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# THE CASE OF SMARTPHONES

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**ABSTRACT**

Firms can increase the demand for their products and consolidate their market power not only by increasing user utility but also by decreasing non-user utility. In this paper, we examine this mechanism by considering the case of smartphones. In particular, Apple has faced criticism for allegedly degrading the Android user experience by making messages to Android devices appear as green bubbles on iPhones—a salient signal often perceived as reflecting a lower socioeconomic status. Using samples of US college students, we show that green bubbles are widely stigmatized and that a majority of both iPhone and Android users would prefer green bubbles to no longer exist. We then conduct an incentivized deactivation experiment, revealing that iPhone users have a significant willingness to pay to prevent their messages from appearing as green bubbles on other iPhones. Next, we examine the market implications of non-user utility and find that respondents are substantially more likely to choose an Android over an iPhone when green bubbles are removed. We conclude by presenting case studies that illustrate how companies use product features to reduce non-user utility in various markets.

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# 1 Introduction

The demand for a product may increase when the utility from consuming it rises but also when the disutility from *not consuming it* increases. This possibility gives companies strategic incentives to design product features that reduce non-user utility. As a result, users end up paying more for the same product, while non-users must settle for inferior alternatives without adequate price compensation. These tactics raise welfare concerns, particularly when dominant firms use them to entrench their market power.

One possible example of such strategies can be found in the US smartphone market, where Apple is the dominant player, particularly among young people. Recent discussions have questioned whether certain iPhone features are intentionally designed not only to enhance the user experience but also to degrade the experience for Android users. This debate has received considerable attention in various news outlets and is, in fact, central to the most recent Department of Justice (DOJ) case against Apple, above and beyond recently resolved compatibility issues that marked iPhone-to-Android communication.[1] In particular, the lawsuit highlights how messages sent between iPhone and Android devices appear as green bubbles on iPhones, in contrast to the blue bubbles that mark iPhone-to-iPhone communication–prominently distinguishing iPhone users from non-users. Historically, this color distinction was associated with different communication standards that led to compatibility issues. Although Apple resolved these problems in the latest iOS update (iOS 18), the color distinction remains.

In this paper, we examine how a dominant company can increase its market power by decreasing the utility of non-users, using the smartphone market as a case study. To do so, we conduct incentivized experiments with US college students to measure the impact of green bubbles on the demand for iPhones and study how they impact the welfare of users and non-users. We also shed light on social stigma as an important mechanism through which green bubbles reduce non-user utility. Finally, we present a series of case studies on product features that plausibly aim to decrease non-user utility to increase market power across various markets.

We begin by providing evidence that green bubbles are stigmatized, based on a comprehensive survey of US college students recruited on Prolific. Over 90% of our respon-

[1] For popular press coverage on the DOJ case and the "green bubble culture," see "Green bubble shaming at play in DOJ suit against Apple" and "Why Apple's iMessage Is Winning: Teens Dread the Green Text Bubble."

dents believe that green bubbles stigmatize Android users, commonly associating them with lower social status and attractiveness. Not surprisingly, a large majority of Android users (79%) reported wanting to have access to a hypothetical software change that would remove the green bubble differentiation, making all messages appear as blue bubbles on iPhones. Strikingly, however, even a majority of iPhone users (66%) would prefer such a software change. Additionally, most respondents believe removing green bubbles increases the perceived quality of Androids while leaving the quality of iPhones largely unchanged. Collectively, this descriptive evidence is inconsistent with green bubbles generating user utility for most users. Instead, it suggests that this iPhone feature harms consumers by generating non-user disutility through the reduction of Android users' perceived social status.

While the previous evidence suggests consumer welfare costs of green bubbles, it does not involve monetary stakes or preference intensities. Measuring welfare in this setting, however, is challenging. As we argue with our conceptual framework, the difficulty arises because both increases in user utility and decreases in non-user utility can generate the same market outcomes. Thus, the welfare effects from features such as green bubbles cannot be identified from product choice data alone.

To address these limitations, we conduct an incentivized deactivation experiment to isolate the demand for this product feature. In this experiment, we hold the user experience of iPhone owners constant and vary whether their messages appear as green (as opposed to blue) bubbles to themselves and other iPhone users. If respondents are willing to forgo money, it must be because they experience lower utility when their messages appear as green rather than blue bubbles to themselves and to others. We operationalize this experiment by telling our respondents that we are conducting a study in which we will ask them to deactivate some of their phone features. We tell respondents that one of two deactivation options will be implemented. In Option 1, we ask how much money they would require to adjust their phone settings so that their messages appear as green bubbles instead of blue on their own and other iPhones for a period of four weeks. We further clarify that this change in their phone settings would not affect any other aspect of their phone user experience. Option 2 involves either deactivating iMessage or deactivating the camera of their phone for a duration of four weeks.

