

Exhibit 9

**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

REBUTTAL TRIAL REPORT OF RAVI IYER, PHD
October 24, 2025

Table of contents

I. Introduction 2

 I.A. Summary of opinions..... 2

 I.B. Assignment 4

II. Dr. Ferrara’s report is non-responsive to my report 6

III. Dr. Birnholtz mischaracterizes my methodology and routinely ignores cited evidence supporting my recommendations 7

 III.A. Dr. Birnholtz mischaracterizes my use of an established methodology 7

 III.B. Dr. Birnholtz routinely ignores cited evidence supporting my recommendations, including “ideal” experimental evidence..... 8

IV. Dr. Birnholtz’s opinion that Meta’s features are “reasonable” is not based on an established methodology and is largely non-responsive to my report..... 13

 IV.A. Dr. Birnholtz’s opinion that Meta’s features are “reasonable” because they provide some potential benefits to users does not negate the fact that such features facilitate excessive usage 14

 IV.B. Dr. Birnholtz’s opinion that Meta’s features are “reasonable” relies on inappropriate comparisons to platforms that do not share Meta’s combination of extended use features and engagement-based algorithms 17

V. Defendants’ Experts fail to rebut my opinion that young users’ harmful experiences cannot be effectively mitigated by Meta’s moderation efforts, safety tools, or user controls 20

 V.A. Dr. Ferrara is incorrect that content moderation systems can effectively mitigate young users’ harmful experiences..... 20

 V.B. Dr. Birnholtz provides no evidence that Meta’s safety tools are effective for reducing young users’ harmful experiences..... 21

 V.C. Dr. Birnholtz ignores evidence that Meta’s safety tools are ineffective for reducing young users’ harmful experiences..... 22

VI. Conclusion 26

Appendix A. Materials considered..... A-1

I. Introduction

I.A. Summary of opinions

- (1) Defendants did not submit a rebuttal report responding to my recommended changes to Meta's algorithm, and thus my opinions stand as expressed in my opening report that: (1) the verifiable removal of all "engagement" signals within algorithms used for young users would reduce young users' harmful experiences, (2) it is feasible for Meta to remove engagement signals from its algorithms for young users, and (3) Meta's safety tools are insufficient to mitigate young users' harmful experiences associated with Meta's engagement-based algorithms.
- (2) Defendants submitted two expert reports from Drs. Ferrara and Birnholtz that purport to rebut my opening report opinions. In summary, those reports are critically flawed and therefore do not change any of the opinions described in my opening report regarding the removal of Meta's extended use design features for young users, including infinite scroll and autoplay, quantification of engagement, and ephemeral content, and the restriction of notifications. Below I summarize my responses to these reports in more detail.
- (3) **Dr. Ferrara's report is non-responsive to my report.** Dr. Ferrara does not attempt to rebut my opening report opinions that (1) my recommended changes to Meta's algorithms and Platform features would reduce young users' harmful experiences, (2) those design changes are feasible, and (3) Meta's current safety tools are ineffective for reducing harmful experiences. Instead, Dr. Ferrara's report addresses the "reasonableness" of Meta's content moderation systems. Those systems address policy violating content, and Dr. Ferrara fails to make a connection between policy violating content and the harmful experiences, including unhealthy and excessive usage, addressed in my opening report. As a result, Dr. Ferrara's descriptions of Meta's content moderation systems are orthogonal to my opinion that my recommended design changes would reduce unwanted, negative, and harmful experiences for young users.
- (4) **Dr. Birnholtz mischaracterizes my methodology and routinely ignores cited evidence supporting my recommendations, including "ideal" experimental evidence.** Dr. Birnholtz incorrectly claims that my design recommendations are not based on an established methodology and are not supported by "ideal" experimental evidence. Contrary to his assertions, I employed a methodology that is well-established across academic and professional disciplines and is the same approach I used in preparing dozens of empirical articles published in peer-reviewed journals and in making hundreds of product decisions across multiple companies. First, Plaintiffs provided clear questions and assumptions that were the focus of my assignment regarding how to remedy Meta's

Platform design to address young users' harmful experiences. Second, I identified the best available evidence to answer these questions. That evidence includes experimental evidence—from both academic articles and popular articles that describe internal platform experiments—as well as non-experimental evidence such as users' own descriptions of their experiences. These types of evidence are widely used in both academic and industry practice to answer questions about product design.

- (5) **Dr. Birnholtz's opinion that Meta's features are "reasonable" is not based on an established methodology, does not negate the fact that such features facilitate excessive usage, and relies on inappropriate comparisons to platforms dissimilar to Meta's.** Dr. Birnholtz does not attempt to rebut my opening report opinions that (1) my recommended changes to Meta's algorithms and Platform features would reduce young users' harmful experiences, (2) those design changes are feasible, and (3) Meta's current safety tools are ineffective for reducing harmful experiences. Instead, Dr. Birnholtz addresses the "reasonableness" of Meta's features without considering whether they contribute to harmful experiences, and thus his report is largely non-responsive to my opinions. Furthermore, Dr. Birnholtz does not define a methodology for determining whether the features are "reasonable," and the only factors he considered in his report are (1) whether some users may enjoy those features and (2) whether those features are used by other platforms. Dr. Birnholtz's opinion that Meta's features provide some potential benefits to users does not negate the fact that such features facilitate excessive usage, and he inappropriately compares Meta's features to platforms that do not share Meta's combination of extended use features and engagement-based algorithms. Simply put, Dr. Birnholtz's opinions are a misdirection.
- (6) **Defendants' Experts fail to rebut my opinion that young users' harmful experiences cannot be effectively mitigated by Meta's moderation efforts, safety tools, or user controls.** Drs. Ferrara and Birnholtz opine that Meta's existing content moderation systems and safety tools are reasonably designed, but they do not assess whether those systems and tools are effective at addressing young users' harmful experiences including excessive usage. In particular, Dr. Ferrara opines that Meta's content moderation policies are "robust and reasonably designed" and disagrees that those systems "should be forced to change to address purported harms." However, he fails to make a connection between content moderation systems and my opening report opinions, since I did not claim that unhealthy and excessive usage is caused by, or can be solved through modification of, Meta's content moderation systems. Dr. Birnholtz opines that Meta's safety features and tools are "reasonably designed" and "promote safety and well-being." But he provides no evidence that Meta's safety tools are effective at reducing young users' harmful experiences, and he ignores evidence that those tools are ineffective at reducing harms. Meta's safety tools, including Teen Accounts, fail to address the root of the problem: the engagement-driven algorithms and extended use features that undermine self-control and perpetuate the very behaviors these tools seek to mitigate. Without meaningful changes to the core design of these algorithms and features (i.e., optimizing for quality signals and explicit user

preference and removing or restricting extended use features), the risks and harms faced by young users will persist, rendering these surface-level solutions largely ineffective.

I.B. Assignment

- (7) I was retained by Plaintiffs in this matter and submitted an opening report on August 1, 2025.¹ In my opening report, I opined that, based on the assumptions of harm provided to me by Plaintiffs² 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.”
 - 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.³

I explained in my opening report that, based on my training, research, industry experience, and review of the literature, each of these design changes is feasible, and that Meta’s safety tools and features, including Teen Accounts, are insufficient to mitigate the unwanted, negative, and harmful experiences, including excessive and unhealthy usage, associated with young users’ use of the Platforms.⁴

- (8) On September 26, 2025, experts retained by Defendants—Meta Platforms, Inc., Instagram, LLC, Meta Payments, Inc., and Meta Platforms Technologies (collectively, “Meta”)— submitted rebuttal reports related to some of these issues. I was asked by counsel to review and, where appropriate,

¹ Trial Report of Ravi Iyer, Ph.D., August 1, 2025 (hereinafter “Iyer Opening Report”).

² Iyer Opening Report, ¶ 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.”).

³ Iyer Opening Report, ¶ 1.

⁴ Iyer Opening Report, ¶¶ 2–4.

respond to the reports of Dr. Jeremy Birnholtz⁵ and Dr. Emilio Ferrara⁶ (collectively, “Defendants’ Experts”).

- (9) As described in more detail in Section III, in reaching my opinions in this matter, 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. 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 and supervised the activities of the team, made all final decisions, and prepared this report.
- (10) I reserve the right to update my opinions if new materials become available during the course of this litigation and to respond to further critiques of my opinions. 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 Expert Report of Dr. Jeremy Birnholtz and Rebuttal to State Attorneys General Expert Dr. Ravi Iyer, September 26, 2025 (hereinafter “Birnholtz Report”).

⁶ Expert Rebuttal Report of Dr. Emilio Ferrara to Report of Dr. Ravi Iyer, September 26, 2025 (hereinafter “Ferrara Report”).

II. Dr. Ferrara's report is non-responsive to my report

- (11) Dr. Ferrara does not attempt to rebut my opening report opinions that (1) my recommended changes to Meta's algorithms and Platform features would reduce young users' harmful experiences, (2) those design changes are feasible, and (3) Meta's current safety tools are ineffective for reducing harmful experiences. Instead, Dr. Ferrara's report addresses the "reasonableness of Meta's content moderation systems,"⁷ and he states that he disagrees with me to the extent that I opine "that Meta's content moderation systems should be forced to change to address purported harms."⁸ I was aware of Meta's content moderation systems when I wrote my report, and Dr. Ferrara's description of those systems does not change my opinions. Those systems address policy violating content, and Dr. Ferrara fails to make a connection between policy violating content and the harmful experiences, including unhealthy and excessive usage, addressed in my opening report. As a result, Dr. Ferrara's descriptions of Meta's content moderation systems are orthogonal to my opinion that my recommended design changes would reduce unwanted, negative, and harmful experiences for young users.
- (12) Furthermore, I did not opine that Meta's content moderation systems should be changed, nor did I suggest that its moderation systems could not coexist with my suggested design changes. In fact, it is my opinion that my suggested design changes to the algorithm and extended use design features would augment the effectiveness of Meta's content moderation systems by reducing the number of harmful experiences that are reported to Meta as potentially policy violating.

⁷ Ferrara Report, ¶ 17.

⁸ Ferrara Report, ¶ 29.

III. Dr. Birnholtz mischaracterizes my methodology and routinely ignores cited evidence supporting my recommendations

- (13) Dr. Birnholtz incorrectly claims that my opinions were not “based on any established method for providing evidence in support of [my] recommendations.”⁹ Dr. Birnholtz ignores that my methodology was described in my opening report, and he ignores the numerous sources of evidence I cited in support of my opinions and recommendations. As I reiterate in Section III.A, I applied a well-established methodology for addressing my assignment in this case that is the same approach I have used in preparing dozens of empirical articles that have been published in peer-reviewed journals and in making hundreds of product decisions across multiple companies. As detailed in Section III.B, that methodology involved identifying the best available evidence, including both experimental evidence and non-experimental evidence, including user experiences, which are widely used in both academic and industry practice to answer questions about product design.

III.A. Dr. Birnholtz mischaracterizes my use of an established methodology

- (14) Dr. Birnholtz incorrectly concludes that my opinions “largely do not appear to be based any established method for providing evidence in support of [my] recommendations.”¹⁰ In reaching the opinions described in my opening report, I employed a methodology that is well established across academic and professional disciplines.¹¹ The first step in that methodology is identifying specific questions or hypotheses to be evaluated, which is key to any academic inquiry. As I outlined in my opening report, Plaintiffs retained me to address the following questions:¹²
- 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

⁹ Birnholtz Report, ¶ 122.

