

Expert Report of
Colin M. Gray, Ph.D.

Public Redacted Version

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA
IN AND FOR THE COUNTY OF MARICOPA

STATE OF ARIZONA, <i>ex rel.</i> MARK)	No. CV2020-006219
BRNOVICH, Attorney General,)	
)	
Plaintiff,)	
)	Assigned to the Hon. Timothy Thomason
v.)	
)	(COMPLEX CALENDAR)
GOOGLE LLC, A Delaware Limited Liability)	
Company,)	
)	
Defendant.)	
_____)	

Expert Report of Colin M. Gray, Ph.D.

May 4, 2022

HIGHLY CONFIDENTIAL – ATTORNEYS’ EYES ONLY
PURSUANT TO PROTECTIVE ORDER

/s/ Colin M. Gray, Ph.D.

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I. Scope of Retention

I was retained by counsel for the State of Arizona to provide my independent expert opinions regarding certain aspects of Google’s disclosures and user interfaces as they relate to the collection, use and exploitation of consumers’ location data. I was asked to apply my experience in recognizing and analyzing dark patterns as part of this analysis. As part of this retention, I reviewed documents from the discovery process and legal proceedings, including the complaint, answer, motions, documents produced in this case (including materials produced during the State’s pre-litigation investigation), and transactions of testimony given by Google employees, as well as academic articles and other similar materials that fall within the scope of my expertise. Through this review, I was asked to determine whether Google employs “dark patterns” and, if so, to characterize and explain certain instances of “dark patterns” that relate to location tracking.

I continue to prepare demonstratives that support the conclusions contained herein, and I reserve the right to rebut any of Google’s expert reports that relate to my area of expertise. Furthermore, I reserve the right to provide additional demonstratives (including those illustrating the account setup process) to support such a rebuttal or to be used at trial.

II. Personal Background

I am an Associate Professor at Purdue University in the Department of Computer Graphics Technology and Associate Professor (by courtesy) in Learning Design & Technology in the Department of Curriculum and Instruction. I am the program lead for an undergraduate major and graduate concentration in UX Design. I hold appointments as Guest Professor at Beijing Normal University in Beijing, People’s Republic of China and as Visiting Researcher at Newcastle University in Newcastle upon Tyne, United Kingdom.

I hold a PhD in Instructional Systems Technology from Indiana University Bloomington, a MEd in Educational Technology from University of South Carolina, a MA in Graphic Design from Savannah College of Art & Design, and a BS in Graphic Design from Bob Jones University. I have worked as an art director, contract designer, and trainer. My involvement in design informs my research on design activity and how design capability is learned. My research focuses on the ways in which the pedagogy and practice of designers inform the development of design ability, particularly in relation to ethics, design knowledge, and learning experience. My work crosses multiple disciplines, including human-computer interaction, instructional design and technology, design theory and education, and engineering and technology education.

I am a leading scholar in the study of dark patterns, and my foundational 2018 paper “The Dark (Patterns) Side of UX Design” (Gray et al. 2018) is the highest cited paper focused on dark patterns as reported by Google Scholar in May 2022 (n=321). I have received two awards from the National Science Foundation totaling \$729,810 to study dark patterns and other issues related to manipulative design practices. I have conducted numerous studies relating to dark patterns, including: documentation of dominant types of dark patterns (Gray et al. 2018), discussion on Twitter relating to dark patterns using #darkpatterns (Fansher, Chivukula, and Gray 2018), descriptions of how designers make and justify manipulative decisions (Chivukula, Brier, and Gray 2018; Chivukula and Gray 2020; Chivukula, Gray, and Brier 2019), tensions that prevent

design practitioners from rejecting pressure to manipulate consumers (Watkins et al. 2020; Chivukula et al. 2020; Gray and Chivukula 2019), experiences of end users when they are manipulated (Gray, Chen, et al. 2021), tensions between design practices and legal requirements relating to dark patterns and the GDPR (Gray, Santos, et al. 2021), and instances of dark patterns that are shared by everyday users on social media (Gray and Chivukula 2021; Gray, Chivukula, and Lee 2020).

Enclosed as Appendix 1 is a current version of my curriculum vitae, which also includes my qualifications, including a list of all publications that I authored in the previous 10 years. I am being compensated for my time on this matter a rate of \$200 per hour. My compensation is not contingent on the outcome of the case or on the substance of my opinions.

III. Summary of Conclusions

Based on my analysis, it is my opinion that Google’s Android user interface (“UI”), the UI of other Google services, and Google’s disclosures regarding its settings contain specific dark patterns that hide important complexity from end users and are designed in a manner that would lead users to think they are managing the totality of location tracking when they are not. Some of my conclusions include the following.

1. Google’s UI included—and continues to include—dark patterns that are designed in a manner that would be expected to deceive users, leading them to believe that they can control (*i.e.* disable) Google’s location tracking through the Location History (“LH”) or the Device Location settings. These dark patterns use ***sneaking and interface interference*** that would encourage users to enable (or not disable) location-related settings during the setup of their devices. This includes dark patterns that hide (or do not show) all settings that track location. These dark patterns also include complex types and scopes of location settings distributed in multiple parts of the UI that are never fully disclosed to the user in an understandable way. These also include dark patterns that do not consistently include certain settings (*e.g.*, WAA and sWAA) in key areas where users are likely to look for them (*e.g.*, the setting “Location” page).
2. Google’s removal of the Location Master (“LM”) toggle on the Quick Settings (“QS”) location tile included ***dark patterns that obstructed*** or otherwise interfered with users’ ability to disable location tracking. These dark patterns were successful, since the removal of the LM from the QS tile resulted in higher location attach rates by reducing the ability of users to easily disable location tracking. Google also successfully persuaded some of its OEM partners on the Android operating system to move the setting in similar ways that make it less accessible to users.
3. Google’s UI includes dark patterns that are designed in a manner that would deceive users into assuming that turning off certain location settings resulted in their location data not being collected or used. For example, Google provides an account-level setting called “Location History,” which would suggest to consumers that enabling or disabling that setting controls whether Google tracks their location. In fact, Google presented a help center page (at least until 2018) that informed consumers, “With Location History off, the places you go are no longer stored.” But disabling LH does not prevent Google from

tracking consumers' location or storing the places they go. For example, another setting (WAA) is also used by Google to track consumers' location. Google's UI has also included dark patterns that would be expected to lead users to believe that WAA is not related to the collection and storage of their location data.

4. Google's UI also includes dark patterns that would lead users to believe that, if they successfully navigate the various settings, they could prevent Google from tracking their location. To the contrary, Google continues to track consumers' location when a user turns off their device location, its location-related account settings like LH or WAA, or any other location-related setting. Google accomplishes this at least through its IPGeo and Realtime IPGeo internal products. At least until March or April of 2019, Google collected and stored relatively fine locations using these features. Since around March or April 2019, Google now employs the strategy of "off means coarse," meaning that it still collects and logs the information but, in some cases, that location is coarsened. The lack of details in the UI that indicate this tracking will occur regardless of what settings are turned on or off, is an example of the dark pattern strategies *forced action or sneaking*, leading users to assume that Google will not collect their location data. However, users have no way to prevent their location from being tracked and stored by Google.
5. Google's UI includes dark patterns by which Google uses data provided by some users who have enabled location-related settings for uses that exceed what the consumers could reasonably expect. Google exploits consumer location data to build a map between IP addresses and physical location, which Google also uses to infer locations for consumers who have disabled the relevant location settings. Google's use of location data exceeds the uses described in its disclosures, an example of the dark pattern strategy *sneaking*. Without informing the public or their users, Google turns consumers into "reporters" whose location is used to determine the location of other users who have declined to provide Google with that personal information. This is an example of the dark patterns strategies *sneaking and forced action*.

I also address further conclusions and opinions in my discussion below.

IV. Background of Litigation

I understand that the State of Arizona has brought a lawsuit in Maricopa County, accusing Google of violating Arizona's Consumer Fraud Act, A.R.S. § 44-1522, which provides as follows: "The act, use or employment by any person of any deception, deceptive or unfair act or practice, fraud, false pretense, false promise, misrepresentation, or concealment, suppression or omission of any material fact with intent that others rely on such concealment, suppression or omission, in connection with the sale or advertisement of any merchandise whether or not any person has in fact been misled, deceived or damaged thereby, is declared to be an unlawful practice." Specifically, I understand that the State accuses Google of deceptive and unfair practices through its collection of consumers' location data, in connection with the sale/advertising of Android devices (including the preloaded Android operating system, other software and apps), as well as other apps and services provided by Google to consumers.

I am familiar with an article called *AP Exclusive: Google tracks your movements, like it or not*, from August 13, 2018, where the AP revealed certain deceptive aspects of Google’s settings and disclosures, specifically relating to the interplay between the “Location History” (LH) and “Web & App Activity” (WAA) settings in the Google account and how they are used by Google to collect location data. I understand that the AP Article triggered an investigation by the Arizona Attorney General’s Office, which ultimately led to this litigation.

I have reviewed the Complaint in this case, as well as some other documents, discovery responses, transcripts from oral testimony and other materials and information produced in this case and in the investigation that preceded the litigation. My opinions in this report are based on the materials I have reviewed and my background and expertise in the area of dark patterns. I reserve the right to supplement these opinions, including based upon any new information that I receive or in response to any reports or arguments raised by Google.

V. An Overview of Dark Patterns

What are Dark Patterns?

The term “dark patterns” was coined in 2010—created by practitioner and cognitive science PhD Harry Brignull—to express concern about the state of manipulative and deceptive design practices and to provide a means for designers and consumers to diagnose the issue and “name and shame” companies relying upon these patterns¹ in hopes of changing these design practices. Brignull’s initial notion of dark patterns described instances where designers “take our understanding of human psychology and flip it over to the dark side.” (Brignull 2011). Brignull went on in later popular press publications to identify dark patterns as “carefully crafted with a solid understanding of human psychology . . . [that] do not have the user’s interests in mind,” particularly calling out examples of dark patterns as “not mistakes” and “not bad design” (Brignull 2013). Common examples of dark patterns include Brignull’s “roach motel” where it is easy to perform an action but difficult to reverse it; for instance, making it easy to sign up for a service but difficult to discontinue it (*cf.*, the Norwegian Consumer Council’s report on this phenomenon in discontinuing Amazon Prime service; Kaldestad 2018). Another common example is Brignull’s “bait and switch” pattern, where a user seeks to perform one task, but something undesirable happens instead. According to Brignull’s darkpatterns.org site, one example of this pattern is when Windows users were shown a pop-up window asking them to upgrade; if the user clicked the “X” button (which would normally mean “close”), instead, this action triggered the operating system to be updated.²

In the past five years, the concept of dark patterns has seen increased usage by researchers, designers, and legal scholars to promote the study of technology manipulation more broadly, with numerous references in the popular press alongside increasing interest by regulatory bodies

¹ Brignull’s early goal for the label of “dark patterns” was for design practitioners to identify the practices and reject them as a community. “Let’s stop turning a blind eye to black-hat UX. Let’s name the offenders and shame them into giving it up. As a community, it’s well within our power to do this.” <https://90percentofeverything.com/2010/08/16/darkpatterns-org-naming-and-shaming-sites-that-use-black-hat-anti-usability-design-patterns/index.html>

² <https://www.darkpatterns.org/types-of-dark-pattern/bait-and-switch>

in relation to dark patterns (e.g., European Union GDPR³ and Digital Services Act⁴; California’s CCPA⁵; Colorado’s CPA⁶).

In recent research, these patterns have been shown to be common in consumers’ technology experiences. De Geronimo et al. (2020) report that their analysis of 240 common smartphone applications “showed that 95% of apps contain one or more forms of DPs [dark patterns] and, on average, popular applications include at least seven different types of deceiving UIs.” However, a recent study from Bongard-Blanchy et al. (2021) reveals that while users are “generally aware of the influence that manipulative designs can exert on their online behavior [sic] . . . being aware does not equip users with the ability to oppose such influence.”

Broad definitions of dark patterns, including specific types, have been disseminated through a public website,⁷ where Brignull and colleagues identified specific types of dark patterns. Over time, this list has been expanded by other human-computer interaction and privacy scholars, with notable examples added by Mathur et al. (2019) (e.g., urgency, misdirection, social proof, scarcity), Bösch et al. (2016) (e.g., maximize, obscure, deny, violate, fake), and the French regulatory body CNIL (“Shaping Choices in the Digital World: From Dark Patterns to Data Protection: The Influence of UX/UI Design on User Empowerment” 2019) (e.g., attention diversion, default sharing, hard to adjust privacy, obfuscating settings).

In 2018, I built on Brignull’s definition and typology of dark patterns, which was by then well-known in the technology and design industry at large. My lab authored a paper that builds upon both industry attention on dark patterns and incipient interest regarding dark patterns in academic research and education. This paper, *The Dark (Patterns) Side of UX Design* (Gray et al. 2018), contributed one of the first widely used typologies of dark patterns beyond the basic types included by Brignull. In this analysis, we performed a content analysis of instances of dark patterns identified by designers and journalists, resulting in five different dominant strategies that encapsulated potential sources of design intent that drove the use of dark patterns. These strategies included Brignull’s types; for instance, “bait and switch” became part of my *Sneaking* strategy, and “roach motel” became part of my *Obstruction* strategy. Since its publication, this framework has been used and extended by a range of scholars, practitioners, and regulators in better describing dark patterns “in the wild,” with 321 citations as of May 2022.

The figure below illustrates the typology I created. Dark patterns identified by Brignull fall into one of the five dark patterns strategies, along with several new patterns that I identified (e.g., hidden information, toying with emotion, intermediate currency).

³ <https://gdpr-info.eu>

⁴ <https://digital-strategy.ec.europa.eu/en/policies/digital-services-act-package>

⁵ <https://oag.ca.gov/privacy/ccpa>

⁶ https://leg.colorado.gov/sites/default/files/2021a_190_signed.pdf

⁷ <https://www.darkpatterns.org/types-of-dark-pattern>. The list of patterns has changed in small ways; for instance, “confirmsaming” was not present in a 2017 snapshot of the website <https://web.archive.org/web/20170923082002/https://www.darkpatterns.org/types-of-dark-pattern>

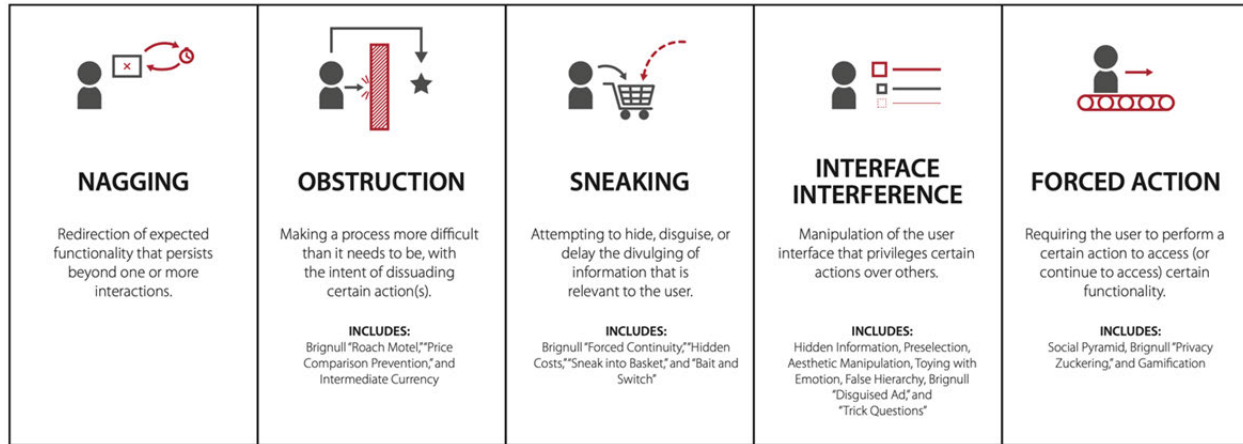


Figure 1. Dark pattern strategies as defined in Gray et al. (2018). Patterns from Brignull, alongside other new dark patterns, are indicated under each strategy.

Notable definitional work that continues on the notion of dark patterns includes an analysis from Mathur et al. (2021), which identifies different aspects of dark patterns in the research literature that relate to characteristics of the user interface, mechanisms of effect on users, the role of designers, and potential benefits and harms. Mathur et al. revealed six primary attributes of dark patterns that modify or shape the end user's experience of choice architecture (or, how users perceive what choices are available to them that helps in determining possible courses of action), including: asymmetry, restriction, disparate treatment, covert behavior, deception, and information hiding.

How are dark patterns deceptive and manipulative?

The scholarship around dark patterns demonstrates the disproportionate power that designers and technologists have to modify the user's perception of choice architecture. In previous work, I have described this tension as an imbalance in user versus stakeholder or shareholder value (Gray et al. 2018), which Narayanan et al. (2020) later described as "user interfaces that benefit an online service by leading users into making decisions they might not otherwise make." In particular, the use of dark patterns has been linked to the potential for harm to consumers (Calo 2013; Luguri and Strahilevitz 2021) and impacts the ability for users to meaningfully consent to data protection terms (Gray, Santos, et al. 2021).

Calo (2013) describes at least three interrelated forms of harm that may be experienced by technology users in relation to manipulative design practices such as the use of dark patterns: economic harm, privacy harm and autonomy harm. Current research relating to GDPR enforcement in the EU and CPRA in California has also investigated the role of privacy and autonomy harms, with King and Stephan (2021) noting that "dark patterns [...] undermine individual autonomy through coercion and manipulation" and Gunawan et al. (2021) describing the compound, aggregate, and longitudinal harms of dark patterns that produce or contribute to privacy and autonomy harms (see also Citron & Solove, 2021).

Economic harm is perhaps the best understood, including work done to describe dark patterns in e-commerce settings (e.g., Mathur et al., 2019) where consumers are misled about prices of items, items are "sneaked into basket" without a user's knowledge, or where social proof is used to coerce users into making a decision with less consideration than they might otherwise. Recent

e-commerce examples relating to services and subscriptions also use dark patterns to prevent users from unsubscribing as easily as they subscribed, or by making terms of a service subscription difficult to understand. Dark patterns present the potential for harm by altering the choice architecture in two key ways as articulated by Mathur et al. (2021): modification of the decision space through covert, asymmetrical, restrictive, or involve disparate treatment; and manipulation of information flow on the web service through deception or the hiding of information.

Emerging Interest in Regulating Dark Patterns

The Federal Trade Commission (FTC) has shown interest in better understanding and regulating technology products through the lens of dark patterns, including a workshop entitled “Bringing Dark Patterns to Light” in April 2021⁸. In October 2021, the FTC announced its first major action relating to the use of dark patterns, focusing on the use of dark patterns that make it more difficult to unsubscribe from internet services than to subscribe to them (“FTC to Ramp up Enforcement against Illegal Dark Patterns That Trick or Trap Consumers into Subscriptions” 2021). The Acting Director of FTC Bureau of Consumer Protection, Daniel Kaufman made the following statement regarding dark patterns on April 29, 2021, “Many of the dark patterns discussed today already are illegal under Section 5 of the FTC Act and state laws prohibiting deceptive and unfair practices, as well as Under the Restoring Online Shoppers' Confidence Act. And the FTC, along with its state and international partners, have been and will continue to be active in investigating and bringing suit to stop these unlawful practices.”⁹

Regulatory agencies in other parts of the world are also investigating the use of dark patterns, including by technology companies. In the European Union, fines have recently been levied against Google for its use of dark patterns as part of the cookie consent process (Ikeda, 2022) under GDPR. As stated in a news report describing the fine, “Central to the case was the use of ‘dark patterns’ by each site, or elements that obscure the process of refusing cookies and intentionally steer users in another direction.”¹⁰ In the EU and elsewhere in Europe, there is emergent interest and investigation into the use of dark patterns in technology services by a range of data protection and consumer protection authorities—most prominently by CNIL in France and Forbrukerrådet in Norway. Additionally, the European Data Protection Board (EDPB) has recently released guidelines on dark patterns in social media platforms¹¹ which may lead to future enforcement efforts under the newly approved Digital Services Act.

On June 27, 2018, the Forbrukerrådet (or “Consumer Council”) of Norway published a report entitled, “Deceived by Design: How tech companies use dark patterns to discourage us from exercising our rights to privacy.” The Norwegian report analyzes a sample of settings in Facebook, Google and Windows 10, and “show[s] how default settings and dark patterns, techniques and features of interface design meant to manipulate users, are used to nudge users

⁸ <https://www.ftc.gov/news-events/events-calendar/bringing-dark-patterns-light-ftc-workshop>

⁹ https://www.ftc.gov/system/files/documents/public_events/1586943/ftc_darkpatterns_workshop_transcript.pdf

¹⁰ <https://www.cpomagazine.com/data-protection/google-and-facebook-hit-with-fines-over-dark-patterns-allegedly-misleading-users-into-cookie-consent/>

¹¹ https://edpb.europa.eu/our-work-tools/documents/public-consultations/2022/guidelines-32022-dark-patterns-social-media_en

towards privacy intrusive options. The findings include privacy intrusive default settings, misleading wording, giving users an illusion of control, hiding away privacy-friendly choices, take-it-or-leave-it choices, and choice architectures where choosing the privacy friendly option requires more effort for the users.”¹²

Allegations of Google’s Use of Dark Patterns

I am aware of multiple instances where Google, specifically, has been accused of engaging in dark patterns, besides by the State of Arizona in this litigation and the EU action described in the previous paragraphs.

In 2022, the search engine provider DuckDuckGo claimed that Google engaged in the use of dark patterns (*The Washington Post* 2022). DuckDuckGo alleges that Google’s Chrome browser manipulated users into disabling Google’s competitors’ browser extensions.¹³ This recent allegation against Google regarding its use of dark patterns is not a unique example, but rather part of a multi-year history of companies (*The Washington Post* 2022), designers (Makes 2020; Brignull et al. 2015), and regulators (Ikeda 2022; Kaldestad 2018) calling attention to Google’s use of manipulative design practices. For instance, the dark patterns corpus my lab published in 2018 that informed the creation of our dark patterns typology (Gray et al. 2018), also available on a public website¹⁴, included examples from Google products, including patterns relating to Google’s Location Services¹⁵ and search results¹⁶. More recent legal scholarship has also cited examples from our corpus. For instance, in Hung (2021), the Google Location Services example from our corpus is used as an example of “nagging”; the author describes this instance as follows: “Google prompts users who have disabled ‘location services’ to consider enabling the feature. While this alert does give users the option to actually decline, that choice is not permanent; users will continue to encounter this pop-up each time they open up Google Maps. Over time, users may become so worn down by this unwanted interruption that they simply enable location services to eliminate any future redirection” (pp. 2489-2490). In January 2022, four attorneys general in the District of Columbia, Texas, Washington and Indiana filed a case against Google that specifically alleges the use of dark patterns to gain users’ location data “repeatedly nudg[ing] or pressur[ing] people to provide more and more location data, ‘inadvertently or out of frustration.’” (*The Washington Post* 2022).

VI. Overview of Google’s Many Location Settings and UI

Google sells and advertises mobile phones—including the Google Pixel family and Google Nexus family—that run on its proprietary version of the open-source Android operating system and are sold preloaded with many of Google’s applications. After users purchase these devices, they activate and setup their device by navigating complex and confusing consent flows designed

¹² <https://fil.forbrukerradet.no/wp-content/uploads/2018/06/2018-06-27-deceived-by-design-final.pdf> at p. 3.

¹³ A browser extension is an application that adds functionality to a web browser, like Google’s Chrome browser.

¹⁴ <https://darkpatterns.uxp2.com/>

¹⁵ <https://darkpatterns.uxp2.com/pattern/google-location-services-spam/>

¹⁶ <https://darkpatterns.uxp2.com/pattern/google-ads-disguised-as-search-results/>

by Google that relate to the plethora of settings discussed herein. By enabling—or by not disabling—these settings, users enable the collection of their location data by Google by simply setting up and using their phone.

Google offers a range of location-related settings which I will refer to throughout this document. These settings may be organized into three distinct categories: 1) account-level, 2) device-level, and 3) app-level. Account-level settings are settings that govern the user’s entire Google account and apply to all of the user’s devices signed into that account. Device-level settings apply to a specific hardware device. A user’s settings on one device may differ from those on another of that user’s devices. App-level settings are those that apply specifically to one application, which may be a Google app—such as Google Maps—or a third-party app. I understand these settings and the disclosures related to these settings may have changed over time.

I provide a list here for reference to indicate consistent use in my analysis in Sections VI-IX. This list is not comprehensive, since my analysis does not address all intricacies of interaction with location settings at device, app, account, sensor, and diagnostic levels.