This deactivation experiment reveals that US college iPhone users, on average, require a payment of $49 to have their messages appear as green instead of blue bubbles on other iPhones for four weeks. In a control condition, designed to measure the privacy and hassle cost of participation, Option 1 simply involves uploading screenshots and receiving a weekly text message as part of the study. In this control condition, participants only require a payment of $18, significantly below the payment required in the blue bubble deactivation experiment ($p < 0.001$). This exercise provides strong evidence of an economically sizable utility loss arising from green rather than blue bubbles, significantly above the hassle and privacy cost of participating in the study.

We benchmark this magnitude by comparing it to the median payment required to deactivate other features. The median valuation of blue bubbles is $25, compared to a valuation of $50 for iMessage and $95 for their their phone camera. Thus, the median valuation of blue bubbles corresponds to 50% and 26% of the median valuation of iMessage and the phone camera, respectively. Our estimates show that respondents put a high value on avoiding green bubbles relative to these benchmark features, underscoring the economic significance of the welfare cost.

Next, we examine the market implications of non-user disutility through an incentivized experiment with US college students that quantifies how green bubbles influence the relative demand for iPhones over Androids. We measure respondents' preferences for iPhones versus Androids under two contingent scenarios, which differ only in whether iPhones retain the green bubbles feature or not. To fix beliefs, we inform all participants that the DOJ lawsuit against Apple's anti-competitive practices could result in the removal of green bubbles in the coming months. We then ask respondents to choose between receiving an iPhone or an Android of similar quality in a lottery that will be held if a certain future scenario occurs.[2] Respondents are then randomly assigned to either a "green bubble treatment" or a "blue bubble treatment." Respondents in the green bubble treatment make their choice considering a scenario where Apple loses the DOJ lawsuit but green bubbles remain. In contrast, respondents in the blue bubble treatment make their choice for a future scenario where Apple also loses the DOJ lawsuit but where green bubbles are banned—and thus the color of all messages becomes blue.[3]

Consistent with our main hypothesis, the experiment shows that, in the contingency when green bubbles are removed, respondents are 7.3 percentage points (p.p.) more likely to choose the Android option over the iPhone option ($p < 0.05$). This is a sizable effect size that corresponds to a 46% increase in the share of respondents choosing the Android

[2]The Android choice also includes a monetary payment to equalize the market value of the two options.

[3]These choices are perceived to be consequential: participants estimate the likelihood of each of the two scenarios occurring in the coming months to be close to 50%.

option, from a base of 15.8% when green bubbles remain. This evidence suggests that green bubbles significantly increase the demand for iPhones and contribute to its dominant market position in the US among our demographic of interest. In an additional experiment, we demonstrate the robustness of our finding when measuring the effects of green bubbles on participants' continuous willingness to pay for an iPhone over an Android using a different treatment manipulation.

We conclude by presenting a series of case studies on product features that diminish non-user utility. We show that this phenomenon is widespread across various industries and illustrate how companies can strategically strengthen their market power. For example, dating apps employ features such as notifications about missed connections, nudging users to remain active to avoid losing chances for potential matches. Social media platforms, like Instagram, foster a fear of missing out (FOMO) with features like ephemeral content (e.g., stories that disappear after 24 hours) and push notifications (e.g., "Your friend just posted for the first time in a while"). Taken together, the case studies reveal that digital platforms with large market power are particularly well-suited to create non-user utility either through technological frictions or by creating social costs. In light of the growing importance of digital products, developing antitrust measures against the strategic creation of non-user utility will become an increasingly important task for regulators.

Our findings reveal that firms can shape consumer demand not only by enhancing user utility but also by diminishing non-user utility. This practice raises critical competition policy concerns, as it suggests that firms may deliberately erode non-user utility to strengthen their dominance, harming both consumers and non-consumers. Crucially, when there is no outside option without the product, it is not possible to distinguish—based on choice and price data alone—cases when user utility increases from cases in which in non-user utility falls. This lack of identification arises because both cases, which carry opposite welfare implications, can result in the same market equilibria, thereby complicating any welfare analysis.