¹⁰ Birnholtz Report, ¶ 122.

¹¹ User experience research is a widespread practice. Mike Kuniavsky, *Observing the User Experience: A Practitioner's Guide to User Research*, Elsevier, 2003; Allam Hassan Allam and Halina Mohamed Dahlan, “User Experience: Challenges and Opportunities,” *Journal of Information Systems Research and Innovation*, vol. 3, no. 1 (2013): 28–36; Candice Lanius, Ryan Weber, and Joy Robinson, “User Experience Methods in Research and Practice,” *Journal of Technical Writing and Communication*, vol. 51, no. 4 (2021): 350–379.

¹² Iyer Opening Report, ¶ 16.

- 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.

As also described in my opening report, Plaintiffs provided me with a set of assumptions regarding harmful experiences on Meta’s Platforms to consider when addressing these questions.¹³

- (15) I then used an established methodology to address each of these questions, including identifying the best available evidence and applying my knowledge and experience in the field.¹⁴ As I discuss in Section III.B, that evidence includes experimental evidence—from both academic articles and popular articles that describe internal platform experiments that are not available within academic research—as well as non-experimental evidence such as users’ own descriptions of their experiences. These types of evidence are widely used in both academic and industry practice to answer questions about product design.
- (16) This methodology of considering evidence to answer specific identified questions is well established across academic disciplines¹⁵ and is the same methodology that I have used in preparing dozens of empirical articles that have been published in peer-reviewed journals and collectively cited over 15,000 times.¹⁶ It is also the same methodology I have used in making hundreds of product decisions across multiple companies.

III.B. Dr. Birnholtz routinely ignores cited evidence supporting my recommendations, including “ideal” experimental evidence

- (17) Dr. Birnholtz also routinely ignores the evidence I cited in support of my recommended design changes. For example, Dr. Birnholtz identifies experimental evidence from controlled experiments or A/B tests as “[t]he ideal test” of design recommendations,¹⁷ because A/B tests “allow for controlled comparisons to understand the effects or implications of that feature.”¹⁸ However, Dr. Birnholtz then

¹³ Iyer Opening Report, ¶ 17 (“For each question, I started with the assumption that Meta’s actions in these two areas—algorithmic recommendation and extended use features—contribute to unwanted, harmful, and negative experiences for young users on the Platforms.”).

¹⁴ Iyer Opening Report, ¶ 18.

¹⁵ “Levels of Evidence in Research,” Elsevier, accessed October 7, 2025, <https://scientific-publishing.webshop.elsevier.com/research-process/levels-of-evidence-in-research/>.

¹⁶ Google Scholar page of Ravi Iyer, accessed October 7, 2025, <https://scholar.google.com/citations?user=7vzqWBYAAAAJ>.

¹⁷ Birnholtz Report, ¶ 123 (“In my experience and as documented in HCI research textbooks (Lazar et al., 2017), demonstrating the effects of a new or modified design can be accomplished in many ways. The ideal test would be a controlled experiment or A/B test, in which some users have the modified feature and others do not, and their experience on some outcome measure (e.g., time spent on platform, affective response, etc.) can be directly compared.”).

¹⁸ Birnholtz Report, ¶ 34.

ignores my references to many such “ideal” experiments in support of my recommended design changes, including the following examples:¹⁹

- Meta’s Project Daisy was an internal product experiment that investigated the effects of engagement quantification on harmful social comparisons. Using A/B testing, the project removed visible counts for a limited set of engagement signals and revealed a measurable decrease in harmful social comparisons.²⁰
- Meta conducted an experiment in which users were randomly assigned an algorithm designed to reduce the distribution of political content in their News Feed. This algorithm achieved its goal by placing less weight on comments and shares when ranking political content. Users who experienced reduced engagement signals spent less time on Facebook and encountered a lower proportion of content they deemed unvaluable.²¹
- Cunningham et al. (2024) examined multiple experimental studies conducted by Meta and other social media platforms on the relationship between content ranking algorithms and user engagement. Experiments where algorithmic ranking was compared to alternatives led to usage decreases between 3% and 38%.²²
- Schaffner et al. (2025) conducted an experimental study with 76 Netflix users in the U.S. to analyze the impact of autoplay on key viewing metrics. They found that disabling autoplay on Netflix significantly reduced key content consumption aggregates, including average daily watching and average session length.²³

¹⁹ See also Iyer Opening Report, ¶ 34 (citing 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 (“Big Levers Ranking Experiment”)); Iyer Opening Report, ¶ 23 (citing META3047MDL-207-00010463 at -482 (“Users with Histories of Positive Engagement from Diverse Others on their Comments Display Higher Integrity”)); 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/>); Iyer Opening Report, ¶ 52 (citing 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.).

²⁰ Iyer Opening Report, ¶ 57 (citing “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-andProject-Daisy_For-Shorenstein-Publication.pdf).

²¹ Iyer Opening Report, ¶ 23 (citing 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 to address feedback from people wanting to see less political content in their Feed, 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.”); 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> (“Although users told Facebook that their feeds were more “worth your time,” they also logged on to the platform 0.18% less.”)).

²² Iyer Opening Report, ¶¶ 22, 25 (citing Tom Cunningham, Sana Pandey, Leif Sigerson, Jonathan Stray, Jeff Allen, Bonnie Barrilleaux, Ravi Iyer, Smitha Milli, Mohit Kothari, and Behnam Rezaci, “What We Know About Using Non-Engagement Signals in Content Ranking,” *arXiv preprint* (2024): 1–16.).

²³ Iyer Opening Report, ¶ 52 (citing Brennan Schaffner, Yaretsi Ulloa, Riya Sahni, Jiatong Li, Ava Kim Cohen, Natasha

(18) In addition to these experimental studies, my report uses other types of evidence that are common in scientific and product research. While experimental studies are ideal, they often require access to a platform to alter design features, which is why many of the experiments referenced above are from internal Meta research. As scientific researchers do not always have the ability to directly manipulate variables of interest, many other kinds of evidence are also commonly used in scientific research, including in the field of Human Computer Interaction.²⁴ The scientific process involves reviews of various common kinds of evidence that are cited in my report, including experimental, correlational, observational, quantitative, and qualitative.²⁵ Product managers also often use such research to inform design decisions, especially research on the experiences of users.²⁶ My report uses many of these kinds of evidence to support my conclusions, including the following examples:

- Qualitative interviews and surveys where young users expressed experiencing harms connected to features like infinite scroll, excessive notifications, and autoplay:²⁷
 - Interviews indicate that infinite scroll makes users feel “caught in the loop” and is associated with regret of social media usage.²⁸
 - 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.²⁹

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.).

²⁴ Jacob O. Wobbrock and Julie A. Kientz, “Research Contributions in Human-Computer Interaction,” *Interactions*, vol. 23, no. 3 (2016): 38–44 (“In HCI, empirical contributions arise from a variety of sources, including experiments, user tests, field observations, interviews, surveys, focus groups, diaries, ethnographies, sensing, log files, and many others.”).

²⁵ “Levels of Evidence in Research,” Elsevier, accessed October 7, 2025, <https://scientific-publishing.webshop.elsevier.com/research-process/levels-of-evidence-in-research/>; Charles Stangor and Jennifer Walinga, “3.5 Psychologists Use Descriptive, Correlational, and Experimental Research Designs to Understand Behaviour,” in *Introduction to Psychology* (2019), <https://www.saskoer.ca/introductiontopsychology/chapter/psychologists-use-descriptive-correlational-and-experimental-research-designs-to-understand-behavior/>.

²⁶ “The State of UX 2022: Bridging the Gap Between UX Insights and Business Impact,” UserZoom, accessed October 17, 2025, <https://www.usertesting.com/sites/default/files/2023-08/The%20State%20of%20UX%202022.pdf>.

²⁷ See also Iyer Opening Report, ¶ 48 (citing 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/>).

²⁸ Iyer Opening Report, ¶ 51 (citing 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).).

²⁹ Iyer Opening Report, ¶ 52 (citing 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.).

- A Meta internal study found that survey participants cited “the number of likes a post got” as a trigger for negative social comparison 26% of the time.³⁰
- 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 seven day period, and also were observed to click them more quickly than other users.³¹
- Correlations between suggested design features and user experiences:³²
 - 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.³³
 - Internal Meta research indicates that negative feedback helps mitigate harmful experiences that may otherwise be encouraged by algorithms in order to drive product usage.³⁴
- Observational studies:
 - Cunningham et al. (2024) states: “Most platforms indicated that the portion of their user base actively utilizing user controls outside of follow controls remains within the single-percentage range.”³⁵ Meta has also 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.³⁶

(19) A prime example of Dr. Birnholtz’s practice of ignoring other valid forms of evidence is his comments regarding autoplay, in which he criticizes evidence I cited because it “relies on users’ perceptions of autoplay, but does not compare the same users’ behavior on a system without

³⁰ Iyer Opening Report, ¶ 55 (citing META3047MDL-207-00022660 at -677 and META3047MDL-207-00034268 at -274 (“Project Daisy, Likes and Social Comparison”).).

³¹ Iyer Opening Report, ¶ 58 (citing META3047MDL-207-00016893 at -900–902 and META3047MDL-096-00000086 at -088 (“Have We Made People Addicted to Facebook?” August 3, 2017).).

³² See also Iyer Opening Report, ¶ 22 (citing Tom Cunningham, Sana Pandey, Leif Sigerson, Jonathan Stray, Jeff Allen, Bonnie Barrilleaux, Ravi Iyer, Smitha Milli, Mohit Kothari, and Behnam Rezaei, “What We Know About Using Non-Engagement Signals in Content Ranking,” *arXiv preprint* (2024): 6.); Iyer Opening Report, ¶ 22 (citing 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)).

³³ Iyer Opening Report, ¶ 25 (citing 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>).).

³⁴ Iyer Opening Report, ¶ 31 (citing META3047MDL-207-00010463 at -482 (“Users with Histories of Positive Engagement from Diverse Others on their Comments Display Higher Integrity”).).

³⁵ Iyer Opening Report, ¶ 40 (citing Tom Cunningham, Sana Pandey, Leif Sigerson, Jonathan Stray, Jeff Allen, Bonnie Barrilleaux, Ravi Iyer, Smitha Milli, Mohit Kothari, and Behnam Rezaei, “What We Know About Using Non-Engagement Signals in Content Ranking,” *arXiv preprint* (2024): 14.).

³⁶ Iyer Opening Report, ¶ 40 (citing Tom Cunningham, Sana Pandey, Leif Sigerson, Jonathan Stray, Jeff Allen, Bonnie Barrilleaux, Ravi Iyer, Smitha Milli, Mohit Kothari, and Behnam Rezaei, “What We Know About Using Non-Engagement Signals in Content Ranking,” *arXiv preprint* (2024): 14.).

autoplay.”³⁷ In this case (and many other cases), Dr. Birnholtz fails to consider that users’ own perceptions of features are indeed a valid kind of evidence that is routinely used in both scientific research and professional practice,³⁸ with 90% of users in this study reporting exceeding their planned watch time and most users blaming features like autoplay.³⁹ Similarly, Dr. Birnholtz ignores users’ own descriptions of receiving excessive notifications as well as the relationship between receiving notifications and quitting Facebook, even though such non-experimental evidence is routinely used in product decision making.