1. Account Level Location Settings
 - a. Location History (“LH”)
 - i. Location Reporting (sub-setting; Device Level)
 - b. Web & App Activity (“WAA”)
 - i. Supplemental Web & App Activity (“sWAA”) (sub-setting; Device and Account Level)
 - c. Google Location Sharing
 - d. Google Ad Personalization (“GAP”)
2. Device Level Location Settings
 - a. Device Location (or Location Master)
 - b. Google Location Accuracy (formerly known as Google Location Services) (“GLA”)
 - c. Usage & Diagnostics
 - d. WiFi Scanning
 - e. WiFi
 - f. Bluetooth Scanning
 - g. Bluetooth
3. App Level Location Settings
 - a. location runtime permission

Location History and Web and App Activity

Location History (“LH”) and Web and App Activity (“WAA”) are both account-level settings that control the collection of users’ location data. LH and WAA are separate settings, *i.e.* turning LH on or off will not affect the state of WAA, and vice versa. (7/12/2019 Monsees EUO Tr. at 244:10–245:18).

(Google’s 7/12/2021 Responses to 30(b)(6) Questions).

Location History “saves a private map . . . of where the user goes with his or her signed-in devices, even when the user is not using a Google service.” (Google’s 2/21/2020 CID Responses

at 18). Location History is off by default, *i.e.* the user must opt-in to utilize Location History. (*See id.*). By opting into Location History, Google creates a map of the user’s locations, which is depicted in a product called Timeline. (*Id. See also* 7/11/2019 McGriff EUO Tr. at 218:13–219:5 (Timeline allows users to view and manage their location data collected through LH)). The location information collected through LH is precise, *i.e.* the location data contains specific latitude and longitude. (7/11/2019 McGriff EUO Tr. at 66:11-22).

Google puts much effort into convincing users to turn on location history (and to leave on WAA), even when doing so is unnecessary for the operation of the device or specific app or services. (*See* GOOG-GLAZ-00299120 at 139:12-35 (David Monsees testifying in Australia that even with LH off, Google Maps can still be used “in a way where it knows where you are and delivers you relevant map results to assist you in that request you’ve made.”), (discussing ways users are prompted to opt into LH: “there are a variety of consent surfaces, including promotion in Google Maps where a user might be invited to get a more personalised map. If you access the Google Maps timeline, . . . it would have an option or a promo to turn on location history setting, and I believe Google Photos also included a [sic] opt-in flow for location history.”).

Web and App Activity collects and “stores a user’s Google activity data to My Activity . . . in their Google Account.” (Google’s 2/21/2020 Responses to CIDs 1–3 at 18–19). Similar to Timeline, My Activity is a user-facing product that takes location data collected through WAA and visually presents it to users. (*Id.*). Whenever a user who has WAA enabled interacts with a Google product, their data is stored through WAA. (*Id.*). Unlike LH, WAA is enabled by default. (7/12/2019 Monsees EUO Tr. at 175:7–176:18). Among other types of data, WAA stores user location data. (*Id.* at 83:12–84:25, 85:23–86:8, 89:20– 91:22; Google’s 2/21/2020 Responses to CIDs 1–3 at 18–19). Location information collected through WAA takes different forms, *e.g.* a rectangle comprised of latitude and longitude lines or a semantic location, such as “Pizza Hut.”

VII. Google’s Internal Documents Show That Google Has Been on Notice for Many Years That Its Settings Are Confusing and Deceptive to Users

One of the key issues that emerged from the August 2018 AP Article concerns Google’s various location-related settings. The AP Article exposes that Google continues to collect location-related data through a setting called WAA even when Location History is off. This was true even though there were no disclosures indicating that WAA relates to location and, in fact, there were disclosures that “*With Location History off, the places you go are no longer stored.*” The fact that consumers did not understand this before the article is fairly evident from the article itself, the Shankari blog post that is quoted in the article, and some of the other press that came out around the same time.

Long before the article, however, it had become well known within Google that these and other location-related settings are a “mess” (discussed further below) in the sense that they were not clearly communicating to users how they can control the collection of their location data. At the same time, from the perspective of design choices, these settings were doing what they were designed to do: nudging consumers to enable (or not disable) settings that granted Google access to their location data. These are dark patterns. I discuss some prior documents first.

go/ul2017

Around early February 2017, a Google engineer named Mike Lopyrev created a document called go/ul2017, which he circulated to his colleague, explaining “take a look at go/ul2017 – work in progress, trying to rein in the overall mess that we have with regards to data collection, consent, and storage.” (GOOG-GLAZ-00057478). I understand Mr. Lopyrev was the head engineer for Location History at the time. (GOOG-GLAZ-00299108). In the follow-up emails, Mr. Lopyrev explained that Location is “a product umbrella that includes Location History, [REDACTED], and a bunch of other stuff that’s super messy. And it’s a Critical User Journey to make sense out of this mess.” (GOOG-GLAZ-00057477 to 478). In follow-on discussions, Mr. Lopyrev described Google’s “user story” as “crazy confusing.” (GOOG-GLAZ-00057477 to 861).

The document go/ul2017 itself has a number of contributors, or so it appears from the face of the document and the many comments. In “go/ul2017,” Googlers discuss “the tale of two critical user journeys:” “Google, stop tracking my location, damnit!” and “Google, you have my permission to use my location to make my apps awesome.” (GOOG-GLAZ-00317865 at 865). The head engineer (Lopyrev) explains, “We collect User Location via so many channels that even Google engineers and PMs don’t fully comprehend it, let alone our 1B+ regular users across Android, Search, Maps, and many other Google products. (*Id.*). In an appendix to go/ul2017, the authors describe Google’s location setup flow on Chrome Google Search as “terribly complicated.” (*Id.* at 870).

In a table contained in the document, one cell in the “Activity History” row and the “Background” column is highlighted red with the note “GATHERING INFORMATION / WORK IN PROGRESS”, suggesting that WAA’s storage of location in the background was not well understood, even by Google employees. (*See id.* at 866). More than a year before the AP Article, Google already understand the conclusions.

In comments relating to this cell and text, Mark Shields (a Google Staff Software Engineer at the time according to his LinkedIn page¹⁷) “assumed this [combination] to be an ‘invalid’ combo by definition of WAA policy,” apparently responded to by user “pososhok” (who I understand to be associated with Mike Lopyrev, a Senior Staff Engineer at Google at the time) by noting “I think this is one of the grey areas as AFAIK, some apps ping Google in the background and include device location via the usual device location path. I’m trying to figure out who is doing this.” Notably, this is the only red cell in the entire table, although there is no explicit color key provided to understand the full implications. (*See generally* GOOG-GLAZ-00317865). It appears these issues were not technical in nature, but rather related to “the high-level conceptual model of User Location.” (*Id.* at 868).

Google’s Internal Studies Confirmed That Users Do Not Understand and Are Deceived

I understand Google conducts internal studies regarding, among other things, user perception, understanding, and specific location-related settings. From my review, Google’s user studies rely on a range of methodologies and means of sampling end users based on the questions

¹⁷ <https://www.linkedin.com/in/mshields822/>

being asked—including exposing end users to interactions or task flows to validate design decisions, identify sources of user confusion or error, and/or identify opportunities to further develop or refine product offerings. User studies like these rely upon common UX methods that are used by companies to better understand how consumers experience different aspects of a product and guide future product roadmaps. One common user study method used by Google in multiple studies was a “usability test,” which tests how users respond to existing or future UI elements when asked to perform a task. Other user study methods include use of a “think aloud protocol,” where users are asked to describe what they are thinking as they conduct a task or view UI elements.

Importantly, Google’s internal research confirms that users do not understand and are deceived by location tracking and settings. These research studies were used to inform product decisions (Gelke Tr. At 103-105). In October of 2014, Hemanshu Ahuja, product manager for Google at the time, created a presentation titled “Simplifying Location History Settings” that was framed by the problem that “*Most users don’t understand difference between location reporting and location history*” (GOOG-GLAZ-00002914 at 916)—an issue that appeared to be a baseline issue of user confusion that was driving further product iteration. This project presentation showed mock-ups of potential design changes that could “provide better transparency,” “reduce confusion around Location History settings,” and “provide better controls” (*Id.* at 917). The proposed mock-up that shows this more transparent approach to reporting location is shown in Figure 2.

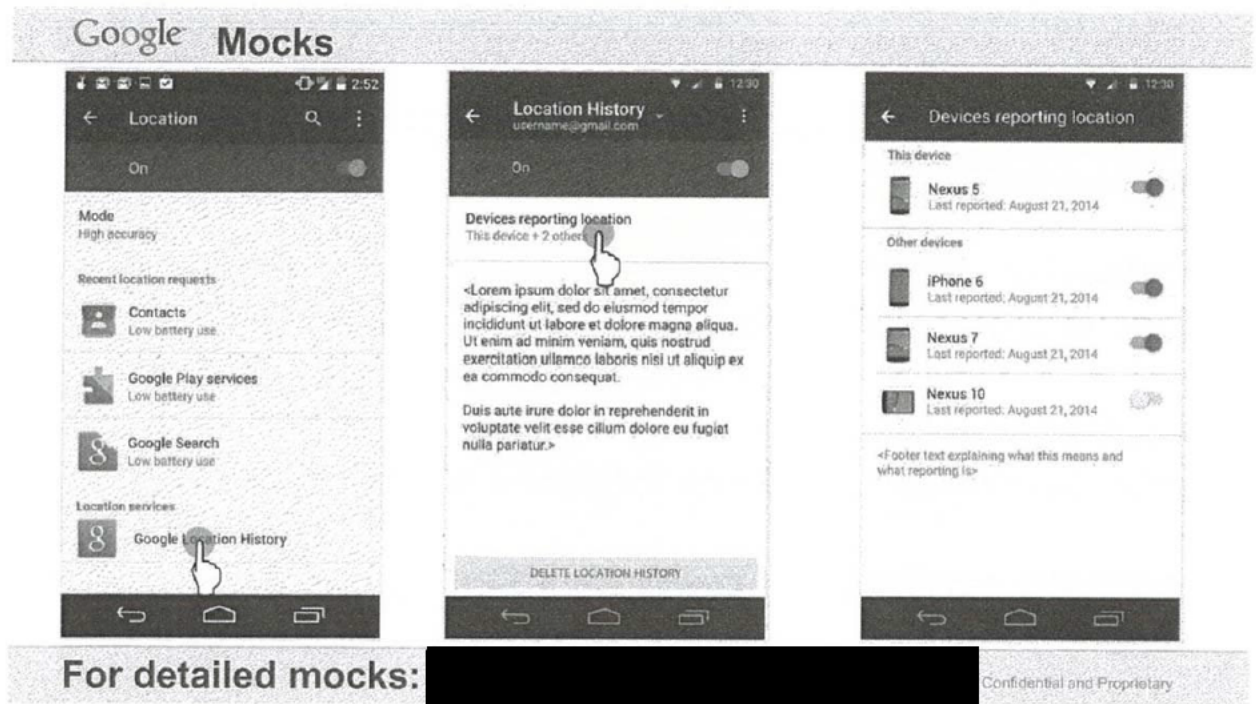


Figure 2. Mockups of more transparent location history controls (reproduced from GOOG-GLAZ-00002914 at 918).

A separate December 2017 study also showed that when users were asked to change specific settings that included location controls, [REDACTED]

[REDACTED] (GOOG-GLAZ-00205306.R at 11.R). This finding revealed that [REDACTED]

[REDACTED] (See e.g. GOOG-GLAZ-00046967 at 968 [REDACTED]

[REDACTED] (GOOG-GLAZ-00205306 at 311).

Additionally [REDACTED] (GOOG-GLAZ-00205306.R at 315.R).

[REDACTED] (GOOG-GLAZ-00275934 at 939) and that [REDACTED]

[REDACTED] (*Id.* at 982). As referenced in GOOG-GLAZ-00205306.R at 12.R, a previous user study also showed that [REDACTED]



Figure 3.

(reproduced from GOOG-GLAZ-00275934 at 982).

This [REDACTED] with the title of a presentation [REDACTED] bearing the subtitle [REDACTED] (GOOG-GLAZ-00027795). In this presentation, takeaways included acknowledgements that [REDACTED] (GOOG-GLAZ-00027795 at 798). References to [REDACTED] (GOOG-GLAZ-00100799 at 800). Another document described [REDACTED] (GOOG-GLAZ-00099239). Finally, an email [REDACTED] (GOOG-GLAZ-00057861). In yet another user study regarding user expectations, Google found that “[f]or many users, DL off means no location data will be used,” despite the fact that when DL is off, Google still collects user location data (GOOG-GLAZ-00256277 at 282).

If the goal is obtaining meaningful user consent, these sources point towards a product that is known to be broken, with broad user deception that negatively impacts users' ability to make informed decisions about how location tracking is enabled or disabled across multiple controls. The precise purpose and impact was generally unknown to users.

Google Employees Themselves Are Confused by the Settings

Key personnel at Google have long acknowledged critical concerns relating to users' understanding of location settings. Indeed, [REDACTED]

[REDACTED] (See e.g. Compl. Ex. 263 (GOOG-GLAZ-00100799) at 800 [REDACTED])

[REDACTED] Googlers understand that location settings are confusing to consumers because the Googlers themselves confess to be unaware and confused.

Google has been aware for years that its location-related settings mislead users. The failure to resolve these issues coupled with specific instances of dark patterns as discussed herein suggests that these location settings were intentionally designed to deceive users. The hallmark of dark patterns is that they are not examples of poor design, but rather thoughtful design choices intended to make use of human psychological characteristics in order to influence and change behavior.

This awareness of location tracking complexity was also made evident through emails among Googlers. In one email posted in response to the 2018 AP news story, one employee described their impressions of location tracking as follows: *"The current UI feels like it is designed to make things possible, yet difficult enough that people won't figure it out. New exceptions, defaulted to on, silently appearing in settings menus you may never see is <redacted>."* (GOOG-GLAZ-00077898 at 899). The range of settings—and the lack of clarity around what settings do what—was also commented on by Googlers. In a set of meeting notes, this deception was described: *"Some people (including even Googlers) don't know that there is a global switch and a per-device switch,"* with issues relating to *"location history [...] picking up the location from the wrong device"* or *"different places at Google that have a notion of 'primary device"*

[REDACTED]

[REDACTED] (See e.g. Compl. Ex. 260 (GOOG-GLAZ-00057339) at 339 [REDACTED])

[REDACTED] Compl. Ex. 264 (GOOG-GLAZ-00048459) at 478 [REDACTED]
[REDACTED] Compl. Ex. 265 (GOOG-GLAZ-00078761) at 761 ("retention settings . . . [REDACTED]; Compl. Ex. 266 (GOOG-GLAZ-00151516) at 517 [REDACTED] Compl. Ex.

23 (GOOG-GLAZ-00001371) at 373 ("Sundar asked that we have a 'Location' code yellow update in Leads" regarding the company's response to the AP Article); Compl. Ex. 267 (GOOG-GLAZ-00035559) at 559 [REDACTED] Ex. 268 (GOOG-GLAZ-00078652) at 652 (discussing LH/WAA interaction, including [REDACTED])

[REDACTED]; Dep. Ex. 47 (GOOG-GLAZ-00033771) at 772 [REDACTED]
[REDACTED] Compl Ex. 269 (GOOG-GLAZ-00073037) at 037–43 [REDACTED]
[REDACTED] Ex. 266 (GOOG-GLAZ-00151516) at 517 [REDACTED]

Even Jen Chai, a product manager for location in Android, could not decipher how Google’s WiFi, WiFi Scanning, and Device Location settings interact with respect to collecting/using user location. (See GOOG-GLAZ-00031017 at 019-23; 9/25/2019 Chai EUO Tr. at 275:9–277:6 (Google’s Android location settings “can be overly complicated” with respect to “recent location requests” in part because “a user cannot turn off location for Google Play Services.”). And when discussing the connections between sharing location with third party apps and Google, one Google employee remarked: “*So there is no way to give a third party app your location and not Google? This doesn’t sound like something we would want on the front page of the NYT*” (GOOG-GLAZ-00149241 at 149241). Additionally, in a new project description, data collection was described as follows: “*Today, collection of device usage and diagnostic data is smeared across 5 settings resulting in conditions that are difficult for Googlers, let alone users, to understand.*” (GOOG-GLAZ-00057940). In “employee deliberations” concerning app-level permissions and location-related features, Google software engineer, Mike Lopyrev (who I understand was involved in [REDACTED] stated, [REDACTED] (GOOG-GLAZ-00028891 at 896. See also GOOG-GLAZ-00161717 at 717 [REDACTED]

Ex. 214 (GOOG-GLAZ-00101814) at 14 [REDACTED]

The multiple levels of location settings with differing names, scopes, and impacts on the user’s experience made informed use of the system virtually impossible, even for the most sophisticated user. See GOOG-GLAZ-00017790 at 790–91 [REDACTED]

The settings themselves, along with the available reactions to the settings, reveal recognizable dark patterns. In many cases in the user interface, this technical complexity resulted in a user’s experience of the dark pattern strategy **obstruction** (“making a process more difficult than it needs to be, with the intent of dissuading certain actions”; Gray, 2018). For example, a user seeking to fully disable location tracking would have to understand the interconnections among a litany of location settings, some of which did not directly include the word “location,” and then use this knowledge to interact with dozens of screens (see Appendices 3-9) to ensure that location tracking was not enabled—only it turns out that fully disabling Google’s collection and use of their location is impossible. Additionally, these interactions and awareness of system complexity also result in a user’s experience of the dark pattern strategy **sneaking** (“attempting to hide, disguise, or delay the divulging of information that is relevant to the user”; Gray, 2018). A user’s assumption that “off means off” or that LH controls all location

tracking would lead them to be surprised if they later found out their location data is still being collected.

As Senator Blumenthal tweeted on August 14, 2018, in response to the AP Article: “*It should be simple—‘off’ means ‘off.’ Google’s relentless obsession with following our every movement is encroaching & creepy. I’ve called for an FTC investigation into its persistent privacy invasions.*” (<https://twitter.com/SenBlumenthal/status/1029407493544390656>). Again, this sentiment was fairly universal in the public reaction. But when “Off” could mean less revenue for Google, it employs dark pattern strategies to “persuade” users to do things they might not otherwise do.

As another example, Emily Dreyfuss of Wired, *Google Tracks You Even If Location History’s Off. Here’s How to Stop It* (August 13, 2018), quotes Alan Butler from the Electronic Privacy Information Center as follows: “*If Google is representing to its users that they can turn off or pause location tracking but it’s nevertheless tracking their location, that seems like textbook deception to me.*”

VIII. Google’s UI and Related Location Collecting Practices Contain Specific Dark Patterns

UI elements that users rely upon to alter a range of location settings have included specific dark patterns that impact users’ ability to make an informed and educated decision. For example, these dark patterns inhibit a user’s ability to discern differences between LH and WAA settings or the WiFi Scanning and WiFi connectivity settings, obstruct users from accessing a commonly-used Location Master control on the Quick Settings (“QS”) tile, and deceive users into believing that their location is not being tracked when the LH, WAA, and other location controls were disabled even though Google still has access to location through other settings and services, like its IPGeo product and “loopholes” in its backend.

Google’s Response to the AP Article

On August 13, 2018, the Associated Press published a news article on Google’s location tracking practices titled “Google tracks your movements, like it or not.” (Dep. Ex. 3). Prior to the publication of the AP Article, Google’s Location History Help Center Page read, “*With Location History off, the places you go are no longer stored.*” (*Id.* See also 7/11/2019 McGriff EUO Tr. at 147:5–149:19 (explaining that Dep. Ex. 11 (GOOG-GLAZ-00000927) was one of two versions of the LH help page disclosed immediately after the version depicted in Exhibit 8, which predated the AP article)). However, this recitation was not true, since [REDACTED] (GOOG-GLAZ-00029585; GOOG-GLAZ-00234771; GOOG-GLAZ-00001288 (“*if you have Web and App Activity enabled and the location toggle enabled, then your search history entries contain your approximate location at the time you made the query*”); GOOG-GLAZ-00069965 at 965 [REDACTED] 11/16/2021 Nielson Decl. ¶¶ 74-80, 98-108).

Through its employees and internal documents, Google confirms the AP Article’s thesis: “Google tracks your movements, like it or not.” (See 7/11/2019 McGriff EUO Tr. at 139:13–17) (“Q. When Location History is turned off, does that affect whether Google stores location data for purposes of other products other than Location History? A. No.”); GOOG-GLAZ-00028891

at 894–95 [REDACTED]

[REDACTED] GOOG-GLAZ-00163209 at 213 (“*Speaking as a user, WTF? More specifically I **thought** I had location tracking turned off on my phone. However the location toggle in the quick settings was on. So our messaging around this is enough to confuse a privacy focused Google-SWE. That’s not good.*”)).

After the AP Article was published, I understand Google went into a sort of crisis mode, causing some in the company to “*freak out that this could be our Cambridge Analytica moment.*” (GOOG-GLAZ-00313082 at 092). Google later changed the Help Center page for Location History to remove the statement: “*With Location History off, the places you go are no longer stored.*” (GOOG-GLAZ-00000927; GOOG-GLAZ-00001374 (Monsees writing in an internal email on August 13, 2018 that Google was working on “*a series of work threads in flight focused on reducing user confusion and increasing transparency*”); 7/11/2019 McGriff EUO Tr. at 147:5–149:19, 340:2–341:9).

It is notable here that Google’s solution—removing the statement from the LH page—did not address the heart of the problem. That is, Google continued to collect location information, even when the setting called “Location History” is off. Google still continues to collect location data through a setting called “Web & App Activity,” which is enabled by default. Google did not modify the disclosures for “Web & App Activity” until much later, but even then, Google did not provide the disclosures to the millions of users whose WAA setting was already enabled. Nor did Google change the default of the WAA setting.

Again, in an internal email thread from around August 14, 2018, Google’s own employees discussed the AP Article and demonstrated their own confusion regarding Google’s settings. In that thread, a Googler named [REDACTED] wrote: “*Although I know it works and what the difference between ‘Location’ and ‘Location History’ is, I did not know that Web and App activity had anything to do with location. Also seems like we are not very good at explaining this to users.*” (GOOG-GLAZ-00001288 at 289). In response, Google software engineer [REDACTED] wrote in the same thread, “*Indeed we aren’t very good at explaining this to users. Add me to the list of Googlers who didn’t understand how this worked an [sic] was surprised when I read the article. Of course, we shouldn’t have to explain this to users. The real failure is that we shipped a [user interface] that confuses users and requires explanation.*” (*Id.* at 290). Googler [REDACTED] then replied, “*The complaint in this article is that if you have Web and App Activity enabled and the location toggle enabled, then your search history entries contain your approximate location at the time you made a query. It’s also not possible to remove them by clearing your location history, which is counter-intuitive – you have to clear your search history instead.*” (*Id.* at 288). Mario Callegaro, yet another Google employee, later chimed in, “*Definitely confusing from a user point of view if we need googlers [to] explain it to us.*” (*Id.* at 289). In a separate email thread of August 13, 2018, Googler Chris Lopez wrote, “*I agree with the [AP] article. Location off should mean location off, not except for this case or that case.*” (GOOG-GLAZ-00001266 at 270).

Google held an “Oh Shit” meeting the Monday after the publication of the AP Article to discuss the article. GOOG-GLAZ-00001521 at 523. In an email thread discussing that meeting, Google’s Director of Communications and Public Affairs wrote “*Both comms and policy are looking for an update on where we are in terms of fixing “location history” fixes [sic] and having one single place to turn off instead of 3.*” (Id.). [REDACTED]

[REDACTED] (See e.g. GOOG-GLAZ-00001371 at 373 (Pichai called a “code yellow” meeting to get updates on the issues discussed in the AP Article from Google’s Senior Vice President of Geo and Maps, Jen Fitzpatrick)).

I also note that Google was first approached by the AP journalist (Mr. Nakashima) more than two months before the article was published. ((GOOG-GLAZ-00313082 at 084). Key Google personnel were also aware of the Shankari blog post that triggered the AP investigation even before they were approached by Mr. Shankari. (GOOG-GLAZ-00313082 at 084). The AP reporter apparently fell “off the radar for a month” before re-appearing. (GOOG-GLAZ-00313082 at 084). Even after these issues were raised—but during the time that the AP reporter fell off the radar—there was no direction by CEO Pichai for a “location” code yellow update. (Fitzpatrick Dep. at 90:15-20). It is my opinion that the incorrect statement in Google’s Location History Help Center page points towards deception on the policy level (*i.e.* that location was still being tracked) and *sneaking* on the UI level (*i.e.* that location controls did not indicate that a user’s location was still being tracked through other means). This is bolstered by the fact that the day following the publication of the AP article, [REDACTED]

[REDACTED] (GOOG-GLAZ-00001458 at 464-65).

