Neely Center focuses on guiding leaders to make responsible decisions regarding the development, implementation, and management of emerging technologies. I am also the Managing Director of the Psychology of Technology Institute, which is a project of the Neely Center. At the Institute, I collaborate with behavioral scientists, technology designers, and policymakers to protect and improve psychological health for society by advancing our understanding and effective use of transformative technologies.
- (6) I hold a PhD in Social Psychology from the University of Southern California, where my research focused on individual values, political opinions, polarization, and the intersection of technology and society. My scholarly contributions aim to deepen the understanding of human values and bridging societal divisions. In particular, my research examines the impact of social media on well-being, strategies for harm reduction, and approaches to addressing polarization and violence through thoughtful algorithmic design. Over the course of my academic career, I have coauthored numerous highly cited empirical studies, which collectively have been referenced thousands of times.
- (7) In addition to my academic endeavors, I have held various roles across the technology and non-profit sectors. I co-founded Ranker.com, where I contributed significantly to developing its initial algorithms. Ranker has since grown into a profitable publisher of crowdsourced lists, serving tens of millions of unique visitors monthly and employing dozens of people. I have also collaborated with several non-profit organizations dedicated to combating societal polarization.
- (8) From 2018 to 2022, I led data science, research, and product teams at Facebook, where I focused on enhancing the societal impact of social media platforms. My work primarily involved studying how to mitigate negative externalities of Facebook's products. It included studies on the effects of reshares and other algorithmic features in News Feed ranking to better understand their influence and improve user outcomes. This research informed meaningful changes to Facebook's approach, such as adjusting the weighting of "reactions" and reducing incentives for engagement with political content, aiming to mitigate negative user experiences. Additionally, I worked to expand the scope of solutions beyond traditional content moderation, emphasizing design and algorithmic innovations that inherently fostered positive social values while reducing harmful impacts. This holistic approach offered new, more robust strategies for promoting healthier interactions and well-being within social media ecosystems. Interventions that I helped develop have been used in dozens of situations by Meta, both while I was there and since I left. Since leaving, I have worked with numerous other companies and civil society organizations on how we can design platforms to be better for users, including children.

- (9) I have actively engaged in various media appearances, including conferences, podcasts, and interviews, to deliver lectures and talks on the societal impact of social media and advocate for more ethical and positive online environments. In addition, I have authored numerous articles offering insightful commentary and analysis on the psychological and societal dimensions of technology, with a particular emphasis on social media. My work highlights the importance of design-based solutions and ethical algorithms as pathways to fostering healthier and more beneficial online platforms. My contributions to improving the societal impact of social media have garnered significant recognition and have been featured in prominent outlets such as The Wall Street Journal, The New York Times, and The Atlantic. I am regularly consulted by regulators seeking to improve social media's impact on society.¹ I currently serve on the UK's Office of Communications' (Ofcom) Academic Panel and have formally advised regulators in Indonesia, Australia, and in the European Union.
- (10) Appendix B contains a copy of my current CV and a list of all publications I have authored in the last 10 years. I am being compensated at a rate of \$450 per hour for my work on this matter. None of my compensation is contingent upon the outcome of this litigation.

I.C. Parties

I.C.1. States

- (11) I understand that the plaintiffs in this lawsuit are a coalition of Attorneys General from 29 U.S. states: Arizona, California, Colorado, Connecticut, Delaware, Hawai'i, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maine, Maryland, Minnesota, Nebraska, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Virginia, Washington, West Virginia and Wisconsin (collectively, "Plaintiffs").

I.C.2. Meta

- (12) I understand that the defendants in this lawsuit are Meta Platforms, Inc.; Instagram, LLC; Meta Payments, Inc.; and Meta Platforms Technologies (collectively, "Meta").

¹ See *e.g.*, "Report on Emerging Technology and Its Effects on Youth Well-Being," The Office of Minnesota Attorney General, Vol.2, February 2025, p. 4, https://www.ag.state.mn.us/Office/Reports/EmergingTechnology_2025.pdf.

I.D. Meta's alleged unfair and deceptive practices

- (13) I understand that certain Plaintiffs allege that Meta has engaged in unfair and unconscionable acts and practices related to the health and safety of its young users on its social media platforms.²
- (14) I also understand that certain Plaintiffs allege that Meta has engaged in deceptive acts and practices regarding its social media platforms.³

I.E. Assignment and methodology

- (15) Counsel has instructed me to assume that (1) many young users have unwanted, negative, and harmful experiences, including excessive and unhealthy usage, while using the Platforms; (2) Meta has misled the public about the nature, severity, and frequency of these experiences, as well as about its own actions or inactions related to these experiences; (3) Meta's recommendation algorithms and Platform features, including infinite scroll, autoplay, quantifications of engagement such as "likes," notifications, and ephemeral content, encourage compulsive use of its Platforms; and (4) Meta's recommendation algorithms and Platform features are harmful to young users' physical and mental health. I understand that other evidence will be offered in the case, including the testimony of other expert witnesses, regarding these assumptions.⁴
- (16) I was retained by Plaintiffs to opine on:
- How Meta can structure its Platform algorithms to address unwanted, negative, and harmful experiences;
 - How Meta can remedy the issues associated with certain extended use features such as quantification of engagement, infinite scroll and autoplay, notifications, and ephemeral content to address unwanted, harmful, and negative experiences; and
 - Whether Meta's safety tools and features, including Teen Accounts, sufficiently remedy the unwanted, harmful, and negative experiences associated with Platform algorithms and certain extended use features.
- (17) To address these topics, I relied on techniques and approaches that I use in my academic and professional work and that experts in my field would reasonably consider and rely upon in forming an opinion on the subject matter of this report. For each question, I started with the assumption that Meta's actions in these two areas—algorithmic recommendation and extended use features—

² Complaint for Injunctive and Other Relief. *People of the State of California, et al. v. Meta Platforms, Inc., et al.* (N.D. Cal. Nos. 4:22-md-03047-YGR-PHK and 4:23-cv-05448-YGR) (November 22, 2023) (hereinafter "Complaint"), ¶ 847.

³ Complaint, ¶ 846.

⁴ See generally Complaint, especially ¶¶ 846–47.

contribute to unwanted, harmful, and negative experiences for young users on the Platforms. In each area, I then:

- Identified proposed changes to Meta’s practices that would help mitigate the unwanted, negative, and harmful experiences, including excessive and unhealthy usage;
- Assessed whether the proposed remedy is feasible for Meta; and
- Assessed whether Meta’s current approaches (e.g., time management tools, Teen Accounts) adequately address the unwanted, harmful, and negative experiences.

- (18) My assessment was based on my knowledge of the field and my experience addressing questions about how to enhance the societal impact of social media platforms, including through my academic research, my work at Facebook,⁵ my collaborations with other companies that have products similar to Meta’s, and my work at the Neely Center. In addition to my training, research, and experience, I relied on a variety of publicly available materials as well as nonpublic materials made available to me through counsel. A complete list of the materials that I considered is identified in Appendix A. In preparing this report, I was assisted by staff at the consulting firm Bates White, LLC. I directed the activities of the team, supervised and made all final decisions, and prepared this report.
- (19) I reserve the right to update my opinions if new materials become available during the course of this litigation. I also reserve the right to employ demonstrative exhibits that summarize facts or opinions disclosed in this report and any subsequent depositions if I am called upon to testify at a hearing or trial.

⁵ I have been careful to not disclose confidential information that I learned while working at Facebook, that is not already public through acts of others.

II. Optimization of Meta’s algorithms for quality signals and explicit user preference to promote youth well-being

- (20) Algorithmic recommendations collectively control what a user sees on social media platforms by deciding which of the many millions of pieces of content could be presented to a user. Meta’s algorithms, based on its own descriptions, are optimized for greater usage of its Platforms.⁶ The majority of signals that influence Meta’s algorithmic recommendations are commonly known as “engagement,” which refers to the various actions that users take when interacting with Meta’s Platforms.⁷
- (21) In Section II.A, I explain that optimizing based on quality signals and explicit user preferences rather than engagement would mitigate unwanted, negative, and harmful experiences, including excessive and unhealthy usage, experienced by young users and that it would be feasible for Meta to do so. I explain in Section II.B why the limited protections Meta has in place, including Teen Accounts and time management tools, do not sufficiently address the unwanted, negative, and harmful experiences, including excessive and unhealthy usage, experienced by young users.

II.A. Optimizing algorithms for quality signals and explicit user preference rather than engagement would mitigate unwanted, negative, and harmful experiences for young users

- (22) Meta’s recommendation algorithms, which are optimized primarily for engagement, also include quality signals and signals that are indicative of explicit user preference, though these signals affect the algorithm to a much lesser extent than engagement signals. Quality signals refer to any signal that can reasonably be connected to the experience or safety of youth. Signals that are indicative of explicit user preference include, for example, whether a user reports content or whether a user hides content. Meta’s own internal research has shown that many users will engage disproportionately with sexually suggestive, shocking, disturbing, or otherwise attention-getting content, but will indicate that such content is unwanted and/or perceived to be low quality.⁸ Algorithms optimized based on quality

⁶ Meta describes the signals that influence its algorithmic recommendations in its model cards. “Introducing 22 System Cards That Explain How AI Powers Experiences on Facebook and Instagram,” Meta Blog, June 29, 2023, <https://ai.meta.com/blog/how-ai-powers-experiences-facebook-instagram-system-cards/>; “Facebook Feed AI System,” Meta Transparency Center, June 4, 2025, <https://transparency.meta.com/features/explaining-ranking/fb-feed/?referrer=1>.