Our work relates to a long-standing literature studying how companies exploit their market power (De Loecker and Eeckhout, 2018; Vickers, 2005; Heidhues et al., 2024; Syverson, 2024). In a classic contribution, Salop and Scheffman (1983) study how firms can induce their rivals to exit the industry by raising their costs. While in Salop and Scheffman (1983) welfare losses are created solely through prices resulting from the contraction of rivals' supply curves, our paper considers a case where the company strategy imposes direct harm on non-users, which creates distortions on the demand-side. Another prominent anti-competitive strategy is tying; forcing consumers to buy a secondary product with a primary one (Whinston, 1989). Unlike tying, which can be more easily regulated, stigma embeds itself in social norms and popular culture, making it potentially harder to counteract.

Relatedly, although our study does not directly address advertising tactics, we uncover a parallel mechanism to negative advertising (Bostanci et al., 2023). Instead of explicitly attacking competitors through marketing campaigns, firms may design product attributes that impose disutility on non-users, resulting in comparable demand shifts. Moreover, increasing non-user disutility strictly lowers welfare, as compared to negative advertising which may carry informational value for consumers. Finally, unlike negative advertising, which may be a prisoners' dilemma outcome, the strategic creation of non-user utility increases the market power and profits for the firm, where competitors may not be able to effectively retaliate.

We contribute to a long-standing literature in industrial organization that models consumer choice in the presence of network effects (Rohlfs, 1974; Katz and Shapiro, 1985; Farrell and Klemperer, 2007; Rochet and Tirole, 2003), a literature on how firms can reduce the quality of their own products to price-discriminate (Deneckere and Preston McAfee, 1996), and a literature studying competition policies and anti-trust implications of market power (Dinielli et al., 2023; Decarolis et al., 2023). The social media trap in Bursztyn et al. (2023b) is an example of non-user disutility whereby many users join social media not because they derive utility from it but because they want to avoid the social cost from being excluded. In this paper, we highlight how such incentives can be embedded into product features to give companies a strategic advantage over their rivals, raising important antitrust considerations. These effects might be magnified if non-user disutility makes consumers become inattentive to quality improvements (Allcott et al., 2024), further increasing switching costs. Lastly, by associating lower-quality features, such as low-resolution photos, with green bubbles, Apple has reinforced negative stereotypes about non-users. The creation of salience of group membership through messaging features ties into a growing behavioral literature on the attention economy, where companies compete for consumers' attention (Bordalo et al., 2016, 2022).

Our analysis also relates to a large literature on positional externalities (Frank, 2005, 2000; Luttmer, 2005; Perez-Truglia, 2020; Clark and Oswald, 1996) and the consumption of status goods (Pesendorfer, 1995; Frank, 1985a,b; Heffetz and Frank, 2011; Bagwell and Bernheim, 1996; Veblen, 1899). Previous empirical work has documented a large demand for status goods (Bursztyn et al., 2018), and a higher willingness to pay for more exclusive products (Imas and Madarász, 2022). We contribute to this literature by providing direct evidence on firm strategies that use social concerns to increase profits. Our mechanism evidence shows that the social stigma associated with being an Android user is an important motive behind consumers' willingness to pay for iPhones. Our case study evidence further reveals that companies strategically exploit social concerns by introducing product features that decrease non-user utility, such as by creating stigma, social exclusion, or inducing FOMO.

Our paper proceeds as follows. Section 2 provides a conceptual framework for interpreting how the strategic creation of non-user utility affects competition and consumer welfare. Section 3 provides evidence on the welfare effects of green bubbles. Section 4 studies the implications of non-user utility on product demand. Section 5 provides a series of case studies highlighting company strategies that create non-user disutility. Finally, Section 6 concludes.

## 2 Conceptual Framework

Two firms, $A$ and $B$, sell an indivisible product—such as a smartphone—at prices $p_A$ and $p_B$, respectively. They both have an equal and constant marginal cost $c > 0$. A continuum of heterogeneous users, with a total mass of one, decide which firm to purchase from.[4] Users have utility that is quasilinear in income. Their utility from consuming product $A$ is $u^i_A$ and that of consuming $B$ is $u^i_B$. These utilities are distributed according to a smooth distribution with full support.