[REDACTED] (GOOG-GLAZ-00001458 at 466).

LH and WAA (as Well as Other Location-Related) Controls Are Indistinct and Confusing

As indicated by findings from internal user studies and discussions by Google employees, the user interface to control location settings is deceptive and misleading. In response to the AP Article, Marlo McGriff, whom I understand is the product manager for Location History at Google, stated: “*The spirit of the article – that our existing location controls are not as intuitive as they could/should be – is correct.*” (GOOG-GLAZ-00311963), while also mentioning ways Google was seeking to increase transparency through “*single-click links to view and manage settings where possible.*” (GOOG-GLAZ-00311963). This potential for user deception was apparent to Google employees as indicated in a response to the AP story, where one comment on an internal document indicates “*the LH controls do not manage *all* location storage and a user might assume they do.*” (GOOG-GLAZ-00313060 at 63). Further, as discussed above, these were apparent to key Google personnel (up to the CEO) for many years before the 2018 AP article. Also, beyond the lack of intuitive controls, there was also significant naming deception regarding the purpose and scope of specific settings, or whether users could even control the collection of user location data through certain settings at all.

David Monsees, whom I understand is the product manager for WAA at Google, states in an email regarding WAA: *“In no way am I saying the names are great, they do cause a bit of confusion (e.g., how do you tell a user how to turn on sWAA). WAA would be great if it was called something like, “stuff you do with Google”, but there is a lot of blur.”* (GOOG-GLAZ-00312069). Monsees similarly expressed concerns regarding the information stored (as opposed to simply collected) through WAA. (GOOG-GLAZ-00107030) at 030 (“The general takeaway is that no one know [sic] what is currently written to Footprints¹⁸ or why.”). Even with WAA off, an email from Google employee Chris Ruemmler indicates that *“The WAA and other controls imply we don’t log the data, but obviously we do. We need to change the description to indicate even with the [WAA] control off, Google retains this data and uses it for X purposes”* (GOOG-GLAZ-00312075 at 075). In this same email, Ruemmler indicates that the wording used to describe the activity controls is *“very deceptive,”* and suggests that Google perform studies *“to see what customers think is happening with their data when they disable these controls [...] and know if what is written is being properly interpreted by our users. I have a fear it most likely is not.”* (GOOG-GLAZ-00312075 at 075). [REDACTED] (e.g., GOOG-GLAZ-00099239; GOOG-GLAZ-00057861; GOOG-GLAZ-00275934).

This deception extended to the user’s understanding of WAA, where Google did not disclose the fact that WAA relates to location tracking using naming conventions and user controls that were known to be confusing ((GOOG-GLAZ-00149867) at 868 (*“The complaint in this article is that if you have Web and App Activity enabled and the location toggle enabled, then your search history entries contain your approximate location at the time you made a query. It’s also not possible to remove them by clearing your location history, which is counter-intuitive – you have to clear your search history instead.”*); GOOG-GLAZ-00312069; GOOG-GLAZ-00275934). Google’s own employees were unaware that WAA collected user location data. (GOOG-GLAZ-00001288 at 289 (*“Although I know it works and what the difference between ‘Location’ and ‘Location History’ is, I did not know that Web and App activity had anything to do with location. Also seems like we are not very good at explaining this to users.”*)). Until as late as mid-2018, Google’s disclosures when a user created a Google account made no mention that Google collects user location data through WAA—a setting that is defaulted to “on.” (7/12/2019 Monsees EUO Tr. at 175:7–15, 374:1–13).

Over time, Google has changed the precision with which user location data is collected via WAA. Prior to 2014, Google would collect “coarse” location from users through WAA (7/12/2019 Monsees EUO Tr. at 182:23–194:12). In 2014 or 2015, Google began collecting precise location data through the WAA setting (*Id.* at 183:24–184:10; (GOOG-GLAZ-00084080) (March 2019 launch description of the coarsening change). I have not seen any disclosures to users that these changes occurred. (*See* 7/12/2019 Monsees EUO Tr. at 195:11–205:22; Google’s 2/21/2020 Responses to CIDs 1-3 at 925-95, Google’s 4/30/2020 Responses to Fourth CID at 12-

¹⁸ I understand Footprints is the database where WAA data is stored. (7/12/2019 Monsees EUO Tr. at 69:15-18).

13). I understand that the motivation for collecting more precise user location data in 2014 or 2015 was, at least in part, the desire to “increase[e] the accuracy of locations served on Search and Ads, in turn improving the search experience and increasing Ads revenue.” (GOOG-GLAZ-00106193 at 194).

Even if users were aware that WAA related to location tracking, Google still logged location data through many other means (GOOG-GLAZ-0031207). In fact, I understand Google’s [REDACTED] and [REDACTED] team is devoted to collected user location data in a manner that is completely unaffected by any user settings—stated another way, despite Google’s plethora of location settings, users cannot opt out of [REDACTED] (9/13/2021 Eriksson Dep. Tr. at 174:10-12, 179:22-180:2; 11/16/2021 Nielson Decl. ¶ 111). Not only is user location data collected when signed-in users disable WAA, but that location data is then stored to [REDACTED] [REDACTED] (GOOG-GLAZ-00077413 at 413). Other settings, like WiFi scanning and Bluetooth scanning, are similarly used to collect location information. (9/25/2019 Chai EUO at 83:14-85:15, 8622-88:3).

All of these instances of deception contributed to a user’s lack of awareness and control over where and how their location data was being tracked and used. In my opinion, these instances of deception regarding users’ understanding of whether or not they had successfully managed or disabled location tracking were further complicated by the presence of specific dark patterns in the UI.

I have also identified key task flows relating to a subset of these location settings to provide context in how a user might locate (or try to locate) a relevant setting or information across multiple screens in the UI (Appendices 3-9). For this portion of my analysis, I relied upon images of the Android UI set-up and settings from 2017 and 2018 as included in Australian court proceedings against Google (GOOG-GLAZ-00299199). I am not aware of any differences between the Australian and U.S. versions of these screens, and neither is Google’s counsel aware of any such differences. As indicated in an email thread sent on August 4, 2021 with subject line “RE: AZ v. Google - Rule 26.1(c) Meet and Confer re ESI” from Google’s counsel, Joshua D. Anderson stated: “*You asked if there were differences between the ACCC screenshots and the screens available to US users. We said there were likely differences in language between the Australia disclosures and those in other countries, and that we did not know whether there were further differences.*” I reserve the right to prepare additional demonstratives (whether related to LH, WAA, or other settings and disclosures), including with screenshots from the Australian litigation and other documents produced in this litigation. My analysis is not dependent on language that is likely to be regionalized. To the extent any differences in the UI come to light, I reserve the right to amend my analysis.

The screenshots in Appendix 3 are screenshots from screens that an Android user would see when navigating to the WAA settings from the Google Account settings panel (shown in Appendix 6). These screenshots were copied from the screenshots that Google produced in the Australian litigation. The screenshots included in the appendices illustrate several instances of Google’s use of dark patterns.

First, Google employs dark patterns through the use of confusing terminology that requires the user to intuit that location data is not only contained within Location History. This is indicative

of the dark pattern strategy *sneaking* (“attempting to hide, disguise, or delay the divulging of information that is relevant to the user”; Gray, 2018). As shown in the WAA task flow (Figure 2), the WAA setting (GOOG-GLAZ-00299199 at 308) includes no indication in the name or setting description that this automatically opted-in setting tracks location data. This modification of the choice architecture relies on a manipulation of the information flow that has a deceptive impact (in that it “induce[s] false beliefs in users either through affirmative misstatements, misleading statements, or omissions”) and hides important information (“obscur[ing] or delay[ing] the presentation of necessary information to users”) (Mathur, Kshirsagar, and Mayer 2021).

Second, the use of opt-in by default for WAA automatically tracks users’ location data, possibly without their knowledge.¹⁹ Because there is no action required here, the user is likely to preserve a default and pre-selected setting. This pre-selection is an example of the dark pattern strategy “*forced action*” (“requiring the user to perform a certain action to access (or continue to access) certain functionality”; Gray, 2018), which could also be the dark pattern strategy *sneaking*, if the user is only later made aware that WAA control includes location tracking when the setting is paused and then re-enabled (GOOG-GLAZ-00299199 at 309 to 310). This modification of the choice architecture relies on a manipulation of the decision space through a restrictive and covert approach that “eliminate[s] certain choices that should be available to users” and “hid[es] the influence mechanism from users” (Mathur, Kshirsagar, and Mayer 2021).

Third, there is also indistinction regarding the number of location settings that are distributed across account, device, and app-specific contexts. The WAA setting included no reference to location tracking even when it was paused and re-enabled (according to GOOG-GLAZ-00299199 at 309). Additionally, the LH setting does not reference that Location History is not the only place to control location tracking. The LH setting can be accessed through at least three different parts of the UI, including the initial account set-up process (Appendix 4), Google account-related settings (Appendix 3), and device settings (Appendix 7).²⁰

The “Location” setting screen of an Android device is shown in Appendix 7. This screen is reached by navigating through the pages shown in Appendix 6 (ending with page 292). On this page, the device location switch is present alongside controls that impact the level of accuracy (Mode), Location History, Scanning, and App-level permissions (GOOG-GLAZ-00299199 at 292). Importantly, WAA controls are not present on this screen, which would lead a reasonable user (especially the least sophisticated user) to conclude that WAA does not relate in any way to location tracking. This absence of all comprehensive location-related controls on this page constitutes an example of the dark pattern strategies *obstruction and sneaking*, since they make it more difficult to control all instances of location (and may lead to the user concluding that all

¹⁹ As discussed above, [REDACTED]
[REDACTED]
GOOG-GLAZ-00001458 at 466.

Id.

See also a set of Oracle white papers that describes multiple ways that Google collects location data on device and beyond the device—for instance, through WiFi and Bluetooth beacons.

relevant location settings are on a settings page marked “Location”) and may result in the use of user location data in ways that are only realized through other means (see “Off means coarse” section below). This modification of the choice architecture relies on a manipulation of the information flow by “obscur[ing] or delay[ing] the presentation of necessary information to users” regarding the role of WAA in managing location tracking, resulting in the potential of confusing or deceiving users through misleading omissions (Mathur, Kshirsagar, and Mayer 2021).

When users paused LH prior to 2018, they were shown text that read, “[W]hen you pause Location History, places you go with your devices will stop being added to your Location History map.” (GOOG-GLAZ-00000150 at 151; 7/12/2019 Monsees EUO Tr. at 291:14–293:14; GOOG-GLAZ-00001366) at 366 (disclosure changed in August 2018)). Users who paused LH after the end of 2018 were met with six paragraphs of text, including the statement “location data may be saved as part of activity on Search and Maps when your Web & App Activity setting is on.” (GOOG-GLAZ-00000150 at 155). In neither of the aforementioned disclosures does Google disclose that location collected through WAA may be as precise as that collected through LH.

Further, as mentioned above, none of the disclosures address the dark-patterns problem raised by the AP Article—namely, that Google has continues to collect location data through WAA (which is on by default) even when the user’s “Location History” has not been enabled.

Google Account Set Up

Once a user purchases an Android device, in order to meaningfully use the device, they are required to “set up” the device by creating or logging into a Google account. (See GOOG-GLAZ-00000058 at 93 (“*Without a Google Account, you won’t be able to: Download apps, music, games, and other content from Google Play; Back up your apps to Google, and sync Google services like Calendar and Contacts with your device; Activate device protection features.*”)). In the initial account setup (Appendix 4), options to change WAA and LH settings are only shown if the user clicks on “More Options” and scrolls down to view the first entry: “Web & App Activity” (the setting text does not indicate that WAA is related to location tracking unless they click on the “Learn more” text underneath the setting; GOOG-GLAZ-00299199 at 257 and 261).²¹ And until early or mid-2018, the account creation disclosures completely omitted any reference to the fact that WAA collects and stores location data. (7/12/2019 Monsees EUO Tr. at 373:18–374:13). Therefore, users who setup their accounts before 2018 could not have seen a disclosure that WAA collects user location data. (*Id.* at 381:16-23). If the user continues to scroll down, they are also shown Location History settings, which describes similar location tracking in the main text and if the user clicks on the “Learn more” text (GOOG-GLAZ-00299199 at 259 and 262). There is no implied or actual connection in this consent flow to the fact that both WAA and LH control location; the user would only

²¹ See Google’s 4/30/2020 Responses to Fourth CID at 21-22 for a nonexhaustive list of the default state of various settings during the setup process. Notably, the setup process prior to 2018 provided no disclosures about WAA or LH whatsoever. (See generally GOOG-GLAZ-00203120; Google’s 4/30/2020 Responses to Fourth CID).

become aware if they clicked on the Learn More text for WAA and carefully read the description. This is an example of the dark pattern strategies **sneaking and obstruction**, since these UI choices dissuade the user from disabling WAA and they disguise or delay information that might cause the user to make a more informed and transparent choice. This modification of the choice architecture relies on a manipulation of the decision space through a restrictive approach that “eliminate[s] certain choices that should be available to users,” while also manipulating the information flow by hiding important information that is necessary and pertinent for the user to make an informed decision (Mathur, Kshirsagar, and Mayer 2021).

Indeed, when asked about the WAA setup screenshots depicted in Appendix 5, Mr. Monsees acknowledged that those disclosures (which now contain a statement regarding location) were not implemented before 2018. (*Id.* at 318:14-22). Notably, the screens shown in Appendix 5 would not be seen by users unless they first disabled WAA and then re-enabled the setting. (*Id.* at 309:24-310:7). (See also AP Article at 6 (“Google offers additional information in a popup that appears if you reactivate the [WAA] setting—an uncommon action for many users, since this setting is on by default.”)). This lack of visible disclosure during setup exemplifies the dark pattern strategy of **sneaking**, since the user would not have access to information regarding the setting’s relationship to location tracking unless they first located the setting and then disabled and reenabled it. Additionally, the fact that WAA defaulted to on—with a disclosure only appearing after the setting is changed twice (first off and then on again)—constitutes an example of the dark pattern strategy **interface interference**, due to its reliance on pre-selection and lack of visual indication of a disclosure—or disclosure as potential part of feedforward—that is only triggered through multiple changes to the setting.

Similarly, when users set up their Google accounts, Google puts much effort into convincing users to turn on location history (and to leave on WAA), even when doing so is unnecessary for the operation of the device or specific app or services. (See GOOG-GLAZ-00299120 at 139:12-35 (Testimony from David Monsees in an Australian litigation that even with LH off, Google Maps can still be used “in a way where it knows where you are and delivers you relevant map results to assist you in that request you’ve made.”), (discussing ways users are prompted to opt into LH: “there are a variety of consent surfaces, including promotion in Google Maps where a user might be invited to get a more personalised map. If you access the Google Maps timeline, . . . it would have an option or a promo to turn on location history setting, and I believe Google Photos also included a [sic] opt-in flow for location history.”)). This is an example of the dark pattern strategies of **sneaking and interface interference**. These approaches to convince users to enable LH foreground without also indicating privacy or security considerations of this choice could be construed as a delayed disclosure that could impact a user’s choice. Additionally, the consent page for LH itself is yet another example of the dark pattern strategy **interface interference**, as it includes a blue button containing “Yes I’m In,” to opt into LH, but the opt out button is greyed out, suggesting the only way to proceed with using the phone as desired is to opt into LH. (See GOOG-GLAZ-00195364).

In the Google account-related settings on an Android device (Appendix 6), the location-related controls are buried within a long chain of screens, requiring the user to click on Settings, select

“Google services and preferences,” click on “Google Account,” and select “Activity controls” (GOOG-GLAZ-00299199 at 282, 286, 304, 306)—only then getting access to “Web & App Activity” and “Google Location History” settings options (GOOG-GLAZ-00299199 at 307).²² This task flow does not indicate any control over location settings until the user has navigated four screens deep into the Google account settings interface, representing the dark pattern strategy *interface interference* (“manipulation of the user interface that privileges certain actions over others”; Gray, 2018). Inasmuch as this complicated task flow reduces the user’s likelihood of accessing these settings or reduces the user’s awareness that device and account-level settings are distinct, these UI choices represent the dark pattern strategy of *obstruction*, since it makes it more difficult than it needs to be to either locate or determine the scope of location control settings. Indeed,

[REDACTED] (GOOG-GLAZ-00078009 at 037. This modification of the choice architecture relies on a manipulation of the decision space through a restrictive approach that “eliminate[s] certain choices that should be available to users” and manipulates the information flow by “obscure[ing] or delay[ing] the presentation of necessary information to users” (Mathur, Kshirsagar, and Mayer 2021).

Google’s Public WAA and LH Disclosures

In Google’s public webpage titled “Manage your Android device’s location settings,” Google lists LH as one of the location-based services, yet makes no mention of the fact that the WAA setting also collects and stores location data. (GOOG-GLAZ-00001105 at 105). This omission of WAA from the list of settings that collect location data continued at least until at least November 30, 2018. (See Google’s May 25, 2018 Privacy Policy, at 3–4, 20; Ex. 297 (Internet Archive Decl. at Ex. A 5-8 (instructing users how to “turn your location on or off,” but failing to mention WAA)). After the publication of the AP article, the “Update your location on Google” page included text telling users how to “Stop sharing your location,” yet again, Google omitted the fact that location data is collected through WAA. (Appendix 8).

Google’s Help Center page titled “Control how your activity across the web is saved & used” discusses how WAA “Make[s] it easier for you to see and control activity that’s saved to your account and how it’s used,” yet (again) makes no mention of how WAA is used to collect location data. (GOOG-GLAZ-00000885 at 885). However, on that same page, Google describes the functionality of WAA without ever disclosing the relationship of the functionality to WAA. (*Id.* at 87). I understand that, during the State’s pre-suit investigation, Google was asked to identify (and failed to do so) any disclosure during the set-up process for accounts created before 2018 that WAA collects user location data. (See Google’s 2/21/2020 Responses to CIDs 1–3) at 98). After the AP Article was published, Google disclosed WAA’s collection of user location

²² Until Android Q, users could not access the WAA and LH settings directly on their phones; instead, they had to access the device settings, click on a Google link that directs them to their Google account page, then navigate to the WAA setting. (7/12/2019 Monsees EUO Tr. at 164:16-166:19, 373:18–374:13).

data in an obscure page titled “See & control your Web & App Activity,” a disclosure that requires a user to locate the relevant page (that the user would have no reason to search for in the first place), then scroll to and click on an “Info about your searches & more” link.

Until as late as November 30, 2018, Google’s Privacy & Terms page made no mention of WAA. (Ex. 297 at Ex. A 11-12). Rather, the vast majority of information contained on that page described collection of user location data through LH. (*Id.*). The Privacy & Terms page made no mention of the fact that Google changed the collection of location data through WAA to be precise in 2015. 7/12/2019 Monsees EUO Tr. at 195:11–205:22 (Google did not make “any changes to the privacy policy, terms and conditions, help desk or help center website . . . that reflected the change.”); Google’s 2/21/2020 Responses to CIDs 1–3 at 92–95 (“The relevant parts of Google’s Privacy Policy have not been updated in the timeframe inquired about.”). As a result, the only way a user could determine WAA’s location collection precision had increased would be to view their My Activity data and discover that the precision had suddenly increased. 7/12/2019 Monsees EUO Tr. at 205:4–23 (confirming he was not aware of other methods)).

The lack of clarity of the role of WAA and LH relating to location tracking is an example of the dark pattern strategies *sneaking and forced action*. First, since the functionality of WAA settings in controlling location tracking was not disclosed to users prior to 2018, the users were both deceived into believing they had control over their location data through other settings, while also being unknowingly *forced* into contributing their location data through WAA—a setting that was enabled by default. Further, even once a disclosure was made after the AP article was published that related to location tracking and WAA, the disclosure was posted on a page that was difficult to access, requiring the user to navigate through multiple links to discover that their location data was being tracked via the WAA setting—an example of the dark pattern strategy *sneaking*. This modification of the choice architecture relies on a manipulation of the decision space through a restrictive approach that “eliminate[s] certain choices that should be available to users,” while also manipulating the information flow by hiding important information that is necessary and pertinent for the user to make an informed decision (Mathur, Kshirsagar, and Mayer 2021). Further, I noted that any changes made to the disclosure would not likely be seen by pre-existing accounts, especially given the default settings.

IPGeo

IPGeo (released as early as November 2009) is an internal service at Google that infers user location from their IP address. *See* GOOG-GLAZ-00222226; 11/16/2021 Nielson Decl. ¶¶ 98–103. In addition to IPGeo, I understand Google has an internal product called [REDACTED] which operates similarly to IPGeo in that it [REDACTED] (*Id.* ¶¶107–113; GOOG-GLAZ-00224647 at 647). I understand that, even if every setting on an Android device were disabled Google would still collect a user’s location data through IPGeo and [REDACTED]. *See* 9/13/2021 Eriksson Dep. Tr. at 174:10–12 (“[REDACTED] as IPGeo, translates the IP to location. It’s independent of settings.”); 11/16/2021 Nielson Decl. ¶¶ 104–105). Because IPGeo and [REDACTED] are “independent of settings,” users cannot opt out of IPGeo or [REDACTED]. 9/13/2021 Eriksson Dep. Tr. at 174:24–25; GOOG-GLAZ-00224739 at 741–743 [REDACTED]

[REDACTED] (emphasis in original); 11/16/2021 Nielson Decl. ¶¶ 104-105, 115-120. This appears to be a design choice by Google. For example, in a PR Communications Document, a Googler wrote, “*None of our systems are built to work as though there's something which the user wishes us not to know. If our systems can infer the information some other way we do nothing to prevent that and in fact actively attempt to do that in some cases such as IPGeo.*” GOOG-GLAZ-00313060 at 067.

Blake Lemoine—a Senior Software Engineer at Google—described IPGeo as follows:

[REDACTED]
[REDACTED] (GOOG-GLAZ-00234771 at 772).

[REDACTED] The [REDACTED] product at Google appears to involve two groups of individuals: a “reporter,” who reports his or her device location (which is mapped to a WiFi access point), and a “user,” who does not have device location enabled, but is connected to the same WiFi access point. GOOG-GLAZ-00224647 at 647; 9/13/2021 Eriksson Dep. Tr. at 170:22-24, GOOG-GLAZ-00224739 at 746; 11/16/2021 Nielson Decl. ¶¶ 107-113.

I understand that Google keeps IPGeo and [REDACTED] from the public eye and has attempted to seal (many times successfully) the name of the products and their functionalities throughout this case. Indeed, until as late as May 25, 2018, Google’s disclosures made no mention of the fact that it determined user location through IP address. (See May 25, 2018 Google Privacy Policy²³). Even there, Google suggests that some combination of settings could prevent the transmission of location data to Google through IPGeo. (See *id.* (“The types of location data we collect depend in part on your device and account settings.”).²⁴ Further, Google’s description of location collection through IP addresses omits any description of the fact that Google commissions user phones to build a map of IP addresses through IPGeo and the fact that “reporters” location can be used to ascertain the location of “users.” (See *id.*).

As a result, and as insinuated by Mr. Lemoine, users are unlikely to be aware that Google has “turned IP addresses into a pervasive worldwide location tracking system for anyone with an Android phone.” (GOOG-GLAZ-00315032 at 034). In fact, Mr. Lemoine noted in June 2018 that a Berkeley computer science student turned off “location history, device location, web and app activity and every single other permission off,” but Google still served him accurate location-based content. *Id.* Given the dearth of publicly available information on Google’s IP to location translation, the Berkeley student **ruled out IP address** as the source of his location data. Vint

²³ <https://policies.google.com/privacy/archive/20180525>

²⁴ See also “Google collects Android users’ locations even when location services are disabled,” available at <https://qz.com/1131515/google-collects-android-users-locations-even-when-location-services-are-disabled/#:~:text=Quartz%20observed%20the%20data%20collection,according%20to%20a%20Google%20spokesperson.>

Cerf—a “VP, Chief Internet Evangelist” at Google since 2005²⁵—wrote in a June 29, 2018 email thread that Mr. Lemoine “*makes a good point that we appear to be tracking even when users have turned off what they think and we imply are tracking mechanisms.*” *Id.* Lemoine himself noted in a response to Cerf that while Google’s reasoning was that “*location information derived from IP addresses is an inescapable part of the internet so we don’t need users’ permission to use it,*” he “*believe[d] that the level of accuracy of [Google’s] IPGeo system is far beyond anything achievable based solely on the location information inherent in IP addresses*” which amounts to “*deceiving users by telling them they can turn off location and then spend[] millions of dollars to infer their location through other means.*” *Id.*

In my opinion, offering settings that give the illusion of choice to users when, in reality, IPGeo always collects and interpolates location data through IPGeo is an example of the dark pattern strategies ***forced action and sneaking***. It is likely that most users are unaware of this level of location accuracy from IP address data alone—particularly since even the Berkeley computer science student referenced in Lemoine’s email (GOOG-GLAZ-00315032 at 034) came to incorrect conclusions regarding Google’s ability to identify accurate location information from an IP address. Since users do not have a choice whether their IP address information is used to more precisely identify their location through IPGeo, this is an example of the dark pattern strategy ***forced action***—even though the vast majority of users are never made aware that their action is being forced simply through their use of basic cellular or WiFi connectivity on their Android device. If a more technically savvy user were to become aware of Google’s IPGeo tracking capability (I am aware of no such users), this could also be an example of the dark pattern strategy ***sneaking***, since the user was not informed of this tracking ability when they purchased their device, completed the consent procedure, or used location settings to attempt to manage how and when their location data was being used by Google. As indicated in an email exchange between Googlers Lemoine and Cerf, the use of location settings gives users the apparent ability to control the collection and use of their location data, but these settings are only a decoy; instead, Google is “*lying to [its] users by giving them a permission setting that [it] then find[s] a way around*”—a decision that has considerable ethical implications (GOOG-GLAZ-00315032 at 034). This modification of the choice architecture relies on a manipulation of the decision space through a restrictive approach that “*eliminate[s] certain choices that should be available to users*” and manipulates the information flow by “*obscur[ing] or delay[ing] the presentation of necessary information to users*” (Mathur, Kshirsagar, and Mayer 2021).