⁷ Alex Moehring, Alissa Cooper, Arvind Narayanan, Aviv Ovadya, Elissa Redmiles, Jeff Allen, Jonathan Stray, Julia Kamin, Leif Sigerson, Luke Thorburn, Matt Motyl, Motahhare Eslami, Nadine Farid Johnson, Nathaniel Lubin, Ravi Iyer, and Zander Arnao, “Better Feeds: Algorithms That Put People First,” Knight-Georgetown Institute, March 4, 2025, p. 4, https://kgi.georgetown.edu/wp-content/uploads/2025/02/Better-Feeds_-Algorithms-That-Put-People-First.pdf.

⁸ META3047MDL-207-00011753 at -753-769 and META3047MDL-207-00030977 at -978-980 (“Providing Negative Feedback Should Be Easy (And Why This Would Be Game Changing for Integrity),” September 26, 2019).

signals and user preferences would reduce the extent to which such content is presented to users, whereas engagement-based optimization would increase its presentation.⁹

- (23) Optimizing for explicit user preference and quality signals and reducing the role of engagement have been shown to reduce unwanted time spent and unwanted content for users. Meta’s own internal experiments provide causal evidence that optimizing its algorithm based on quality signals and the use of explicit preference signals improves user experiences.¹⁰ For example, Meta conducted an experiment in which it randomly assigned users to be given an algorithm that showed them less content that was likely to be engaged with (e.g., it was less likely to be commented on or reshared). Users for whom engagement signals were reduced both spent less time using Facebook and saw a lower proportion of content they did not find valuable.¹¹ Per the Wall Street Journal, removing engagement signals means that users specifically see less content that was deemed “bullying, inaccurate information, and graphic violence.”¹²
- (24) Meta has indicated that it makes judgments about the quality of posts in order to improve user experience, either in response to user feedback (e.g., reducing clickbait and engagement bait) or to foster a safer community (e.g., reducing content from producers who violate policies such as bullying or violence).¹³ Although optimizations that incorporate these quality signals have been shown to improve user experiences, their utility is limited by the fact, acknowledged by Meta, that low-quality content is not fully definable.¹⁴ Thus, Meta’s current approach of restricting the distribution of defined categories of low-quality content, while still continuing to optimize for engagement, does not fully address the underlying issues. As discussed in more detail in Section II.B, Teen Accounts’ Sensitive Content restrictions similarly fail to fully address content quality issues. In contrast, optimizing for

⁹ Tom Cunningham, Sana Pandey, Leif Sigerson, Jonathan Stray, Jeff Allen, Bonnie Barrilleaux, Ravi Iyer, Smitha Milli, Mohit Kothari, Behnam Rezaei, “What We Know About Using Non-Engagement Signals in Content Ranking,” *arXiv preprint* (2024): 6 (“Predicted engagement often has a negative relationship with quality scores.”).

¹⁰ META3047MDL-207-00010463 at -482 (“Users With Histories of Positive Engagement From Diverse Others on their Comments Display Higher Integrity”); Josh Constone, “Facebook Will Change Algorithm to Demote ‘Borderline Content’ That Almost Violates Policies,” TechCrunch, November 15, 2018, <https://techcrunch.com/2018/11/15/facebook-borderline-content/>.

¹¹ Anna Stepanov, “Political Content in Feeds,” Meta Newsroom, updated May 28, 2025, <https://about.fb.com/news/2021/02/reducing-political-content-in-news-feed/> (“As part of these tests... we put less weight on comments and shares when ranking political content. When surveyed, people who experienced these changes said they saw less of the content they did not find valuable. Based on those results, we’re further expanding tests globally.”).

¹² Jeff Horwitz, Keach Hagey and Emily Glazer, “Facebook Wanted Out of Politics. It Was Messier Than Anyone Expected,” The Wall Street Journal, January 5, 2023, <https://www.wsj.com/articles/facebook-politics-controls-zuckerberg-meta-11672929976>.

¹³ “Reducing the Distribution of Problematic Content,” Meta Transparency Center, updated April 25, 2025, <https://transparency.meta.com/enforcement/taking-action/lowering-distribution-of-problematic-content/>.

¹⁴ META3047MDL-053-00020001 (“Instagram Well-Being Research Memo,” Facebook Papers, July 8, 2020); Josh Constone, “Facebook Will Change Algorithm to Demote ‘Borderline Content’ That Almost Violates Policies,” TechCrunch, November 15, 2018, <https://techcrunch.com/2018/11/15/facebook-borderline-content/>.

explicit user preference and quality signals and reducing the role of engagement would more fully address the underlying issue.

- (25) It is widely recognized across the broader technology industry that reducing engagement signals in favor of quality signals or explicit user feedback improves user experiences and mitigates unwanted, negative, and harmful experiences. For example, the Integrity Institute, which is an industry group comprised of trust and safety workers across companies, recently released a report showing that Instagram’s engagement-based model leads to untrustworthy content about eating disorders.¹⁵ They recommend optimizing for quality signals instead. YouTube endorses the use of surveys within its algorithms and the importance of demoting borderline content from recommendations.¹⁶ Pinterest has publicly released a “Field Guide to Non-Engagement Signals” to illustrate the need for alternative algorithms rather than a focus on usage.¹⁷ A group of industry professionals across multiple platforms, including public representatives from LinkedIn, has released similar recommendations acknowledging that optimizations for quality or surveys as to explicit user preference will reduce over-usage and unwanted content.¹⁸ Algorithmic reforms that mirror the recommendations in this report have been adopted by policymakers in the European Union and in several U.S. states.¹⁹
- (26) As acknowledged by Meta’s internal research and the broader technology field, optimizing algorithms primarily for quality signals and explicit user preference, rather than optimizing primarily for engagement, mitigates unwanted, negative, and harmful experiences. Such optimization would entail removing all engagement signals within algorithms used for youth, leaving only signals that are indicative of explicit preference (e.g., a “like” or “love” reaction) or signals related to Meta’s judgments of content quality (e.g., whether a post is original). This would include replacing any engagement signal optimizations for comments, reshares, or time spent viewing content with optimizations for explicit user preference and quality signals. Figure 1 below illustrates the current and desired states.

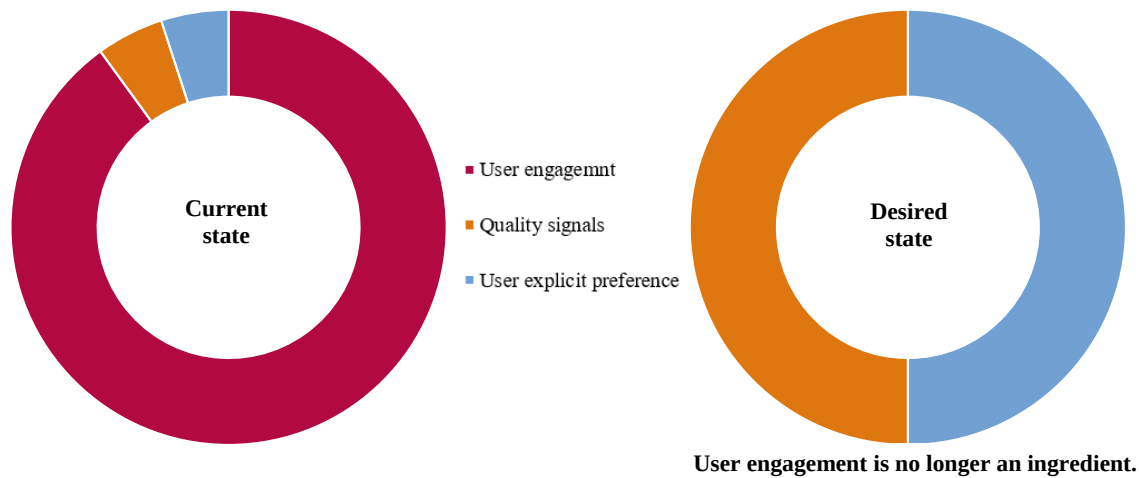
¹⁵ Jeff Allen, “Why Is Instagram Search More Harmful Than Google Search?” Integrity Institute, February 13, 2024, <https://integrityinstitute.org/blog/why-is-instagram-search-more-harmful-than-google-search>.

¹⁶ Christos Goodrow, “On YouTube’s Recommendation System,” YouTube Official Blog, September 15, 2021, <https://blog.youtube/inside-youtube/on-youtubes-recommendation-system/>.

¹⁷ Leif Sigerson and Wendy Matheny, “The Field Guide to Non-Engagement Signals,” Pinterest Engineering Blog, Medium, March 26, 2024, <https://medium.com/pinterest-engineering/the-field-guide-to-non-engagement-signals-a4dd9089a176>.