We assume that one firm can adjust its product design to create *non-user disutility*. For example, Apple chooses to distinguish text messages that are sent from iPhones to Android phones (which appear as green bubbles) from those sent to other iPhones (which appear as blue bubbles). This distinction, as we show empirically, generates a disutility on Android users in the form of social stigma. Concretely, we assume that firm $A$'s product design generates a disutility $g$ on consumers of $B$.[5] For simplicity, we assume that only one firm can create non-user disutility and take it as exogenous, but we microfound both of these

[4] To match our empirical application, we assume that consumers must choose one of two products, with no outside option. Note that over 99% of US undergraduates own a smartphone (see `https://er.educause.edu/articles/2023/1/the-evolving-landscape-of-students-mobile-learning-practices-in-higher-education`). In this market, Apple and Android have a market share above 99%.

[5] In practice, what matters is users' expectations about g, rather than the actual costs, since users select firm A specifically to avoid incurring the cost and therefore never actually experience it.

features on Appendix A. In our microfoundation, both user and non-user utility arise due to social image concerns associated with buying the product. Intuitively, when consumers care about the type of users buying the product, one of the firms has a "better" composition of users and benefits from inducing stigma. The firm with a "worse" composition of users will not deepen the stigma, since it would decrease its own demand.

After firm $A$'s product design choice $g$, both firms compete in prices à la Bertrand. Consumers solve the following problem given prices and user and non-user utilities:

$$\max \left\{ u_A^i - p_A, u_B^i - g - p_B \right\}.$$

Let $Q(p_A - p_B - g)$ denote the aggregate demand for product $A$ and note that $1 - Q$ is the demand for $B$. We now impose a standard assumption on these demands which ensures a unique Bertrand-Nash equilibrium in the subgame that follows firm $A$'s product design decision.

**Assumption 1.** *The density $f$ of the difference in utilities, $u_A^i - u_B^i$, is log-concave.*

**Lemma 1.** *Under Assumption 1, there exists a unique Bertrand-Nash equilibrium.*

Consider now firm $A$'s product design decision. Suppose that it can marginally and costlessly decrease non-user utility, by increasing $g$. For example, Apple can rewrite a few lines of code to change the color of messages sent from Androids from blue to green. The next proposition summarizes how this decision changes the market equilibrium.

**Proposition 1.** *When firm $A$ marginally and costlessly decreases non-user utility, its markup, market share, and profits increase. The markup, market share, and profits of firm $B$ decrease.*

The reduction in non-user utility gives firm $A$ a strategic advantage by increasing the demand for its product and decreasing its competitor's demand. These changes create upward pressure in the price of $A$ and downward pressure in the price of $B$, but these price changes are not enough to offset the initial demand changes.

One thing to note is that the equilibrium prices and quantities would have been identical if we had assumed that firm $A$ could increase *user utility* instead of decreasing *non-user utility*. That is, when consumers solve: $\max \left\{ u_A^i + g - p_A, u_B^i - p_B \right\}$, demands remain unchanged. In this model, the source of the increase in $g$ does not alter the market equilibrium. However, it will matter for welfare, as the next proposition shows.

**Proposition 2.** *In equilibrium, consumer welfare decreases when firm $A$ creates non-user disutility and increases when it creates user utility.*

The cases in which firm $A$ creates user utility or non-user disutility are observationally equivalent in terms of their impact on prices and quantities (and thus on profits, market power, and concentration), but carry opposite welfare implications. In the former case, welfare increases because the firm only extracts part of the consumer surplus it creates among its consumers, without harming non-users—in fact it even benefits non-users by generating downward price pressure on its competitor. In this case, the firm becomes more dominant because it adds more value to its users. In the latter case, the firm increases its market power at the expense of both users and non-users: users pay more for the same product and non-users experience a worse product without enough price compensation.

The empirical implication of Propositions 1 and 2 is that, while standard choice data can help determine the market effects of product characteristics such as green bubbles, this data, alone, is not sufficient to understand the welfare implications. In what follows, our experiments will help show that green bubbles can indeed increase the demand for Apple while simultaneously worsening non-user utility without large impacts to user utility.

# 3 The Welfare Effects of Green Bubbles

## 3.1 Setting

In this section, we discuss the US smartphone market and the compatibility issues between iPhones and Androids, including the green bubbles that appear on iPhones when messaging an Android device. Appendix B provides additional details on the smartphone market.