- (20) Dr. Birnholtz also ignores evidence I cite from content creators discussing the relationship between design features and user attention.⁴⁰ In my professional experience, the practices of content creators—who routinely run experiments to understand how to gain distribution and attention—are key signals for understanding the effects of design choices and are again routinely used in product decision making.

³⁷ Birnholtz Report, ¶ 153 (citations omitted) (“None of the studies that Dr. Iyer cites, moreover, provide evidence that his suggestion of removing auto-play and requiring users to click for another video would affect users’ actual behavior or experience. The Chaudhary et al. study at footnote 66 relies on users’ perceptions of autoplay, but does not compare the same users’ behavior on a system without autoplay.”).

³⁸ A variety of evidence types are used and accepted in adjacent scientific fields, such as Human Computer Interaction. Jacob O. Wobbrock and Julie A. Kientz, “Research Contributions in Human-Computer Interaction,” *Interactions*, vol. 23, no. 3 (2016): 38–44 (“In HCI, empirical contributions arise from a variety of sources, including experiments, user tests, field observations, interviews, surveys, focus groups, diaries, ethnographies, sensing, log files, and many others.”).

³⁹ Iyer Opening Report, ¶ 52 (citing 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.).

⁴⁰ See e.g., Iyer Opening Report, ¶¶ 58–61 (citing Ryan Romero, “The Role of Ephemeral Content in Creating FOMO: A Social Media Strategy,” Multipost Digital, accessed October 7, 2025, <https://www.multipostdigital.com/blog/the-role-of-ephemeral-content-in-creating-fomo-a-social-media-strategy>; 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).

Such practices are also cited in academic research. See e.g., Aarif Alutaybi, John McAlaney, Angelos Stefanidis, Keith T. Phalp, and Raian Ali, “Designing Social Networks to Combat Fear of Missing Out,” *In Proceedings of the 32nd International BCS Human Computer Interaction Conference* (2018): 1–5. Daniel Maar, Hajer Kefi, and Mehmet A. Orhan, “Should Brands Foster Their Instagram Account Followers’ Fear of Missing Out by Posting Ephemeral Content?” *Recherche et Applications en Marketing (English Edition)*, vol. 38, no. 4 (2023): 104–120. Aya Nachtaoui, “The Impact of the Ephemeral Content on Social Media Consumer Engagement,” *HEC-Ecole de gestion de l’Université de Liège (Master thesis)* (2022).

IV. Dr. Birnholtz’s opinion that Meta’s features are “reasonable” is not based on an established methodology and is largely non-responsive to my report

- (21) Dr. Birnholtz does not attempt to rebut my opening report opinions that (1) my recommended changes to Meta’s algorithms and Platform features would reduce young users’ harmful experiences, (2) those design changes are feasible, and (3) Meta’s current tools are ineffective for reducing harmful experiences. In fact, he states that the question of “whether Meta’s features may cause adverse mental health effects” and the “design of Meta’s recommendation algorithms” are “outside the scope” of his report.⁴¹ Instead, Dr. Birnholtz addresses “the reasonableness of Meta’s design of its features and tools,”⁴² and he mischaracterizes my opinions when concluding that he “disagree[s] with Dr. Iyer’s opinions that Meta’s social media services were not reasonably designed.”⁴³ Dr. Birnholtz does not consider the potential for features to contribute to harmful experiences—or the potential for my proposed design changes to reduce harmful experiences—as part of his reasonableness determination, and thus his report is largely non-responsive to my opinions. In short, Dr. Birnholtz fails to address the question of an appropriate remedy if the assumed harmful experiences are found to be correct.
- (22) Furthermore, Dr. Birnholtz does not define a methodology for determining whether Meta’s features are “reasonable,” and the only factors he considered in his report are (1) whether some users may enjoy those features and (2) whether those features are used by another “online service or application.”⁴⁴ Below, I respond to Dr. Birnholtz’s specific arguments with respect to his opinion that Meta’s features are reasonable because they provide some potential benefits to users (Section IV.A) and are used by other online services or applications (Section IV.B), including why his arguments are flawed and not relevant to my opinions.

⁴¹ Birnholtz Report, ¶ 3, footnote 2.

⁴² Birnholtz Report, ¶ 3.

⁴³ Birnholtz Report, ¶ 9.

⁴⁴ Birnholtz Report, ¶¶ 127–131, 133–139, 142–147, 150–157, 159–162.

IV.A. Dr. Birnholtz’s opinion that Meta’s features are “reasonable” because they provide some potential benefits to users does not negate the fact that such features facilitate excessive usage

- (23) Dr. Birnholtz’s rebuttal arguments address whether Meta’s Platform features provide some potential benefit for some users, including notifications,⁴⁵ infinite scroll,⁴⁶ autoplay,⁴⁷ and ephemeral content.⁴⁸ For each feature, he states that there are some users who may experience some perceived benefit such as convenience—most of which he presents without evidence to support the existence of those benefits for young users—while ignoring whether those features may contribute to young users’ harmful experiences. Thus, he does not address or rebut my opinion that removing those features for young users would mitigate the unwanted, negative, and harmful experiences of young users on Meta’s Platforms, or the evidence I cite in support of that opinion.⁴⁹
- (24) For example, with regards to notifications, instead of engaging on the central point that reducing notifications would reduce unwanted, excessive usage by young users, Dr. Birnholtz instead states that notifications have potential benefits, such as helping people “feel good” or “prompt[ing] further connection with one’s friends or family.”⁵⁰ But merely identifying potential benefits does not address the question of whether reducing notifications for young users can mitigate harmful experiences, in the same way that pointing out alcohol can make teens “feel good” or “prompt further connection” would not address the question of whether restricting teenage alcohol use would mitigate harmful underage drinking.
- (25) Dr. Birnholtz’s only substantive rebuttal argument to reducing notifications by default was that “this may frustrate users who would then have to take the time to select all the notifications they wish to receive.”⁵¹ Dr. Birnholtz then states that “I disagree with Dr. Iyer to the extent he opines that Meta’s notifications are unreasonable.”⁵² But he does not address or rebut my opinion that reducing notifications for young users would mitigate their harmful experiences, and he ignores supporting

⁴⁵ Birnholtz Report, ¶ 127 (“helping people manage their attention and feel good about being contacted” or “prompt[ing] further connection with one’s friends and family”).

⁴⁶ Birnholtz Report, ¶ 143 (“helps users achieve their goals of connecting with others, expressing themselves, and pursuing their interests”).

⁴⁷ Birnholtz Report, ¶ 154 (“allows users to more easily view the content of their family and friends, or view videos that align with or expand their interests”).

⁴⁸ Birnholtz Report, ¶ 159 (“can be an essential aspect of self-presentation and sharing information in the moment that need not become part of the permanent profile”).

⁴⁹ Iyer Opening Report, Section III.A.

⁵⁰ Other examples he provides are used in settings that are not comparable to Meta’s, “such as an amber alert or an earthquake warning.” Birnholtz Report, ¶¶ 127, 131.

⁵¹ Birnholtz Report, ¶ 125.

⁵² Birnholtz Report, ¶ 126.

evidence I cited, such as the findings that users left Facebook after receiving a disproportionate share of notifications or specifically called out excessive notifications as a pain point.⁵³ Again, the fact that other users may want notifications is not responsive to the argument that reducing notifications would mitigate harms towards young users who identify notifications as a pain point, or who have not considered the issue. Moreover, even young users who “want” notifications may be harmed by them, in the same way that a teenager who wants alcohol would be harmed by regular prompts to consume more alcohol.

- (26) With respect to like counts, Dr. Birnholtz makes the argument that like counts are valuable because some users enjoy seeing them.⁵⁴ Dr. Birnholtz’s discussion of whether users enjoy seeing like counts is, however, irrelevant to whether removing like counts would mitigate harm from social comparison and excessive usage. Dr. Birnholtz both ignores the substance of my opinion that removing like counts would mitigate harm and fails to rebut evidence cited in my opening report that removing like counts has been shown to reduce harm. For example, in my opening report I cited experimental evidence—which Dr. Birnholtz called out as “[t]he ideal test”⁵⁵ for adjudicating design choices—showing that removing like counts reduced social comparison⁵⁶ and another Meta study showing that 21.4% of Instagram teen users reported experiencing negative social comparison in a seven day period.⁵⁷ Dr. Birnholtz ignores these studies showing that like counts could be harming the approximately 4–5 million teens who experience negative social comparison weekly.⁵⁸ The possibility that a feature appeals to some users does not negate its harmful impact on young users nor does it negate the need to mitigate those harmful experiences.
- (27) With respect to autoplay and infinite scroll, Dr. Birnholtz considers the lack of conscious decision making more “efficient” in that it removes a step in the process,⁵⁹ but many users who report using

⁵³ Iyer Opening Report, ¶¶ 58–59 (citing META3047MDL-207-00016893 and META3047MDL-096-00000086 (“Have We Made People Addicted to Facebook?” August 3, 2017).).

⁵⁴ Birnholtz Report, ¶¶ 134–135.

⁵⁵ Birnholtz Report, ¶ 123.

⁵⁶ Iyer Opening Report, ¶ 57 (citing META3047MDL-207-00022660 and META3047MDL-207-00034268 (“Project Daisy, Likes and Social Comparison”); “Discussion Paper: Case Study on Online Youth Harms – Project Daisy,” Harvard Kennedy School, accessed October 7, 2025, pp. 1–2, https://shorensteincenter.org/wp-content/uploads/2023/11/Discussion-Paper_Youth-Online-Harms-andProject-Daisy_For-Shorenstein-Publication.pdf).

⁵⁷ Iyer Opening Report, ¶ 55 (citing META3047MDL-004-00015029 at -048 (“Bad Experiences and Encounters Framework (BEEF) Survey”)).

⁵⁸ According to U.S. Census Bureau estimates, there were approximately 43 million youth aged 10–19 in the United States in 2023. A 2024 survey of U.S. teens aged 13 to 17 found that 50% of participants reported visiting or using Instagram at least once a day. Additionally, Meta’s internal research indicates that 21.4% of surveyed teens aged 13–15 experienced negative social comparison within a seven-day period. Based on these figures, the estimated number of affected youth is calculated as follows: 43 million × 50% × 21.4% = 4.6 million. “U.S. Teen Demographics,” ACT for Youth, accessed October 7, 2025, <https://actforyouth.org/adolescence/demographics/>; Michelle Faverio and Olivia Sidoti, “Teens, Social Media and Technology 2024,” Pew Research Center, December 12, 2024, <https://www.pewresearch.org/internet/2024/12/12/teens-social-media-and-technology-2024/>; META3047MDL-004-00015029 at -048 (“Bad Experiences and Encounters Framework (BEEF) Survey”).

⁵⁹ Birnholtz Report, ¶ 142.

these products too much may appreciate the opportunity to reconsider their ongoing usage and engage their willpower.⁶⁰ As discussed in my opening report, many users may want this “friction” associated with making conscious decisions about how to spend their time.⁶¹ Autoplay and infinite scroll remove that conscious decision making, which can lead to feelings of manipulation and regret. As such, the significant number of teens who report using social media excessively would be aided by the removal of features such as infinite scroll and autoplay. But Dr. Birnholtz does not address or attempt to rebut the fact that this removal would reduce excessive usage.