¹⁸ Tom Cunningham, Sana Pandey, Leif Sigerson, Jonathan Stray, Jeff Allen, Bonnie Barrilleaux, Ravi Iyer, Smitha Milli, Mohit Kothari, Behnam Rezaei, “What We Know About Using Non-Engagement Signals in Content Ranking,” *arXiv preprint* (2024): 1–16.

¹⁹ Harsh Vardhan Pachisia, “The EU’s Digital Services Act takes on ‘The Algorithm,’” Chicago Policy Review, January 1, 2024, <https://chicagopolicyreview.org/2024/01/01/the-eus-digital-services-act-takes-on-the-algorithm/>; “Holding Social Media Accountable,” State of Utah, accessed July 11, 2025, <https://socialmedia.utah.gov/>.

Figure 1: Comparison between the current and desired algorithmic changes

Note: This figure is illustrative of the general direction and types of changes desired, rather than precise or definitive measurements.

- (27) In order to verify that the algorithm’s objective function has indeed been changed, disclosure of the specifics of Meta’s algorithmic practices is needed. According to a broad consensus among industry and academic experts, this disclosure should include a list of signals used within each algorithm, along with data that allows for the understanding of each signal’s impact on content ranking positions.²⁰ Without such detail, it would be impossible to understand which parts of an algorithm were more or less important in driving user experiences. Transparency about product experiment results that relate to these changes as well as the ongoing product decision making for teams working on algorithms also serve important verification purposes by ensuring that these changes are not circumvented.²¹ In particular, long term (12 month or longer) holdout experiments, where a group of users who receive recent changes are compared to a group of users who do not receive such changes, should be conducted, reported publicly, and audited by an independent third party on an ongoing basis.²² In concert, these transparency provisions will provide confidence that Meta’s algorithms have indeed been robustly reformed.

²⁰ Alex Moehring, Alissa Cooper, Arvind Narayanan, Aviv Ovadya, Elissa Redmiles, Jeff Allen, Jonathan Stray, Julia Kamin, Leif Sigerson, Luke Thorburn, Matt Motyl, Motahhare Eslami, Nadine Farid Johnson, Nathaniel Lubin, Ravi Iyer, and Zander Arnao, “Better Feeds: Algorithms That Put People First,” Knight-Georgetown Institute, March 4, 2025, pp. 30–34, https://kgi.georgetown.edu/wp-content/uploads/2025/02/Better-Feeds_-Algorithms-That-Put-People-First.pdf.

²¹ Luke Thorburn, Jonathan Stray, Priyanjana Bengani, “Experiments are the Best Kind of Transparency,” Medium, June 8, 2024, <https://medium.com/understanding-recommenders/experiments-are-the-best-kind-of-transparency-ea35c1661479>.

²² Alex Moehring, Alissa Cooper, Arvind Narayanan, Aviv Ovadya, Elissa Redmiles, Jeff Allen, Jonathan Stray, Julia Kamin, Leif Sigerson, Luke Thorburn, Matt Motyl, Motahhare Eslami, Nadine Farid Johnson, Nathaniel Lubin, Ravi Iyer, and Zander Arnao, “Better Feeds: Algorithms That Put People First,” Knight-Georgetown Institute, March 4, 2025, pp. 38–40, https://kgi.georgetown.edu/wp-content/uploads/2025/02/Better-Feeds_-Algorithms-That-Put-People-First.pdf; Nathaniel Lubin and Ravi Iyer, “How Tech Regulation Can Leverage Product Experimentation Results,” The

- (28) Finally, once these algorithmic reforms have taken effect, ongoing monitoring of the resulting outputs of Meta’s systems can ensure that the changes are having the desired effect on user experiences. This transparency would include improved visibility of the most popular content, to ensure that algorithms are not distributing harmful content widely. Such reports have provided both internal and external accountability for algorithmic practices in the past.²³ It would also include ongoing measurement of the experiences of youth, which is also a widely accepted accountability practice.²⁴ This transparency will ensure that Meta both implements the required changes and that it does not engage in practices that would undo these changes. This level of transparency has been widely recommended by numerous academic and industry experts as well as by many regulators.²⁵
- (29) For quality- and explicit preference-based algorithm optimization to function appropriately to minimize unwanted, negative, and harmful experiences, including excessive and unhealthy usage, users must have a low-friction method to report preferences, including negative signals, with a single click. Meta’s internal research shows that explicit actions about negative experiences are particularly rare in proportion to the volume of negative experiences reported on Meta’s Platforms.²⁶ Meta has estimated that 5–10% of its content generates a negative experience, yet only about 0.5% of the feedback it receives on content is negative, as compared to positive signals.²⁷ Meta’s current functionality for reporting negative experiences often requires accessing the relatively unused three dot expandable menu.²⁸ In some instances, Meta does provide an “X” in the corner of posts that

Lawfare Institute, July 11, 2023, <https://www.lawfaremedia.org/article/how-tech-regulation-can-leverage-product-experimentation-results>.

²³ Barbara Ortutay, “Meta Kills Off Misinformation Tracking Tool CrowdTangle Despite Pleas from Researchers, Journalists,” Associated Press News, updated August 14, 2024, <https://apnews.com/article/meta-crowdtangle-research-misinformation-shutdown-facebook-977ece074b99addb4887bf719f2112a>.

²⁴ “The Online Experiences of Children in Australia,” eSafety Commissioner, accessed July 31, 2025, <https://www.esafety.gov.au/research/the-online-experiences-of-children-in-australia>.

²⁵ Luke Thorburn, Jonathan Stray, Priyanjana Bengani, “Experiments are the Best Kind of Transparency,” Medium, June 8, 2024, <https://medium.com/understanding-recommenders/experiments-are-the-best-kind-of-transparency-ea35c1661479>; “Minnesota Attorney General’s Report on Emerging Technology and Its Effects on Youth Well-Being,” The Office of Minnesota Attorney General Keith Ellison, accessed July 18, 2025, pp. 5–7, https://www.ag.state.mn.us/Office/Reports/EmergingTechnology_2025.pdf; Ravi Iyer, “The Surgeon General Has New Social Media Guidelines. Minnesota Already Made Some of Them into Law,” Boston Globe, updated July 16, 2024, <https://www.bostonglobe.com/2024/07/16/opinion/surgeon-general-social-media-minnesota/>; Alex Moehring, Alissa Cooper, Arvind Narayanan, Aviv Ovadya, Elissa Redmiles, Jeff Allen, Jonathan Stray, Julia Kamin, Leif Sigerson, Luke Thorburn, Matt Motyl, Motahhare Eslami, Nadine Farid Johnson, Nathaniel Lubin, Ravi Iyer, and Zander Arnao, “Better Feeds: Algorithms That Put People First,” Knight-Georgetown Institute, March 4, 2025, <https://kgi.georgetown.edu/research-and-commentary/better-feeds/>.

²⁶ META3047MDL-207-00011753 at -753-769 and META3047MDL-207-00030977 at -978-980 (“Providing Negative Feedback Should Be Easy (And Why This Would Be Game Changing for Integrity),” September 26, 2019).

²⁷ META3047MDL-207-00011753 at -756-758 and META3047MDL-207-00030977 at -978 (“Providing Negative Feedback Should Be Easy (And Why This Would Be Game Changing for Integrity),” September 26, 2019).

²⁸ Deposition of Sayed Oturu, Exhibit 9 (“13.59% of Youth users predicted to reside in the U.S. used the Report tool to report a profile or a piece of content on Instagram between November 28, 2023, and April 1, 2024. [...] 2.9% of Youth users predicted to reside in the U.S. used Not Interested on a recommended post in Explore on Instagram between November 28, 2023, and April 1, 2024.”).

allows for wider feedback, which has been shown to improve user experiences in internal research.²⁹ However, it is unclear how often that interface is used given its placement and ambiguous meaning, and external studies have suggested that such negative signals are not currently meaningfully affecting algorithms.³⁰

- (30) Meta can increase the visibility of the negative signal interface by making negative signals on unwanted content a more salient, top-level, universally accessible action to allow for more widespread explicit control. Per internal research, users often do not know what to do when they have negative experiences on Meta's Platforms.³¹ Disclosure by Meta of the extent to which users actually utilize negative signals would enable transparency, allowing the public to understand whether the signal is being used in proportion to the amount of negative experiences reported. Meta can increase visibility by making the negative signal interface more obvious and accessible with a single click, similar to the current clear ability to reshare or "like" content. This signal would be an indication of explicit user preference that allows the user to flag content that they wish to see less of, irrespective of whether it violates policies or increases usage. Once a user has provided negative feedback, they can also be given the opportunity to report that content as policy violating. Finally, transparency of exactly how this signal is used within algorithms and how it is weighted against other factors is critical, to ensure that not only can users indicate negative experiences, but also that those negative experiences are meaningfully abated.
- (31) Many successful platforms include more prominent negative feedback mechanisms, and their users report fewer negative experiences as compared to Meta's Platforms. For example, YouTube and Reddit both have "dislike" and "downvote" options respectively, which are placed alongside positive feedback options and are accessible via a single click.³² Meta has itself experimented with negative feedback, but internal research has indicated that such negative feedback is often a sparse signal in algorithms, and making it less sparse would be a "game changer" in terms of increased user safety.³³ Internal Meta research also indicates that negative feedback helps mitigate harmful experiences that may otherwise be encouraged by algorithms in order to drive product usage.³⁴ By making such

²⁹ META3047MDL-207-00010463 at -482 ("Users With Histories of Positive Engagement From Diverse Others on their Comments Display Higher Integrity").