A further important, but less obvious, impact of this dark pattern is that it harmfully affects not only the “user” group of individuals, but also the “reporter” groups. For example, a “reporter” who has agreed to share location with Google has not necessarily agreed to “report” location of those around them.

²⁵ Mr. Cerf is widely regarded as the “Father of the Internet” for co-designing the TCP/IP protocols and architecture of the Internet. “Vint Cerf,” INTERNET HALL OF FAME, <https://internethalloffame.org/inductees/vint-cerf#:~:text=Widely%20known%20as%20a%20%E2%80%9CFather,founding%20and%20developing%20the%20Internet.>

Removing Location from the QS Tile

The Quick Settings (“QS”) panel on an Android device is a panel of commonly used settings that users can quickly access by pulling down from the top of the screen. Chai EUO Tr. at 202:12–23.

[REDACTED] (GOOG-GLAZ-00026360). In my opinion, the QS location toggle was the easiest, most accessible way for a user to disable their device location due to its persistence (always available to be accessed by the user by swiping down from the top of any screen) and prominence (8-9 controls are included in the primary QS panel²⁶ as compared to the large number of settings found in other parts of the UI). Indeed, as shown in the screenshots above, a user would otherwise have to navigate through a number of screens to toggle their device location off. [REDACTED]

[REDACTED] (GOOG-GLAZ-00026768 at 772).

(See GOOG-GLAZ-00026768 at 772

GOOG-GLAZ-00027187 at 196

(discussed in Section VIII)

(GOOG-GLAZ-00026768 at 768-77).

Until around Q3 of 2018, the default position for the device location toggle was “on,” and there was nothing a user could do during device setup to turn it off (Ex. 202 (Google’s 2/21/2020 Responses to CIDs 1–3) at 20; Ex. 273 (9/25/2019 Chai EUO Tr.) at 163:13–18 (Android Q released around September 2019); Ex. 274 (2/28/2020 Berlin EUO Tr.) at 402:8-11 (“Android releases come out at a yearly clip.”)). After Q3 of 2018, the default position of the LM on Account setup was determined by another setting—Google Location Accuracy (Ex. 202 (Google’s 2/21/2020 Responses to CIDs 1–3) at 20).

[REDACTED] (GOOG-GLAZ-00026360). Internal documents indicated that [REDACTED]

[REDACTED] (GOOG-GLAZ-00026360 at 361, emphasis in original; GOOG-GLAZ-00026768 at 789 [REDACTED]

²⁶ Screenshots of the Quick Settings panel can be found in Google’s Android Quick Start Guide: https://static.googleusercontent.com/media/www.google.com/en//help/hc/images/android/android_ug_42/en-GB_Kitkat-1.11.pdf

[REDACTED] (GOOG-GLAZ-00026360 at 360). Internal documents further noted:

[REDACTED] (GOOG-GLAZ-00026360). In this same slide deck,

[REDACTED] (GOOG-GLAZ-00026772).

Google’s own Privacy Working Group²⁷ recommended [REDACTED]

[REDACTED] (GOOG-GLAZ-00026360 at 361)

[REDACTED] (GOOG-GLAZ-00026360 at 361).

[REDACTED] (GOOG-GLAZ-00005425 at 428;

GOOG-GLAZ-00028327 at 327

[REDACTED] GOOG-GLAZ-00029585 at 614; 9/25/2019 Chai EUO Tr. at 201:25–202:9).

[REDACTED] (GOOG-GLAZ-00026768 at 785).

[REDACTED] (GOOG-GLAZ-00026786).

[REDACTED] (GOOG-GLAZ-00026843 at 849). I am not aware of anyone at

Google following up with Samsung with further data.

[REDACTED] (GOOG-GLAZ-00005425 at 428) even though later internal emails

²⁷ The Privacy Working Group is “a group of individuals that provides consultation, recommendations, [and] guidelines on privacy-related matters” at Google. (9/25/2019 Chai EUO Tr. at 174:19-23, Google’s 4/30/2020 Responses to Fourth CID at 13-14).

[REDACTED] (GOOG-GLAZ-00005425 at 425). [REDACTED]

[REDACTED] (GOOG-GLAZ-

00027518 at 518; GOOG-GLAZ-00032539 at 539–40).

[REDACTED] (See GOOG-GLAZ-00032447

at 450
[REDACTED]

In my opinion, [REDACTED] is an example of the dark pattern strategies *obstruction* and *interface interference*. This decision was *obstructive* in that it specifically made turning off location tracking more difficult than it needed to be (and then it actually was in previous iterations of Android OS) with the intent of dissuading users from disabling location tracking.

[REDACTED] (GOOG-GLAZ-00026360) at 361
[REDACTED]

This decision was also an example of *interface interference* in that it relied upon knowledge and subsequent manipulation of human perception and hierarchy of functionality; even though Google knew that users extensively used the toggle when it was in QS, moving it to a deeply nested part of the settings menu or the second page of the QS panel, or requiring it to be re-added to the QS panel implied it was less important to the end user’s experience and should not be in parallel with other common actions in QS such as Wi-Fi, Bluetooth, audio controls, and screen rotation. This modification of the choice architecture relies on a manipulation of the decision space through a restrictive approach that “eliminate[s] certain choices that should be available to users” and manipulates the information flow by “obscur[ing] or delay[ing] the presentation of necessary information to users” (Mathur, Kshirsagar, and Mayer 2021).

Google Search Footer

When users perform a search using Google Search, Google currently appends a footer at the bottom of the search page that purports to inform the user how Google determined their location. (3/26/2020 Menzel EUO Tr. at 355:25-356:11). This footer does not appear to apply to Google’s Display Ads. In my professional experience as a UX researcher, when viewing search results on pages such as Google’s Search results, consumers typically click on results on the first page and are unlikely to scroll down far enough to ever see the buried disclosure in the footer. This assertion is also supported by prior research external to Google that has shown that the majority of users click one of the top five search results (e.g., Chitika Research (2013) states that over 76% of users click one of the first five results, while Hazan (2013) cites research that the top three results in 2006 “enjoyed 79 percent of clicks” and reflected on a Senate hearing that “estimated the share of the first few results to be 90 percent today” (p. 794)), making it unlikely that a large plurality of users ever scroll far enough to view the footer or become aware that this information exists.

Certain search queries can cause the footer to move even farther down the page via the introduction of additional Google-generated content, such as “Popular Places,” “People also ask,” specific locations on Maps, such as clothing stores, and “Popular Products.” To the extent the footer is intended to be a disclosure, by positioning it at the bottom of the search results page, Google prevents most users from ever seeing the disclosure or how their location data is being used to inform the search results. Evidencing this point is the fact that [REDACTED]

[REDACTED] (GOOG-GLAZ-00297712 at 17). I’m not aware of any reason Google cannot make the location information in the footer more prominent for users (i.e., by putting the disclosure at the top of the search results page), and indeed, Google considered making such a change shortly after the AP article was released (“*Moving location info from footer to header: goal is to more clearly surface when location is being used and allow faster controls*”; GOOG-GLAZ-00270334 at 35) although this change does not appear to be implemented in the current Google Search interface.²⁸

In my opinion, the positioning of the location footer is an example of the dark patterns strategies *sneaking and interface interference*. The location of the footer constitutes an example of *sneaking* in that this placement of the disclosure either delays or completely avoids communicating to the user that their location data is being used to inform their search results; if the user never scrolls to the footer where this disclosure is placed, this could also be an example of the dark pattern strategy *forced action* since the user has no awareness of a choice to disable or otherwise control this functionality. The UI elements that comprise the footer disclosure is also an example of *interface interference* since the text uses a non-standard link color (gray instead of Google’s default blue; GOOG-GLAZ-00294304 notes “*We’re making the footer more obviously a link by making the source text blue*”) which could prevent users from recognizing that the disclosure is actionable and potentially changeable. Additionally, interface interference is used by placing the disclosure in an area far below the search results that would be unlikely to be connected in terms of information hierarchy, thus making it less likely to be proximally related to the outcomes of the search. The extremely low engagement rate with the footer further supports the conclusion that its designs comprise dark patterns. This modification of the choice architecture relies on a manipulation of the decision space through a restrictive approach that manipulates the information flow by “obscur[ing] or delay[ing] the presentation of necessary information to users” (Mathur, Kshirsagar, and Mayer 2021).

WiFi Connectivity and WiFi Scanning

As mentioned above, two of Google’s many settings are WiFi Scanning and WiFi connectivity. See Section V *supra*. According to Jen Chai, the WiFi connectivity setting “*allows a connection to WiFi or cuts off a connection to WiFi,*” whereas the WiFi Scanning setting controls whether

²⁸ I understand that in February 2021, Google began placing a “location header module” at the top of the results page, only when the search on its face is location-sensitive (such as a search for “coffee near me”). GOOG-GLAZ-00298797. I understand that, for all other searches that do not implicate location, Google still obtains user location and uses the basic footer.

“system apps and third-party apps can request WiFi scans.” ((9/25/2019 Chai EUO Tr. at 91:2–7) at 117:4–118:5). These are two independent settings, each of which may be disabled by the user (see Appendix 9). In its public disclosures, Google suggests that only the WiFi Scanning setting is related to the collection of user location data. (GOOG-GLAZ-00001105 at 106 (“To help apps get better location info, you can let your device scan for nearby Wi-Fi access points . . . Tap Advanced > Scanning . . . Turn Wi-Fi scanning . . . on or off”). However, I understand that Google Location Accuracy (formerly known as Google Location Services) collects location data when *either* WiFi Scanning *or* WiFi Connectivity is enabled, and device location is enabled. (9/25/2019 Chai EUO Tr. At 88:23–89:10). Thus, when a user has turned off the WiFi Scanning, Google will still “periodically collect WiFi scans in order to build the estimated location for where WiFi Access Points are,” assuming various other settings (device location, GLA and WiFi connectivity) are on. (*Id.* At 91:2–7).

The user interface for the WiFi Scanning setting can be found within the location settings (Appendix 9), whereas the user interface for the WiFi connectivity setting itself is in a separate location. Depending on the manufacturer of the mobile device, the specific location of the WiFi connectivity setting may be different places. Because the WiFi Scanning and WiFi connectivity settings are located in different places, users are led to believe that the two functions (scanning and connectivity) are separate. Similarly, users are likely to think if they disable the WiFi Scanning permission on their device, Google will not collect, use, or store location information derived from WiFi scans. Google’s employees have recognized the indistinction between these settings, calling them [REDACTED]” and “a bit of a mess that we are working to clear up.” (GOOG-GLAZ-00031017 at 020-21). I understand, however, that as late as Android P, this “mess” was not fully fixed. *Id.* at 021. [REDACTED]

In my opinion, the lack of clarity and potential for user deception regarding the user controls for controlling WiFi scanning and its relationship to Google’s tracking of a user’s location is an example of the dark pattern strategies *sneaking and forced action*. The decision to separate UI elements relating to the control of [REDACTED] is an example of sneaking, because this design choice could lead users to believe that they have successfully disabled location tracking relating to WiFi connectivity when turning either of these separate controls off. Additionally, Google’s use of WiFi to identify a user’s location even when the related setting is turned off and Google’s enablement of apps to request a WiFi scan that reveals a user’s location, even when they have device location turned off, constitutes an example of forced action. Even if the user becomes aware that their location is being tracked, the user has no recourse to limit or control location tracking relating to WiFi without fully disabling WiFi functionality on their device. This modification of the choice architecture relies on a manipulation of the decision space through a restrictive approach that “eliminate[s] certain choices that should be available to users” and manipulates the information flow by “obscur[ing] or delay[ing] the presentation of necessary information to users” and deceptively “induc[ing] false beliefs in users either through affirmative misstatements, misleading statements, or omissions” (Mathur, Kshirsagar, and Mayer 2021).

Collection of User Location Data Even When Relevant Permissions Are Disabled

Backend Location Sharing

Before around October 2015, when Android Marshmallow was publicly released, I understand that Google implemented an “install-time” permission model wherein permission to collect user data was sought only at the time of installation. (See 9/25/2019 Chai EUO Tr. at 215:3-216:7; 11/16/2021 Nielson Decl. ¶ 89). Google has since moved to a “run-time” permissions model that allows users to alter their settings after installation. (9/25/2019 Chai EUO Tr. at 215:3-216:7; 11/16/2021 Nielson Decl. ¶ 90). This run-time permission model suggests to users that, by denying an app permission to collect location data, the app would be prohibited from accessing user location data. (See GOOG-GLAZ-00000381 at 381 (help page stating users “*can control which apps can see and use your phone’s location. For example, you could let Google Maps use your phone’s location to give you driving directions, but not share the location with a game or social media app.*”); 11/16/2021 Nielson Decl. ¶ 90).

This suggestion that apps cannot access user location when permissions are disabled is, however, incorrect, because

GOOG-GLAZ-00005829 at 829– 32

GOOG-GLAZ-00060013 at 013

GOOG-GLAZ-

00198467 at 469

(GOOG-GLAZ-

00114667) at 667–68 (Google’s chat bot, GBot, is

11/16/2021 Nielson Decl. ¶¶ 91-97). I understand is Google’s internal service that provides user location data to “clients,” *i.e.* other Google apps and services, such as ads products. (11/16/2021 Nielson Decl. ¶¶ 92, 123).

Backend sharing of user location data among Google’s apps was known by Google employees for years. For example, on March 24, 2017, Mike Lopyrev—a Senior Staff Engineer at Google at the time—emailed other Googlers describing Android permissions as

GOOG-

GLAZ-00005829 at 831. According to Mr. Lopyrev, “*this loophole existed for 2+ years*” as of 2017, a time that was Google’s “*chance to fix it.*” GOOG-GLAZ-00027501.R at 507.R. Yet for at least another year, See GOOG-GLAZ-00033771 at 772 (discussing

Moreover,

See *e.g.* GOOG-GLAZ-00027697 (describing

In my opinion, these “loopholes” that enabled Google to collect and use location data even when the user explicitly disabled location tracking through various combinations of settings is an example of the dark pattern strategies *sneaking and forced action*. Google’s knowledge that apps were able to discern a user’s location through backend sharing without transparency to the end user is an example of *sneaking*, since users are not made aware that location data from one app might be used by another app without additional opportunities to decline this access. In addition, since these permission issues were built into the code of Android OS, there is no way for a user to manage location settings on their device on a granular level without fully disabling location tracking, with the potential for a user’s location to become known to apps they have never explicitly authorized to receive location data. This is an example of *forced action*, since users are not given any choice in whether or how their location data is distributed among apps via backend sharing, and even if they become aware, there is no way to disable this behavior without turning off key connectivity functions. This modification of the choice architecture relies on a manipulation of the decision space through a restrictive approach that “eliminate[s] certain choices that should be available to users” and manipulates the information flow by “obscur[ing] or delay[ing] the presentation of necessary information to users” (Mathur, Kshirsagar, and Mayer 2021).

Collecting Location Information as if “Off Means Coarse”

Google has changed its strategies with regard to location settings over time in response to both increases in technical capacity (e.g., IPGeo) and different levels of setting or permissions granularity (e.g., shifting from static to dynamic app permissions; the use of device, account, and app-level settings to manage location use and collection), as well as potentially in relation to public pressure. In relation to this complex and changing landscape, as revealed through the framing of internal research studies on [REDACTED]

[REDACTED] (GOOG-GLAZ-00029585 at 622), [REDACTED]

[REDACTED] (GOOG-GLAZ-00029585 at 602; see details of how coarsening occurred at GOOG-GLAZ-00290225). *See also* (GOOG-GLAZ-00055452 at 452) (“*Real people just think in terms of ‘location is on’, ‘location is off’ because that’s exactly what you have on the front screen of your phone.*”). However, [REDACTED]

[REDACTED] (See GOOG-GLAZ-00085619 (third and final phase of Off-Means-Coarse implemented in April of 2019)). Whereas Google previously inferred the more precise location available, more recently Google has implemented a policy of interpreting a users’ disabling of location tracking as “Off-Means-Coarse” (OMC): [REDACTED]

[REDACTED] (GOOG-GLAZ-00157550). The practical implication of this decision is that users who turn off device location could still receive targeted ads with coarse location (GOOG-GLAZ-00096793 at 807). The policy further had the impact of [REDACTED]

[REDACTED] (GOOG-GLAZ-00234771 at 771 to 772).

Google’s use of OMC was apparently adopted in place of a competing proposal (at some level of

unknown detail; see document referred to as “go/omo”; 03/03/2022 Fitzpatrick EUO Tr. at 53:5-17) that Off Means Off. Even though there appears to have been a serious consideration of “off means off”—which better reflected users’ mental model of location tracking and privacy—this was rejected in favor of “off means coarse.”

In my opinion, this “off means coarse” (OMC) design choice is an example of the dark pattern strategy of *forced action*, in that users have no way to fully prevent their location from being known, tracked, and utilized for advertising and other purposes. In other words, not only is the OMC behavior hidden from users, there is also no way to opt out if the user did somehow become aware that their location is coarsened (05/21/2020 Hennessy EUO Tr. At 101:6-102:16), even if they have turned location tracking off. This design choice, if conceptually understood by more technologically savvy users may also constitute the dark pattern strategy of *sneaking*, in that data is being collected at varying level of fineness or coarseness without direct user control over these settings that are not directly exposed to the user in the settings interface. The use of alternative strategies to make users less aware that Google has more location information than specific interactions might indicate (e.g., GOOG-GLAZ-00085638) is also an example of *sneaking*, where Google perhaps is aware of and tracking location data in the background but chooses selectively to not utilize this estimation of location in instances where it could raise user’s concern about being tracked. This modification of the choice architecture relies on a manipulation of the decision space through a restrictive and covert approach that “eliminate[s] certain choices that should be available to users”; the use of location tracking beyond available controls is an example of “hiding the influence mechanism from users” while restrictive modification was used by not allowing users access to a setting to indicate to Google that they did not expressly permit such use. Further, the choice architecture was modified by manipulating the information flow, resulting in the potential of confusing or deceiving users by “induc[ing] false beliefs [...] through misleading statements or omissions” and through “obscure[ing] or delay[ing] the presentation of necessary information to users” (Mathur, Kshirsagar, and Mayer 2021); users were led to believe that location tracking did not occur when the location master was off, even though Google was still able to use this data with their internal systems to identify the user’s location in relation to other Google users.

IX. Connecting Google’s Use of Dark Patterns to Business Goals

As described above, Google used multiple strategies that reduced user awareness and control over location tracking by manipulating the user’s choice architecture. I understand that Google relies upon user location data—using comprehensive internal systems that can infer location based on a wide range of signals—as a key part of its service delivery and advertising strategy.

As shown in internal strategy reports, Google has a demonstrated interest in building both their base of devices being used and the “attach rate” of those devices that provides location data, with one report describing how [REDACTED]

[REDACTED] (GOOG-GLAZ-00246795 at 797 to 800). Similarly, in his promotion rationale, Ankit Gupta (Google’s previous Team Lead for [REDACTED]) touted that [REDACTED] (GOOG-GLAZ-

00224777 at 778). Another report stated that [REDACTED]

[REDACTED] (GOOG-GLAZ-00027795 at 805).

“Location attach rate” is “the percent of devices that have the device location setting [aka the Location Master setting] on.” (9/25/2019 Chai EUO Tr. at 199:4–6). Google’s user interface plays a critical role in increasing or decreasing the location attach rate. (GOOG-GLAZ-00026481 at 481–82 [REDACTED])

[REDACTED] GOOG-GLAZ-00026768 at 769–72 [REDACTED]

[REDACTED].²⁹ In her “Getting Started Guide” as part of her onboarding, Jen Chai was told, “*Location is a critical area of Android that has a broad impact . . . on Google’s ad business and innovative advertising products*” and that [REDACTED]

[REDACTED] (GOOG-GLAZ-00026480 at 481. *See also*

GOOG-GLAZ-00026768 at 770 [REDACTED]

As yet another example, for Q4 2016, one of Google’s draft “OKRs” (or objective and key results, which are company goals set by Google (2/27/2020 Berlin Dep. Tr. at 252:1-9)), [REDACTED]

[REDACTED] (GOOG-GLAZ-00026768 at 773).³⁰ Accordingly, Google has turned users’ Android devices “*into a pervasive worldwide location tracking system.*” (GOOG-GLAZ-00315032 at 034). This is likely because, as reflected in internal Google presentations on advertisements, user location data is used in the vast majority of Google advertisements. (*See* GOOG-GLAZ-000249475 at 476; GOOG-GLAZ-00166095 at 115).

Overall, the presence of individual dark patterns I have identified appear to relate to Google’s stated desire to increase not just the “location attach rates” for device location, but also to increase and optimize all of the various settings, services and policies through which Google can collect user location data. These are examples on the system level that obscure important information regarding the tracking and use of location data (*cf.* “off means coarse”, IPGeo, WiFi Connectivity and Scanning, Backend Location Sharing), examples on the settings level that potentially confuse users regarding how various controls relate to the overall tracking and management of location data (*cf.* LH and WAA controls, WiFi Connectivity and Scanning), and examples on the interface level that discourage certain types of interactions to disable or limit location tracking (*cf.* removing the QS location setting).

Each of these dark patterns is harmful on its own and consumers cannot reasonably avoid them for the reasons explained above. However, the aggregation of so many dark patterns becomes

²⁹ See Google’s 4/30/2020 Responses to Fourth CID for [REDACTED]

Notably, that same presentation [REDACTED]

[REDACTED] (GOOG-GLAZ-00026772).

particularly pervasive and makes it practically impossible for consumers to avoid.³¹ For example, Dr. Nielson explains that Google use of IPGeo and [REDACTED] to collect information from unwilling users is present not only on Android devices, but also iOS and other platforms. (11/16/2021 Nielson Decl. ¶ 114). Hence, any transaction with Google “*becomes an opportunity for Google to collect, store, and exploit the users’ location information.*” (11/16/2021 Nielson Decl. ¶ 119).

Google creates obstructions and other dark patterns that interfere with the user’s ability to disable (or not enable) individual settings, as described above. Google then diversifies its settings for collecting location information [REDACTED]

[REDACTED] and others, each without own default and flows—so that a user who disables one can still be a source of location data through another channel. And if the user somehow manages the herculean task of navigating *all* those settings, Google still collects location information through IPGeo and [REDACTED] from which a user cannot opt-out. Taken together, this becomes the ultimate combination of *sneaking*, *interference interface*, *obstruction* and *forced action*.

These instances of dark patterns appear to directly support Google’s desire to obtain the “*next billion location users*” (GOOG-GLAZ-0081787 at 796).

X. Expert Disclosures

Colin M. Gray, 225 N 2nd Street, Unit 3B, Lafayette, IN 47901.