- (28) Finally, Dr. Birnholtz similarly focuses on only the potential benefits of ephemeral content, such as users’ desire to manage the visibility of their content,⁶² rather than the harmful ways that ephemeral content increases usage. The fact that ephemeral content can have benefits for some users who want to manage their content’s visibility is not responsive to the position that ephemeral content increases temptation by activating a fear of missing out,⁶³ which can encourage over-usage, and the fact that such experiences are widely reported on social media platforms.⁶⁴ Furthermore, Dr. Birnholtz does not consider in his report whether there are ways to achieve his stated goal of allowing users to manage the visibility of their content in a way that also reduces over-usage (e.g., impermanence tied to when each individual user has viewed the content rather than a particular amount of time passing). As a result, it remains my opinion that it is necessary to remove ephemeral content without the ability for it to be turned back on in order to mitigate excessive, unwanted usage of Meta’s Platforms by young users.

⁶⁰ Michaelleen Doucleff, “Can’t stop scrolling? Ideas from teens for curbing your social media habit,” Oregon Public Broadcasting, May 17, 2023, <https://www.opb.org/article/2023/05/17/social-media-addiction-solution-teens/>; Leonardo Bursztyrn, Benjamin Handel, Rafael Jiménez-Durán, and Christopher Roth, “When Product Markets Become Collective Traps: The Case of Social Media,” The University of Chicago: Becker Friedman Institute for Economics, October 12, 2023, <https://bfi.uchicago.edu/insight/research-summary/when-product-markets-become-collective-traps-the-case-of-social-media/>.

⁶¹ Iyer Opening Report, ¶ 51 (citing 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): 1956–1975); “Constant Companion: A Week in the Life of a Young Person’s Smartphone Use,” Common Sense, accessed October 20, 2025, https://www.common sense media.org/sites/default/files/research/report/2023-cs-smartphone-research-report_final-for-web.pdf.

⁶² Birnholtz Report, ¶ 159.

⁶³ Ryan Romero, “The Role of Ephemeral Content in Creating FOMO: A Social Media Strategy,” Multipost Digital, accessed October 7, 2025, <https://www.multipostdigital.com/blog/the-role-of-ephemeral-content-in-creating-fomo-a-social-media-strategy>. Aarif Alutaybi, John McAlaney, Angelos Stefanidis, Keith T. Phalp, and Raian Ali, “Designing Social Networks to Combat Fear of Missing Out,” *In Proceedings of the 32nd International BCS Human Computer Interaction Conference* (2018): 1–5. Daniel Maar, Hajer Kefi, and Mehmet A. Orhan, “Should Brands Foster Their Instagram Account Followers’ Fear of Missing Out by Posting Ephemeral Content?” *Recherche et Applications en Marketing (English Edition)*, vol. 38, no. 4 (2023): 104–120. Aya Nachtaoui, “The Impact of the Ephemeral Content on Social Media Consumer Engagement,” *HEC-Ecole de gestion de l’Université de Liège (Master thesis)* (2022).

⁶⁴ Kuan-Ju Chen and Hoi Ling Cheung, “Unlocking the Power of Ephemeral Content: The Roles of Motivations, Gratification, Need for Closure, and Engagement,” *Computers in Human Behavior*, vol. 97 (2019): 67–74.

IV.B. Dr. Birnholtz’s opinion that Meta’s features are “reasonable” relies on inappropriate comparisons to platforms that do not share Meta’s combination of extended use features and engagement-based algorithms

- (29) Dr. Birnholtz also cites the usage of same or similar features on other online services or applications as purported evidence that Meta’s features are reasonable.⁶⁵ As discussed above in Section III.A, Dr. Birnholtz fails to consider that my proposed changes to the extended use features would reduce young users’ harmful experiences. Additionally, Dr. Birnholtz considers these features in isolation while making comparisons to platforms dissimilar to Meta’s. As I explained in my opening report, Meta’s Platforms include at least the following features: (i) push notifications, (ii) infinite scroll, (iii) autoplay, and (iv) ephemeral content.⁶⁶ Each of these features has been shown, either in Meta’s internal research or elsewhere, to lead to users spending more time on social media platforms.⁶⁷ These features will inevitably reinforce the harmful effects of algorithmic systems optimized for usage, whether by increasing opportunities for temptation, or by decreasing opportunities for users’ willpower to mitigate the effects of such temptation. Dr. Birnholtz fails to consider these reinforcing effects of Meta’s Platform design when comparing its features to other platforms.
- (30) Instead, as described in more detail below, Dr. Birnholtz considers each feature in isolation and often cites platforms that lack engagement-based algorithmic feeds, that have limited opportunities for social comparison, or that teens do not report using “almost constantly” and “too much.” As explained further below, one cannot judge the reasonableness of Meta’s features through their existence on platforms dissimilar to Meta’s.
- (31) Dr. Birnholtz also looks to platforms that, unlike Meta’s Platforms, do not have engagement-based algorithmic feeds. For example, in addition to Amber Alerts⁶⁸ and Apple iOS direct audio messaging,⁶⁹ Dr. Birnholtz identifies Microsoft Outlook (likes),⁷⁰ earthquake warnings (notifications),⁷¹ and Signal (ephemeral content)⁷² as platforms that share a feature in common with Meta’s Platforms. However, such services are not optimized based on increasing usage of these platforms and therefore the cited features are unlikely to contribute to excessive usage.

⁶⁵ See, e.g., Birnholtz Report, ¶¶ 131, 139, 147, 157, Figures 14–30.

⁶⁶ See, e.g., Iyer Opening Report, ¶ 47.

⁶⁷ See, e.g., Iyer Opening Report, ¶¶ 47–61.

⁶⁸ Birnholtz Report, ¶ 131.

⁶⁹ Birnholtz Report, ¶ 162.

⁷⁰ Birnholtz Report, ¶ 139.

⁷¹ Birnholtz Report, ¶ 131.

⁷² Birnholtz Report, ¶ 162.

- (32) Dr. Birnholtz also identifies platforms that have limited opportunities for social comparison compared to Meta's Platforms, where groups of friends publicly interact with and often judge each other. For example, he points to the New York Times, Pinterest, and Microsoft Outlook as each implementing "like" features.⁷³ As noted in my opening report, teens have cited the quantification of engagement signals as a trigger for social comparison,⁷⁴ and social comparison is more common for youth in relation to friends.⁷⁵ There is therefore less risk of social comparison on several platforms identified by Dr. Birnholtz on which groups of friends generally do not publicly judge each other's content. In my experience, it is rare for friend groups to interact on sites like the New York Times, as the vast majority of people reading any given article are strangers. Pinterest is primarily used to gain information rather than as a social tool.⁷⁶ Social comparison is particularly rare on email systems, as users generally lack information on others' like counts.
- (33) Finally, Dr. Birnholtz frequently refers to platforms that teens do not report using "almost constantly" and "too much," as they do with Meta's platforms.⁷⁷ For example, Dr. Birnholtz identifies LinkedIn, Kindle, and Google Images with regards to infinite scroll⁷⁸ and Amber Alerts, earthquake warnings, and the New York Times with regards to notifications. Extended use features are more likely to be harmful in a situation where one is actively seeking to resist the platform. As described in my opening report, users may decide to intentionally use Meta's Platforms less: in one recent survey, 44% of teens reported having attempted to do this.⁷⁹ If a teen decides to stop using social media for any period of time or has experienced stress related to their usage, extended use features such as notifications will create unwanted temptation to override that decision.⁸⁰
- (34) In sum, one cannot judge the reasonableness of a feature through its existence in environments that do not have the same combination of features and have not shown the levels of harm as Meta's Platforms. In addition to the flaws described above for his individual feature comparisons, Dr.

⁷³ Birnholtz Report, ¶ 139.

⁷⁴ Iyer Opening Report, ¶ 55 (citing META3047MDL-207-00022660 at -677 and META3047MDL-207-00034268 at -274 ("Project Daisy, Likes and Social Comparison").).

⁷⁵ Thomas Mussweiler and Katja Rüter, "What Friends Are For! The Use of Routine Standards in Social Comparison," *Journal of Personality and Social Psychology*, vol. 85, no. 3 (2003): 467–481; Ladd Wheeler and Kunitate Miyake, "Social Comparison in Everyday Life," *Journal of Personality and Social Psychology*, vol. 62, no. 5 (1992): 760–773.

⁷⁶ Matt Motyl, "Social Media Experiences Across Nearly 2 Years Since Launching the Social Media Index," Designing Tomorrow, April 24, 2025, <https://psychoftech.substack.com/p/social-media-experiences-across-nearly>.

⁷⁷ 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/>; Michelle Faverio and Olivia Sidoti, "Teens, Social Media and Technology 2024," Pew Research Center, December 12, 2024, <https://www.pewresearch.org/internet/2024/12/12/teens-social-media-and-technology-2024/>.

⁷⁸ Birnholtz Report, ¶ 147.

⁷⁹ Iyer Opening Report, ¶ 51 (citing 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/>).

⁸⁰ Markus Salo, Henri Pirkkalainen, and Tiina Koskelainen, "Technostress and Social Networking Services: Explaining Users' Concentration, Sleep, Identity, and Social Relation Problems," *Information Systems Journal*, vol. 29, no. 2 (2019): 408–435.

Birnholtz's approach is more generally flawed because it fails to account for the fact that, both individually and in combination, the Meta Platform features either amplify the effects of algorithmic temptation or reduce the ability of users to exercise willpower against the temptations that algorithms create. For example, Meta's artificial intelligence powered recommendation systems for ephemeral content, Instagram feed, and notifications are all optimized for greater usage.⁸¹ This design contributes to young users engaging with the Meta Platforms longer than they intended or reducing friction that enables them to manage their usage. It is therefore unsurprising that platforms like Meta's are the platforms which users most regret the existence of.⁸² Because teens are still developing their ability to exercise self-control,⁸³ it is unsurprising that they often fail to resist the temptation that engagement-optimized algorithms, ephemeral content, and push notifications create, individually and in combination.⁸⁴ Dr. Birnholtz's consideration of comparison platforms based on individual features fails to capture these reinforcing effects.

⁸¹ "From FOMO to ROI: Getting Real About AI in Marketing," RTS Labs, September 23, 2024, <https://rtslabs.com/getting-real-about-ai-in-marketing>; "The Psychology of FOMO: Leveraging Fear of Missing Out in Push Notifications for Increased Engagement," nGrow.ai, April 2, 2024, <https://www.ngrow.ai/blog/the-psychology-of-fomo-leveraging-fear-of-missing-out-in-push-notifications-for-increased-engagement>; "Advanced Techniques for AI-driven Push Notifications," nGrow.ai, May 27, 2024, <https://www.ngrow.ai/blog/advanced-techniques-for-ai-driven-push-notifications>; "AI Will Shape the Future of Marketing," Harvard Division of Continuing Education, April 14, 2025, <https://professional.dce.harvard.edu/blog/ai-will-shape-the-future-of-marketing/>; "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/>.

⁸² See, e.g., Iyer Opening Report, ¶¶ 52–54, 59–61; Jonathan Haidt and Will Johnson, "Gen Z Has Regrets," The New York Times, September 17, 2024, <https://www.nytimes.com/2024/09/17/opinion/social-media-smartphones-harm-regret.html>; Leonardo Bursztyn, Benjamin Handel, Rafael Jiménez-Durán, and Christopher Roth, "When Product Markets Become Collective Traps: The Case of Social Media," The University of Chicago: Becker Friedman Institute for Economics, October 12, 2023, <https://bfi.uchicago.edu/insight/research-summary/when-product-markets-become-collective-traps-the-case-of-social-media/>.

⁸³ BJ Casey and Kristina Caudle, "The Teenage Brain: Self Control," *Current Directions in Psychological Science*, vol. 22, no. 2 (2013): 82–87.