³⁰ "Algorithms of Trauma: New Case Study Shows That Facebook Doesn't Give Users Real Control Over Disturbing Surveillance Ads," Panoptikon Foundation, September 29, 2021, <https://en.panoptikon.org/algorithms-trauma-new-case-study-shows-facebook-doesnt-give-users-real-control-over-disturbing>.

³¹ META3047MDL-207-00009287 at -290 ("Starship Takes Flight: Early Insights," July 11, 2019); META3047MDL-004-00015029 ("Bad Experiences and Encounters Framework (BEEF) Survey").

³² "An Update to Dislikes on YouTube," YouTube Blog, November 10, 2021, <https://blog.youtube/news-and-events/update-to-youtube/>; "What are Upvotes and Downvotes?" Reddit Help, accessed July 21, 2025, <https://support.reddithelp.com/hc/en-us/articles/7419626610708-What-are-upvotes-and-downvotes>.

³³ META3047MDL-207-00011753 at -771-772 and META3047MDL-207-00030977 at -981 ("Providing Negative Feedback Should Be Easy (And Why This Would Be Game Changing for Integrity)," September 26, 2019).

³⁴ META3047MDL-207-00010463 at -482 ("Users with Histories of Positive Engagement from Diverse Others on their Comments Display Higher Integrity").

negative feedback easier, Meta is likely to mitigate a variety of negative experiences that are not caught by policies.

- (32) Optimization would also involve Meta increasing the weighting of explicit positive signals in its algorithm such as “love” reactions and preferences expressed through Meta’s topic picker. Internal product work has shown that this can improve the user experience. A “love” reaction, for example, is less likely to be provided on unwanted content and has been shown to be related to improved user experiences.³⁵
- (33) Similarly, Meta’s topic picker lets teens “select topics they want to see more of in Explore and their recommendations so they can focus on the fun, positive content they love.”³⁶ In contrast, engagement signals such as views, reshares, or comments—which as I explain above are weighted significantly more than explicit positive signals—do not always reflect the content users actually want to see more of. These engagement signals frequently occur on objectionable or attention-getting content, including posts that users “dislike.”³⁷
- (34) Based on my research and experience, it is feasible for Meta to replace engagement signals with optimizations for quality and user preference signals that prioritize the experience and well-being of youth. Meta already has some quality and preference signals available and has demonstrated that altering the composition of its algorithms to prioritize these signals reduces unwanted usage and increases the safety of users,³⁸ though these signals are either limited relative to engagement signals or are only used in limited circumstances as described in Section II.B. For example, Instagram Reels algorithms incorporate user preference signals on how likely a user is to click “Interested,” while Facebook Feed recommendations consider how likely a user is to click “X” to hide a post.³⁹ Meta also has introduced Favorites and Following Feeds on Instagram that offer users the option to reduce emphasis on engagement and increase emphasis on user agency.⁴⁰ Although these are not currently the default feeds, they further show the feasibility of replacing engagement optimizations. Finally, as part of Meta’s “break the glass” measures in times of crises, Meta has often removed specific

³⁵ META3047MDL-207-00007530 at -533-536 (“Users with Histories of Positive Engagement from Diverse Others on their Comments Display Higher Integrity”).

³⁶ “Introducing Instagram Teen Accounts: Built-In Protections for Teens, Peace of Mind for Parents,” Meta News, updated June 11, 2025, <https://about.fb.com/news/2024/09/instagram-teen-accounts/>.

³⁷ META3047MDL-207-00009287 at -317 (“Starship Takes Flight: Early Insights,” July 11, 2019).

³⁸ Ivan Mehta, “Instagram Tests a ‘Dislike’ Button for Comments,” TechCrunch, February 14, 2025, <https://techcrunch.com/2025/02/14/instagram-tests-a-dislike-button-for-comments/>.

³⁹ “Instagram Reels Chaining AI System,” Meta Transparency Center, updated March 7, 2025, <https://transparency.meta.com/features/explaining-ranking/ig-reels-chaining/?referrer=1>; “Facebook Feed Recommendations AI System,” Meta Transparency Center, updated June 4, 2025, <https://transparency.meta.com/features/explaining-ranking/fb-feed-recommendations/?referrer=1>.

⁴⁰ Adam Mosseri, “Control your Instagram Feed with Favorites and Following,” Instagram Blog, March 23, 2022, <https://about.instagram.com/blog/announcements/favorites-and-following>.

engagement signals from its algorithms.⁴¹ The removal of engagement signals has become an integral part of Meta’s playbook for reducing harm in “risky” settings.⁴² However, such removals are often temporary or limited.

- (35) It is also feasible for Meta to make it easier for users to provide negative signals and incorporate those signals into a quality- and explicit preference-optimized algorithm. Though Meta already uses sparse negative signals within its algorithms, these signals appear to have less impact on user experiences compared to positive engagement signals and are limited by user frictions for reporting negative signals. One effort to address this is Meta’s current testing of a “dislike” button for Instagram, which, if rolled out broadly, would make negative signals more readily accessible.⁴³ In addition, Meta has previously demoted borderline content,⁴⁴ but its algorithm descriptions suggest that it applies these negative signals to a lesser degree as compared to other platforms.⁴⁵ Taken together, Meta’s use of negative signals and prior reduction of borderline content, though limited, indicate that fully implementing quality optimization is readily feasible.
- (36) Meta also has established systems to engage experts and users in the creation of these quality and user preference signals.⁴⁶ Finally, as discussed above, other companies in the broader technology industry, such as YouTube, have successfully optimized based on quality signals and explicit user preference.

II.B. Meta’s harmful algorithmic optimization is not remedied by its Teen Accounts and time management tools

- (37) Meta has launched “tools, features and resources” that it purports “help teens have safe, positive experiences, and give parents simple ways to set boundaries for their teens.”⁴⁷ Most recently, Meta has launched Teen Accounts, which have some “built-in protections” turned on by default for teenage users.⁴⁸ According to Meta, its Teen Accounts are “designed to address parents’ biggest concerns,

⁴¹ META3047MDL-207-00003134 at -134 (“Big Levers Ranking Experiment”).

⁴² Mercy Ndegwa, “An Update on Our Longstanding Work to Protect People in Ethiopia,” Meta News, November 9, 2021, <https://about.fb.com/news/2021/11/update-on-ethiopia/>; META3047MDL-207-00003134 at -134 (“Big Levers Ranking Experiment”).

⁴³ Ivan Mehta, “Instagram Tests a ‘Dislike’ Button for Comments,” TechCrunch, February 14, 2025, <https://techcrunch.com/2025/02/14/instagram-tests-a-dislike-button-for-comments/>.

⁴⁴ Josh Constine, “Facebook Will Change Algorithm to Demote ‘Borderline Content’ That Almost Violates Policies,” TechCrunch, November 15, 2018, <https://techcrunch.com/2018/11/15/facebook-borderline-content/>.

⁴⁵ Joel Kaplan, “More Speech and Fewer Mistakes,” Meta News, January 7, 2025, <https://about.fb.com/news/2025/01/meta-more-speech-fewer-mistakes/>.

⁴⁶ Monika Bickert, “Publishing Our Internal Enforcement Guidelines and Expanding Our Appeals Process,” Meta News, April 24, 2018, <https://about.fb.com/news/2018/04/comprehensive-community-standards/>; META3047MDL-004-00015029 (“Bad Experiences and Encounters Framework (BEEF) Survey”).

⁴⁷ “Our Tools, Features and Resources to Help Support Teens and Parents,” Meta Help Center, accessed July 16, 2025, <https://www.meta.com/help/policies/809291991003600/>.

⁴⁸ “Introducing Instagram Teen Accounts: Built-In Protections for Teens, Peace of Mind for Parents,” Meta News, updated June 11, 2025, <https://about.fb.com/news/2024/09/instagram-teen-accounts/>.

including who their teens are talking to online, the content they're seeing and whether their time is being well spent."⁴⁹ Rather than optimizing the algorithm for quality signals and explicit user preference, which would make it easier for youth to control their Platform usage, Teen Accounts purport to provide greater controls for both teenagers and supervising parents through time management tools (e.g., notifications to teenage users encouraging them to leave Instagram after 60 minutes of daily use) and content restrictions.⁵⁰

- (38) Despite Meta's representations, these tools are relatively ineffective as compared to the recommendations in this report. As an initial matter, such tools only work if age verification is effective.
- (39) Further, research suggests that parental supervision tools are rarely used and easily evaded, even when used.⁵¹ It is unlikely that parents are aware of these features or that they will take the time to adjust settings given how many apps a typical teenager uses. Internal studies at Meta indicate that in 2022, under 10% of Meta teens were subject to parental controls, even as parents reported a widespread desire to reduce their children's exposure to digital harms.⁵²
- (40) Meta has acknowledged that any parental and user controls are likely to be underutilized based on both its own experiences with controls as well as the experiences of other organizations.⁵³ Per a cross-industry paper that surveyed representatives from many major platforms and which cited several Meta documents, "most platforms indicated that the portion of their user base actively utilizing user controls remains within the single-percentage range."⁵⁴

⁴⁹ "Introducing Instagram Teen Accounts: Built-In Protections for Teens, Peace of Mind for Parents," Meta News, updated June 11, 2025, <https://about.fb.com/news/2024/09/instagram-teen-accounts/>.

