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EXHIBIT M

EXPERT REPORT OF COLIN M. GRAY, PhD

State of New Mexico v. Meta Platforms, Inc., et al.

State of New Mexico, First Judicial District Court, Santa Fe County

No. D-101-CV-2023-02838

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designs (EUDs) to maximize user engagement, covering similar conceptual territory as ACDPs.[10] The researchers found the platforms they evaluated employ several strategies—such as pressure (e.g., creating a social obligation to start a session), enticement (e.g., using reward-driven mechanisms to encourage use), lulling (e.g., encouraging mindless engagement to extend a session), and trapping (e.g., obfuscating options to reduce use of a platform)—to maintain user attention. EUDs, such as **infinite scroll** and **auto-play**, contribute to what has been termed **attention capture**, whereby users are nudged to continue engaging with the platform. Chen and colleagues found these techniques are not only prevalent across VLOPs but also particularly aggressive on social media platforms, concluding: "social media platforms that depend on user attention employed twice as many EUDs as platforms that rely on other business models." These findings further highlight the intersection of dark patterns and attention-capture techniques, showing how these designs exploit users' time, attention, and cognitive load, creating an environment that discourages disengagement and increases the chance for users to experience multiple forms of harm.

61. The findings of these studies are also mirrored by a 2025 report from a consumer protection organization in Germany (the Verbraucherzentrale Bundesverband e.V.) that underscores the growing concerns regarding "Hyper-Engaging Dark Patterns" on social media platforms (Bundesverband der Verbraucherzentralen und Verbraucherverbände, 2025). These manipulative design techniques—including push notifications, countdowns, **infinite scroll**, and **auto-play**—are specifically designed to induce addictive behavior, particularly among young users, and leverage the same mechanisms as those exploited in gambling, such as stimulated variably timed dopamine release. The report highlights how these techniques, often using psychological mechanisms like the fear of missing out (FOMO) and variable rewards, drive users to spend excessive amounts of time on the platforms. The report notes that addictive engagement is especially concerning for minors, who are more vulnerable to the emotional and psychological

[10] EUDs and ACDPs share strong conceptual overlap, with EUDs focusing on specific types of harms (extended use) and ACDPs focusing on specific physiological triggers (attention and engagement).

effects of these designs, and could lead to negative long-term consequences, such as impaired decision-making and addictive behaviors.

62. Researchers have concluded that the ubiquity of dark patterns in digital systems, including on social media platforms, is by design: these patterns are effective at enabling shareholder goals and often represent a focus on business incentives to the detriment of user experience and societal impact (Leiser & Santos, 2024; Mathur et al., 2021). However, the normalization of these practices is out of alignment with the professional responsibilities of technologists to produce systems that have positive social impact and promote user autonomy and agency (e.g., ACM Code of Ethics; Nielsen, 1995). Instead, the use of dark patterns in these systems results in what Doctorow (2022) refers to as the "enshittification" of the web, creating user experiences that maximize user engagement at the expense of user value. Instead of providing a user with a sense of control, many dark patterns result in a systemic disempowerment that prevents users from reaching their desired goal (Gray, Santos, et al., 2021; Gray, Gairola, & Mildner, 2025).

VI. Guidelines Applicable to Technologists

63. Technologists, including designers, engineers, and other computing professionals, typically receive ethical training as part of their formal education.[11] This exposure to ethical concepts, theories, and practices aims to prepare them for the ethical complexities of their roles, ensuring they can make informed decisions that promote positive social outcomes. Like codes of ethics that guide designers and engineers,[12] this exposure is overseen in the United States through accreditation. ABET (formerly known as the Accreditation Board for Engineering and Technology) is the relevant accreditation body.[13] While such codes are typically not binding since most technology fields are not licensed (rare exceptions include the title of "professional

[11] Buwert, P. (2018, June); Hess, J. L., & Fore, G. (2018).
[12] Buwert, P. (2018, June).
[13] ABET. https://www.abet.org (last accessed May 15, 2025).

while public-by-default profiles maximize incoming stimuli, including unsolicited comments, interactions with strangers, and algorithmically presented exposure to emotionally provocative or manipulative content. This combined effect leaves little opportunity for teen users to pause, understand, and mitigate the psychological and social risks of these settings. Rather than scaffolding intentional or mindful use, Meta's sign-up and onboarding process encourages quick dependency, exploiting the developmental vulnerabilities of teen users in the pursuit of growth and retention metrics.