⁸⁴ META3047MDL-020-00005380 ("Problematic Use Overview") at -384 ("[...] surfaced triggers and attitudes that contribute to Problematic Use on Facebook and resulting life impacts -- additional or redesigned product work could be considered to address these triggers and life impacts. Triggers: Notifications; Entertaining content; Videos (e.g., auto-play); Groups; Fear of missing out (FOMO); Mystery of the algorithm; Marketplace/Ads; Recent post/comment; Time-bound content; Boredom/free time."); Debasmita De, Mazen El Jamal, Eda Aydemir, and Anika Khera, "Social Media Algorithms and Teen Addiction: Neurophysiological Impact and Ethical Considerations," *Cureus*, vol. 17, no. 1 (2025): 1–7.

V. Defendants’ Experts fail to rebut my opinion that young users’ harmful experiences cannot be effectively mitigated by Meta’s moderation efforts, safety tools, or user controls

- (35) Drs. Ferrara and Birnholtz opine that Meta’s existing content moderation systems and safety tools are reasonably designed, but they do not assess whether those systems and tools are effective at addressing young users’ harmful experiences including excessive usage. In particular, Dr. Ferrara opines that Meta’s content moderation policies are “robust and reasonably designed”⁸⁵ and disagrees that those systems “should be forced to change to address purported harms.”⁸⁶ As I describe below in Section V.A, Dr. Ferrara fails to make a connection between content moderation systems and my opening report opinions. Dr. Birnholtz similarly opines that Meta’s safety tools are “reasonably designed” and “promote safety and well-being.”⁸⁷ Below I explain that he provides no evidence that Meta’s safety tools are effective at reducing young users’ harmful experiences (Section V.B), and he ignores evidence that those tools are ineffective at reducing those harms (Section V.C).

V.A. Dr. Ferrara is incorrect that content moderation systems can effectively mitigate young users’ harmful experiences

- (36) I disagree with Dr. Ferrara’s opinion that Meta’s content moderation policies and systems are a reasonable, effective, or sufficient response to young users’ unwanted, negative, and harmful experiences, including excessive and unhealthy usage. First, as described in Section II, content moderation systems address policy-violating content. Dr. Ferrara fails to make a connection between policy-violating content and the harmful experiences, including unhealthy and excessive usage, addressed in my opening report. Dr. Ferrara also fails to make a connection between content moderation systems and my opening report opinions more broadly, since I did not claim that unhealthy and excessive usage is caused by, or can be solved through modification of, Meta’s content moderation systems. Dr. Ferrara’s descriptions of Meta’s content moderation systems are therefore orthogonal to my opinion that my recommended changes to the Platform’s algorithms and extended use features would reduce unwanted, negative, and harmful experiences for young users.

⁸⁵ Ferrara Report, heading of Section V.

⁸⁶ Ferrara Report, ¶ 29.

⁸⁷ Birnholtz Report, ¶¶ 12, 14.

V.B. Dr. Birnholtz provides no evidence that Meta’s safety tools are effective for reducing young users’ harmful experiences

- (37) Dr. Birnholtz argues in his report that various tools and user controls are “reasonably designed” to allow teens to manage their activity on Meta Platforms and to allow parents to manage their teens’ activity on Meta Platforms.⁸⁸ For example, Dr. Birnholtz argues that teens have tools such as “Time Spent,” “Your Activity,” “Daily Limit,” “Supervision,” “Sleep Mode,” “Take a Break,” and “Nighttime Nudge” that can be used to reasonably manage use of Meta’s Platforms based on a teen’s goals.⁸⁹ Dr. Birnholtz also states that parents have the ability to ask their teens to opt-in to supervising Teen Accounts, which he argues provides a “reasonable” mechanism for parents to control how much time their children spend on Meta’s Platforms.⁹⁰ Dr. Birnholtz does not define the term “reasonable” or “reasonableness,” and he provides no evidence that these tools are actually used by teens or parents or that they are effective at reducing young users’ harmful experiences. As described in more detail below, I disagree that these tools, as described by Dr. Birnholtz and by Meta’s documentation, are effectively designed to mitigate the harms I discussed above and throughout my opening report.
- (38) It is worth noting that Dr. Birnholtz fails to identify any tools or controls to specifically turn off engagement-based algorithms, infinite scroll, autoplay, or ephemeral content. To my knowledge, Meta does not offer an option for a feed based fully on quality⁹¹ or explicit preferences without additional engagement optimization.⁹² Nor is there any way to opt out of ephemeral content, autoplay, or infinite scroll. As a result, Dr. Birnholtz’s opinions regarding safety tools are not directly responsive to my recommendations to remove these features.⁹³ It remains my opinion that redesigning such features as outlined in my opening report would reduce over-usage. With respect to certain other problematic aspects of the Platforms, safety tools exist that purport to address those specific features, but they are not effective as I discuss in more detail below.

⁸⁸ Birnholtz Report, Section VI.

⁸⁹ Birnholtz Report, ¶¶ 74–80.

⁹⁰ Birnholtz Report, ¶¶ 92–93.

⁹¹ Meta makes content quality determinations based on whether or not Meta wants to allow that type of content to be posted and shared on Meta Platforms, per Meta’s community standards. “Community Standards,” Meta Transparency Center, accessed October 24, 2025, <https://transparency.meta.com/policies/community-standards/>.

⁹² As discussed in my opening report, Meta has introduced Favorites and Following Feeds on Instagram that offer users the option to reduce (but not eliminate as far as I am aware) emphasis on engagement and increase emphasis on user agency, although these are not currently the default feeds. Iyer Opening Report, ¶ 34.

⁹³ Iyer Opening Report, ¶ 62.

V.C. Dr. Birnholtz ignores evidence that Meta's safety tools are ineffective for reducing young users' harmful experiences

- (39) Many of Meta's safety tools for young users, 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. It is widely known amongst both scientists and parents that teens are still developing their self-control,⁹⁴ such that expecting them to exercise such control over their usage in the face of technologically facilitated temptation is unlikely to succeed. The low uptake of many such tools indicates that this is not occurring for most young users.⁹⁵ Some tools are on by default for young users, but those tools only work if age verification is effective, and, even when turned on, they are often easily dismissed in the face of temptation.⁹⁶ In some cases, the tools provide a small amount of friction, but far less than what would result from removing features like autoplay or infinite scroll. Additionally, all these tools require active maintenance to ensure that they remain available for users. In recent independent testing, 64% of Meta's Instagram safety tools were found ineffective, with only 17% working as described.⁹⁷ Below, I discuss specific Meta safety tools identified by Dr. Birnholtz and reiterate the evidence from my opening report that these tools do not remedy Meta's harmful algorithmic optimization or extended use features.
- (40) Dr. Birnholtz states that tools such as "Mute Notifications" allow users to configure push notifications.⁹⁸ However, it is well known that most users do not use controls to change their default settings.⁹⁹ Meta's notification settings prioritize Platform usage by requiring active use of controls to limit such notifications. Predictably, a relatively small percentage of users used opt-in tools like

⁹⁴ BJ Casey and Kristina Caudle, "The Teenage Brain: Self Control," *Current Directions in Psychological Science*, vol. 22, no. 2 (2013): 82–87.

⁹⁵ Deposition of Sayed Oturu, Exhibit 9. Meta internal documents indicate that many teens and parents are unaware of Meta's safety tools. *See, e.g.*, META3047MDL-072-00320760 at -761 ("Overall parent and teen awareness of Meta's YWB tools (e.g., Parental Supervision, time management features, sensitive content controls) is extremely low.") and META3047MDL-046-00401133, p. 5 ("Awareness is low for time management controls as compared to other well-being tools (and much lower than creation and connection tools). Parents also have low understanding of how they can better help their teens manage their time and the content they see.").

⁹⁶ For example, teens can manually dismiss the time limit reminders on Instagram. These notifications alert them to leave the app after using it for 60 minutes each day, but they can choose to keep scrolling if they feel tempted to continue. "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/>.

⁹⁷ "Instagram Teen Accounts Fail to Protect Children, Safety Tools Testing Reveals," Fairplay, September 24, 2025, <https://fairplayforkids.org/instagram-teen-accounts-fail-to-protect-children-safety-tools-testing-reveals/>.

⁹⁸ Although the Quiet Mode tool had been shared with Meta executives such as Sheryl Sandberg in 2017, and the well-being team at Instagram was seeking to launch the tool in 2018, Instagram did not roll out Quiet Mode until January 2023, when it was later renamed Sleep Mode. Quiet Mode (Sleep Mode) was enabled by default for Instagram Teen Accounts in September 2024, which will mute notifications overnight and send auto-replies to DMs. Deposition of Mark Zuckerberg, March 27, 2025, 368:8–369:2, 370:3–370:18. "Introducing Instagram Teen Accounts: Built-In Protections for Teens, Peace of Mind for Parents," Instagram, September 17, 2024, <https://about.fb.com/news/2024/09/instagram-teen-accounts/>.

⁹⁹ Tom Cunningham, Sana Pandey, Leif Sigerson, Jonathan Stray, Jeff Allen, Bonnie Barrilleaux, Ravi Iyer, Smitha Milli, Mohit Kothari, and Behnam Rezaei, "What We Know About Using Non-Engagement Signals in Content Ranking," *arXiv preprint* (2024): 1–16.

“Mute Notifications” to reduce notifications that interfere with sleep,¹⁰⁰ even as 45% of teens reported that social media hurts their sleep.¹⁰¹

- (41) Dr. Birnholtz explains that “[t]he ‘Time Spent’ or ‘Your Activity’ tool shows the per-day average time spent on the platform (on that device) over the past week.”¹⁰² Such information is unlikely to help the vast majority of teens, especially those who engage in excessive usage.¹⁰³ The tool requires enough self-control to stop using Meta’s Platforms, seek out the tool, investigate one’s usage, and then take action accordingly, potentially by linking to a supervising parent account and asking that parent to set up periods of time in which the teen is blocked from accessing the Platform. The successful completion of these onerous steps requires discipline and willpower, which most teens lack,¹⁰⁴ especially the many teens who demonstrate a lack of discipline and willpower by engaging on such platforms “almost constantly.”¹⁰⁵ As such, only 16.1% of U.S. young users had enabled daily limits on usage over a year period,¹⁰⁶ even as a much larger share of teens (44%) reported having tried to use social media less.¹⁰⁷
- (42) Similarly, “Hide Reactions” requires a user to know the tool exists and overcome their desire to know who liked their posts and how their posts compare to others.¹⁰⁸ Independent testing has found that there is also considerable friction in the process of activating this tool.¹⁰⁹ Per Meta’s internal research, 1% of teens use this tool,¹¹⁰ despite the fact that negative social comparison, experienced by 21.4% of

¹⁰⁰ Deposition of Sayed Otaru, Exhibit 9.

¹⁰¹ 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/>.

¹⁰² Birnholtz Report, ¶ 74.

¹⁰³ Roy F. Baumeister, Kathleen D. Vohs, and Dianne M. Tice, “The Strength Model of Self-Control,” *Current Directions in Psychological Science*, vol. 16, no. 6 (2007): 351–355. META3047MDL-060-00000456 (“IG Mental Well-being, Behavior Reduction Strategy: Late Night Use”) at -462 (“Users don’t expect usage insights alone to change behavior (Hanko, 2022), Expert input supports this.”).