⁵⁰ "Introducing Instagram Teen Accounts: Built-In Protections for Teens, Peace of Mind for Parents," Meta News, updated June 11, 2025, <https://about.fb.com/news/2024/09/instagram-teen-accounts/>.

⁵¹ Naomi Nix, "Meta Says its Parental Controls Protect Kids. But Hardly Anyone Uses Them," The Washington Post, updated January 30, 2024, <https://www.washingtonpost.com/technology/2024/01/30/parental-controls-tiktok-instagram-use/>; "How Kids Bypass Parental Controls in 2024: A Parent's Guide," SafeTelecom, October 8, 2024, <https://kosheros.com/blogs/news/how-kids-bypass-parental-controls-in-2024-a-parents-guide>.

⁵² Naomi Nix, "Meta Says its Parental Controls Protect Kids. But Hardly Anyone Uses Them," The Washington Post, updated January 30, 2024, <https://www.washingtonpost.com/technology/2024/01/30/parental-controls-tiktok-instagram-use/>; Michelle Faverio, Monica Anderson and Eugenie Park, "Teens, Social Media and Mental Health," Pew Research Center, April 22, 2025, <https://www.pewresearch.org/internet/2025/04/22/teens-social-media-and-mental-health/>; Tom Cunningham, Sana Pandey, Leif Sigerson, Jonathan Stray, Jeff Allen, Bonnie Barrilleaux, Ravi Iyer, Smitha Milli, Mohit Kothari, Behnam Rezaei, "What We Know About Using Non-Engagement Signals in Content Ranking," *arXiv preprint* (2024): 1–16; Deposition of Sayed Oturu, Exhibit 9.

⁵³ Tom Cunningham, Sana Pandey, Leif Sigerson, Jonathan Stray, Jeff Allen, Bonnie Barrilleaux, Ravi Iyer, Smitha Milli, Mohit Kothari, Behnam Rezaei, "What We Know About Using Non-Engagement Signals in Content Ranking," *arXiv preprint* (2024): 1–16.

⁵⁴ Tom Cunningham, Sana Pandey, Leif Sigerson, Jonathan Stray, Jeff Allen, Bonnie Barrilleaux, Ravi Iyer, Smitha Milli, Mohit Kothari, Behnam Rezaei, "What We Know About Using Non-Engagement Signals in Content Ranking," *arXiv preprint* (2024): 1–16.

- (41) In September 2024, Meta implemented additional default restrictions through Teen Accounts, and in April 2025 it claimed that “97% of teens aged 13–15 have stayed in these built-in restrictions.”⁵⁵ Additional information is needed to understand this statistic, including what percentage of all young user accounts in the U.S. have been placed into Teen Accounts, including those who misrepresent their age. It also begs the questions what restrictions, exactly, are being measured in this statistic, and how much of this percentage accounts for teens ages 13–15 who cannot change certain settings without a supervising parent’s permission, as compared to teens ages 16–17 who can change these settings without permission. Regardless of the answers to these questions, these restrictions are still not enough to address the unwanted, negative, and harmful experiences of youth, including excessive and unhealthy usage of the Platforms.
- (42) Meta attempts to address these issues by simply defining low-quality experiences (e.g., clickbait) and restricting their distribution. For example, Meta’s Sensitive Content restrictions are defaulted for teens and purport to prevent the viewing of broad categories of content that are deemed more sensitive. This approach, however, does not mitigate these issues to the same extent that optimizing the algorithm for quality signals and explicit user preference does. Attempting to define low-quality experiences and restrict their distribution cannot fully or verifiably mitigate the harms associated with Meta’s algorithms, in part because of the impossibility of fully, successfully defining what is or is not harmful content.⁵⁶ Essentially, Meta is continuing to optimize its recommendation algorithms for engagement—a strategy that leads to unwanted, negative, and harmful experiences for youth—and then trying to undo those harms with limited content definitions. It would be far more effective for Meta to instead stop optimizing its algorithms for engagement.
- (43) Across features, Meta’s Teen Accounts fail to address the root of the problem: the engagement-driven algorithms that undermine self-control and perpetuate the very behaviors these tools seek to mitigate. Teen Accounts do not substantially address the issues because, to the best of my knowledge, Teen Accounts still are subject to algorithms that are optimized for engagement rather than quality or explicit preference, and that account for the bulk of over-usage and otherwise harmful experiences associated with young users’ use of the Platforms.
- (44) The mitigations of Teen Accounts effectively leave in place powerful engagement-based algorithms that can overwhelm the self-control of youth, whose inhibition systems are still developing.⁵⁷ Accordingly, it is unrealistic to expect the protections offered by Teen Accounts to fully mitigate

⁵⁵ “We’re Introducing New Built-In Restrictions for Instagram Teen Accounts, and Expanding to Facebook and Messenger,” Meta News, April 8, 2025, <https://about.fb.com/news/2025/04/introducing-new-built-in-restrictions-instagram-teen-accounts-expanding-facebook-messenger/>.

⁵⁶ “Written Testimony of Arturo Bejar before the Subcommittee on Privacy, Technology, and the Law,” U.S. Senate Committee on the Judiciary, November 7, 2023, https://www.judiciary.senate.gov/imo/media/doc/2023-11-07_-_testimony_-_bejar.pdf.

⁵⁷ BJ Casey and Kristina Caudle, “The Teenage Brain: Self Control,” *Current Directions in Psychological Science*, vol. 22, no. 2 (2013): 82–87.

these issues, and further design changes are necessary such that powerful algorithms are no longer working against both youth and parents. Without meaningful changes to the core design of these algorithms or features (i.e., optimizing for quality signals and explicit user preference), the risks and harms faced by teens will persist, rendering these surface-level solutions largely ineffective.

III. Removal and restriction of Meta's extended use features

- (45) Below in Section III.A, I explain that there is no tool or feature that could effectively minimize the effects of Meta's use of infinite scroll and autoplay, quantifications of engagement, and ephemeral content, other than their removal for young users. I also explain that it is necessary to restrict Meta's notifications to young users to only those that are truly time sensitive. Additionally, I explain that it would be feasible for Meta to remove and restrict these extended use features for young users. In Section III.B, I explain why the limited protections Meta has in place, including Teen Accounts and time management tools, do not overcome the harm associated with extended use features.

III.A. Removing infinite scroll and autoplay, quantification of engagement, and ephemeral content, and restricting notifications to those that are truly time sensitive would mitigate excessive and unhealthy usage for young users

- (46) Based on my research and experience, there is no tool or feature that could effectively minimize the effects of Meta's use of infinite scroll and autoplay, quantification and engagement, and ephemeral content, other than their removal for young users. Similarly, the only way to effectively minimize the effects of Meta's use of notifications for young users is to restrict these to notifications that are truly time sensitive.
- (47) Some of these features, including infinite scroll and autoplay, reduce the ability to exercise self-control by depriving users of the time necessary to consider whether they want to keep using the Platform. Other design features, including the quantification of engagement, the excessive use of notifications, and the use of ephemeral content, are designed to create emotional motivation to find out what others may or may not be doing. Such social motivations cannot be expected to be mitigated by teens' self-control, especially since other features are working to limit the amount of thought that teens put into their continued usage. Given how these features facilitate excessive and unhealthy usage, infinite scroll and autoplay, quantification of engagement, and ephemeral content should be removed, and notifications should be substantially restricted for teens.
- (48) Most human behavior is not just a function of thoughtful, rational consideration, but is also impulsive, emotional, and subject to social temptation. Hundreds of academic studies have shown that human beings are often irrational and extremely social.⁵⁸ This is especially true for teens, as it is widely

⁵⁸ Dan Ariely, *Predictably Irrational, Revised and Expanded Edition: The Hidden Forces That Shape Our Decisions*, Revised and Expanded ed. (Harper Perennial, 2010); David Brooks, *The Social Animal: The Hidden Sources of Love, Character, and Achievement*, Reprint. (Random House Trade Paperbacks, 2012).

understood that teens are still developing their self-control, and therefore a greater part of their behavior is in response to social or emotional stimuli.⁵⁹ For example, many teens and adults report a desire to stop using online platforms but a difficulty in doing so, with social media use being cited specifically as detrimental.⁶⁰ As such, while offering the option to engage in explicit self-control is helpful, it is insufficient, especially for teens. Accordingly, mitigating the problems associated with Meta's extended use features requires the removal and restriction of those features.

- (49) Below, I discuss four extended use features implemented by Meta: (1) infinite scroll and autoplay, (2) quantification of engagement, (3) notifications, and (4) ephemeral content. For each feature, I explain that it is both necessary and feasible for Meta to remove or restrict it to address unwanted, harmful, and negative experiences for young users on the Platforms.