**The US smartphone market** The US smartphone market is valued at $61 billion, as of 2024 (Market Research Future, 2024). Apple's US smartphone market share is high: The company holds an overall market share of 56% (StatCounter, 2024b), 68% among 18 to 29 year olds (Statista, 2024) and a striking 87% among teenagers (Axios, 2021). Android sales are mostly comprised of the established leader Samsung (StatCounter, 2024b) and increasingly popular Google devices (Schoon, 2024).

**Compatibility issues** In 2011, Apple introduced iMessage, a proprietary messaging platform that facilitated communication between Apple devices. Messages sent between these devices appear as blue bubbles. iPhones with cellular plans also have access to text messages via short message service (SMS) and multimedia messaging service (MMS), which appear as green bubbles on iPhones, as displayed in Figure 1. Notably, while SMS/MMS messages between iPhones also appear as green bubbles, iMessage is the default system for iPhone to iPhone communication.[6] Thus, green bubbles commonly indicate, and indeed strongly signal, communication with an Android user. There are several other prominent compatibility differences when comparing iMessage to SMS/MMS on iPhones. For example, typing indicators and read receipts are not available when using SMS/MMS on iPhones. These compatibility issues might plausibly contribute to the perception that green bubbles are associated with low quality devices and hence, could signal a low socioeconomic status of the user.

Apple's newest operating system for iPhones, iOS 18, was released on September 16th, 2024. As part of the update, Apple introduced support for rich communication services (RCS), a new text messaging protocol to replace SMS/MMS. RCS fixed many existing compatibility issues between iPhones and Androids, including enabling typing indicators, read receipts, and the ability to send high-quality photos and videos (Apple Inc., 2024).[7] However, the green text message bubble color, a pronounced visual contrast to iMessage, remains with this update.

**Antitrust cases against Apple** Apple has faced increasing regulatory scrutiny over its anti-competitive practices. In March 2024, the DOJ, along with 16 state attorney generals, filed an antitrust lawsuit against Apple that accuses the company of violating Section 2 of the Sherman Act (U.S. Department of Justice, 2024). The lawsuit addresses various aspects of the iPhone ecosystem and explicitly argues that Apple deliberately degrades cross-device messaging features to increase profits and market share. In particular, the lawsuit highlights the role of green bubbles in creating a social stigma against Android users by introducing a visually salient indicator of smartphone ownership.

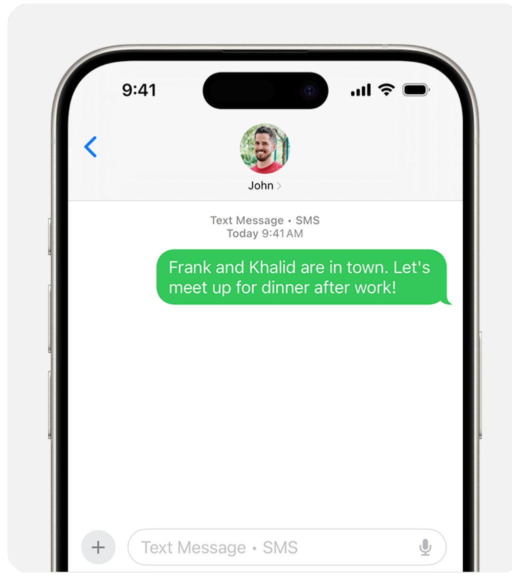
The lawsuit also presents direct evidence that Apple is aware that iMessage and its blue bubbles make it more difficult for users to switch smartphones, thereby reinforcing its market power. For example, in 2013, Apple's Senior Vice President of Software Engineering explained that enabling cross-platform messaging on iMessage "would simply serve to re-

[6]Prior to iMessage in 2011, all messages between smartphones were sent via SMS/MMS and appeared as green.

[7]It is possible that Apple adopted RCS as an anticipated response to the rising pressures from the DOJ lawsuit and European Digital Markets Act (DMA) (U.S. News & World Report, 2024).

Figure 1: Blue versus Green Bubbles on iPhones


**(a)** Blue Bubbles on iMessage




**(b)** Green Bubbles on SMS/MMS

*Notes:* Figure 1 Panel (a) displays an interaction between two iPhones via iMessage, where messages always show up as blue bubbles. In contrast, Panel (b) shows an interaction via SMS, where messages are displayed as green bubbles on iPhones. While SMS messaging can take place between iPhones, it is not the default. Therefore, it is primarily associated with texting between an iPhone and an Android device. The pictures are from Apple Support (2024).

move [an] obstacle to iPhone families giving their kids Android phones" (U.S. Department of Justice, 2024). In March 2016, Apple's Senior Vice President of Worldwide Marketing forwarded an email to CEO Tim Cook making a similar point: "moving iMessage to Android will hurt us more than help us" (U.S. Department of Justice, 2024). A more detailed discussion of the DOJ lawsuit and other regulatory action against Apple is in Appendix C.