XI. References

- Bongard-Blanchy, Kerstin, Arianna Rossi, Salvador Rivas, Sophie Doublet, Vincent Koenig, and Gabriele Lenzini. 2021. ““I Am Definitely Manipulated, Even When I Am Aware of It. It’s Ridiculous!” - Dark Patterns from the End-User Perspective.” In *Designing Interactive Systems Conference 2021*, 1:763–76. DIS ’21. New York, NY, USA: ACM.
- Bösch, Christoph, Benjamin Erb, Frank Kargl, Henning Kopp, and Stefan Pfattheicher. 2016. “Tales from the Dark Side: Privacy Dark Strategies and Privacy Dark Patterns.” *Proceedings on Privacy Enhancing Technologies* 2016 (4). <https://doi.org/10.1515/popets-2016-0038>.
- Brignull, Harry. 2011. “Dark Patterns: Deception vs. Honesty in UI Design.” *A List Apart* (blog). November 11, 2011. <https://alistapart.com/article/dark-patterns-deception-vs.-honesty-in-ui-design>.
- . 2013. “Dark Patterns: Inside the Interfaces Designed to Trick You.” *The Verge*. 2013. <http://www.theverge.com/2013/8/29/4640308/dark-patterns-inside-the-interfaces-designed-to-trick-you>.
- Brignull, Harry, Marc Miquel, Jeremy Rosenberg, and James Offer. 2015. “Dark Patterns - User Interfaces Designed to Trick People.” *DarkPatterns.Org*. 2015. <http://darkpatterns.org/>.

³¹ This is supported by my analogous research on the confluence and multi-dimensionality of dark patterns—both in aggregate and experienced over time—in the context of cookie consent banners; Gray et al. (2021).

- Calo, Ryan. 2013. “Digital Market Manipulation.” *The George Washington Law Review* 82: 995.
- Chitika Insights. (2013). *The value of Google result positioning*. <https://www.silesiasem.pl/wp-content/uploads/2013/07/chitikainsights-valueofgoogleresultspositioning.pdf>
- Chivukula, Shruthi Sai, Jason Brier, and Colin M. Gray. 2018. “Dark Intentions or Persuasion?: UX Designers’ Activation of Stakeholder and User Values.” In *Proceedings of the 2018 ACM Conference Companion Publication on Designing Interactive Systems*, 87–91. DIS ’18 Companion. New York, New York, USA: ACM.
- Chivukula, Shruthi Sai, and Colin M. Gray. 2020. “Co-Evolving Towards Evil Design Outcomes: Mapping Problem and Solution Process Moves.” In *DRS Biennial Conference Series*. Design Research Society. <https://doi.org/10.21606/drs.2020.107>.
- Chivukula, Shruthi Sai, Colin M. Gray, and Jason A. Brier. 2019. “Analyzing Value Discovery in Design Decisions Through Ethicography.” In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. CHI ’19. New York, NY, USA: ACM. <https://doi.org/10.1145/3290605.3300307>.
- Chivukula, Shruthi Sai, Chris Rhys Watkins, Rhea Manocha, Jingle Chen, and Colin M. Gray. 2020. “Dimensions of UX Practice That Shape Ethical Awareness.” In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, 1–13. CHI ’20. New York, NY, USA: Association for Computing Machinery.
- Citron, Danielle Keats and Solove, Daniel J., Privacy Harms (February 9, 2021). *GWU Legal Studies Research Paper No. 2021-11*, *GWU Law School Public Law Research Paper No. 2021-11*, *102 Boston University Law Review* 793 (2022), Available at SSRN: <https://ssrn.com/abstract=3782222> or <http://dx.doi.org/10.2139/ssrn.3782222>
- Di Geronimo, Linda, Larissa Braz, Enrico Fregnan, Fabio Palomba, and Alberto Bacchelli. 2020. “UI Dark Patterns and Where to Find Them: A Study on Mobile Applications and User Perception.” In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, 1–14. CHI ’20. New York, NY, USA: Association for Computing Machinery.
- Fansher, Madison, Shruthi Sai Chivukula, and Colin M. Gray. 2018. “#darkpatterns: UX Practitioner Conversations About Ethical Design.” In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*, LBW082. New York, New York, USA: ACM.
- “FTC to Ramp up Enforcement against Illegal Dark Patterns That Trick or Trap Consumers into Subscriptions.” 2021. October 28, 2021. <https://www.ftc.gov/news-events/press-releases/2021/10/ftc-ramp-enforcement-against-illegal-dark-patterns-trick-or-trap>.
- Gray, Colin M., Jingle Chen, Shruthi Sai Chivukula, and Liyang Qu. 2021. “End User Accounts of Dark Patterns as Felt Manipulation.” *Proceedings of the ACM on Human-Computer Interaction* 5 (CSCW2): Article 372.
- Gray, Colin M., and Shruthi Sai Chivukula. 2019. “Ethical Mediation in UX Practice.” In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems - CHI ’19*. ACM Press. <https://doi.org/10.1145/3290605.3300408>.
- . 2021. “‘That’s Dastardly Ingenious’: Ethical Argumentation Strategies on Reddit.” *Proceedings of the ACM on Human-Computer Interaction* 4 (CSCW1): 70.
- Gray, Colin M., Shruthi Sai Chivukula, and Ahreum Lee. 2020. “What Kind of Work Do ‘Asshole Designers’ Create? Describing Properties of Ethical Concern on Reddit.” In *Proceedings of the 2020 ACM Designing Interactive Systems Conference*, 61–73. DIS ’20. New York, NY, USA: Association for Computing Machinery.

- Gray, Colin M., Yubo Kou, Bryan Battles, Joseph Hoggatt, and Austin L. Toombs. 2018. “The Dark (Patterns) Side of UX Design.” In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, 534:1-534:14. CHI ’18. New York, NY, USA: ACM.
- Gray, Colin M., Cristiana Santos, Nataliia Bielova, Michael Toth, and Damian Clifford. 2021. “Dark Patterns and the Legal Requirements of Consent Banners: An Interaction Criticism Perspective.” In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. CHI’21. ACM Press. <https://doi.org/10.1145/3411764.3445779>.
- Gunawan, J., Choffnes, D., Hartzog, W., & Wilson, C. (2021). Towards an understanding of dark pattern privacy harms. *Position paper at the CHI 2021 Workshop: What can CHI do about dark patterns?*. <https://johannagunawan.com/assets/pdf/gunawan-2021-chiworkshop.pdf>
- Hazan Joshua G. (2013). Stop being evil: A proposal for unbiased Google search. *Michigan Law Review*, 111(5), 789–820. <https://doi.org/10.3316/agispt.20191106019519>
- Hung, Alison. 2021. “Keeping Consumers in the Dark: Addressing ‘Nagging’ Concerns and Injury.” <https://doi.org/10.2139/ssrn.3803936>.
- Ikeda, Scott. 2022. “Google and Facebook Hit With Fines Over ‘Dark Patterns’, Allegedly Misleading Users Into Cookie Consent.” CPO Magazine. January 11, 2022. <https://www.cpomagazine.com/data-protection/google-and-facebook-hit-with-fines-over-dark-patterns-allegedly-misleading-users-into-cookie-consent/>.
- Kaldestad, Øyvind. 2018. “New analysis shows how Facebook and Google push users into sharing personal data.” Forbrukerrådet. June 27, 2018. <https://www.forbrukerradet.no/side/facebook-and-google-manipulate-users-into-sharing-personal-data/>.
- King, J., & Stephan, A. (2021). Regulating Privacy Dark Patterns in Practice—Drawing Inspiration from California Privacy Rights Act. *Georgetown Law Technology Review*. <https://georgetownlawtechreview.org/regulating-privacy-dark-patterns-in-practice-drawing-inspiration-from-california-privacy-rights-act/GLTR-09-2021/>
- Luguri, Jamie, and Lior Jacob Strahilevitz. 2021. “Shining a Light on Dark Patterns.” *The Journal of Legal Analysis* 13 (1): 43–109.
- Makes, Johnny. 2020. “Why Google’s New Search Results Design Is a Dark Pattern.” UX Collective. January 23, 2020. <https://uxdesign.cc/why-googles-new-search-results-design-is-a-dark-pattern-168935802f95>.
- Mathur, Arunesh, Gunes Acar, Michael J. Friedman, Elena Lucherini, Jonathan Mayer, Marshini Chetty, and Arvind Narayanan. 2019. “Dark Patterns at Scale: Findings from a Crawl of 11K Shopping Websites.” *Proceedings of the ACM on Human-Computer Interaction* 3 (CSCW): Article No. 81.
- Mathur, Arunesh, Mihir Kshirsagar, and Jonathan Mayer. 2021. “What Makes a Dark Pattern... Dark? Design Attributes, Normative Considerations, and Measurement Methods.” In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, 1–18. 360. New York, NY, USA: Association for Computing Machinery.
- Narayanan, Arvind, Arunesh Mathur, Marshini Chetty, and Mihir Kshirsagar. 2020. “Dark Patterns: Past, Present, and Future.” *Queueing Systems. Theory and Applications* 18 (2): 67–92.
- “Shaping Choices in the Digital World: From Dark Patterns to Data Protection: The Influence of UX/UI Design on User Empowerment.” 2019. CNIL.

- The Washington Post*. 2022. “Google Is Manipulating Browser Extensions to Stifle Competitors, DuckDuckGo CEO Says,” January 5, 2022.
<https://www.washingtonpost.com/politics/2022/01/05/google-is-manipulating-browser-extensions-stifle-competitors-duckduckgo-ceo-says/>.
- Watkins, Chris Rhys, Colin M. Gray, Austin L. Toombs, and Paul Parsons. 2020. “Tensions in Enacting a Design Philosophy in UX Practice.” In *DIS’20: Proceedings of the Designing Interactive Systems Conference 2020*. DIS’20. New York, NY: ACM Press.
<https://doi.org/10.1145/3357236.3395505>.

colin m. gray curriculum vitae

401 N Grant Street, Room 309, West Lafayette, Indiana, United States of America
gray42@purdue.edu | 765.494.6363 | colingray.me | uxp2.com

Education

- June 2014 **Indiana University—Bloomington, IN**
Ph.D. Instructional Systems Technology
Minor: Informatics, Human-Computer Interaction design
- May 2010 **University of South Carolina—Columbia, SC**
M.Ed. Educational Technology
- June 2008 **Savannah College of Art and Design—Savannah, GA**
M.A. Graphic Design
- May 2005 **Bob Jones University—Greenville, SC**
B.S. Graphic Design

Appointments and Professional Experience

- 2021—present **Associate Professor, Purdue University**
Department of Computer Graphics Technology, Purdue Polytechnic Institute
Department of Curriculum and Instruction, College of Education (by courtesy)
UX Design Program Lead (2017-present)
- 2018—present **Guest Professor, Beijing Normal University** Beijing, People's Republic of China
- 2017—present **Visiting Researcher, Newcastle University** Newcastle upon Tyne, United Kingdom
- 2015—2021 **Assistant Professor, Purdue University**
Department of Computer Graphics Technology, Purdue Polytechnic Institute (2015-present)
UX Design Program Lead (2017-present)
Fellow, Educational Research and Development Incubator (2015-2017)
- 2014—2015 **Postdoctoral Research Associate, Iowa State University**
Research, instructional development, and implementation lead for the dissemination of the Design Heuristics method in engineering and design education
Funded by NSF Grant No. 1323251: Collaborative Research: Evidence-based Pedagogy in Engineering Education: Design Heuristics for Concept Generation [TUES Type II]
- 2012—2014 **Research Assistant, Indiana University**
Assistant Editor of the *International Journal of Designs for Learning*
- 2011—2012 **Graduate Assistant, Indiana University**
- 1998—2016 **Principal, graydesign**
Branding and visual strategy; interactive & print development
Interaction design and instructional strategy
- 2007—2010 **Art Director, Think Up Consulting**
Art direction of all organizational activities; oversight of graphic production
Integration of instructional design, development, and implementation processes and procedures
Management of a team of desktop publishers, graphic designers, and interns

Dissertation

Gray, C. M. (2014). *Living in Two Worlds: A Critical Ethnography of Academic and Proto-Professional Interactions in a Human-Computer Interaction Design Studio*. (Unpublished doctoral dissertation). Indiana University, Bloomington, IN. **[Awarded Instructional Systems Technology Dissertation of the Year Award]**

Peer Reviewed Journal Publications

Goffe, L. Chivukula, S. S., Bowyer, A., Bowen, S., Toombs, A. L., & **Gray, C. M.** (in press). Web Augmentation for Well-being: The Human-Centred Design of a Takeaway Food Ordering Digital Platform. *Interacting with Computers*.

Gray, C. M., Chivukula, S. S., Hasib, A., & Li, Z. (2022). Using Decisive Constraints to Create Design Methods to Guide Ethical Impact. *Design Studies*, 79, Article No. 101097. <https://doi.org/10.1016/j.destud.2022.101097>

Debs, L., **Gray, C. M.**, & Asunda, P. A. (2022). Factors Influencing Undergraduate Students' Reasoning About Ethics of New Technology. *International Journal of Art & Design Education*. <https://doi.org/10.1007/s10798-021-09719-w>

Gray, C. M. (2022). Building an Ethnographic Toolbox: Engaging Analog and Digital Tools in Virtual and Physical Spaces. *TechTrends* (SI: Ethnographic Experiences in Learning Design), 66, 56-67. <https://doi.org/10.1007/s11528-021-00680-y>

Gray, C. M. (2022). Language Design Methods. *Design Studies*, 78, Article No. 101076. <https://doi.org/10.1016/j.destud.2021.101076>

Gray, C. M. (2021). "Scaling Up" and Adapting to Crisis: Shifting a Residential UX Studio Program Online. *Design and Technology Education: An International Journal*. 26(4), 37-49. <https://ojs.lboro.ac.uk/DATE/article/view/2969>

Liu, W., Lee, K.-P., **Gray, C. M.**, Toombs, A. L., Chen, K.-H., & Leifer, L. (2021). Transdisciplinary Teaching and Learning in UX Design: A Review and AR Case Studies. *Applied Sciences* (SI: State-of-the-Art in Human Factors and Interaction Design), 11(22). <https://doi.org/10.3390/app112210648>

Allred, A. M., & **Gray, C. M.** (2021). "Be Gay, Do Crimes": The Co-Production and Activist Potential of Contemporary Fanzines. *Proceedings of the ACM: Human-Computer Interaction*, 5(CSCW2), Article 376, 35 pages. <https://doi.org/10.1145/3479520>

Gray, C. M., Chen, J., Chivukula, S. S., & Qu, L. (2021). End User Accounts of Dark Patterns as Felt Manipulation. *Proceedings of the ACM: Human-Computer Interaction*, 5(CSCW2), Article 372, 25 pages. <https://doi.org/10.1145/3479516>

Gray, C. M., & Chivukula, S. S. (2021). "That's dastardly ingenious": Ethical Argumentation Strategies on Reddit. *Proceedings of the ACM: Human-Computer Interaction*, 5(CSCW1), Article 70, 25 pages. <https://doi.org/10.1145/3449144>

Exter, M. E., **Gray, C. M.**, & Fernandez, T. (2020). Conceptions of Design by Transdisciplinary Educators: Disciplinary Background and Pedagogical Engagement. *International Journal of Technology and Design Education*, 30, 777-798. <https://doi.org/10.1007/s10798-019-09520-w>

Gray, C. M., Parsons, P., Toombs, A. L., Rasche, N., & Vorvoreanu, M. (2020). Designing an Aesthetic Learner Experience: UX, Instructional Design, and Design Pedagogy. *International Journal of Designs for Learning*, 11(1), 41-58. **[Awarded Outstanding Design Case, American Educational Research Association, SIG Design & Technology]** <https://doi.org/10.14434/ijdl.v11i1.26065>

Gray, C. M. (2019). Democratizing assessment practices through multimodal critique in the design classroom. *International Journal of Technology and Design Education*, 29(4), 929-946. <https://doi.org/10.1007/s10798-018-9471-2>

Gray, C. M. (2019). Revealing Students' Ethical Awareness During Problem Framing. *International Journal of Art & Design Education*, 38(2), 299-313. <https://doi.org/10.1111/jade.12190>

Gray, C. M., & Kou, Y. (2019). Co-Producing, Curating, and Defining Design Knowledge in an Online Practitioner Community. *CoDesign*, 15(1), 41-58. <https://doi.org/10.1080/15710882.2018.1563193>

Gray, C. M., McKilligan, S., Daly, S. R., Seifert, C. M., & Gonzalez, R. (2019). Using Creative Exhaustion to Foster Idea Generation. *International Journal of Technology and Design Education*, 29(1), 177-195. <https://doi.org/10.1007/s10798-017-9435-y>

Gray, C. M., & Fernandez, T. M. (2018). When world(view)s collide: Contested epistemologies and ontologies in transdisciplinary education. *International Journal of Engineering Education*, 34(2B), 574-589. [Selected for publication in a special issue from Mudd Design Workshop X]

Kou, Y., & **Gray, C. M.** (2018). "What do you recommend a complete beginner like me to practice?": Professional Self-Disclosure in an Online Community. *Proceedings of the ACM: Human-Computer Interaction*, 2(CSCW), Article 94, 25 pages. <https://doi.org/10.1145/3274363>

Kou, Y., **Gray, C. M.**, Toombs, A. L., & Adams, R. S. (2018). Understanding Social Roles in an Online Community of Volatile Practice: A Study of User Experience Practitioners on Reddit. *ACM Transactions on Social Computing*, 1(4), Article No. 17. <https://doi.org/10.1145/3283827>

Gray, C. M., & Boling, E. (2017). Designers' Articulation and Activation of Instrumental Design Judgments in Cross-Cultural User Research. *Codesign*. <https://doi.org/10.1080/15710882.2017.1393546>

Kou, Y., & **Gray, C. M.** (2017). Supporting Distributed Critique through Interpretation and Sense-Making in an Online Creative Community. In *Proceedings of the ACM on Human-Computer Interaction*, 1(CSCW), Article 60, 20 pages. doi:10.1145/3134695

Gray, C. M., & Boling, E. (2016). Inscribing Ethics and Values in Designs for Learning: A Problematic. *Educational Technology Research & Development*, 64(5), 969-1001. doi:10.1007/s11423-016-9478-x

Gray, C. M., Seifert, C. M., Yilmaz, S., Daly, S. R., & Gonzalez, R. (2016). What is the Content of "Design Thinking"? Design Heuristics as Conceptual Repertoire. *International Journal of Engineering Education*, 32(3B), 1349-1355. [Selected for publication in a special issue from Mudd Design Workshop IX] http://www.ijee.ie/latestissues/Vol32-3B/05_ijee3220ns.pdf

Gray, C. M., Dagli, C., Demiral-Uzan, M., Ergulec, F., Tan, V., Altuwaijri, A., Gyabak, K., Hilligoss, M., Kizilboga, R., Tomita, K., & Boling, E. (2015). Judgment and Instructional Design: How ID Practitioners Work in Practice. *Performance Improvement Quarterly*, 28(3), 25-49. doi:10.1002/piq.21198

Boling, E., **Gray, C. M.**, Modell, M. G., Altuwaijri, A., & Jung, J. (2014). Learners Interpreting Instructional Images: Meaning-making and decision-making strategies. *Journal of Visual Literacy*, 33(2), 27-51.

Gray, C. M. & Howard, C. D. (2014). Designerly Talk in Non-Pedagogical Social Spaces. *Journal of Learning Design*, 7(1), 40-58.

Gray, C. M. & Siegel, M. A. (2014). Sketching Design Thinking: Representations of Design in Education and Practice. *Design and Technology Education*, 19(1), 48-61. [Selected for publication in a special issue from DRS // CUMULUS 2013]

Gray, C. M. (2013). Factors That Shape Design Thinking. *Design and Technology Education*, 18(3), 8-20.

Gray, C. M. (2013). Informal Peer Critique and the Negotiation of Habitus in a Design Studio. *Art, Design & Communication in Higher Education*, 12(2), 195-209. [Selected for publication in a special issue from DRS // CUMULUS 2013]

Gray, C. M., Jung, J., Watson, C., Jia, X., & Frick, T. W. (2012). Models and Design Judgment: Conflicting Perspectives on Redesigning a Doctoral Readings Course. *International Journal of Designs for Learning* 3(1), 27-38.

Modell, M. G., **Gray, C. M.** (2011). Searching for Personal Territory in a Human-Computer Interaction Design Studio. *Journal for Education in the Built Environment* 6(2), 54-78.

Invited Journal Publications

Gray, C. M. (2020). Markers of Quality in Design Precedent. *International Journal of Designs for Learning*, 11(3), 1-12. <https://doi.org/10.14434/ijdl.v11i3.31193>

Gray, C. M. & Howard, C. D. (2015). Reflection on Designerly Talk in Non-Pedagogical Social Spaces. *Journal of Learning Design: 10th Anniversary Issue*, 8(3), 143-164. <https://doi.org/10.5204/jld.v8i3.259> [reflection with republished version of Gray & Howard (2014)]

Howard, C. D., & **Gray, C. M.** (2014). Introduction to the Special Issue on Historic Design Cases. In Gray, C. M. & Howard, C. D. (Eds.) *International Journal of Designs for Learning* [Special Issue on Historic Design Cases], 5(2), i-iv.

Boling, E., & **Gray, C. M.** (2014). Design: The topic that should not be closed. *TechTrends*, 58(6), 17-19. <http://dx.doi.org/10.1007/s11528-014-0798-6>

Trade Publications

Gray, C. M., & Chivukula, S. S. (2020). When Does Manipulation Turn a Design “Dark”? *Interactions*, 27(1), 96–96. <https://doi.org/10.1145/3173574>

Gray, C. M., Toombs, A. L., Owczarzak, M., & Watkins, C. (2019). Digital civics goes abroad. *Interactions*, 26(2), 74-77. <https://doi.org/10.1145/3301661>

Media Coverage

Bloomberg Law, ‘Dark Patterns’ in Consumer Data Privacy Garner Policy Attention. <https://news.bloomberglaw.com/tech-and-telecom-law/dark-patterns-in-consumer-data-privacy-garner-policy-attention> March 23, 2021

Wired, *How Facebook and Other Sites Manipulate Your Privacy Choices*. <https://www.wired.com/story/facebook-social-media-privacy-dark-patterns/> August 12, 2020

Kiplinger, *Beware Dark Patterns on the Web*. <https://www.kiplinger.com/article/investing/T031-C023-S002-beware-dark-patterns-on-the-web.html> August 29, 2019

The Atlantic, *The Endless, Invisible Persuasion Tactics of the Internet*. <https://www.theatlantic.com/technology/archive/2019/08/how-dark-patterns-online-manipulate-shoppers/595360/> August 2, 2019

Conference Proceedings

Full Conference Papers

Gray, C. M. (2022, June). Critical Pedagogy and the Pluriversal Design Studio. In *Proceedings of the Design Research Society Conference*. Bilbao, Spain: Design Research Society. <https://doi.org/10.21606/drs.2022.238> [preprint]

Gray, C. M., Liu, W., Xin, X., Chin, D., Marks, J., Bunting, S., Anglin, J., Hutzler, B., Kokate, S., & Yang, Y. (2022, May). Defamiliarization and Intercultural Learning in Cross-Cultural HCI Education. In *4th Annual ACM SIGCHI Symposium on HCI Education (EduCHI 2022)*, New Orleans, Louisiana. <https://educchi2022.hcilivingcurriculum.org/wp-content/uploads/2022/04/educchi2022-final26.pdf>

Parsons, P., & **Gray, C. M.** (2022, May). Separating Grading and Feedback in UX Design Studios. In *4th Annual ACM SIGCHI Symposium on HCI Education (EduCHI 2022)*, New Orleans, Louisiana. <https://educchi2022.hcilivingcurriculum.org/wp-content/uploads/2022/04/educchi2022-final18.pdf>

Pivonka, A., Makary, L., & **Gray, C. M.** (2022, May). Organizing Metaphors for Design Methods in Intermediate HCI Education. In *4th Annual ACM SIGCHI Symposium on HCI Education (EduCHI 2022)*, New Orleans, Louisiana. <https://educchi2022.hcilivingcurriculum.org/wp-content/uploads/2022/04/educchi2022-final30.pdf>

Di, Z., **Gray, C. M.**, Toombs, A. L., & Liu, W. (2021, December). Building a Cross-Cultural UX Design Dual Degree. In *IASDR 2021: The Ninth Congress of the International Association of Societies of Design Research*. Hong Kong.

Li, Z., **Gray, C. M.**, Toombs, A. L., McDonald, K., Marinovic, L., & Liu, W. (2021, September). Cross-Cultural UX Pedagogy: A China–US Partnership. In *LearnxDesign: 6th International Conference for Design Education Researchers*. Shandong University of Art & Design, Jinan, China.

Wolford, C., Zhao, Y., Kashyap, S., & **Gray, C. M.** (2021, September). Critique Assemblages in Response to Emergency Hybrid Studio Pedagogy. In *LearnxDesign: 6th International Conference for Design Education Researchers*. Shandong University of Art & Design, Jinan, China.