III.A.1. Infinite scroll and autoplay

- (50) Meta's Platforms, including Teen Accounts on those Platforms, use "infinite scroll," in which content automatically and continuously loads at the bottom of a screen, and "autoplay," in which video or audio automatically begins playing when a user navigates to or scrolls through a set of videos without any explicit action on the part of a user. Without infinite scroll and autoplay, users would be required to take an explicit action to continue to use a platform or to view or listen to specific video or audio content. In considering whether to take that action, users may reflect on whether they do or do not want to continue using the platform or content.
- (51) Interviews indicate that infinite scroll makes users feel "caught in the loop" and is associated with regret of social media usage.⁶¹ Many teens would likely prefer to have to take an explicit action to continue platform use given that, in one recent poll, 45% of teens reported using social media too much and 44% reported trying to cut back on social media use.⁶² In one study, over 70% of teens reported feeling manipulated by online platforms and many teens report using services

⁵⁹ BJ Casey and Kristina Caudle, "The Teenage Brain: Self Control," *Current Directions in Psychological Science*, vol. 22, no. 2 (2013): 82–87.

⁶⁰ Michelle Faverio, Monica Anderson and Eugenie Park, "Teens, Social Media and Mental Health," Pew Research Center, April 22, 2025, <https://www.pewresearch.org/internet/2025/04/22/teens-social-media-and-mental-health/>; "Are You Addicted to Your Phone? American Phone Usage & Screen Time Statistics," Harmony Healthcare IT Blog, accessed July 18, 2025, <https://www.harmonyhit.com/phone-screen-time-statistics/>.

⁶¹ Jan Ole Rixen, Luca-Maxim Meinhardt, Michael Glöckler, Marius-Lukas Ziegenbein, Anna Schlothauer, Mark Colley, Enrico Rukzio, and Jan Gugenheimer, "The Loop and Reasons to Break It: Investigating Infinite Scrolling Behaviour in Social Media Applications and Reasons to Stop," *Proceedings of the ACM on Human-Computer Interaction*, vol. 7, no. 228 (2023): 1–22; Hyunsung Cho, DaEun Choi, Donghwi Kim, Wan Ju Kang, Eun Kyoung Choe, and Sung-Ju Lee, "Reflect, Not Regret: Understanding Regretful Smartphone Use with App Feature-Level Analysis," *Proceedings of the ACM on Human-Computer Interaction*, vol. 5, no. 456 (2021), 1–36; META3047MDL-207-00016893 and META3047MDL-096-00000086 ("Have We Made People Addicted to Facebook?" August 3, 2017).

⁶² Michelle Faverio, Monica Anderson and Eugenie Park, "Teens, Social Media and Mental Health," Pew Research Center, April 22, 2025, <https://www.pewresearch.org/internet/2025/04/22/teens-social-media-and-mental-health/>.

“unconsciously” such that they “can’t control their use.”⁶³ Research has found that at least some older teens do reintroduce friction into their experiences to reduce their usage, such as applying screen locks or reminders, in order to address feelings of lack of control.⁶⁴ However, the same research found that teens across age groups struggle to stop.⁶⁵ A safer design for youth users would require them to take an affirmative step to load more content on a page, indicating their active desire to engage more with the platform. Removing infinite scroll is essential for reducing unwanted, problematic usage for millions of teens as reflected by the high proportion that report over-usage.

- (52) Similar regret and unwanted usage are facilitated by the autoplay feature, whereby video or audio begins playing without any explicit user action indicating a desire for that to occur. In a diary study of video consumption across streaming platforms, 90% of users reported exceeding their planned watch time and most users blamed features like autoplay.⁶⁶ An experiment where autoplay was introduced for some preschool users of a newly presented video player showed extended video watch time, less self-regulation, and more need for parental intervention.⁶⁷ Demonstrating the value and attractiveness of removing autoplay features, in a study where Netflix users were experimentally assigned to have autoplay removed, one-third of users decided to continue without autoplay after experiencing the benefit of added friction that enabled them to consider their consumption choices.⁶⁸ Removal of the autoplay feature would similarly require young users to specifically ask for audio or video to play.
- (53) Some amount of friction is essential to ensure that consumers make meaningful choices, especially when users engage with companies in ways that may be detrimental to users. For example, the practice of “auto renewing” subscriptions makes a continued business relationship frictionless, but without a meaningful affirmative decision from the consumers, consumers often feel manipulated and may regret their decisions.⁶⁹ Similarly, automatically and infinitely presenting content without

⁶³ “A Double-Edged Sword: How Diverse Communities of Young People Think About the Multifaceted Relationship Between Social Media and Mental Health,” Common Sense, accessed July 28, 2025, p. 4, https://www.common sense media.org/sites/default/files/research/report/2024-double-edged-sword-hopelab-report_final-release-for-web-v2.pdf.

⁶⁴ Nikhila Natarajan, “Do They Stop? How Do They Stop? Why Do They Stop? Whether, How, and Why Teens Insert ‘Frictions’ into Social Media’s Infinite Scroll,” *International Journal of Communication*, vol. 18 (2024): 1956.

⁶⁵ Nikhila Natarajan, “Do They Stop? How Do They Stop? Why Do They Stop? Whether, How, and Why Teens Insert ‘Frictions’ into Social Media’s Infinite Scroll,” *International Journal of Communication*, vol. 18 (2024): 1956.

⁶⁶ Akash Chaudhary, Jaivrat Saroha, Kyzyl Monteiro, Angus G. Forbes, and Aman Parnami, “‘Are You Still Watching?’: Exploring Unintended User Behaviors and Dark Patterns on Video Streaming Platforms,” *DIS ‘22: Proceedings of the 2022 ACM Designing Interactive Systems Conference* (2022): 776–791.

⁶⁷ Alexis Hiniker, Sharon S. Heung, Sungsoo (Ray) Hong, and Julie A. Kientz, “Coco’s Videos: An Empirical Investigation of Video-Player Design Features and Children’s Media Use,” *CHI ‘18: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, no. 254 (2018): 1–13.

⁶⁸ Brennan Schaffner, Yarezi Ulloa, Riya Sahni, Jiatong Li, Ava Kim Cohen, Natasha Messier, Lan Gao, and Marshini Chetty, “An Experimental Study of Netflix Use and the Effects of Autoplay on Watching Behaviors,” *Proceedings of the ACM on Human-Computer Interaction*, vol. 9, no. 2 (2025): 1–22.

⁶⁹ “Deep Product Insights Into Auto-Renewal Optimization in High-Retention Strategies,” UMA Technology, July 11, 2025, <https://umatechnology.org/deep-product-insights-into-auto-renewal-optimization-in-high-retention-strategies/>; “Social Media, Social Life: Teens Reveal Their Experiences,” Common Sense, accessed July 18, 2025, p. 15,

allowing for a meaningful affirmative decision on the part of teen users has left many teens feeling manipulated.⁷⁰ Accordingly, removal of infinite scroll and autoplay for teens, without the ability for these features to be turned back on, is necessary to mitigate excessive and unhealthy usage for young users.

- (54) Based on my research and experience, it is feasible for Meta to implement these changes. Infinite scroll and autoplay can readily be removed and many successful companies have done so, proving the feasibility.⁷¹ For example, YouTube has turned off autoplay for identified children.⁷² Google removed infinite scroll from search results.⁷³ Facebook already has settings to disable autoplay that could easily be turned on by default for youth, rather than opt in as they currently are.⁷⁴ Turning off autoplay and infinite scroll for young users, without the ability for these features to be turned back on, would prevent regretted and unwanted consumption for millions of youth.⁷⁵

III.A.2. Quantification of engagement

- (55) Social influence is another way that youth are encouraged towards greater usage of Meta's Platforms. Engagement metrics, such as the visible count of how many "likes," comments, clicks, views, or reactions any user-generated item has received, create a natural impulse to engage in social comparison. For example, research has shown that many social media users understand the number of "likes" or shares that a given piece of content gets as an indication of popularity amongst peers.⁷⁶ Negative social comparison, per Meta's internal research, is especially prevalent amongst teens on Instagram with 21.4% reporting experiencing it within a 7 day period (as compared to 6.8% of users

<https://www.commonsensemedia.org/sites/default/files/research/report/2018-social-media-social-life-executive-summary-web.pdf>.

⁷⁰ "Social Media, Social Life: Teens Reveal Their Experiences," Common Sense, accessed July 18, 2025, p. 15, <https://www.commonsensemedia.org/sites/default/files/research/report/2018-social-media-social-life-executive-summary-web.pdf>.

⁷¹ Mindy Brooks, "Giving Kids and Teens a Safer Experience Online," Google Blog, August 10, 2021, <https://blog.google/technology/families/giving-kids-and-teens-safer-experience-online/>.

⁷² Mindy Brooks, "Giving Kids and Teens a Safer Experience Online," Google Blog, August 10, 2021, <https://blog.google/technology/families/giving-kids-and-teens-safer-experience-online/>.