**Green bubbles as a strategic choice** When Apple introduced blue bubbles in 2011, their primary purpose was likely technological, signaling to users that their messages were sent via iMessage rather than SMS. Over time, however, green bubbles may have endogenously evolved into a signal associated with lower socioeconomic status. Apple's continued distinction between green and blue bubbles now appears to be a deliberate strategy aimed at reinforcing its market dominance while reducing the appeal and utility of non-iPhone devices. Direct evidence supports this interpretation: In a 2022 interview, Apple CEO Tim Cook dismissed concerns regarding the green bubble issue. When asked about improving cross-platform messaging, he responded, "Buy your mom an iPhone." Furthermore, even with the release of iOS 18, Apple has notably refrained from promoting enhancements to cross-platform messaging, despite persistent user dissatisfaction. In contrast, Android manufacturers and carriers actively promote the new RCS support on iPhones, emphasizing the improvements while exposing Apple's deliberate strategy of sustaining incompatibility.

## 3.2 Survey Evidence

To provide evidence on the welfare effects of green bubbles among both Android and iPhone, we collect rich survey data.[8]

### 3.2.1 Sample

**Student sample** We recruited 476 students from the US aged between 18 and 22 through Prolific in early September 2024, prior to the release of iOS 18. We allowed for a natural distribution of phone types, resulting in 16% Android users and 84% iPhone users, closely reflecting the observed market shares for this demographic. We focus on college students for several key reasons. First, this younger segment of the market is particularly important given the potential lock-in effects, as early brand preferences can influence long-term consumer loyalty. This demographic is also plausibly more sensitive to social image concerns and dating market considerations, where green bubbles may play a significant role. As a result and as seen in popular culture, the green bubble stigma is primarily associated with teenagers and young adults, making them the most relevant demographic for welfare considerations from a policy perspective.

**Pre-registration** The pre-registration for the data collection can be found on AsPredicted #188972 and includes the experimental design, hypotheses, primary and secondary outcomes, sample size, and exclusion criteria.[9]

**Sample characteristics** Our final sample size consists of 476 participants.[10] Our final sample is 53% female, with an average age of 20.4 years. Summary statistics for our sample can be found in Appendix Table A3.

[8] For reference, Appendix D provides details of all data collection activities discussed in this paper.
[9] For details, see `https://aspredicted.org/r27m-69c8.pdf`.
[10] As per the pre-registration, we exclude participants based on one incentivized attention check.

### 3.2.2 Design

In this survey, we measure consumers' stereotypes about Android users, preferences for green versus blue bubbles, and collect rich data about their general perceptions. After asking our respondents a series of open-ended questions, we inform participants about the recent DOJ lawsuit against Apple related to its alleged anti-competitive practices in order to increase respondent motivation to engage with the survey questions. We inform them that Apple could be forced to eliminate green bubbles and that the survey aims to gather information about the representative opinion of everyday users with no vested interest in the outcome of the case. We tell respondents that we are creating a report that will feature the average statistics from the responses to this survey and that we plan to widely circulate the findings on social media and in academic conferences. More than half of the respondents self-report to have put in more effort as a result of the public report covering their responses, while virtually no respondents indicate exerting lower effort. We provide additional discussion in Appendix E.2. In addition, Appendix J.1 contains the instructions and questions for this survey.

### 3.2.3 Results

In this section, we present our main pre-registered results.

**Smartphone stereotypes and the green bubble stigma** We start by providing evidence on the stereotypes associated with Android users. To do so, we ask participants an unprompted open-ended question at the very start of the survey. In particular, we ask: "When you think of someone who owns an Android instead of an iPhone, what comes to mind?" To analyze the unstructured text data, we devise a simple coding scheme with seven non-mutually exclusive categories. *Stigma and Social Status* responses mention social judgment, peer pressure, or negative status perceptions (e.g. "I think they are someone more average. They are not as wealthy. They also have fewer friends" or "When i think of someone who owns an Android instead of an iPhone think there is a clear difference in social class."). *Personality* responses mention specific personality characteristics (e.g. "I think they're someone who is outside the norm in a way. They also may be more technically savvy" or "I think they are someone who doesn't care about the opinions of other people".). *Green bubble* responses explicitly mention green bubbles (e.g. "I think of the green text bubbles and limited communication as I cannot send pdf to an android user.