Gray, C. M., Chivukula, S. S., Melkey, K., & Manocha, R. (2021, August). Understanding “Dark” Design Roles in Computing Education. In *ICER’21: Proceedings of the 14th ACM Conference on International Computing Education Research*. <https://doi.org/10.1145/3446871.3469754>

Goffe, L. Chivukula, S. S., Bowyer, A., Bowen, S., Toombs, A. L., & **Gray, C. M.** (2021, July). Appetite for Disruption: Designing Human-Centred Augmentations to an Online Food Ordering Platform. In *Proceedings of the 33rd British Human Computer Interaction Conference*. University of West London, London, UK. <http://dx.doi.org/10.14236/ewic/hci2021.16>

Gray, C. M., Wolford, C., & Huston, D. (2021, June). Iterating Overnight: Using Cardboard to Teach Audio During a Pandemic. In *Proceedings of the Mudd Design Workshop XII: Designing Through Making: 2-D and 3-D Representations of Designs In Campus Facilities and Remotely*. Claremont, CA: Harvey Mudd College.

Chivukula, S. S., Hasib, A., Li, Z., Chen, J., & **Gray, C. M.** (2021, May). Identity Claims that Underlie Ethical Awareness and Action. In *CHI’21: Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. New York, NY: ACM Press. <https://doi.org/10.1145/3411764.3445375>

Gray, C. M., Santos, C., Bielova, N., Toth, M., & Clifford, D. (2021, May). Dark Patterns and the Legal Requirements of Consent Banners: An Interaction Criticism Perspective. In *CHI’21: Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. New York, NY: ACM Press. **Best of CHI Honorable Mention, top 5%** <https://doi.org/10.1145/3411764.3445779>

Boling, E., **Gray, C. M.**, & Smith, K. (2020, August). Educating for Design Character in Higher Education: Challenges in Studio Pedagogy. In *Proceedings of the Design Research Society Conference*. Brisbane, Australia: Design Research Society. <https://doi.org/10.21606/drs.2020.120>

Chivukula, S. S., & **Gray, C. M.** (2020, August). Co-Evolving Towards Evil Design Outcomes: Mapping Problem and Solution Process Moves. In *Proceedings of the Design Research Society Conference*. Brisbane, Australia: Design Research Society. <https://doi.org/10.21606/drs.2020.107>

Gray, C. M., Chivukula, S. S., & Lee, A. (2020, July). What Kind of Work Do “Asshole Designers” Create? Describing Properties of Ethical Concern on Reddit. In *DIS’20: Proceedings of the 2020 CHI Conference on Designing Interactive Systems* (pp. 61–73). New York, NY: ACM Press. **[Awarded Honorable Mention, top 5%]** <https://doi.org/10.1145/3357236.3395486>

Watkins, C. R., **Gray, C. M.**, Toombs, A. L., & Parsons, P. (2020, July). Tensions in Enacting a Design Philosophy in UX Practice. In *DIS’20: Proceedings of the 2020 CHI Conference on Designing Interactive Systems* (pp. 2107–2118). New York, NY: ACM Press. <https://doi.org/10.1145/3357236.3395505>

Kharrufa, A., & **Gray, C. M.** (2020, April). Threshold Concepts in HCI Education. In *2nd Annual ACM SIGCHI Symposium on HCI Education (EduCHI 2020)*. Honolulu, HI.

Chivukula, S. S., Watkins, C., Chen, J., Manocha, R., & **Gray, C. M.** (2020, April). Dimensions of UX Practice that Shape Ethical Awareness. In *CHI’20: Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. New York, NY: ACM Press. <https://doi.org/10.1145/3313831.3376459>

Jo, E., Toombs, A. L., **Gray, C. M.**, & Hong, H. (2020, April). Understanding Parenting Stress through Co-designed Self-Trackers. In *CHI’20: Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. New York, NY: ACM Press. <https://doi.org/10.1145/3313831.3376359>

Toombs, A. L., Whitley, D., & **Gray, C. M.** (2020, January). Autono-preneurial Agents in the Community: Developing a Socially Aware API for Autonomous Entrepreneurial Lawn Mowers. In *GROUP’20: Companion of the 2020 ACM International Conference on Supporting Group Work* (pp. 69-82). New York, NY: ACM Press. <https://doi.org/10.1145/3323994.3369900>

Chivukula, S. S., **Gray, C. M.**, & Brier, J. (2019, May). Analyzing Value Discovery in Design Decisions Through Ethicography. In *CHI’19: Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. New York, NY: ACM Press. <https://doi.org/10.1145/3290605.3300307>

Gray, C. M., & Chivukula, S. S. (2019, May). Ethical Mediation in UX Practice. In *CHI’19: Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. New York, NY: ACM Press. <https://doi.org/10.1145/3290605.3300408>

Kou, Y., & **Gray, C. M.** (2019, May). A Practice-Led Account of the Conceptual Evolution of UX Knowledge. In *CHI’19: Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. New York, NY: ACM Press. <https://doi.org/10.1145/3290605.3300279>

- Chivukula, S. S., Brier, J., & **Gray, C. M.** (2018, June). Dark Intentions or Persuasion? UX Designers' Activation of Stakeholder and User Values. In *DIS'18 Companion: ACM Conference on Designing Interactive Systems* (pp. 87-91). New York, NY: ACM Press. <https://doi.org/10.1145/3197391.3205417>
- Kou, Y., & **Gray, C. M.** (2018, June). Distinctions between the Communication of Experiential and Academic Design Knowledge: A Linguistic Analysis. In *Proceedings of the Design Research Society Conference* (pp. 1582-1595). Limerick, Ireland: Design Research Society. <https://doi.org/10.21606/dma.2017.532>
- Kou, Y., & **Gray, C. M.** (2018, June). Exploring the Knowledge Creation Practices of UX Designers on Stack Exchange. In *DIS'18 Companion: ACM Conference on Designing Interactive Systems* (pp. 69-74). New York, NY: ACM Press. <https://doi.org/10.1145/3197391.3205414>
- Strahm, B., **Gray, C. M.**, & Vorvoreanu, M. (2018, June). Generating Mobile Application Onboarding Insights Through Minimalist Instruction. In *DIS'18: Proceedings of the 2018 CHI Conference on Designing Interactive Systems*. New York, NY: ACM Press. doi:10.1145/3196709.3196727
- Fansher, M., Chivukula, S. S., & **Gray, C. M.** (2018, April). #darkpatterns: UX Practitioner Conversations About Ethical Design. In *CHI EA '18: CHI'18 Extended Abstracts on Human Factors in Computing Systems*. New York, NY: ACM Press. doi:10.1145/3170427.3188553
- Gray, C. M.**, Kou, Y., Battles, B., Hoggatt, J., & Toombs, A. L. (2018, April). The Dark (Patterns) Side of UX Design. In *CHI'18: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. New York, NY: ACM Press. doi:10.1145/3173574.3174108
- Kou, Y., **Gray, C. M.**, Toombs, A. L., & Nardi, B. (2018, April). The Politics of Titling: The Representation of Countries in CHI Papers. In *CHI EA '18: CHI'18 Extended Abstracts on Human Factors in Computing Systems*. New York, NY: ACM Press. doi:10.1145/3170427.3188409
- Toombs, A. L., **Gray, C. M.**, Zhou, G., & Light, A. (2018, April). Appropriated and Inauthentic Care in Gig-Economy Platforms: An Uber and Lyft Driver Autoethnography. In *CHI EA '18: CHI'18 Extended Abstracts on Human Factors in Computing Systems*. New York, NY: ACM Press. doi:10.1145/3170427.3188657
- Toombs, A. L., Morrissey, K., Simpson, E., **Gray, C. M.**, Vines, J., & Balaam, M. (2018, April). Supporting the Complex Social Lives of New Parents. In *CHI'18: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. New York, NY: ACM Press. doi:10.1145/3173574.3173994
- Kou, Y., & **Gray, C. M.** (2018, January). Towards Professionalization in an Online Community of Emerging Occupation: Discourses among UX Practitioners. In *GROUP'18: Proceedings of the 20th International Conference on Supporting Group Work* (pp. 322-334). New York, NY: ACM Press. doi:10.1145/3148330.3148352
- Kou, Y., **Gray, C. M.**, Toombs, A. L., & Adams, R. S. (2018, January). Knowledge Production and Social Roles in an Online Community of Emerging Occupation: A Study of User Experience Practitioners on Reddit. In *Proceedings of the Hawaii International Conference on Systems Sciences (HICSS)* (pp. 2068-2077). Waikoloa Village, HI. <http://hdl.handle.net/10125/50148>
- Brier, J., **Gray, C. M.**, & Kou, Y. (2017, June). In Search of UX Translators: Analyzing Researcher-Practitioner Interactions on Twitter. In *DIS'17 Companion: ACM Conference on Designing Interactive Systems* (pp. 111-115). New York, NY: ACM Press. doi:10.1145/3064857.3079129
- Gray, C. M.**, & Kou, Y. (2017, June). UX Practitioners' Engagement with Intermediate-Level Knowledge. In *DIS'17 Companion: ACM Conference on Designing Interactive Systems* (pp. 13-17). New York, NY: ACM Press. doi:10.1145/3064857.3079110
- Exter, M. E., Ashby, I., **Gray, C. M.**, Wilder, D., & Krause, T. (2017, June). Systematically Integrating Liberal Education in a Transdisciplinary Design Studio Environment. In *Proceedings of the ASEE Annual Conference, Liberal Education/Engineering & Society Division*. Washington, DC: ASEE.
- Gray, C. M.**, Exter, M. E., & Krause, T. (2017, June). Moving Towards Individual Competence from Group Work in Transdisciplinary Education. In *Proceedings of the ASEE Annual Conference, Design in Engineering Education Division*. Washington, DC: ASEE.
- Gray, C. M.**, & Fernandez, T. F. (2017, June). Developing a Socially-Aware Engineering Identity Through Transdisciplinary Learning. In *Proceedings of the Mudd Design Workshop X: Design and the Future of the Engineer of 2020*. Claremont, CA: Harvey Mudd College.

Gray, C. M., & Boling, E. (2016, November). Designers' Articulation and Activation of Instrumental Design Judgments in Cross-Cultural User Research. Submitted to *DTRS'11: 11th annual Design Thinking Research Symposium*. Copenhagen, DK: Copenhagen Business School.

Gray, C. M. (2016, June). What is the Nature and Intended Use of Design Methods?. In *Proceedings of the Design Research Society*. Brighton, UK: Design Research Society.

Gray, C. M., El Debs, L. D., Exter, M., & Krause, T. S. (2016, June). Instructional Strategies for Incorporating Empathy in Transdisciplinary Technology Education. In *Proceedings of the ASEE Annual Conference, Engineering Ethics Division*. Washington, DC: ASEE. doi:10.18260/p.25746 **[Nominated for Best Diversity Paper]**

Van Epps, A., Ashby, I., **Gray, C. M., & Exter, M.** (2016, June). Supporting Student Attainment and Management of Competencies in a Transdisciplinary Degree Program. In *Proceedings of the ASEE Annual Conference, Multidisciplinary Engineering Division*. Washington, DC: ASEE. doi:10.18260/p.25977

Gray, C. M. (2016, May). "It's More of a Mindset Than a Method": UX Practitioners' Conception of Design Methods. In *CHI'16: Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (pp. 4044-4055). New York, NY: ACM Press. doi:10.1145/2858036.2858410

Gray, C. M., Toombs, A. L., & McKay, C. (2016, May). Meaning Reconstruction as an Approach to Analyze Critical Dimensions of HCI Research. In *CHI EA '16: CHI'16 Extended Abstracts on Human Factors in Computing Systems* (pp. 328-340). New York, NY: ACM Press. doi:10.1145/2851581.2892571

Gray, C. M., Yilmaz, S., Daly, S., Seifert, C. M., & Gonzalez, R. (2015, August). Creativity 'Misrules': First Year Engineering Students' Production and Perception of Creativity in Design Ideas. In *ASME 2015 International Design Engineering Technical Conferences (IDETC); 12th International Conference on Design Education (DEC)*. New York, NY: ASME.

Gray, C. M., Yilmaz, S., Daly, S., Seifert, C. M., & Gonzalez, R. (2015, July). Supporting Idea Generation Through Functional Decomposition: An Alternative Framing For Design Heuristics. In *2015 International Conference on Engineering Design*. Milan, IT: The Design Society.

Boling, E., **Gray, C. M., & Smith, K. M.** (2015, June). Studio Teaching in the Low-Precedent Context of Instructional Design. In *LearnxDesign: The 3rd International Conference for Design Education Researchers and PreK-16 Design Educators*. Chicago, IL: School of the Art Institute of Chicago. [Acceptance rate: 81%]

Gray, C. M., & Howard, C. D. (2015, June). "Why are they not responding to critique?": A student-centered construction of the crit. In *LearnxDesign: The 3rd International Conference for Design Education Researchers and PreK-16 Design Educators*. Chicago, IL: School of the Art Institute of Chicago. [Acceptance rate: 81%]

Gray, C. M., Yilmaz, S., Daly, S., Seifert, C. M., & Gonzalez, R. (2015, June). What Problem Are We Solving? Encouraging Idea Generation and Effective Team Communication. In *LearnxDesign: The 3rd International Conference for Design Education Researchers and PreK-16 Design Educators*. Chicago, IL: School of the Art Institute of Chicago. [Acceptance rate: 81%]

Gray, C. M., Yilmaz, S., Daly, S. R., Seifert, C. M., & Gonzalez, R. (2015, June). Idea Generation Through Empathy: Reimagining the 'Cognitive Walkthrough'. In *Proceedings of the ASEE Annual Conference, Design in Engineering Education Division*. Washington, DC: ASEE.

Yilmaz, S., Daly, S. R., Seifert, C. M., Gonzalez, R., & **Gray, C. M.** (2015, June). Expanding evidence-based pedagogy with Design Heuristics. In *Proceedings of the ASEE Annual Conference, NSF Grantees Poster Session*. Washington, DC: ASEE.

Gray, C. M., Toombs, A., & Gross, S. (2015, April). Flow of Competency in UX Design Practice. In *CHI'15: Proceedings of the 2015 CHI Conference on Human Factors in Computing Systems* (pp. 3285-3294). New York, NY: ACM Press. **[Best of CHI Honorable Mention, top 5%]**

Gray, C. M., & Howard, C. D. (2014, October). Normativity in Design Communication: Inscribing Design Values in Designed Artifacts. In *DTRS'10: 10th annual Design Thinking Research Symposium*. West Lafayette, IN: Purdue University.

Howard, C. D., & **Gray, C. M.** (2014, October). Learner v. Expert Design Talk: A Content Analysis of the Discourse of Designerly Talk. In *DTRS'10: 10th annual Design Thinking Research Symposium*. West Lafayette, IN: Purdue University.

Gray, C. M., Stolterman, E., & Siegel, M. A. (2014, June). Reprioritizing the Relationship Between HCI Research and Practice: Bubble-Up and Trickle-Down Effects. In *DIS'14: Proceedings of the 2014 CHI Conference on Designing Interactive Systems* (pp.725-734). New York, NY: ACM Press. **[Awarded Best Paper, top 1%]**

Gray, C. M. (2014, June). Locating the Emerging Design Identity of Students Through Visual and Textual Reflection. In *Proceedings of the Design Research Society*. Umeå, Sweden. [Acceptance rate: 48%]

Gray, C. M. (2014, April). Evolution of Design Competence in UX Practice. In *CHI'14: Proceedings of the 2014 CHI Conference on Human Factors in Computing Systems* (pp. 1645-1654). New York, NY: ACM Press. [Acceptance rate: 23%]

Gray, C. M. (2013, November). Emergent Critique in Informal Design Talk: Reflections of Pedagogical and Epistemological Features in an HCI Studio. *Critique 2013: An International Conference Reflecting On Creative Practice in Art, Architecture, and Design*, Adelaide, South Australia, 341-355.

Gray, C. M., & Howard, C. D. (2013, November). Expectations of Reciprocity? An Analysis of Critique in Facebook Posts by Student Designers. *Critique 2013: An International Conference Reflecting On Creative Practice in Art, Architecture, and Design*, Adelaide, South Australia, 381-395.

Gray, C. M. (2013). Discursive Structures of Informal Critique in an HCI Design Studio. *Nordes 2013: Experiments in Design Research*, Copenhagen, Denmark/Malmö, Sweden, 110-118. [Acceptance rate: 41%]

Short Conference Papers and Other Extended Abstracts

Parsons, P., **Gray, C. M.,** Baigelenov, A., & Carr, I. (2020). Design Judgment in Data Visualization Practice. *IEEE VIS Short Paper Proceedings*. <http://arxiv.org/abs/2009.02628>

Parsons, P., Rasche, N., **Gray, C. M.,** & Toombs, A. L. (2020). Vertical Integration in UX Design Studios. In *2nd Annual ACM SIGCHI Symposium on HCI Education (EduCHI 2020)*. Honolulu, HI.

Gray, C. M., & Chivukula, S. S. (2019). Engaging Design Students in Value Discovery as “Everyday Ethicists.” *Dialogue: Proceedings of the AIGA Design Educators Community Conferences (Decipher, Vol. 1)*, 187–189. <https://doi.org/10.3998/mpub.11688977>

Murdoch-Kitt, K., **Gray, C. M.,** Parsons, P., Toombs, A. L., Louw, M., & Van Gent, E. (2019). Developing Students’ Instrumental Judgment Capacity for Design Research Methods. *Dialogue: Proceedings of the AIGA Design Educators Community Conferences (Decipher, Vol. 1)*, 108–115. <https://doi.org/10.3998/mpub.11688977>

Toombs, A. L., Dow, A., Vines, J., **Gray, C. M.,** Dennis, B., Clarke, R., & Light, A. (2018, May). Designing for Everyday Care in Communities. In *DIS '18 Companion: Proceedings of the 2018 ACM Conference Companion Publication on Designing Interactive Systems* (pp. 391-394). New York, NY: ACM Press. <https://doi.org/10.1145/3197391.3197394>

Vorvoreanu, M., **Gray, C. M.,** Parsons, P., & Rasche, N. (2017, May). Advancing UX Education: A Model for Integrated Studio Pedagogy. In *CHI'17: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (pp. 1441-1446). New York, NY: ACM Press. <https://doi.org/10.1145/3025453.3025726>

Posters or Work-In-Progress

Chivukula, S. S., & Gray, C. M. (2020, April). Bardzell’s “Feminist HCI” Legacy: Analyzing Citational Patterns. In *CHI EA '19: CHI'19 Extended Abstracts on Human Factors in Computing Systems*. New York, NY: ACM Press. <https://doi.org/10.1145/3334480.3382936>

Chivukula, S. S., Watkins, C., McKay, L., & Gray, C. M. (2019, May). “Nothing Comes Before Profit”: Asshole Design In the Wild. In *CHI EA '19: CHI'19 Extended Abstracts on Human Factors in Computing Systems* (Paper No. LBW1279). New York, NY: ACM Press. <https://doi.org/10.1145/3290607.3312863>

Chivukula, S. S., Brier, J., & Gray, C. M. (2018, June). Dark Intentions or Persuasion? UX Designers’ Activation of Stakeholder and User Values. In *DIS'18 Companion: ACM Conference on Designing Interactive Systems* (pp. 87-91). New York, NY: ACM Press. <https://doi.org/10.1145/3197391.3205417>

Kou, Y., & Gray, C. M. (2018, June). Exploring the Knowledge Creation Practices of UX Designers on Stack Exchange. In *DIS'18 Companion: ACM Conference on Designing Interactive Systems* (pp. 69-74). New York, NY: ACM Press. <https://doi.org/10.1145/3197391.3205414>

Fansher, M., Chivukula, S. S., & Gray, C. M. (2018, April). #darkpatterns: UX Practitioner Conversations About Ethical Design. In *CHI EA '18: CHI'18 Extended Abstracts on Human Factors in Computing Systems* (Paper No. LBW082). New York, NY: ACM Press. <https://doi.org/10.1145/3170427.3188553>

Toombs, A. L., Gray, C. M., Zhou, G., & Light, A. (2018, April). Appropriated and Inauthentic Care in Gig-Economy Platforms: An Uber and Lyft Driver Autoethnography. In *CHI EA '18: CHI'18 Extended Abstracts on Human Factors in Computing Systems* (Paper No. LBW532). New York, NY: ACM Press. <https://doi.org/10.1145/3170427.3188657>

Brier, J., Gray, C. M., & Kou, Y. (2017, June). In Search of UX Translators: Analyzing Researcher-Practitioner Interactions on Twitter. In *DIS'17 Companion: ACM Conference on Designing Interactive Systems* (pp. 111-115). New York, NY: ACM Press. <https://doi.org/10.1145/3064857.3079129>

Gray, C. M., & Kou, Y. (2017, June). UX Practitioners' Engagement with Intermediate-Level Knowledge. In *DIS'17 Companion: ACM Conference on Designing Interactive Systems* (pp. 13-17). New York, NY: ACM Press. <https://doi.org/10.1145/3064857.3079110>

Invited or Juried Conference Publications

Gray, C. M., Toombs, A. L., Light, A., & Vines, J. (2018). Editorial: Ethics, Values, and Designer Responsibility. In *Proceedings of the Design Research Society Conference* (pp. 83-85), Limerick, Ireland. <https://doi.org/10.21606/dma.2018.003>

Gray, C. M., Jia, X., Watson, C., Wang, Y., Jung, J., & Frick, T. W. (2011). Frameworks for Facilitating Research Thinking: Redesigning a Residential Course for Online Use in Higher Education. *Association for Educational Communications and Technology 2011 Convention Proceedings*, Jacksonville, Florida.

Edited Books

Boling, E., **Gray, C. M.**, Howard, C. D., & Baaki, J. (Eds.) (2021). *Historical Instructional Design Cases: ID Knowledge in Context and Practice*. New York, NY: Routledge. ISBN: 978-0367353704

Boling, E., Schwier, R. A., Campbell, K., Smith, K. M., & **Gray, C. M.** (Eds.) (2016). *Studio Teaching in Higher Education: Selected Design Cases*. New York, NY: Routledge. ISBN:978-1138902435

Book Chapters

Gray, C. M., Westbrook, A., Williams, R. M., Parsons, P., & Toombs, A. L. (in press). Trajectories of Student Engagement with Social Justice-Informed Design Work. In B. Hokanson, M. Exter, M. Schmidt, & A. Tawfik (Eds.) *Toward Inclusive Learning Design: Social Justice, Equity, and Community*. Springer.

Lachheb, A., **Gray, C. M.**, & Boling, E. (2022). Inscripting a Designer Mindset to Instructional Design Students. In J. Stefaniak & R. Reese (Eds.), *The Instructional Designer's Training Guide: Authentic Practices and Considerations for Mentoring ID and Ed Tech Professionals*. <https://doi.org/10.4324/9781003109938-3>

Gray, C. M. (2021). "Supervising Women Workers": The Rise of Instructional Training Films (1944). In E. Boling, C. M. Gray, C. Howard, & J. Baaki (Eds.), *Historical Instructional Design Cases: ID Knowledge in Context and Practice*. New York, NY: Routledge.

Gray, C. M., & Howard, C. D. (2021). Setting the Cases in Historical Context. In E. Boling, C. M. Gray, C. Howard, & J. Baaki (Eds.), *Historical Instructional Design Cases: ID Knowledge in Context and Practice*. New York, NY: Routledge.

Boling, E., & **Gray, C. M.** (2021). Instructional Design and User Experience Design: Values and Perspectives Examined through Artifact Analysis. In B. Hokanson et al. (Eds.), *Intersections across disciplines: Interdisciplinarity and learning design* (pp. XX-XX). Switzerland: Springer.

Gray, C. M. (2020). Paradigms of Knowledge Production in Human-Computer Interaction: Towards a Framing for Learner Experience (LX) Design. In M. Schmidt, A. A. Tawfik, Y. Earnshaw, and I. Jahnke (Eds.) *Learner and User Experience Research: An Introduction for the Field of Learning Design & Technology*. EdTech Books.

Gray, C. M., Parsons, P., & Toombs, A. L. (2020). Building a Holistic Design Identity Through Integrated Studio Education. In B. Hokanson, G. Clinton, A. Tawfik, A. Grincewicz, & M. B. Schmidt (Eds.) *Educational Technology Beyond Content* (pp. 43-55). Switzerland: Springer. https://doi.org/10.1007/978-3-030-37254-5_4

Varner, D., Exter, M. E., & **Gray, C. M.** (2020). Towards a Content-Agnostic Praxis for Transdisciplinary Education. In B. Hokanson, G. Clinton, A. Tawfik, A. Grincewicz, & M. B. Schmidt (Eds.) *Educational Technology Beyond Content* (pp. 141-151). Switzerland: Springer. https://doi.org/10.1007/978-3-030-37254-5_12

Boling, E., & **Gray, C. M.** (2018). Use of Precedent as a Narrative Practice in Design. In B. Hokanson, G. Clinton, & K. Kaminiski (Eds.) *Educational Technology and Narrative: Story and Instructional Design* (pp. 51-64). Switzerland: Springer. https://doi.org/10.1007/978-3-319-69914-1_21

Gray, C. M. (2018). Narrative Qualities of Design Argumentation In B. Hokanson, G. Clinton, & K. Kaminiski (Eds.) *Educational Technology and Narrative: Story and Instructional Design* (pp. 259-270). Switzerland: Springer. https://doi.org/10.1007/978-3-319-69914-1_5

Gray, C. M., & Boling, E. (2017). Designers' Articulation and Activation of Instrumental Design Judgments in Cross-Cultural User Research. In B. T. Christensen, L. J. Ball, & K. Halskov (Eds.) *Analysing Design Thinking: Studies of Cross-Cultural Co-Creation* (pp. 191-211). Leiden, NL: CRC Press/ Taylor & Francis.