¹⁰⁴ META3047MDL-003-00091414 (“Teen Mental Health”) at -428 (“Teens are hooked despite how it makes them feel Instagram is addictive, and time-spend on platform is having a negative impact on mental health. [...] They have an addicts’ narrative about their Instagram use - it can make them feel good, it can make them feel bad, they wish they could spend less time caring about it, but they can’t help themselves.”).

¹⁰⁵ Michelle Faverio and Olivia Sidoti, “Teens, Social Media and Technology 2024,” Pew Research Center, December 12, 2024, <https://www.pewresearch.org/internet/2024/12/12/teens-social-media-and-technology-2024/>.

¹⁰⁶ Deposition of Sayed Otaru, Exhibit 9.

¹⁰⁷ 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/>.

¹⁰⁸ Ana da Silva Pinho, Violeta Céspedes Izquierdo, Björn Lindström, and Wouter van den Bos, “Youths’ Sensitivity to Social Media Feedback: A Computational Account,” *Science Advances*, vol. 10, no. 43 (2024): 1–11.

¹⁰⁹ “Teen Accounts, Broken Promises: How Instagram is Failing to Protect Minors,” Fairplay, accessed October 7, 2025, <https://fairplayforkids.org/wp-content/uploads/2025/09/Teen-Accounts-Broken-Promises-How-Instagram-is-failing-to-protect-minors.pdf> (“there is considerable friction that makes it less likely a teen will actually hide Likes or Shares. In order for a teen to hide their Like or Share count, they have to post first, then go to the settings of that post and select to hide one or the other. They are unable to hide Like and Share counts at the same time, and there is no way for a teen to make hiding counts the default option across all their posts.”).

¹¹⁰ Deposition of Sayed Otaru, Exhibit 9.

surveyed Instagram teen users aged 13–15 within a seven-day period, regularly affects millions of teens.¹¹¹

- (43) Though Meta more recently turned other tools on by default, like “Sleep Mode” with its ability to turn off notifications during designated times of the day,¹¹² these tools still may fail in many cases when the temptation of what young users may be missing is too strong. “Take a Break” similarly requires users to demonstrate the ability to decide to reduce their usage, despite other design features that encourage excessive use through temptation, fear of missing out, and the possibility of social comparison. Young users who struggle to control their usage are especially unlikely to be able to exercise the self-control to use such tools.¹¹³
- (44) Meta also provides some tools that allow parents to substitute their preferences for young users. However, as noted in my opening report, Meta itself has suggested that parents are unable to manage the 40+ apps that youth often use.¹¹⁴ It is therefore unsurprising that few young users are protected by parental tools, even as concerns are widespread. Even if young users were to be supervised by parental tools, Meta makes it easy to create duplicate accounts that would likely evade supervision. Dr. Birnholtz argues that Meta “has put in place measures to circumvent [] tactics [to evade the supervision]”.¹¹⁵ No evidence has been provided by Dr. Birnholtz as to their effectiveness for preventing teens from evading parental supervision. Moreover, when parental controls are in place, they rarely provide parents with meaningful insights into how platform design may be influencing behavior, including with respect to infinite scroll, variable reward mechanisms, and social comparison triggers. This leaves caregivers without the context needed for effective intervention and is likely to give them a false sense of security.¹¹⁶
- (45) Lastly, tools like “Nighttime Nudge” and “Daily Limits” reminders are unlikely to successfully help a teen who has limited self-control to reconsider their usage. Such tools are readily ignored since the

¹¹¹ META3047MDL-004-00015029 at -048 (“Bad Experiences and Encounters Framework (BEEF) Survey”).

¹¹² “Introducing Instagram Teen Accounts: Built-In Protections for Teens, Peace of Mind for Parents,” Instagram, September 17, 2024, <https://about.fb.com/news/2024/09/instagram-teen-accounts/>.

¹¹³ Roy F. Baumeister, Kathleen D. Vohs, and Dianne M. Tice, “The Strength Model of Self-Control,” *Current Directions in Psychological Science*, vol. 16, no. 6 (2007): 351–355.

¹¹⁴ Iyer Opening Report, ¶ 61 (citing 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>).

¹¹⁵ Birnholtz Report, ¶ 100 (citing META3047MDL-129-00022703).

¹¹⁶ “Teen Accounts, Broken Promises: How Instagram is Failing to Protect Minors,” Fairplay, accessed October 7, 2025, <https://fairplayforkids.org/wp-content/uploads/2025/09/Teen-Accounts-Broken-Promises-How-Instagram-is-failing-to-protect-minors.pdf> (“Concerningly, we found a clear disconnect between the content being algorithmically recommended on Teen Accounts and the overview being provided to parents (where the Teen Account was paired with a supervisory parental account). Specifically, parental accounts were not provided with any indication that potentially harmful and age-inappropriate categories of material had been recommended to the Teen Account, including the violent, graphic, and suicide and self-injury material outlined above. This worrying disconnect raises a palpable risk that parents may experience a false sense of security as a result of the way in which the Teen Accounts supervisory function is being operated.”).

limits are generally optional. When presented with urgent notifications that may relate to their social status, teens may struggle to resist the desire to view such information given their limited willpower.¹¹⁷ These usage reminders are also infrequent compared with the number of frictions or opportunities to exercise willpower that removing autoplay or infinite scroll would create. Only approximately 50% of teens see any Nighttime Nudges over a several month period¹¹⁸ and independent testing has found that receiving Nighttime Nudges is a relatively rare occurrence.¹¹⁹

- (46) Overall, Meta’s safety tools including Teen Accounts fail to address the root of the problem: the engagement-driven algorithms and extended use features that undermine self-control and perpetuate the very behaviors these tools seek to mitigate. It is unrealistic to expect safety tools to fully mitigate young users’ harmful experiences on the Platforms, including excessive and unhealthy usage. Without meaningful changes to the core design of these algorithms or features (i.e., optimizing for quality signals and explicit user preference and removing or restricting extended use features), the risks and harms faced by young users will persist, rendering these surface-level solutions largely ineffective.

¹¹⁷ Roy F. Baumeister, Kathleen D. Vohs, and Dianne M. Tice, “The Strength Model of Self-Control,” *Current Directions in Psychological Science*, vol. 16, no. 6 (2007): 351–355.

¹¹⁸ Deposition of Sayed Otaru, Exhibit 9.

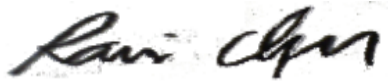
¹¹⁹ “Teen Accounts, Broken Promises: How Instagram is Failing to Protect Minors,” Fairplay, accessed October 7, 2025, <https://fairplayforkids.org/wp-content/uploads/2025/09/Teen-Accounts-Broken-Promises-How-Instagram-is-failing-to-protect-minors.pdf> (“We were also unable to find any evidence that Instagram’s Nighttime Nudges feature was either in place or effective. In January 2024, Meta announced that teens would receive a notification when they had spent more than 10 minutes on a particular Instagram feature late at night. The prompts would remind teens that it’s late and encourage them to close the app. However, during our safety testing, we were unable to trigger any of these prompts across multiple product surfaces that we tested during nighttime hours.”).

VI. Conclusion

- (47) In conclusion, it remains my opinion that implementing the changes to Meta's products outlined in my opening report, including (1) removal of all engagement signals within algorithms for young users, and (2) removal of infinite scroll and autoplay, quantification of engagement, and ephemeral content, and restriction of notifications, is necessary to mitigate unwanted, negative, and harmful experiences, including excessive and unhealthy usage, for Meta's young users.

Rebuttal 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

October 24, 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

- Trial Report of Ravi Iyer, Ph.D., August 1, 2025.
- Expert Rebuttal Report of Dr. Emilio Ferrara to Report of Dr. Ravi Iyer, September 26, 2025.
- Expert Report of Dr. Jeremy Birnholtz and Rebuttal to State Attorneys General Expert Dr. Ravi Iyer, September 26, 2025.

A.2. Books and academic papers

- Aarif Alutaybi, John Mcalaney, Angelos Stefanidis, Keith Phalp, and Raian Ali, “Designing Social Networks to Combat Fear of Missing Out,” *In Proceedings of the 32nd International BCS Human Computer Interaction Conference* (2018): 1–5.
- 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.
- Alberto Monge Roffarello and Luigi De Russis, “Towards Understanding the Dark Patterns That Steal Our Attention,” *CHI Conference on Human Factors in Computing Systems Extended Abstracts* (2022): 1–7.
- 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.
- Allam Hassan Allam and Halina Mohamed Dahlan, “User Experience: Challenges and Opportunities,” *Journal of Information Systems Research and Innovation*, vol. 3, no. 1 (2013): 28–36.

- Ana da Silva Pinho, Violeta Céspedes Izquierdo, Björn Lindström, and Wouter van den Bos, “Youths’ Sensitivity to Social Media Feedback: A Computational Account,” *Science Advances*, vol. 10, no. 43 (2024): 1–11.
- Andreas Holzinger, Anna Saranti, Alessa Angerschmid, Bettina Finzel, Ute Schmid, and Heimo Mueller, “Toward Human-Level Concept Learning: Pattern Benchmarking for AI Algorithms,” *Patterns*, vol. 4, no. 8 (2023): 1–21.
- Atharva Dange, Kavitha R Gowda, V. R. Srinidhi, and D. Halaswamy, “Analysing the Attitude of Social Media Users towards Ephemeral Marketing as a Digital Marketing Tool,” *Acta Universitatis Bohemiae Meridionalis*, vol. 24, no. 3 (2021): 77–94.
- Aya Nachtaoui, “The Impact of the Ephemeral Content on Social Media Consumer Engagement,” *HEC-Ecole de gestion de l'Université de Liège (Master thesis)* (2022).
- BJ Casey and Kristina Caudle, “The Teenage Brain: Self Control,” *Current Directions in Psychological Science*, vol. 22, no. 2 (2013): 82–87.
- Brennan Schaffner, Neha Lingareddy, and Marshini Chetty, “Understanding Account Deletion and Relevant Dark Patterns On Social Media,” *In Proceedings of the ACM on Human-Computer Interaction* (2022): 1–43.
- Brennan Schaffner, Yaretzi 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.
- Candice Lanius, Ryan Weber, and Joy Robinson, “User Experience Methods in Research and Practice,” *Journal of Technical Writing and Communication*, vol. 51, no. 4 (2021): 350–379.
- Daniel Maar, Hajer Kefi, and Mehmet A. Orhan, “Should Brands Foster Their Instagram Account Followers’ Fear of Missing Out by Posting Ephemeral Content?” *Recherche et Applications en Marketing (English Edition)*, vol. 38, no. 4 (2023): 104–120.
- Debasmita De, Mazen El Jamal, Eda Aydemir, and Anika Khera, “Social Media Algorithms and Teen Addiction: Neurophysiological Impact and Ethical Considerations,” *Cureus*, vol. 17, no. 1 (2025): 1–7.
- Erin Vogel, Jason P Rose, Lindsay Roberts, and Katheryn Eckles, “Social Comparison, Social Media, and Self-Esteem,” *Psychology of Popular Media Culture*, vol. 3, no. 4 (2014): 206–222.
- Fabian Baumann, Nipun Arora, Iyad Rahwan, and Agnieszka Czaplicka, “Dynamics of Algorithmic Content Amplification on TikTok,” *arXiv preprint* (2025): 1–34.
- Fatma Eltaher, Rahul Krishna Gajula, Luis Miralles Pechuan, Patrick Crotty, Juan Martínez-Otero, Christina Thorpe, and Susan McKeever, “Protecting Young Users on Social Media:

Evaluating the Effectiveness of Content Moderation and Legal Safeguards on Video Sharing Platforms,” *arXiv preprint* (2025): 1–20.