The two makes are not that compatible"). *Demographic* responses mention specific demographic characteristics that are associated with iPhone or Android users, such as age (e.g. "I would think a person with an android would be a middle aged or older."). *Financial and Practical* responses mention cost, affordability, or practical reasons for using Android (e.g. "I think it's more cost efficient and the newer models have a lot of cool features that iPhones don't have"). *Technical* responses mention technical differences in quality or features between Androids and iPhones (e.g. "I think they probably have a lower camera quality"). *Neutral or Indifferent* responses shows indifference to the distinction between Android and iPhone users ("Nothing really, I don't think anything different of them" or "They prefer the Android brand"). We categorize responses by hand-coding the responses from two independent research assistants who reconcile any differentially coded responses. We also validate the coding scheme with the OpenAI API and find similar conclusions.

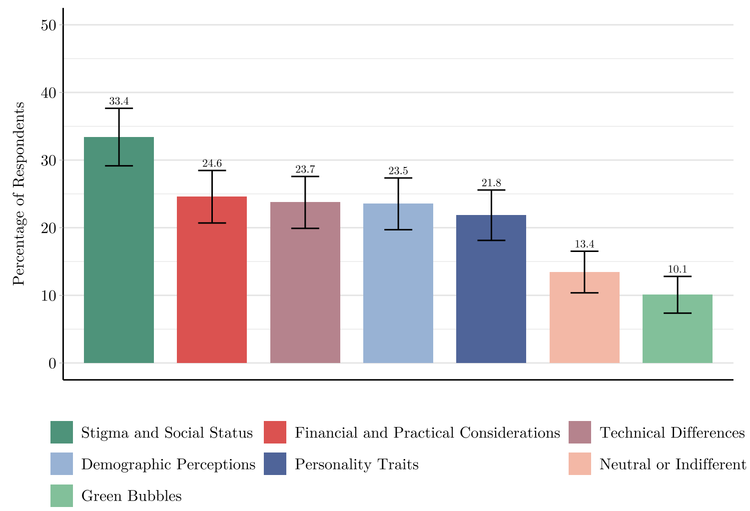
Figure 2 displays the distribution of the responses across the seven categories from our hand-coding procedure. The largest fraction of responses (33.4%) mention stigma and perceptions of social status, primarily related to the perceived lower social status of Android users and the negative connotations of not owning an iPhone. A substantial fraction of responses (23.7%) cite technical reasons, such as differences in camera quality or compatibility issues, which worsen the user experience when interacting with Android devices. Similarly, 23.5% of responses relate to demographic differences, often implicitly alluding to social concerns. For example, many demographic responses emphasize the older age of Android users, which may be seen as an undesirable trait to signal among our young adult sample. Financial or practical reasons are cited by 24.6% of respondents, associating Android devices with being cheaper or suggesting that people who prefer customization choose Androids.

Personality-related perceptions are mentioned by 21.8% of respondents, suggesting that some view Android users as having specific personality traits, such as being tech-savvy. A smaller but notable fraction (13.4%) of responses are classified as neutral. Finally, 10.1% of respondents explicitly mention green bubbles in this open-ended question.[11] Notably, among respondents who mentioned green bubbles, 27% also raised concerns about stigma and social status, underscoring their significant role in shaping associations about Android users. Overall, we interpret these responses as compelling evidence that the salience of owning an Android promotes the formation of associations, often leading to unfavorable

[11] Moreover, over 97% of respondents were aware of the green bubble messaging feature prior to starting our survey, highlighting the widespread recognition among our demographic.

stereotypes about Android users.