Gray, C. M. (2016). Emergent Views of Studio. In E. Boling, R. A. Schwier, C. M. Gray, K. M. Smith, & K. Campbell (Eds.) *Studio Teaching in Higher Education: Selected Design Cases*. New York, NY: Routledge.

Gray, C. M., & Smith, K. M. (2016). Critical Views of Studio Education. In E. Boling, R. A. Schwier, C. M. Gray, K. M. Smith, & K. Campbell (Eds.) *Studio Teaching in Higher Education: Selected Design Cases*. New York, NY: Routledge.

Gray, C. M., & Howard, C. D. (2016). Normativity Concerns, Avoided: Instructional Barriers in Designing for Social Change. In R. S. Adams, P. Buzzanell, & J. A. Siddiqui (Eds.) *Analyzing Design Review Conversations*. West Lafayette, IN: Purdue University Press. **[Selected for publication from DTRS'10]**

Boling, E., & **Gray, C. M.** (2015). Designerly Tools, Sketching, and Instructional Designers and the Guarantors of Design. In B. Hokanson, G. Clinton, & M. Tracey (Eds.) *The Design of Learning Experience: Creating the Future of Educational Technology*. New York, NY: Springer.

Gray, C. M. (2015). Critiquing the Role of the Learner and Context in Aesthetic Learning Experiences. In B. Hokanson, G. Clinton, & M. Tracey (Eds.) *The Design of Learning Experience: Creating the Future of Educational Technology*. New York, NY: Springer.

Awarded External Funding

PI. **Gray, C. M.** (2019). CHS: Small: "Everyday Ethics" in Sociotechnical Practice. *National Science Foundation: IIS*. (Grant Period: 2019-2022). **\$498,520**. [+ REU Supplement '20: **\$16,000** + REU Supplement '21: **\$16,000**]

PI. **Gray, C. M.** (2017). CRIL: CHS: Dark patterns, Pragmatist Ethics, and User Experience. *National Science Foundation: CISE*. (Grant Period: 2017-2019). **\$167,290** [+ REU Supplement '17: **\$16,000** + REU Supplement '18: **\$16,000**]

Co-PI. Yilmaz, S., & **Gray, C. M.** (2014). Investigating impacts on the ideation flexibility of engineers. *National Science Foundation IUCRC, Iowa State University Center for e-Design, Industry Advisory Board*. (Grant Period: 2015-2016). \$30,000.

Conference Presentations

Refereed

Santos, C., **Gray, C. M.**, & Bielova, N. (2022, June). Usable and accessible GDPR consent: Is it possible?. *Privacy Law Scholars Conference (PLSC) 2022*, Boston, MA.

Gray, C. M., & Chivukula, S. S. (2019, April). *(Un)Designing "Darkness" in Computing Education*. Paper Session at the 2019 AERA Annual Meeting, New York, NY.

Gray, C. M., & Toombs, A. L. (2018, April). *Forming a Design Identity in Computing Education Through Reflection and Peer Interaction*. Paper Session at the 2018 AERA Annual Meeting, San Antonio, TX.

Gray, C. M., Exter, M. E., Ashby, I., & Varner, D. (2018, April). *Breaking the Model, Breaking the "Rules:" Instructional Design in a Transdisciplinary Learning Environment*. Paper Session at the 2018 AERA Annual Meeting, San Antonio, TX.

Exter, M. E., **Gray, C. M.**, & Fernandez, T. F. (2017, June). *Transdisciplinary Design Education: Do Differing Disciplinary Backgrounds Divide or Unify?*. Poster Session at the Mudd Design Workshop X: Design and the Future of the Engineer of 2020, Claremont, CA.

Boling, E., **Gray, C. M.**, & Smith, K. M. (2017, April). *The designer in the design student: The evolution of feedback in an instructional graphics studio*. Roundtable Session at the 2017 AERA Annual Meeting, San Antonio, TX.

Wilder, D., & **Gray, C. M.** (2016, November). *Enculturating Peer and Instructor Critique in a Transdisciplinary Technology Studio Environment*. Poster Session at the Association of American Colleges & Universities (AAC&U) Transforming Undergraduate STEM Education Conference: Implications for 21st Century Society, Boston, MA.

Gray, C. M., Krause, T., & Exter, M. (2016, October). *Barriers to Developing Empathic Ability: Gender Inclusivity in Technology Education*. Concurrent Session at Association for Educational Communications and Technology (AECT) International Convention, Las Vegas, NV.

Gray, C. M., & Howard, C. D. (2016, April). *Inverting Critique: Emergent Technologically-Mediated Critique Practices of Developing Design Students*. Paper Session at the 2016 AERA Annual Meeting, Washington, DC.

Boling, E., & **Gray, C. M.** (2016, April). *Examining the Prior Knowledge of Instructional Design Practitioners Studying Visual Methods at the Masters Level*. Poster Session at the 2016 AERA Annual Meeting, Washington, DC.

Gray, C. M. (2016, April). *Developing an Ethically-Aware Design Character through Problem Framing*. Paper Session at the 2016 AERA Annual Meeting, Washington, DC.

Howard, C. D., & **Gray, C. M.** (2016, April). *Meaning Making in an Interactive Video Annotation Environment*. Paper Session at the 2016 AERA Annual Meeting, Washington, DC.

Boling, E., & **Gray, C. M.** (2015, November). *Students' lived knowledge applied to learning visual methods in design*. Paper Session at 47th Annual International Visual Literacy Association Conference, San Francisco, CA.

Boling, E., **Gray, C. M.**, & Smith, K. S. (2015, April). *Who are these "novices"? Challenging the deficit view of design students*. Paper Session at AERA Annual Meeting 2015, Chicago, IL.

Gray, C. M. (2015, April). *Struggle Over Representation in the Studio: Critical Pedagogy in Design Education*. Paper Session at AERA Annual Meeting 2015, Chicago, IL.

Yilmaz, S., **Gray, C. M.**, Seifert, C. M., Daly, S., & Gonzalez, R. (2015, April). *What Happens when Creativity is Exhausted? Design Tools as an Aid for Ideation*. Paper Session at AERA Annual Meeting 2015, Chicago, IL.

Boling, E., **Gray, C. M.**, & Demiral-Uzan, M. (2014, November). *Stop Telling Designers What To Do: Reframing Instructional Design Education Through the Lens of ID Practice*. Concurrent Session at AECT International Convention 2014, Jacksonville, FL.

Gray, C. M. (2014, November). *Exploring the Lived Experience of Learners: Broadening our Understanding of Aesthetic Learning Experiences*. Concurrent Session at AECT International Convention 2014, Jacksonville, FL.

Gray, C. M., & Boling, E. (2014, November). *Design in the "Real World": Situating Academic Conceptions of ID Practice*. Concurrent Session at AECT International Convention 2014, Jacksonville, FL.

Howard, C. D., & **Gray, C. M.** (2014, November). *Extra-curricular Design Learning: Emergent Critique in Learners' SNS Interactions*. Concurrent Session at AECT International Convention 2014, Jacksonville, FL.

Gray, C. M. (2014, April). *Accounting for Learner Agency in an Aesthetic Learning Experience*. Research Study Session at Instructional Systems Technology Conference 2014, Bloomington, IN.

Harris, M., **Gray, C. M.**, Boling, E., Dagli, C., Demiral-Uzan, M., Ergulec, F., Gyabak, K., Kizilboga, R., Tan, V., & Tomita, K. (2014, April). *Design Judgments in Instructional Design Practice*. Research Study Session at Instructional Systems Technology Conference 2014, Bloomington, IN.

Boling, E., **Gray, C. M.**, & Tan, V. (2014, April). *Instructional Design In Action: Observing the Judgments of ID Practitioners*. Paper Session at AERA Annual Meeting 2014, Philadelphia, PA.

Gray, C. M. (2013, November). *Informal Peer Critique and the Negotiation of Habitus in a Design Studio*. Concurrent Session as part of the ECT Foundation Qualitative Inquiry Award at AECT International Convention 2013, Anaheim, CA.

Gray, C. M. (2013, November). *The Hidden Curriculum of the Design Studio: Student Engagement in Informal Critique*. Concurrent Session at AECT International Convention 2013, Anaheim, CA.

Gray, C. M. (2013, November). *Classroom Reflection as a Tool to Externalize Conceptions of Design*. Poster Session at AECT International Convention 2013, Anaheim, CA.

Gray, C. M. (2013, March). *Informal Peer Critique and the Negotiation of Habitus in a Design Studio*. Research Paper Session at Instructional Systems Technology Conference 2013, Bloomington, IN.

Gray, C. M. & Siegel, M. A. (2013, March). *Sketching Design Thinking: Representations of Design in Education and Practice*. Research Paper Session at Instructional Systems Technology Conference 2013, Bloomington, IN.

Boling, E., Altuwaijri, A., Jung, J., **Gray, C. M.**, Yildirim, C., Modell, M. G., Howard, C., Ergulec, F., & Demiral, M. (2012, November). *Learners' Strategies for Interpreting Instructional Images*. Concurrent Session at AECT International Convention 2012, Louisville, KY.

Gray, C. M. (2012, November). *Design Thinking in a Graduate Design Studio: Personal and Pedagogical Factors*. Concurrent Session at AECT International Convention 2012, Louisville, KY.

Gray, C. M. (2012, November). *Verbalization of Design Thinking through Informal Peer Critique*. Concurrent Session at AECT International Convention 2012, Louisville, KY.

Boling, E., Altuwaijri, A., Jung, J., Yildirim, C., **Gray, C.**, Modell, M., & Howard, C. (2012, March). *Strategies for Interpreting Instructional Images Used to Support Language Learning*. Research Paper Session at Instructional Systems Technology Conference 2012, Bloomington, IN.

Gray, C. M. (2012, March). *The Role of Personal and Pedagogical Factors in Graduate Design Education*. Research Paper Session at Instructional Systems Technology Conference 2012, Bloomington, IN.

Jung, J., **Gray, C.**, Howard, C., Kwon, S., Modell, M., & Boling, E. (2011, November). *Preparation of Visual Materials to Study How EFL Learners Use Images in the Learning Process*. Roundtable Discussion at AECT International Convention 2011, Jacksonville, FL.

Watson, C., **Gray, C.**, Jia, K., Jung, J., & Wang, Y. (2011, November). *A Case Study in Designing Online Instruction Using van Merriënboer's Ten Steps to Complex Learning*. Concurrent Session at AECT International Convention 2011, Jacksonville, FL.

Altinay, B., Altuwaijri, A., Callison, M., **Gray, C.**, Jung, E., Jung, J., & Yildirim, C. (2011, February). *A Needs Assessment of Distance Education in the School of Education at Indiana University Bloomington*. Poster Session at Instructional Systems Technology Conference 2011, Bloomington, IN.

Boling, E., Howard, C., Altuwaijri, A., Caldwell, K., **Gray, C.**, Jung, J., Kwon, S., Modell, M., Whiting, J., Wu, T., & Yildirim, C. (2011, February). *Visuals for Learning*. Roundtable Discussion at Instructional Systems Technology Conference 2011, Bloomington, IN.

Watson, C., **Gray, C.**, Jia, K., Jung, J., Wang, Y., & Frick, T. (2011, February). *A Case Study in Designing Online Instruction using van Merriënboer's 4C/ID model*. Roundtable Discussion at Instructional Systems Technology Conference 2011, Bloomington, IN.

Gray, C. M. (2009, June). *Rapid e-learning: How do we get from here to there?* Upstate Technology Conference 2010, Greenville, SC.

Invited

Gray, C. M. (2021, May). *Infrastructuring the Vertically-Integrated Studio: Challenges and Opportunities to Build Student Engagement and Ownership*. Invited talk at Polytechnic Summit, TU Dublin/Virtual.

Gray, C. M. (2019, February 4). *Building Transdisciplinary Design Capability through an Integrated Studio Approach*. Interaction Design Education Summit, Seattle, WA.

Gray, C. M. (2018, August). *Developing Students' Transdisciplinary Thinking in User Experience Design Pedagogy*. Invited talk at International Innovation and Entrepreneurship Education (IIEE) Conference, Beijing Normal University, Beijing, China.

Gray, C. M. (2018, August). *Tangible Embodied Interaction: Beyond the Screen and into Our Everyday Lives*. Invited talk at Future Learning and Innovative Talents Forum, Sino-Finnish Joint Learning Innovation Institute, Xi'an, China.

Gray, C. M., Parsons, P., & Toombs, A. L. (2018, June). *The Integrated Design Studio as an Approach to Transdisciplinary Design Learning*. Invited talk at Polytechnic Summit, Lima, Peru.

Exter, M. E., **Gray, C. M.**, & Smith, M. (2017, June). *Integrating Liberal Education Perspectives in a Transdisciplinary Design Studio*. Invited talk at Polytechnic Summit, Purdue University, West Lafayette, IN.

Gray, C. M., Vorvoreanu, M., Parsons, P., & Rasche, N. (2017, June). *Transforming User Experience Design Education Through Integrated Learning*. Invited talk at Polytechnic Summit, Purdue University, West Lafayette, IN.

Gray, C. M. (2015, November). *Building a Multidimensional View of Professional Practice through Trace and In Situ Data Collection*. Invited talk at Academics and Practitioners: Symposium on Connecting HCI and UX, University of Nottingham, Nottingham, UK.

Tracey, M. W., Boling, E., Campbell, K., & **Gray, C. M.** (November 2014). *Design of Learning Experience: The 2014 AECT Research Symposium*. Invited panel discussion at the Association for Educational Communication and Technology Conference, Jacksonville, FL.

Gray, C. M. (November 2013). *Informal Peer Critique and the Negotiation of Habitus in a Design Studio*. Invited Concurrent Session for ECT Foundation Qualitative Inquiry Award at AECT International Convention 2013, Anaheim, CA.

Workshops

Refereed

MacDonald, C. M., St-Cyr, O., **Gray, C. M.**, Potter, L. E., Lallemand, C., Vasilchenko, A., Sin, J., Carter, A. R. L., Pitt, Caroline, Sari, E., Padhi, D. R., & Pillai, A. G. (2022, May). *EduCHI 2022: 4th Annual Symposium on HCI Education*. Symposium at CHI 2022 (CHI'22), Virtual Conference.

Lukoff, K., Hiniker, A., **Gray, C. M.**, Mathur, A., & Chivukula, S. S. (2021, May). What Can CHI Do About Dark Patterns? Workshop at CHI 2021 (CHI'21), Virtual Conference.

MacDonald, C. M., St-Cyr, O., **Gray, C. M.**, Potter, L. E., Vasilchenko, A., Sin, J., Vasilchenko, A., & Churchill, E. (2021, May). *EduCHI 2021: 3rd Annual Symposium on HCI Education*. Symposium at CHI 2021 (CHI'21), Virtual Conference.

St-Cyr, O., MacDonald, C. M., **Gray, C. M.**, Potter, L. E., Vasilchenko, A., Sin, J., & Churchill, E. (2020, April). *EduCHI 2020: 2nd Annual Symposium on HCI Education*. Symposium at CHI 2020 (CHI'20), Honolulu, HI. <https://doi.org/10.1145/3334480.3375066>

Gray, C. M., Chivukula, S. S., Toombs, A. L., & Light, A. (2018, June 25). *Visualizing Values to Analyze Designers' Ethical Responsibility*. Workshop at Design Research Society 2018, Limerick, Ireland.

Toombs, A. L., Dow, A., Vines, J., **Gray, C. M.**, Dennis, B., Clarke, R., & Light, A. (2018, June 6). *Designing for Everyday Care in Communities*. Workshop at Designing Interactive Systems 2018 (DIS'18), Hong Kong.

Boling, E., Howard, C. D., **Gray, C. M.**, & Baaki, J. (2016, October 17). *Student Design Case SLAM*. Workshop at AECT International Convention 2016, Las Vegas, NV.

Gray, C. M., & Hu, Y. (2015, November 9-10). *Service Design Workshop: Design for Fairness*. Workshop at the 2015 Global Chinese Industrial Design Conference (GDIDC), Changsha, Hunan Province, China.

Gray, C. M., Yilmaz, S., Daly, S., Seifert, C. M., & Gonzalez, R. (2015, June). *Building Students' Ideation Ability through Design Heuristics*. Workshop at LearnxDesign: The 3rd International Conference for Design Education Researchers and PreK-16 Design Educators, Chicago, IL.

Gray, C. M., Yilmaz, S., & Daly, S. (2015, June 14). *Innovative Idea Generation for Engineering Design*. Workshop at ASEE Annual Conference 2015, Seattle, WA.

Boling, E., **Gray, C. M.**, & Howard, C. D. (2013, October 30). *Design Case Workshop: International Journal of Designs for Learning*. Workshop at AECT International Convention 2013, Anaheim, CA.

Invited

Gray, C. M., & Toombs, A. L. (2017, October 11,13). *Practical Approaches to Qualitative Inquiry*. Open Lab, Newcastle University, Newcastle upon Tyne, United Kingdom.

Gray, C. M. (2017, October 10). *Evaluating Technological Interventions through the Lens of Instructional and Learning Theory*. Open Lab, Newcastle University, Newcastle upon Tyne, United Kingdom.

Gray, C. M., & Toombs, A. L. (2017, July 19). *Qualitative Inquiry: Thematic Analysis, Meaning Reconstruction, and Data Management*. Open Lab, Newcastle University, Newcastle, United Kingdom.

Gray, C. M. (2015, April 10). *Selling Your Design: Communicating Problem Finding and Exploration Strategies*. Industrial Design Workshop Series, College of Design, Iowa State University, Ames, IA.

Gray, C. M., & Yilmaz, S. (2015, April 3). *Framing the Problem: Strategies for Problem Finding and Exploration*. Industrial Design Workshop Series, College of Design, Iowa State University, Ames, IA.

Gray, C. M., Yilmaz, S., & Dhadphale, T. (2014, October 10). *Finding the 'Right Design': An Introduction to Problem Exploration*. Industrial Design Workshop Series, College of Design, Iowa State University, Ames, IA.

Gray, C. M. (2014, September 24). *Collaborative Idea Generation through Functional Decomposition*. Guest Lecturer, IND D-301, Industrial Design Studio III. Iowa State University, Ames, IA.

Teaching

2021—present **Associate Professor, Purdue University—West Lafayette, IN**

CGT 172-08: UXD Studio 1: Fundamentals (Spring 2022 + course coordination)
CGT 271-08: UXD Studio 2: Screen (Fall 2021)
TECH 533-00: Design Theory and Technology (Fall 2021)

2015—2021 **Assistant Professor, Purdue University—West Lafayette, IN**

CGT 172-08: UXD Studio 1: Fundamentals (Spring 2016; Spring 2017; Spring 2018; Spring 2019; Spring 2020; Spring 2021)
CGT 271-08: UXD Studio 2: Screen (Fall 2016; Fall 2017; Fall 2018; Fall 2019; Fall 2020)
CGT 272-08: UXD Studio 3: Cross-Channel (co-designed)
CGT 371-08: UXD Studio 4: Strategy (co-designed)
CGT 372-08: UXD Studio 5: Specialization (Spring 2018, Spring 2019; Spring 2020; Spring 2021)
CGT 572-00: UXD Grad Studio 1: Fundamentals (Fall 2018, Fall 2020)
CGT 597-00: UXD Grad Capstone (Spring 2020; Spring 2021)
TECH 299-00: Design Lab II (Spring 2016)
TECH 533-00: Design Theory and Technology (Fall 2016; Fall 2017; Fall 2019)
TECH 697-00: Qualitative Research Methods in Technology Studies (Spring 2018; Spring 2019; Spring 2020)

Awards

Best of CHI Honorable Mention, ACM SIGCHI Conference on Human Factors in Computing Systems, 2021.

Outstanding Design Case, American Educational Research Association, SIG Design & Technology, 2021.

Honorable Mention, ACM SIGCHI Conference on Designing Interactive Systems, 2020.

Best of CHI Honorable Mention, ACM SIGCHI Conference on Human Factors in Computing Systems, 2019.

Best Diversity Paper Nominee, American Society for Engineering Education (ASEE), 2016.

Summer Research Institute Awardee, Consortium for the Science of Sociotechnical Systems (CSST), 2015.

Instructional Systems Technology (IST) Dissertation of the Year Award, Indiana University, 2015.

Best of CHI Honorable Mention, ACM SIGCHI Conference on Human Factors in Computing Systems, 2015.

Best Paper Award, ACM SIGCHI Conference on Designing Interactive Systems, 2014.

Qualitative Inquiry Award, Educational Communications and Technology (ECT) Foundation, 2013.

NSF Early Career Symposium Awardee, AECT International Convention, 2013.

Award for Outstanding Service to the Division, AECT Design & Development Division, 2013.

Professional Service

Editorial

2020-present. Editorial Board, Design Studies.

2014-present. Advisory Board Member, International Journal of Designs for Learning.

Gray, C. M., Howard C. D. (Eds.) (2014). Historic Design Cases, Special Issue of *International Journal of Designs for Learning*, 5(2).

Professional Leadership & Committees

2017-2019. Program Chair and SIG Chair, Design and Technology SIG, American Educational Research Association (AERA).

2016-2017. Secretary/Treasurer, Design and Technology SIG, American Educational Research Association (AERA).

2013-2014. Design & Development Board Associate, Association for Educational Communications and Technology (AECT).

2013-2014. Research, Development, External Partnerships Committee. Indiana University School of Education.

College and Department Leadership & Committees

2018-2021. Research Advisory Council Member (College)

2019-2021. Realizing the Digital Enterprise Research Impact Area Co-Lead (College)

2018-2019. Communities and Civic Engagement Research Impact Area Co-Lead (College)

2017-present. User Experience (UX) Design Program Lead (Department)

2017-2019. Graduate Education Committee Member (College)

2017-2019. Graduate Committee Co-Chair (Department)

Reviewing

Journal

2011-present. International Journal of Designs for Learning.

2014-present. Interdisciplinary Journal of Problem-Based Learning.

2015-present. CoDesign.

2015-present. Design Studies.

2016-present. Journal of Engineering Education.

2017-present. Review of Educational Research.

2018-present. ACM Transactions on Computer-Human Interaction (TOCHI).

2018. International Journal of Engineering Education.

2015-2017. Journal of Computing in Higher Education.

2017. International Journal of Fashion Design, Technology, and Education.

2016. American Educational Research Journal.

2016. Interacting with Computers.

2013. Journal of Learning Design.

2013. Journal of Online Learning and Teaching.

Conference

2013-present. ACM SIGCHI: CHI ['19, '20, '21, '22 AC], DIS ['16, '17, '18, '19, '20 Papers AC; '18 PWiP AC], Creativity & Cognition ['19 AC], CSCW ['19-'21 AC], MobileHCI.

2013-present. AERA Annual Meeting ['18 SIG Program Chair].

2014-present. ASEE Annual Conference: ERM, Engineering Ethics, DEED, LEES, MULTI, and NEE Divisions.

2016, 2018. Design Research Society ['18 Track Chair].

2018. Decipher (AIGA + DARIA).

2018. NordiCHI.

2012-2016. AECT International Convention: Design & Development; Research & Theory; and Culture, Learning, and Technology Divisions.

2015. ASME IDETC Conference.

2015. LearnxDesign Conference (DRS//CUMULUS//Design-Ed).

2015. Online Learning Consortium (formerly Sloan-C) International Conference.

2013, 2015. Nordes Conference.

2012-2014. Indiana University Instructional Systems Technology Conference.

Invited Talks

Keynote

Gray, C. M. (2020, October 20). Invited Keynote Speaker. *"Dark Patterns" and Designer Responsibility*. The Influence of Design on Privacy: Building Expertise in New Zealand. Delivered via Zoom to Victoria University of Wellington, Wellington, New Zealand.

Gray, C. M. (2019, May 4). Invited Keynote Speaker. *Making the Case for HCI Education: Developing and Sustaining Competence in Global HCI Education*. EduCHI 2019 Symposium, Co-located with the 2019 ACM SIGCHI Conference on Human Factors in Computing Systems.