- George Beknazar-Yuzbashev, Rafael Jiménez-Durán, Jesse McCrosky, and Mateusz Stalinski, “Toxic Content and User Engagement on Social Media: Evidence from a Field Experiment,” *CESifo (working paper)*, no. 11644 (2025): 1–38.
- Ha Dao and Kensuke Fukuda, “Alternative to Third-Party Cookies: Investigating Persistent PII Leakage-Based Web Tracking,” *In Proceedings of the 17th International Conference on Emerging Networking Experiments and Technologies* (2021): 223–229.
- Hemant K. Bhargava, “Infinite Scroll: Addiction by Design in Information Platforms,” *Theory in Economics of Information Systems* (2023): 1–23.
- 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,” *In Proceedings of the ACM on Human-Computer Interaction*, vol. 5, no. 456 (2021), 1–36.
- Jacob O. Wobbrock and Julie A. Kientz, “Research Contributions in Human-Computer Interaction,” *Interactions*, vol. 23, no. 3 (2016): 38–44.
- 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,” *In Proceedings of the ACM on Human-Computer Interaction*, vol. 7, no. 228 (2023): 1–22.
- Jingsong Wang and Shen Wang, “The Emotional Reinforcement Mechanism of and Phased Intervention Strategies for Social Media Addiction,” *Behavioral Sciences*, vol. 15, no. 5 (2025): 1–21.
- Joohye Park and Yoonhyuk Jung, “Unveiling the Dynamics of Binge-Scrolling: A Comprehensive Analysis of Short-Form Video Consumption Using a Stimulus-Organism-Response Model,” *Telematics and Informatics*, vol. 95 (2024): 102200.
- Julian Bäumler, Helen Bader, Marc-André Kaufhold, and Christian Reuter, “Towards Youth-Sensitive Hateful Content Reporting: An Inclusive Focus Group Study in Germany,” *In Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems* (2025): 1–22.
- Julie A. Vera and Sourojit Ghosh, “‘They’ve Over-Emphasized That One Search’: Controlling Unwanted Content on TikTok’s For You Page,” *In Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems* (2025): 1–8.
- Kai Lukoff, Ulrik Lyngs, Himanshu Zade, J. Vera Liao, James Choi, Kaiyue Fan, Sean A. Munson, and Alexis Hiniker, “How the Design of YouTube Influences User Sense of Agency,”

In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (2021): 1–17.

- Karan Vombatkere, Sepehr Mousavi, Savvas Zannettou, Franziska Roesner, and Krishna P. Gummadi, “TikTok and the Art of Personalization: Investigating Exploration and Exploitation on Social Media Feeds,” *WWW ‘24: Proceedings of the ACM Web Conference* (2024): 3789–3797.
- Kil-Soo Suh, Hongki Kim and Eung Kyo Suh, “What If Your Avatar Looks Like You? Dual-Congruity Perspectives for Avatar Use,” *MIS Quarterly*, vol. 35, no. 3 (2011): 711–729.
- Kosuke Imai, Dustin Tingley, and Teppei Yamamoto, “Experimental Designs for Identifying Causal Mechanisms,” *Journal of the Royal Statistical Society Series A: Statistics in Society*, vol. 176, no. 1 (2013): 5–51.
- Kuan-Ju Chen and Hoi Ling Cheung, “Unlocking the Power of Ephemeral Content: The Roles of Motivations, Gratification, Need for Closure, and Engagement,” *Computers in Human Behavior*, vol. 97 (2019): 67–74.
- Ladd Wheeler and Kunitate Miyake, “Social Comparison in Everyday Life,” *Journal of Personality and Social Psychology*, vol. 62, no. 5 (1992): 760–773.
- Liliana Pasquale, Paola Zippo, Cliona Curley, Brian O’Neill, and Marina Mongiello, “Digital Age of Consent and Age Verification: Can They Protect Children?” *IEEE Software*, vol. 39, no. 3 (2022): 50–57.
- Luke Clark and Martin Zack, “Engineered Highs: Reward Variability and Frequency as Potential Prerequisites of Behavioural Addiction,” *Addictive Behaviors*, vol. 140 (2023): 1–7.
- Majid Altuwairiqi, Emily Arden-Close, Elvira Bolat, Laura Vuillier, and Raian Ali, “When People are Problematically Attached to Social Media: How Would the Design Matter?” *In 2019 IEEE International Conference on Systems, Man and Cybernetics* (2019): 1–8.
- Markus Salo, Henri Pirkkalainen, and Tiina Koskelainen, “Technostress and Social Networking Services: Explaining Users’ Concentration, Sleep, Identity, and Social Relation Problems,” *Information Systems Journal*, vol. 29, no. 2 (2019): 408–435.
- Meysam Alizadeh, Emma Hoes, and Fabrizio Gilardi, “Tokenization of Social Media Engagements Increases the Sharing of False (and Other) News but Penalization Moderates It,” *Scientific Reports*, vol. 13 (2023): 1–9.
- Mike Kuniavsky, *Observing the User Experience: A Practitioner’s Guide to User Research*, Elsevier, 2003.
- Muhammad Ali, Piotr Sapiezynski, Miranda Bogen, Aleksandra Korolova, Alan Mislove, and Aaron Rieke, “Discrimination Through Optimization: How Facebook’s Ad Delivery Can Lead to Biased Outcomes,” *In Proceedings of the ACM on Human-Computer Interaction* (2019): 1–30.

- Nancy Costello, Rebecca Sutton, Madeline Jones, Mackenzie Almassian, Amanda Raffoul, Oluwadunni Ojumu, Meg Salvia, Monique Santoso, Jill R. Kavanaugh, and S. Bryn Austin, “Algorithms, Addiction, and Adolescent Mental Health: An Interdisciplinary Study to Inform State-level Policy Action to Protect Youth from the Dangers of Social Media,” *American Journal of Law & Medicine*, vol. 49, no. 2-3 (2024): 135–172.
- Nicole Blabst and Sarah Diefenbach, “WhatsApp and Wellbeing: A Study on WhatsApp Usage, Communication Quality and Stress,” *In Proceedings of British HCI* (2017): 1–6.
- 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): 1956–1975.
- Paula Bitrián, Isabel Buil, and Sara Catalán, “Enhancing User Engagement: The Role of Gamification in Mobile Apps,” *Journal of Business Research*, vol 132 (2021): 170–185.
- Ren Zhou, “Understanding the Impact of TikTok’s Recommendation Algorithm on User Engagement,” *International Journal of Computer Science and Information Technology*, vol. 3, no. 2 (2024): 201–208.
- Rob Cover, Jennifer Beckett, Benedetta Brevini, Catharine Lumby, Rhyle Simcock, and Jay Daniel Thompson, “Reporting Online Abuse to Platforms: Factors, Interfaces and the Potential for Care,” *Convergence: The International Journal of Research into New Media Technologies* (2025): 1–17.
- Roy F. Baumeister, Kathleen D. Vohs, and Dianne M. Tice, “The Strength Model of Self-Control,” *Current Directions in Psychological Science*, vol. 16, no. 6 (2007): 351–355.
- Thomas Mussweiler and Katja Rüter, “What Friends Are For! The Use of Routine Standards in Social Comparison,” *Journal of Personality and Social Psychology*, vol. 85, no. 3 (2003): 467–481.
- Tom Cunningham, Sana Pandey, Leif Sigerson, Jonathan Stray, Jeff Allen, Bonnie Barrilleaux, Ravi Iyer, Smitha Milli, Mohit Kothari, and Behnam Rezaei, “What We Know About Using Non-Engagement Signals in Content Ranking,” *arXiv preprint* (2024): 1–16.
- Ulrik Lyngs, Kai Lukoff, Petr Slovak, William Seymour, Helena Webb, Marina Jirotko, Jun Zhao, Max Van Kleek, and Nigel Shadbolt, “‘I Just Want to Hack Myself to Not Get Distracted’: Evaluating Design Interventions for Self-Control on Facebook,” *In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (2020): 1–15.
- Ziwei Gao, “Personalizing Time Loss Aversion to Reduce Social Media Use,” *In Proceedings of the 31st ACM Conference on User Modeling, Adaptation and Personalization* (2023): 78–84.

A.3. Websites, articles, and press releases

- 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.
- “About Instagram Teen Privacy and Safety Settings,” Instagram Help Center, accessed October 21, 2025, <https://help.instagram.com/3237561506542117>.
- “Advanced Techniques for AI-driven Push Notifications,” nGrow.ai, May 27, 2024, <https://www.ngrow.ai/blog/advanced-techniques-for-ai-driven-push-notifications>.
- “AI Will Shape the Future of Marketing,” Harvard Division of Continuing Education, April 14, 2025, <https://professional.dce.harvard.edu/blog/ai-will-shape-the-future-of-marketing/>.
- “A Look Behind the Screens: Examining the Data Practices of Social Media and Video Streaming Services,” Federal Trade Commission, accessed October 23, 2025, <https://www.ftc.gov/reports/look-behind-screens-examining-data-practices-social-media-video-streaming-services>.
- 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/>.
- “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/>.
- “Bullying and Harassment,” Meta Transparency Center, accessed October 24, 2025, <https://transparency.meta.com/reports/community-standards-enforcement/bullying-and-harassment>.
- Charles Stangor and Jennifer Walinga, “3.5 Psychologists Use Descriptive, Correlational, and Experimental Research Designs to Understand Behaviour,” in Introduction to Psychology (2019), <https://www.saskoer.ca/introductiontopsychology/chapter/psychologists-use-descriptive-correlational-and-experimental-research-designs-to-understand-behavior/>.
- Christos Goodrow, “On YouTube’s Recommendation System,” YouTube Official Blog, September 15, 2021, <https://blog.youtube/inside-youtube/on-youtubes-recommendation-system/>.
- “Community Standards,” Meta Transparency Center, accessed October 24, 2025, <https://transparency.meta.com/policies/community-standards/>.
- 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/>.

- “Constant Companion: A Week in the Life of a Young Person’s Smartphone Use,” Common Sense, accessed October 20, 2025, https://www.common sense media.org/sites/default/files/research/report/2023-cs-smartphone-research-report_final-for-web.pdf.
- “Digital Well-Being Index,” Wave 3 Research findings, July 23, 2024, https://assets.ctfassets.net/kw9k15zxztrs/4wCEWECodqzJ5gNCN1S28E/54c2b17d5c974629da3e491c170d49e6/Digital_Well-Being_Index_Wave_3_Report_Presentation.pptx.pdf.
- “Digital Well-Being Index – Year Three,” Snap Values, February 2025, <https://values.snap.com/safety/dwbi>.
- “Discussion Paper: Case Study on Online Youth Harms – Project Daisy,” Harvard Kennedy School, accessed October 7, 2025, https://shorensteincenter.org/wp-content/uploads/2023/11/Discussion-Paper_Youth-Online-Harms-andProject-Daisy_For-Shorenstein-Publication.pdf.
- “From FOMO to ROI: Getting Real About AI in Marketing,” RTS Labs, September 23, 2024, <https://rtslabs.com/getting-real-about-ai-in-marketing>.
- Google Scholar page of Ravi Iyer, accessed October 7, 2025, <https://scholar.google.com/citations?user=7vzqWBYAAAAJ>.
- “How Common is Cyberbullying Among Children in Australia?” eSafety Commissioner, accessed October 24, 2025, <https://www.esafety.gov.au/research/the-online-experiences-of-children-in-australia/snapshot-cyberbullying>.
- “How to See More of What You Want on Instagram,” Instagram Blog, August 30, 2022, <https://about.instagram.com/blog/tips-and-tricks/control-your-instagram-feed>.
- “Instagram Feed AI System,” Meta Transparency Center, September 12, 2025, <https://transparency.meta.com/features/explaining-ranking/ig-feed/?referrer=1>.
- “Instagram Notifications AI System,” Meta Transparency Center, December 13, 2024, <https://transparency.meta.com/features/explaining-ranking/ig-notifications/?referrer=1>.
- “Instagram Notification Ranking Cuts Repetitive Alerts for Creators,” Storyy, September 3, 2025, <https://storyy.co/2025/09/03/instagram-notification-ranking-cuts-repetitive-alerts-for-creators/>.
- “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/>.
- “Instagram Teen Accounts Fail to Protect Children, Safety Tools Testing Reveals,” Fairplay, September 24, 2025, <https://fairplayforkids.org/instagram-teen-accounts-fail-to-protect-children-safety-tools-testing-reveals/>.