103. Instead of building in friction to encourage deliberation, Meta's defaults also offered no prompts for teen users to reflect on who might be able to view or interact with their content. A more ethical design that upholds professional responsibilities towards the end user and society would have provided private-by-default accounts and clear, developmentally appropriate options for adjusting visibility—supporting a teen's autonomy while helping them understand and assess the risks of public exposure. In failing to structure these choices in an intentional and informed way, Meta deprived teen users of a significant measure of control over their privacy and safety, and instead normalized high-risk exposure as a default condition.

iv. Social Notifications and Engagement Metrics Amplified Attention Capture and Social Comparison

104. Instagram's notification infrastructure plays a central role in driving user engagement, especially among teen users who are developmentally more vulnerable to persuasive and compulsive interface cues (Sanchez Chamorro et al., 2024; see generally Kim et al., 2025). While Meta has publicly acknowledged the importance of helping young users "manage their time" on the platform, the design and delivery of **recapture notifications**—socially driven alerts that encourage users to return to the app—directly undermine those stated goals. Rather than respecting users' attempts to disengage or self-regulate, Instagram's notification system can have the net result of disrupting periods of intentional disengagement, often leveraging relationships or prior interactions to pull users back into the platform. (METANMAG-028-00118695 at -00118744.) The power of these recapture techniques is

underscored by both academic research (Herder & Moerland, 2024; Lee et al., 2025; Zhang et al., 2022) and Meta's own internal research (e.g., METANMAG-005-00172179; METANMAG-002-01117687; METANMAG-021-00000004 at -000000037 ("Addicted users tend to open notifications more than the average and also receive more")).

105. These **recapture notifications** include alerts related to platform features, such as likes, posts from friends, or general encouragement to log back onto the platform. These messages can appear even when a user has not interacted with those accounts recently, and the purpose for the notification lacks clarity (e.g., whether it is algorithmically surfaced or based on direct engagement). The timing and recurrence of these notifications drives engagement by leveraging social interest and FOMO—mechanisms that are well-documented in the psychology of habitual and compulsive media use (e.g., Coskun & Muslu, 2019). While some features were considered to enable users to be "more in control of their time spent" on Facebook in 2018 (METANMAG-008-00000325 at -00000325), there was notably no alignment of functionality to control notifications—even for teens who wanted to reduce their screen time or set break reminders. (See METANMAG-002-01633206 at -01633209 (noting that notifications make it hard for users to take breaks).) Further, outcomes of one internal study included recommendations to "help people (especially young people) control their usage" while also "ensur[ing] a rewarding outcome for each notification they receive" (METANMAG-002-01117687 at -01117715-01117716)—two goals which are clearly at odds with each other, given the power of notifications to drive engagement.[46]

106. These practices fall under the high-level **forced action** dark pattern strategy, particularly through the meso-level pattern of **nagging**, and are also prime examples of the

[46] Within the last few years, Meta released an opt-in "Quiet Mode" feature that, when enabled, muted Instagram notifications during late night hours. Instagram Quiet Mode: A New Way to Manage Your Time and Focus. Meta. (https://about.fb.com/news/2023/01/instagram-quiet-mode-manage-your-time-and-focus/ (last accessed May 15, 2025). This was a step in the right direction, although Meta then packaged up these notifications and pushed them out to users as a digest first thing in the morning. As explained by one former Meta employee, "if you mute [notifications] completely and just never show them at any point, you're going to lose a bunch of potential sessions and time spent. If you – if you show them as a digest in the morning, you can recover at least some of them." (Volichenko Dep. 177:23-178:25). This witness further explained that this was a compromise selected in order to win approval for Quiet Mode from the notifications team.