Gray, C. M. (2015, November 7). Invited Keynote Speaker. *Origins of UX Design Culture: Building Knowledge Across Education and Practice*. China Universities Industrial Design Education Seminar 2015 & the 11th Global Chinese Industrial Design Conference (GCIDC), Changsha, Hunan Province, China.

Research Presentation

Gray, C. M. (2021, September 14). *Dark Patterns, Ethical Engagement, and the Possibility for Action*. Invited Talk at BostonCHI, Virtual. [video]

Gray, C. M. (2021, September 9). *Translational Design Research: A Provocation for Research Quality*. Invited Talk at the Design Research Society Festival of Emergence: A Research Quality Moment, Virtual.

Gray, C. M. (2020, September 3). *"Dark Patterns" and the Language of Evil*. Invited Talk at the Bi-Annual David Hutton Interdisciplinary Lecture Series, Purdue University, West Lafayette, IN.

Gray, C. M. (2019, November 19). *"Dark Patterns" and Ethical Engagement in Design Activity*. Invited Talk for the Instructional Media course, Instructional Design & Technology Program, The University of Tampa, Tampa, FL.

Gray, C. M. (2019, September 2). *Exploring Dark Patterns and Conceptions of Designer Responsibility*. Invited Lecture at the 4th Interdisciplinary Summerschool on Privacy, Nijmegen, The Netherlands.

Gray, C. M. (2019, March 13). *Unraveling Ethical Design Complexity in UX Practice*. NORTH Lab, Northumbria University, Newcastle upon Tyne, United Kingdom.

Gray, C. M. (2018, October 17). *Ontology, Mindset, and Conception of Design Methods in UX Education and Practice*. Invited Talk at the Instructional Psychology & Technology Seminar Series / Creativity, Innovation, & Design Lecture Series, Brigham Young University, Provo, UT.

Gray, C. M. (2018, September 14). *Ethical Engagement and the Dark Side of User Experience Design*. Invited Talk at the Human-Computer Interaction Institute Seminar Series, Carnegie Mellon University, Pittsburgh, PA.

Gray, C. M. (2018, August). *Developing Students' Transdisciplinary Thinking in User Experience Design Pedagogy*. Invited Talk at the International Innovation and Entrepreneurship Education (IIEE) Conference, Beijing Normal University, Beijing, China.

Gray, C. M. (2018, August). *Tangible Embodied Interaction: Beyond the Screen and into Our Everyday Lives*. Invited Talk at the Future Learning and Innovative Talents Forum, Sino-Finnish Joint Learning Innovation Institute, Xi'an, China.

Gray, C. M. (2017, June). *Dark Patterns and an Ethic of Designerly Care*. Open Lab, Newcastle University, Newcastle upon Tyne, England.

Gray, C. M. (2016, November 18). *Ontology, Mindset, and Conception of Design Methods in UX Education and Practice*. Aarhus University, Aarhus, Denmark.

Gray, C. M., & Toombs, A. L. (2016, November 18). *Tracing Meaning-Making Through Reconstructive Analysis*. Participatory Information Technology Colloquium, Aarhus University, Aarhus, Denmark.

Gray, C. M. (2016, November 9). *Translating Studio Practices to Technology Education*. Computer Science Colloquium, College of Sciences and Humanities, Ball State University, Muncie, IN.

Gray, C. M. (2016, October 14). *Bridging the Divide: Developing and Sustaining UX Competence in Education and Practice*. Human-Centered Computing Colloquia Speaker Series, School of Informatics and Computing, Indiana University-Purdue University Indianapolis (IUPUI), Indianapolis, IN.

Guest Lecturer

2020, October 27. Guest Lecturer, SI 482, Interaction Design Studio. *Dark Patterns and Designer Responsibility*. University of Michigan (virtual).

2019, November 19. Guest Lecturer, Instructional Media course, Instructional Design & Technology Program. *"Dark Patterns" and Ethical Engagement in Design Activity*. The University of Tampa (virtual).

2017, September 18. Guest Lecturer, EDCI 62700, Educational Software Design. *Strategies for Innovative Problem Framing*. Purdue University, West Lafayette, IN.

2017, February 22. Guest Lecturer, TECH 69700, Qualitative Research Methods in Technology Studies. *Interviewing Techniques*. Purdue University, West Lafayette, IN.

2017, February 16. Guest Lecturer, CGT 27208, User Experience Design Studio III: Cross-Channel. *Critical and Reflective Design*. Purdue University, West Lafayette, IN.

2016, October 3 and 5. Guest Lecturer, PTEC 30800, Deep Immersion. *Bodystorming and Embodied Ideation*. Purdue University, West Lafayette, IN.

2016, September 26 and 28. Guest Lecturer, CGT 41100, Contemporary Problems in Applied Computer Graphics. *Introduction to Research and Evaluation Methods*. Purdue University, West Lafayette, IN.

2016, October 5. Guest Lecturer, EDCI 62700, Educational Software Design. *Strategies for Innovative Problem Framing*. Purdue University, West Lafayette, IN.

2016, October 3 and 5. Guest Lecturer, PTEC 30800, Deep Immersion. *Bodystorming and Embodied Ideation*. Purdue University, West Lafayette, IN.

2016, September 26 and 28. Guest Lecturer, CGT 41100, Contemporary Problems in Applied Computer Graphics. *Introduction to Research and Evaluation Methods*. Purdue University, West Lafayette, IN.

2015, October 22. Guest Lecturer, EDCI 62700, Educational Software Design. *Wireframing and Rapid Prototyping Techniques*. Purdue University, West Lafayette, IN.

2015, September 30. Invited Speaker, IT 566, Understanding Online Interaction. *"The Crit" as Technologically Mediated Assessment*. University of Tennessee, Knoxville, TN.

2015, April 1. Invited Speaker, CI 615 B, Seminar in Instructional Technology. *Locating Learner Experience in Instructional Design Theory and Practice*. Iowa State University, Ames, IA.

2015, February 27. Invited Speaker, HCI 591 XE, Seminar in Human Computer Interaction. *Building and Performing UX Competencies: Moving from Theory to Practice*. Iowa State University, Ames, IA.

2014, October 9. Guest Lecturer, C I-512, Research Trends in Digital Learning. Building Design Knowledge: Creating and Disseminating Design Precedent. Iowa State University, Ames, IA.

2014, September 24. Guest Lecturer, IND D-301, Industrial Design Studio III. Collaborative Idea Generation through Functional Decomposition. Iowa State University, Ames, IA.

Professional Affiliations

Association for Computing Machinery (ACM)

American Educational Research Association (AERA)

American Society for Engineering Education (ASEE)

Design Research Society (DRS)

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Wired: Google Tracks You Even If Location History's Off. Here's How to Stop It	4
NYT: Your Apps Know Where You Were Last Night, and They're Not Keeping It Secret	5
MIT Technology Review: How to get Google to stop tracking your location for real	6
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2020-11-04 SEALED Google Opposition to Motion for Summary Judgment

2020-11-04 SEALED Google Separate Statement of Facts in Support of Motion for Summary Judgment

2020-12-15 SEALED Eshaghian Declaration

2020-12-15 SEALED Exhibits to Eshaghian Declaration

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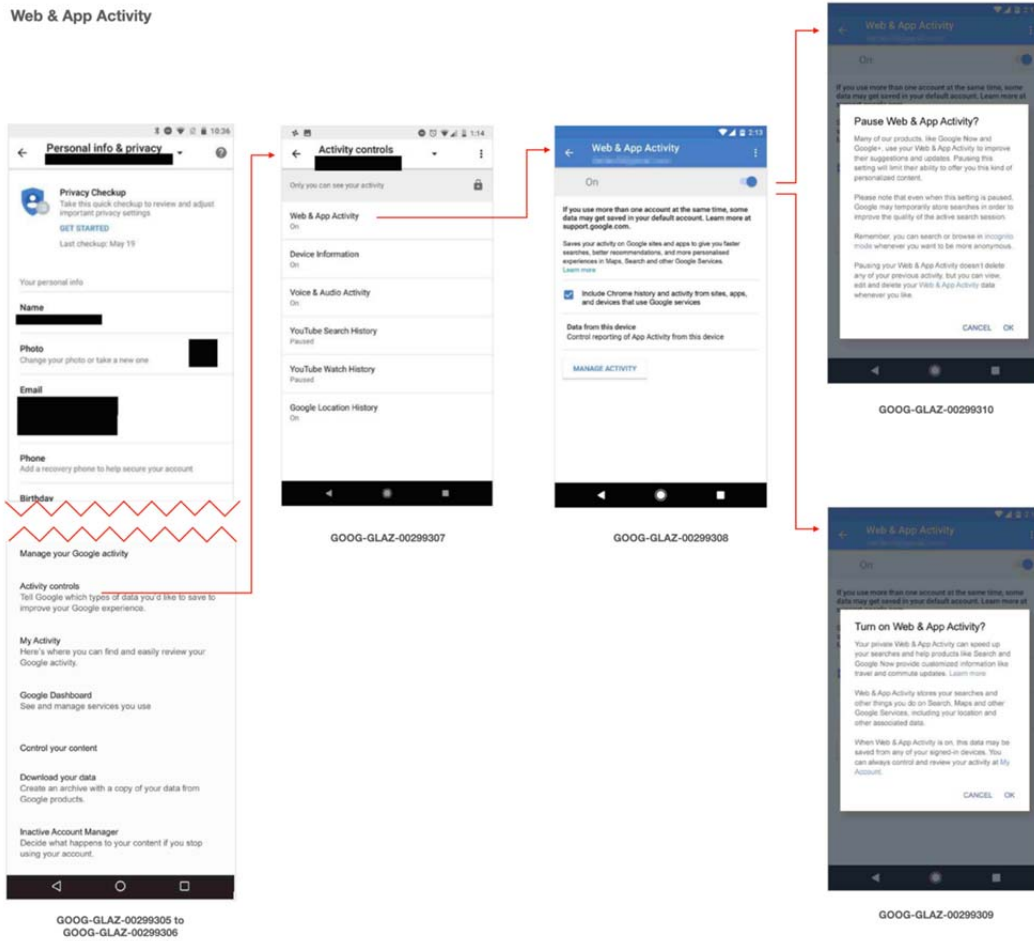
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Appendix 3: Web and App Activity Settings

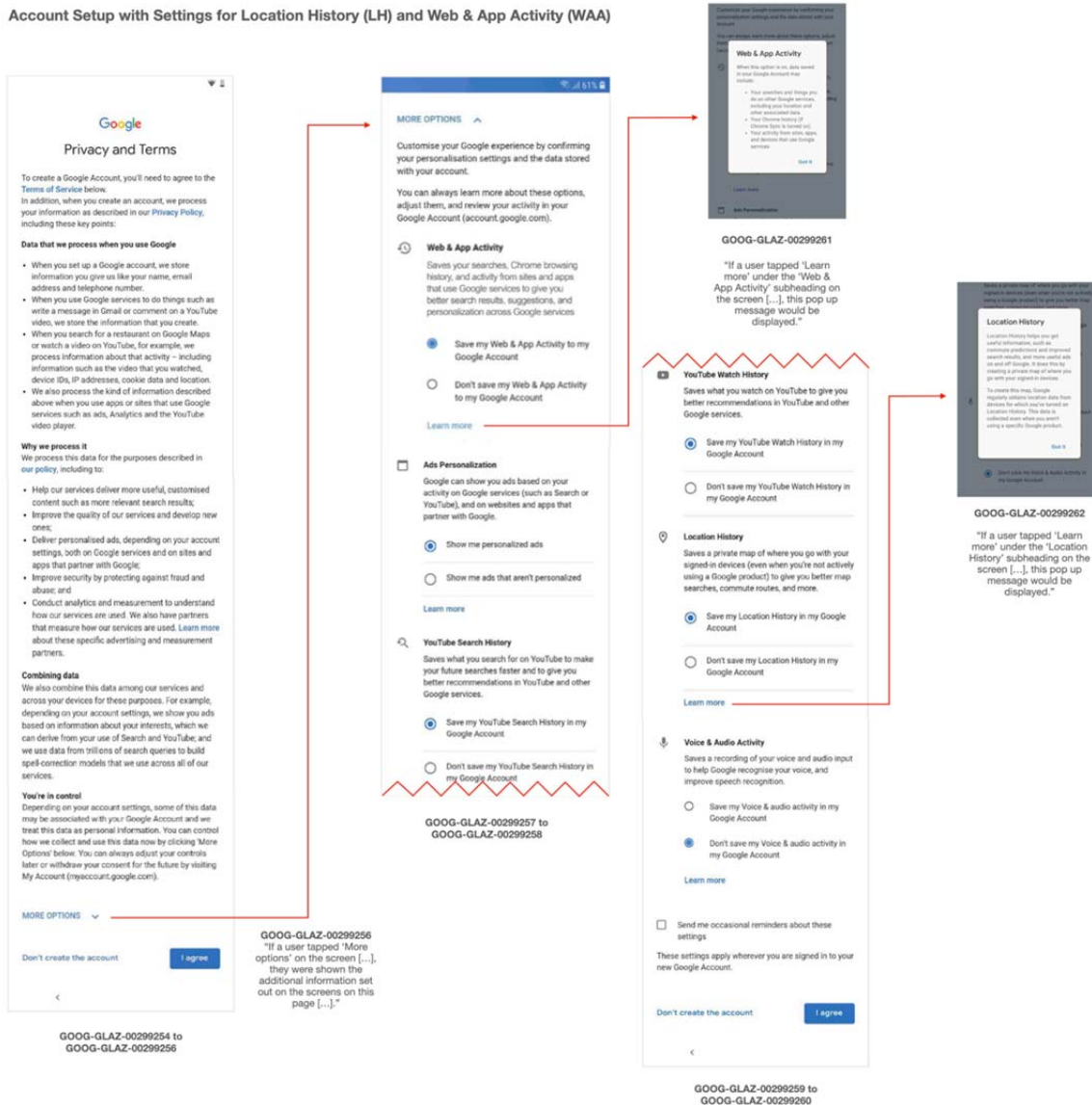
Web & App Activity



Images from GOOG-GLAZ-00299199 as indicated. All red arrows and lines were added by me to illustrate the task flow as users navigated between the screens.

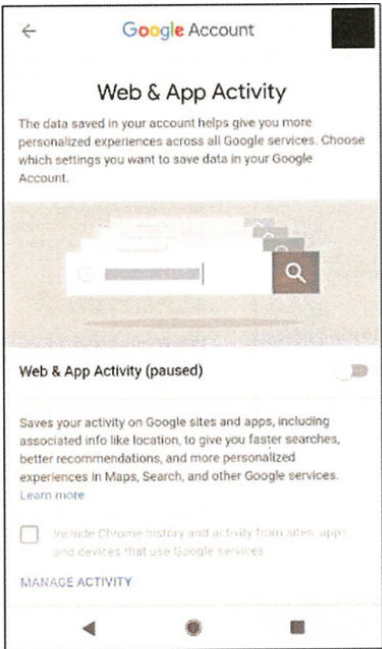
Appendix 4: LH and WAA on Account Setup

Account Setup with Settings for Location History (LH) and Web & App Activity (WAA)

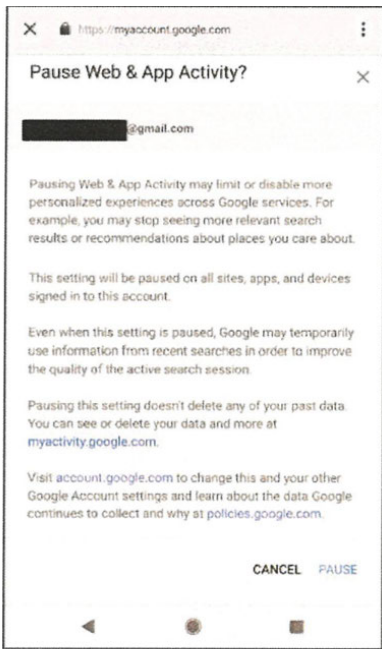


Images from GOOG-GLAZ-00299199 as indicated. All red arrows and lines were added by me to illustrate the task flow as users navigated between the screens.

Appendix 5: Pausing WAA Circa 2018



GOOG-GLAZ-00000161

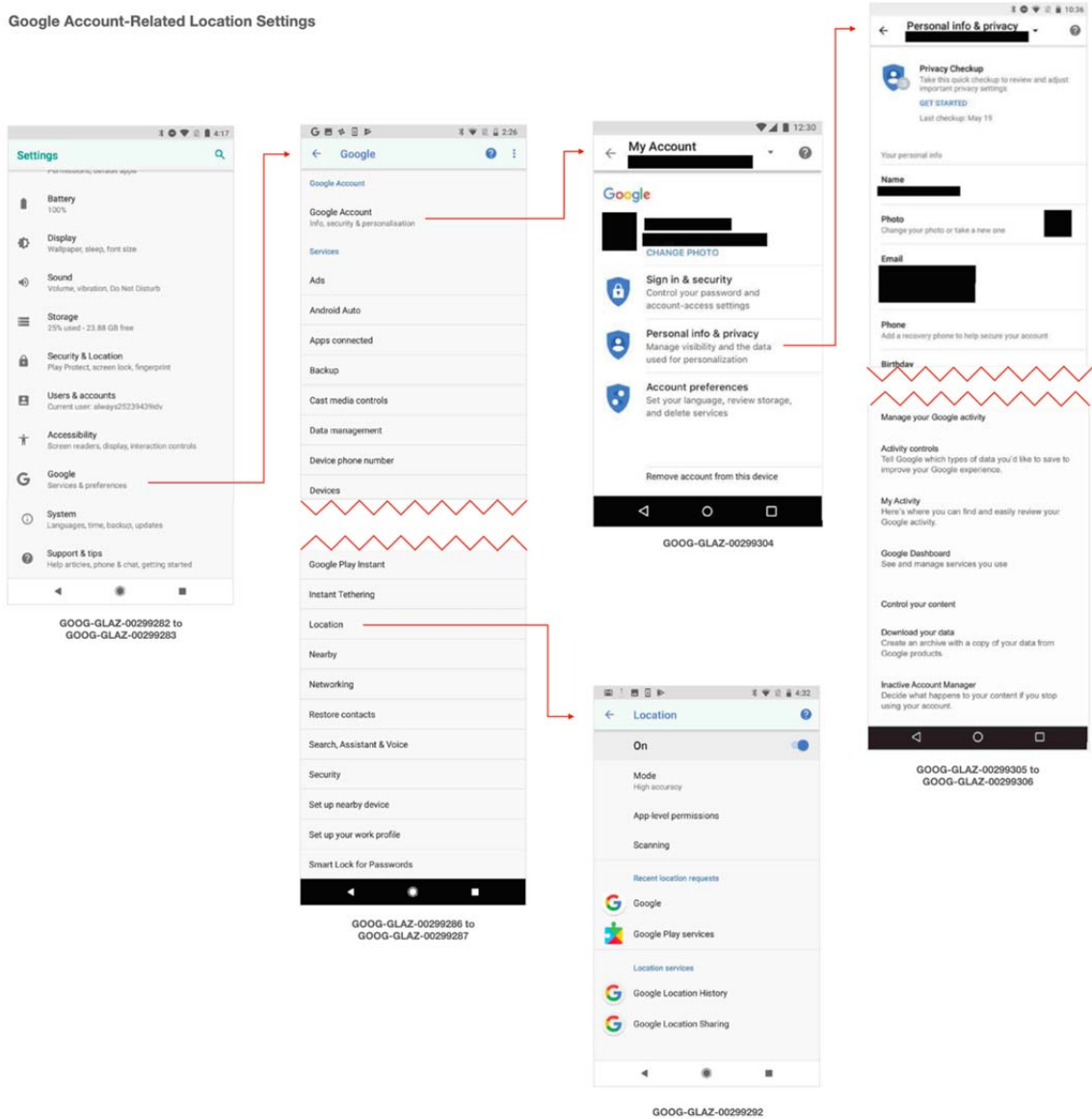


GOOG-GLAZ-00000162

Images taken from GOOG-GLAZ-00000150 as indicated.

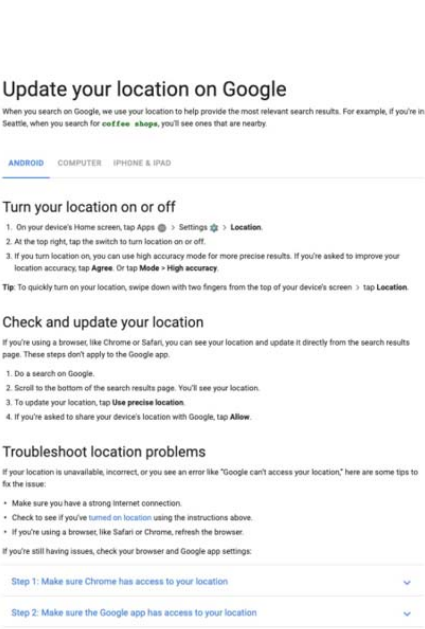
Appendix 6: Google Account Settings

Google Account-Related Location Settings

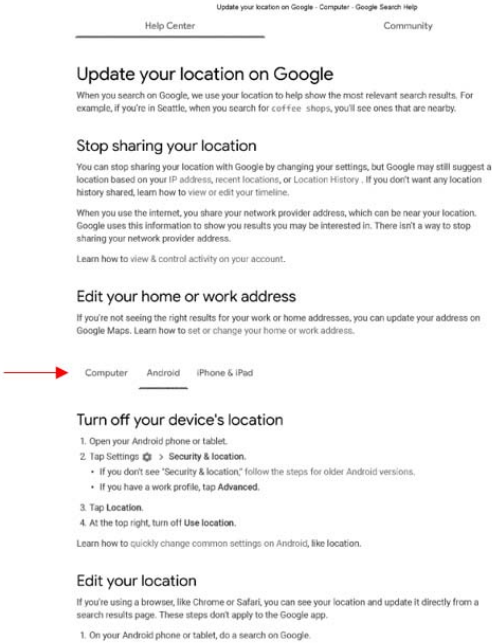


Images from GOOG-GLAZ-00299199 as indicated. All red arrows and lines were added by me to illustrate the task flow as users navigated between the screens.

Appendix 8: “Update Your Location” Help Center Page



Internet Archive Decl. at Ex. A

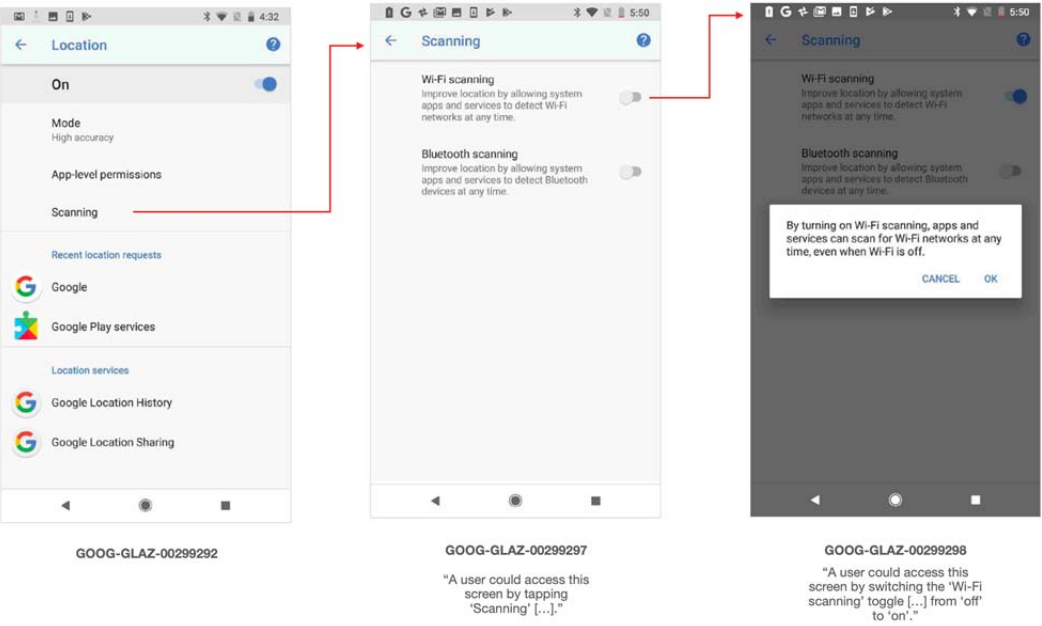


GOOG-GLAZ-00000942 at 942

Images taken from Ex. 297 (Internet Archive Decl.) and GOOG-GLAZ-00000942 as indicated. The red arrow was added by me to illustrate the change in the disclosure after the publication of the AP Article.

Appendix 9: WiFi Scanning and Bluetooth Scanning Settings

Wifi Scanning and Bluetooth Scanning



Images from GOOG-GLAZ-00299199 as indicated.