⁷³ Andrew Liszewski, "Google is Killing Infinite Scroll on Search Results," The Verge, June 25, 2024, <https://www.theverge.com/2024/6/25/24185727/google-search-continuous-scrolling-doomscrolling-graveyard>.

⁷⁴ "Stop Videos and Animations From Playing Automatically in your Feed on Facebook," Facebook Help, accessed July 18, 2025, <https://www.facebook.com/help/1406493312950827/>.

⁷⁵ Luca-Maxim Meinhardt, Maryam Elhaidary, Mark Colley, Michael Rietzler, Jan Ole Rixen, Aditya Kumar Purohit, Enrico Rukzio, "Scrolling in the Deep: Analysing Contextual Influences on Intervention Effectiveness during Infinite Scrolling on Social Media," *CHI '25: Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems*, no. 964 (2025): 1–3.

⁷⁶ Aarif Alutaybi, John McAlaney, Angelos Stefanidis, Keith Phalp, and Raian Ali, "Designing Social Networks to Combat Fear of Missing Out," *Proceedings of the 32nd International BCS Human Computer Interaction Conference (HCI)* (2025): 1–5.

over age 45).⁷⁷ In one study, users cited “the number of likes a post got” as a trigger for negative social comparison 26% of the time.⁷⁸

- (56) Teen Accounts still see this engagement quantification by default. Though Meta has implemented an option to “Hide Likes & Views” on Instagram and “Hide Reactions” on Facebook, estimates of usage of these features range from 0.4% to 3.5% of youth users.⁷⁹ In contrast, features that allow teens to provide a popularity boost to others by automating the process of engaging with content have proved more popular, with approximately 45% of youth using the “Like Comments” feature.⁸⁰ Given the known low adoption rate of any non-defaulted setting, providing the option is insufficient to mitigate unwanted, negative, and harmful experiences, including excessive and unhealthy usage, for young users. In such cases, removing quantification, without the ability to add it back, is the safest setting for teens.
- (57) It is feasible for Meta to remove the quantification of engagement for youth users, since the feature already exists as a setting and has been tested. This would include hiding the visible count of how many “likes,” comments, clicks, views, or reactions any user-generated item has received. Meta’s “Project Daisy” was an internal product experiment that removed the visible counts for a limited number of engagement signals, leading to a measurable decrease in harmful social comparisons.⁸¹ In one variant of this experiment, users reported a 2.5% decrease in self-reported negative social comparison, with teen girls reporting a 6% decrease.⁸² This product test result shows that such design changes are both practical and effective, even when done at limited scale. Removing all quantification of engagement for youth users would likely affect millions of teens, including because Meta’s internal research indicates that 30% of Instagram users believe that Instagram makes social comparison worse.⁸³

⁷⁷ META3047MDL-004-00015029 at -048 (“Bad Experiences and Encounters Framework (BEEF) Survey”).

⁷⁸ META3047MDL-207-00022660 at -677 and META3047MDL-207-00034268 at -274 (“Project Daisy, Likes and Social Comparison”).

⁷⁹ Deposition of Sayed Otaru, Exhibit 9.

⁸⁰ Deposition of Sayed Otaru, Exhibit 9.

⁸¹ “Discussion Paper: Case Study on Online Youth Harms – Project Daisy,” Harvard Kennedy School, accessed July 10, 2025, pp. 1–2, https://shorensteincenter.org/wp-content/uploads/2023/11/Discussion-Paper_Youth-Online-Harms-and-Project-Daisy_For-Shorenstein-Publication.pdf.

⁸² META3047MDL-207-00022660 at -675 and META3047MDL-207-00034268 at -286 (“Project Daisy, Likes and Social Comparison”).

⁸³ META3047MDL-207-00022660 at -673 and META3047MDL-207-00034268 at -273 (“Project Daisy, Likes and Social Comparison”).

III.A.3. Notifications

- (58) Notifications drive extended use.⁸⁴ In an internal Meta study of people who quit Facebook due to the fact that they had spent too much time on the Platform or wanted to leave temporarily, such users had received 60% more notifications than the average user over a 7 day period, and also were observed to click them more quickly than other users.⁸⁵ This suggests that excessive notifications are a pain point that drives unwanted usage of Meta’s Platforms. In the words of one teen, “I turned [my notifications] off because IG notifies you every time someone posts; like anytime anyone you Follow or someone that Follows you, when they post; or when someone starts a Live video; or when someone adds to their Story... It’s just a bunch of notifications.” While teens can conceivably adjust their notifications, as this teen did, many will not because the settings are not easy to navigate or because they fear missing out on something truly time sensitive.⁸⁶ Meta estimated that only 0.26% of U.S. youth Instagram users and 7.5% of U.S. youth Facebook users used notification settings to limit or turn off notifications.⁸⁷
- (59) Restriction of notifications would address this issue by limiting notifications, by default, to those that are truly time sensitive, such as those that (1) concern personal direct messages (i.e., “DMs”) from others or (2) are expressly and unambiguously requested by users as requiring notification. Meta has features that limit notifications already, but many of those features are off by default. Meta could easily turn them on as the default setting for teens, and allow teens who want more notifications to change this setting. While stronger notification protections are offered by default for young users during sleeping hours,⁸⁸ this fails to address the urgency that teens feel throughout the day.

III.A.4. Ephemeral content

- (60) Another extended use feature on Meta’s Platforms is ephemeral content that disappears after a certain period of time.⁸⁹ This creates urgency as a user who does not view such content may fear missing out

⁸⁴ Abdul Rehman, “The Power of Notifications: Capturing and Retaining User Attention,” Medium, November 4, 2024, https://medium.com/@abdul.rehman_84899/the-power-of-notifications-capturing-and-retaining-user-attention-2ededf44127a.

⁸⁵ META3047MDL-207-00016893 at -900-902 and META3047MDL-096-00000086 at -088 (“Have We Made People Addicted to Facebook?” August 3, 2017).

⁸⁶ Ryan Romero, “The Role of Ephemeral Content in Creating FOMO: A Social Media Strategy,” Multipost Digital, accessed July 18, 2025, <https://www.multipostdigital.com/blog/the-role-of-ephemeral-content-in-creating-fomo-a-social-media-strategy>.

⁸⁷ Deposition of Sayed Otaru, Exhibit 9.

⁸⁸ “Introducing Instagram Teen Accounts: Built-In Protections for Teens, Peace of Mind for Parents,” Meta News, updated June 11, 2025, <https://about.fb.com/news/2024/09/instagram-teen-accounts/>; “Instagram Quiet Mode: A New Way to Manage Your Time and Focus,” Meta News, January 19, 2023, <https://about.fb.com/news/2023/01/instagram-quiet-mode-manage-your-time-and-focus/>.

⁸⁹ Ryan Romero, “The Role of Ephemeral Content in Creating FOMO: A Social Media Strategy,” Multipost Digital, accessed July 18, 2025, <https://www.multipostdigital.com/blog/the-role-of-ephemeral-content-in-creating-fomo-a-social-media-strategy>.

on something important.⁹⁰ Meta only introduced ephemeral content on Instagram in 2016 and on Facebook in 2017, and its products existed without such content for many years.⁹¹ Several successful competitors (e.g., Twitter and Pinterest) do not have ephemeral content functionality. Accordingly, it is feasible and necessary for Meta to remove ephemeral content from its Platforms, without the ability for it to be turned back on, removing yet another design feature that encourages over-usage of its products by youth.

III.B. Meta’s harmful extended use features are not remedied by its Teen Accounts and time management tools

- (61) Teen Accounts and time management tools alone are insufficient to mitigate the excessive and unhealthy usage associated with Meta’s extended use features. Rather than removing and restricting these extended use features, which would make it easier for youth to control their Platform usage, Teen Accounts and time management tools, by default, rely on youth exercise of self-control. As I explained above, tools that rely on teens’ biologically undeveloped self-control are unlikely to succeed. For example, by default, Meta sends notifications to teenage users encouraging them to leave Instagram after 60 minutes of daily use, but it does not actually restrict their time spent on the Platform.⁹² Such notifications do not constitute a meaningful amount of friction to impact Platform usage. Similarly, through “Sleep mode,” Meta mutes notifications overnight for teen users from 10 pm to 7 am, but does not actually restrict their access to the Platform during those hours.⁹³ And while parents who have set up supervision over their teenagers’ accounts can block their teenagers’ access to their account based on the amount of time spent per day or for set time periods,⁹⁴ a Meta executive has acknowledged that expecting parents to manage usage of 40+ apps is unrealistic,⁹⁵ and almost all

⁹⁰ Ryan Romero, “The Role of Ephemeral Content in Creating FOMO: A Social Media Strategy,” Multipost Digital, accessed July 18, 2025, <https://www.multipostdigital.com/blog/the-role-of-ephemeral-content-in-creating-fomo-a-social-media-strategy>.

⁹¹ “Introducing Instagram Stories,” Instagram Blog, August 2, 2016, <https://about.instagram.com/blog/announcements/introducing-instagram-stories>; Connor Hayes, “More Ways to Share With the Facebook Camera,” Meta News, March 28, 2017, <https://about.fb.com/news/2017/03/more-ways-to-share-with-the-facebook-camera/>.