- “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/>.
- “Introducing Instagram Stories,” Instagram Blog, August 2, 2016, <https://about.instagram.com/blog/announcements/introducing-instagram-stories>.
- “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/>.
- 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>.
- 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>.
- Jonathan Haidt and Will Johnson, “Gen Z Has Regrets,” The New York Times, September 17, 2024, <https://www.nytimes.com/2024/09/17/opinion/social-media-smartphones-harm-regret.html>.
- 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/>.
- Kevin Brown, “The Rise of Push Notification Marketing: How Creators Are Taking Back Control,” FanCircles, October 15, 2025, <https://www.fancircles.com/the-rise-of-push-notification-marketing-how-creators-take-back-control/>.
- Leonardo Bursztyn, Benjamin Handel, Rafael Jiménez-Durán, and Christopher Roth, “When Product Markets Become Collective Traps: The Case of Social Media,” The University of Chicago: Becker Friedman Institute for Economics, October 12, 2023, <https://bfi.uchicago.edu/insight/research-summary/when-product-markets-become-collective-traps-the-case-of-social-media/>.
- “Levels of Evidence in Research,” Elsevier, accessed October 7, 2025, <https://scientific-publishing.webshop.elsevier.com/research-process/levels-of-evidence-in-research/>.
- Mariel Pelaez, “What Are Push Notifications and Can They Help You Get More Clicks?” Thrive Agency, June 24, 2024, <https://thriveagency.com/news/what-are-push-notifications-and-can-they-help-you-get-more-clicks/>.
- Matt Motyl, “Social Media Experiences Across Nearly 2 Years Since Launching the Social Media Index,” Designing Tomorrow, April 24, 2025, <https://psychoftech.substack.com/p/social-media-experiences-across-nearly>.

- 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/>.
- Michaeleen Doucleff, “Can’t Stop Scrolling? Ideas From Teens for Curbing Your Social Media Habit,” Oregon Public Broadcasting, May 17, 2023, <https://www.opb.org/article/2023/05/17/social-media-addiction-solution-teens/>.
- Michelle Faverio and Olivia Sidoti, “Teens, Social Media and Technology 2024,” Pew Research Center, December 12, 2024, <https://www.pewresearch.org/internet/2024/12/12/teens-social-media-and-technology-2024/>.
- 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/>.
- Mosseri, “Stories are an Important Way to Engage Your Followers...” Instagram, October 28, 2024, <https://www.instagram.com/reel/DBqsPQxPsB9/?hl=en%2C>.
- 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>.
- “Notify Sticker,” Instagram, April 4, 2024, https://www.instagram.com/p/C5V_HoSr_RJ/?hl=en&img_index=1%2C.
- “Our Approach to Explaining Ranking,” Meta Transparency Center, December 31, 2023, <https://transparency.meta.com/features/explaining-ranking/>.
- “Our Approach to Facebook Feed Ranking,” Meta Transparency Center, June 11, 2025, <https://transparency.meta.com/features/ranking-and-content/>.
- “Pathways: How Digital Design Puts Children At Risk,” 5Rights Foundation, accessed October 23, 2025, <https://5rightsfoundation.com/wp-content/uploads/2021/09/Pathways-how-digital-design-puts-children-at-risk.pdf>.
- Rebecca Kowalewicz, “Ephemeral Content Strategies,” Forbes, updated November 27, 2023, <https://www.forbes.com/councils/forbesagencycouncil/2023/11/07/ephemeral-content-strategies/>.
- “Reshare Speed - First Round Analysis and Experiment,” FBarchive, August 28, 2019, <https://fbarchive.org/doc/odoc9195853347w32>.
- Ryan Romero, “The Role of Ephemeral Content in Creating FOMO: A Social Media Strategy,” Multipost Digital, accessed October 7, 2025, <https://www.multipostdigital.com/blog/the-role-of-ephemeral-content-in-creating-fomo-a-social-media-strategy>.

- “Teen Accounts, Broken Promises: How Instagram is Failing to Protect Minors,” Fairplay, accessed October 7, 2025, <https://fairplayforkids.org/wp-content/uploads/2025/09/Teen-Accounts-Broken-Promises-How-Instagram-is-failing-to-protect-minors.pdf>.
- “The 18th International Research Conference on Management and Finance (IRCMF – 2023): Management in Turbulent Times: The Way Forward,” November 17, 2023, https://mgmt.cmb.ac.lk/ircmf/2023/wp-content/uploads/sites/6/2024/01/Proceedings-without-book-cover-02.12.23-2.29pm_compressed-1_compressed-1.pdf#page=512.
- “The Online Experiences of Children in Australia,” eSafety Commissioner, accessed October 7, 2025, <https://www.esafety.gov.au/research/the-online-experiences-of-children-in-australia>.
- “The Psychology of FOMO: Leveraging Fear of Missing Out in Push Notifications for Increased Engagement,” nGrow.ai, April 2, 2024, <https://www.ngrow.ai/blog/the-psychology-of-fomo-leveraging-fear-of-missing-out-in-push-notifications-for-increased-engagement>.
- “The State of UX 2022: Bridging the Gap Between UX Insights and Business Impact,” UserZoom, accessed October 17, 2025, <https://www.usertesting.com/sites/default/files/2023-08/The%20State%20of%20UX%202022.pdf>.
- “Updated Disrupted Childhood: The Cost of Persuasive Design,” 5Rights Foundation, accessed October 23, 2025, https://5rightsfoundation.com/wp-content/uploads/2024/08/5rights_DisruptedChildhood_G.pdf.
- “U.S. Teen Demographics,” ACT for Youth, accessed October 7, 2025, <https://actforyouth.org/adolescence/demographics/>.
- “Youth Perspectives on Online Safety, 2024: an Annual Report of Youth Attitudes and Experiences,” Thorn, September 2025, https://info.thorn.org/hubfs/Research/Thorn_24_YouthMonitoring_Report.pdf?_gl=1*k3htm1*_gcl_au*MTUyMTMxNzE4LjE3NTc3MTQyMDk.

A.4. Depositions

- Deposition of Adam D. Mosseri, March 17, 2025.
- Deposition of Adam D. Mosseri, March 18, 2025.
- Deposition of Alexander Schultz, February 27, 2025.
- Deposition of Alexander Schultz, February 28, 2025.
- Deposition of Antigone Davis, March 4, 2025.
- Deposition of Antigone Davis, March 5, 2025.

- Deposition of Kristin Hendrix, January 22, 2025.
- Deposition of Kristin Hendrix, January 23, 2025.
- Deposition of Liza Crenshaw, March 5, 2025.
- Deposition of Liza Crenshaw, March 6, 2025.
- Deposition of Mark Zuckerberg, March 27, 2025.
- Deposition of Michael “Miki” Rothschild, January 21, 2025.
- Deposition of Michael “Miki” Rothschild, January 22, 2025.
- Deposition of Sayed Otaru, Exhibit 9.

A.5. Discovery

- | | |
|----------------------------|----------------------------|
| ■ META3047MDL-003-00091414 | ■ META3047MDL-065-00035321 |
| ■ META3047MDL-004-00015029 | ■ META3047MDL-072-00320760 |
| ■ META3047MDL-014-00401043 | ■ META3047MDL-072-01079791 |
| ■ META3047MDL-019-00066376 | ■ META3047MDL-087-00032244 |
| ■ META3047MDL-020-00005380 | ■ META3047MDL-087-00032360 |
| ■ META3047MDL-020-00099343 | ■ META3047MDL-087-00032387 |
| ■ META3047MDL-028-00001643 | ■ META3047MDL-087-00032399 |
| ■ META3047MDL-028-00001725 | ■ META3047MDL-087-00033562 |
| ■ META3047MDL-028-00001747 | ■ META3047MDL-092-00001888 |
| ■ META3047MDL-028-00001750 | ■ META3047MDL-092-00003318 |
| ■ META3047MDL-028-00001754 | ■ META3047MDL-092-00003332 |
| ■ META3047MDL-034-00137403 | ■ META3047MDL-092-00003373 |
| ■ META3047MDL-039-00000250 | ■ META3047MDL-092-00003384 |
| ■ META3047MDL-040-00000354 | ■ META3047MDL-092-00003390 |
| ■ META3047MDL-046-00122221 | ■ META3047MDL-092-00003400 |
| ■ META3047MDL-046-00401133 | ■ META3047MDL-092-00003411 |
| ■ META3047MDL-053-00019928 | ■ META3047MDL-092-00003415 |
| ■ META3047MDL-060-00000456 | ■ META3047MDL-092-00003432 |

Rebuttal Trial Report of Ravi Iyer, PhD

- META3047MDL-092-00003443
- META3047MDL-092-00003462
- META3047MDL-092-00003478
- META3047MDL-092-00003495
- META3047MDL-092-00003506
- META3047MDL-092-00003515
- META3047MDL-092-00003530
- META3047MDL-092-00003535
- META3047MDL-092-00003546
- META3047MDL-092-00003557
- META3047MDL-092-00003572
- META3047MDL-092-00003577
- META3047MDL-092-00003595
- META3047MDL-096-00000086
- META3047MDL-112-00001358
- META3047MDL-112-00033880
- META3047MDL-112-00054350
- META3047MDL-129-00022616
- META3047MDL-129-00022703
- META3047MDL-129-00022778
- META3047MDL-129-00085725
- META3047MDL-129-00089098
- META3047MDL-143-00000141
- META3047MDL-143-00000303
- META3047MDL-143-00000319
- META3047MDL-143-00000327
- META3047MDL-143-00000330
- META3047MDL-143-00000343
- META3047MDL-143-00000347
- META3047MDL-143-00000351
- META3047MDL-143-00000385
- META3047MDL-143-00000390
- META3047MDL-143-00000398
- META3047MDL-146-00048009
- META3047MDL-204-00010924
- META3047MDL-207-00003134
- META3047MDL-207-00007530
- META3047MDL-207-00008366
- META3047MDL-207-00010463
- META3047MDL-207-00011753
- META3047MDL-207-00016893
- META3047MDL-207-00022660
- META3047MDL-207-00029485
- META3047MDL-207-00030977
- META3047MDL-207-00033669
- META3047MDL-207-00034268
- META3047MDL-208-00056822