⁹² “Introducing Instagram Teen Accounts: Built-In Protections for Teens, Peace of Mind for Parents,” Meta News, updated June 11, 2025, <https://about.fb.com/news/2024/09/instagram-teen-accounts/>.

⁹³ “Introducing Instagram Teen Accounts: Built-In Protections for Teens, Peace of Mind for Parents,” Meta News, updated June 11, 2025, <https://about.fb.com/news/2024/09/instagram-teen-accounts/>.

⁹⁴ “Introducing Instagram Teen Accounts: Built-In Protections for Teens, Peace of Mind for Parents,” Meta News, updated June 11, 2025, <https://about.fb.com/news/2024/09/instagram-teen-accounts/>.

⁹⁵ Natalie Fahmy, “Meta Testifies at Ohio Statehouse in Favor of Age Verification in App Store,” MSN, accessed July 21, 2025, <https://www.msn.com/en-us/news/technology/meta-testifies-at-ohio-statehouse-in-favor-of-age-verification-in-app-store/ar-AA1FFetS>.

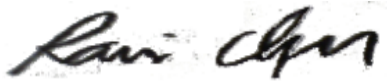
users maintain default settings.⁹⁶ Many teens will likely figure out ways around such tools as well, especially as Instagram currently allows for the creation and maintenance of multiple accounts.

- (62) Meta does attempt to add friction into teen experiences at specific intervals as an acknowledgment that friction provides some opportunity to evaluate continued product usage. However, Meta's Teen Accounts and time management tools stop well short of the amount of friction that would actually be effective to mitigate excessive and unhealthy usage, all of which I described in Section III.A. As an example, the current friction, which reminds users that they have been spending more than an hour on Instagram, occurs much less frequently than the friction I recommend regarding autoplay (e.g., requiring the user to actively decide to watch each video by clicking play). As such, the friction that Meta has added within Teen Accounts experiences is clearly inadequate given the powerful algorithms and design choices pushing teens toward continued usage.
- (63) In conclusion, addressing the combination of engagement-based feeds and frictionless user interfaces—which present teen users with the most tempting content with as little opportunity to reflect on their consumption as possible—is necessary to mitigate unwanted, negative, and harmful experiences, including excessive and unhealthy usage, for young users. Meta has introduced some design mitigations for these issues, which shows that such mitigations are feasible. However, those mitigations have been temporary, limited in scope, and/or limited in terms of strength of implementation.

⁹⁶ “We’re Introducing New Built-In Restrictions for Instagram Teen Accounts, and Expanding to Facebook and Messenger,” Meta News, April 8, 2025, <https://about.fb.com/news/2025/04/introducing-new-built-in-restrictions-instagram-teen-accounts-expanding-facebook-messenger/>.

Trial Report of Ravi Iyer, PhD

The undersigned hereby certifies their understanding that they owe a primary and overriding duty of candor and professional integrity to help the Court on matters within their expertise and in all submissions to, or testimony before, the Court. The undersigned further certifies that their report and opinions are not being presented for any improper purpose, such as to harass, cause unnecessary delay, or needlessly increase the cost of litigation.



Ravi Iyer, PhD

August 1, 2025

Date

Appendix A. Materials considered

In addition to all materials below, I incorporate by reference all materials used or cited in the footnotes of my report.

A.1. Legal and other case documents

- Complaint for Injunctive and Other Relief. *People of the State of California, et al. v. Meta Platforms, Inc., et al.* (N.D. Cal. Nos. 4:22-md-03047-YGR-PHK and 4:23-cv-05448-YGR) (November 22, 2023).
- Meta Defendants' Responses and Objections to Plaintiffs' Second Set of Interrogatories. *People of the State of California, et al. v. Meta Platforms, Inc., et al.* (N.D. Cal. No. 4:22-md-03047-YGR) (November 27, 2024).
- Meta Defendants' Supplemental Responses and Objections to Plaintiffs' Second Set of Interrogatories. *People of the State of California, et al. v. Meta Platforms, Inc., et al.* (N.D. Cal. No. 4:22-md-03047-YGR) (December 26, 2024).
- Meta Defendants' Third Supplemental and Amended Responses and Objections to Plaintiffs' Second Set of Interrogatories. *People of the State of California, et al. v. Meta Platforms, Inc., et al.* (N.D. Cal. No. 4:22-md-03047-YGR) (February 28, 2025).
- Meta Defendants' Fourth Supplemental and Amended Responses and Objections to Plaintiffs' Second Set of Interrogatories. *People of the State of California, et al. v. Meta Platforms, Inc., et al.* (N.D. Cal. No. 4:22-md-03047-YGR) (March 14, 2025).
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A.4. Depositions

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A.5. Discovery

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- META3047MDL-207-00030977
- META3047MDL-004-00015029
- META3047MDL-207-00002841
- META3047MDL-207-00028106
- META3047MDL-207-00005085
- META3047MDL-207-00028759
- META3047MDL-207-00016893
- META3047MDL-096-00000086

Trial Report of Ravi Iyer, PhD

- META3047MDL-207-00009287
- META3047MDL-207-00022660
- META3047MDL-207-00034268
- META3047MDL-053-00019928
- META3047MDL-039-00000250
- META3047MDL-207-00010697
- META3047MDL-207-00030640
- META3047MDL-207-00010703
- META3047MDL-207-00010463
- META3047MDL-207-00003134
- META3047MDL-053-00020001
- META3047MDL-207-00007530

Trial Report of Ravi Iyer, PhD

Appendix B. Curriculum vitae of Ravi Iyer, PhD

Ravi Iyer, Ph.D.

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[Google Scholar Profile](#)

Academic Curriculum Vitae

Research Interests

Political polarization, social media impact on society, moral psychology, algorithmic influence on human behavior, data science applications in psychology.

Education

- **Ph.D., Social Psychology**, University of Southern California, 2011
 - **M.A., Psychology**, University of Southern California, 2010
 - **B.A., Political Science** (Minor: Computer Science), Columbia University, 1996
-

Academic Positions & Research Experience

Managing Director, Psychology of Technology Institute, USC Neely Center

2022–Present

- Conceived and developed the "Neely Design Code for Social Media" initiative, which has been presented at numerous universities, has informed numerous policies, and has been cited in many media articles that discuss technology's impact on society.
- Established and maintained relationships with partners, including OfCom, the Anxious Generation, the FTC, the Minnesota Attorney General's Office, and many technology companies.
- Developed "Neely Ethics and Technology Indices" – a national tracking poll of technology experience that has been widely distributed within companies, amongst policy makers, and is being used for several in-prep academic publications.
- Authored numerous peer reviewed empirical articles about technology's impact on society for both academic, general public and policy audiences. Work has been featured in *The New York Times*, *Wall Street Journal*, *Boston Globe*, *Lawfare*, *Tech Policy Press*, and more.

Research Manager / Data Science Manager / Product Manager, Facebook (Meta)

2018–2022

- Led interdisciplinary teams working on mitigating sensationalism, misinformation, polarization, inauthentic behavior, and violence incitement.
- Founded teams focused on issues of violence incitement in regions such as Myanmar and Sri Lanka.
- Developed algorithmic and UI solutions to improve the societal impact of Facebook’s newsfeed and civic content.
- Managed multiple teams of data scientists and researchers across Meta’s family of apps.
- Worked as a product manager on the AI team on aligning algorithms with human values.

Chief Data Scientist / Co-Founder, Ranker

2009–2018

- Built Ranker.com from an idea into a top 100 internet platform with 40+ million monthly visitors.
- Designed and implemented crowdsourcing algorithms and fraud detection methods across 200,000+ lists.
- Led teams across product design, ad operations, front-end and back-end engineering, analytics, and business development.

Founding Executive Director, CivilPolitics

2008–2018

- Developed the *YourMorals* platform in collaboration with Jonathan Haidt, which educated hundreds of thousands of users annually and provided data for dozens of peer-reviewed publications.
- Led a 501(c)(3) non-profit organization focused on political polarization research and intervention.
- Research featured in *The New York Times*, *BBC*, *The Atlantic*, *Los Angeles Times*, *Washington Post*, *NPR*, and more.

Data Science & Research Consulting

1996–Present

- Provided expertise for organizations including Compaq/HP, Goldman Sachs, and multiple startups.
 - Taught social science and data science courses at USC and General Assembly.
-

Publications & Citations

(Selected Articles)

Moehring, A., Cooper, A., Narayanan, A., Ovadya, A., Redmiles, E., Allen, J., Stray, J., Kamin, J., Sigerson, L., Thorburn, L., Motyl, M., Eslami, M., Johnson, N. F., Lubin, N., **Iyer, R.**, & Arnao, Z. (2025, March). *Better feeds: Algorithms that put people first*. Knight-Georgetown Institute. https://kgi.georgetown.edu/wp-content/uploads/2025/02/Better-Feeds_-Algorithms-That-Put-People-First.pdf

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Graham, J., Haidt, J., Koleva, S., Motyl, M., **Iyer, R.**, Wojcik, S. P., & Ditto, P. H. (2013). Moral foundations theory: The pragmatic validity of moral pluralism. In P. Devine & A. Plant (Eds.),

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