**Figure 2:** Android User Stereotypes

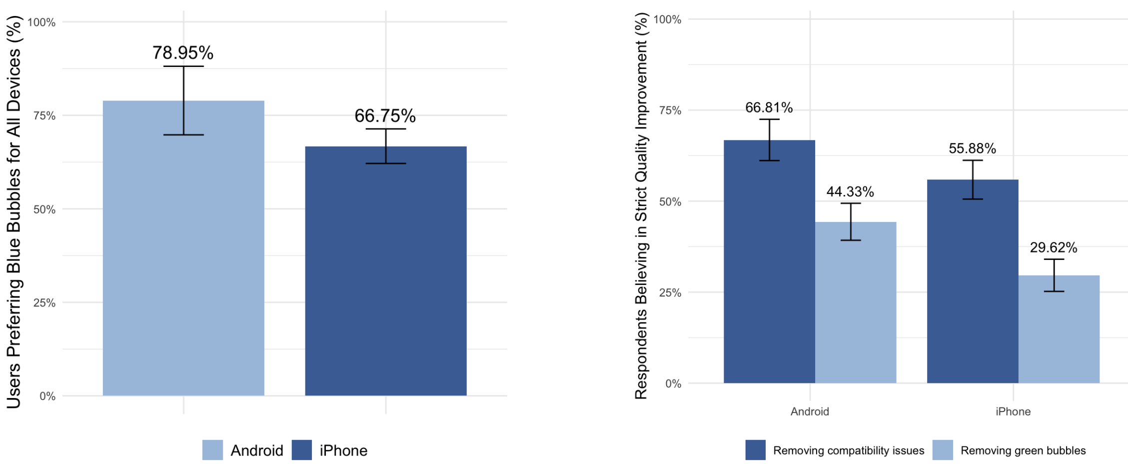



*Notes:* Figure 2 presents the results from our open-ended classification scheme for the question "When you think of someone who owns an Android instead of an iPhone, what comes to mind?". Two research assistants reviewed and hand-coded responses into one of seven (non-mutually exclusive) categories independently, with a high degree of correlation, and then reconciled any differences. We reach similar conclusions when we classify responses using the OpenAI API.

While this open-ended evidence highlights the significance of social concerns, the unstructured nature of the data complicates quantitative interpretation (Haaland et al., 2024). Therefore, we complement these measures with evidence from structured questions, as seen in the figures displayed in Appendix E.3. We find that an overwhelming majority (90%) of respondents believe there is a social stigma against Android users, whose text messages appear as green bubbles on iPhones, and that Android users are perceived to earn 10.5% less income than iPhone users in the US. We also find that over 90% of iPhone users, as well as the majority of Android users, perceive iPhone users as more attractive than Android users. Collectively, this data points to a series of social mechanisms that drive non-user utility.

**Preferences over green bubbles** As a next step, we examine whether respondents would prefer a hypothetical software change that replaces green bubbles with blue bubbles for all users, even after iOS 18 has resolved many of the previously longstanding compatibility issues. Remarkably, as shown in Figure 3, Panel (a) we find that a large majority of Android users (79%) would prefer such a software change. This holds true even among iPhone users, where a majority (66%) would prefer such a software change.[12] We explicitly state that this software change would only affect the color of the bubbles and inform respondents about the compatibility improvements already implemented by iOS 18 before they make their decision. A key question is whether those iPhone users who oppose such a software change actually receive utility from green bubbles. We provide some evidence on this question in the next section.

**Figure 3:** Mechanism Evidence on Non-User Utility from Green Bubbles




**(a)** Fraction of Respondents that Prefer a Software Giving Blue Bubbles For Everyone

**(b)** The Effect of Compatibility Issues or Green Bubbles on Perceived Quality

*Notes:* Figure 3 Panel (a) presents the results by phone ownership for the fraction of people that prefer a software update making all messages appear as blue bubbles to everyone. Panel (b) presents the results for how removing compatibility issues or green bubbles affects the perceived quality of Androids and iPhones. We plot the percentage of people that think there is a strict quality improvement (4 or 5 on a 1-5 Likert scale). We only include respondents that pass all attention checks and bot detection protocols as per our pre-registration. We report 95% confidence intervals in both panels.

**Perceived quality** From the perspective of our conceptual framework, the strong preference for the blue bubble update could arise from either an increase in user utility or a reduction in non-user utility. To disentangle these effects, we measure the perceived im-

[12]The main reasons for this are concerns about the stigmatization of Android users, perceived inequality, and a preference for a uniform aesthetic.

pact of removing compatibility issues or green bubbles on the quality of both Androids and iPhones, using perceived quality as a proxy for user utility. As shown in Figure 3, Panel (b), adding read receipts and typing indicators to text messaging on iPhones would strictly improve the perceived quality of Androids for approximately two-thirds of respondents and the perceived quality of iPhones for about half of respondents. Additionally, removing green bubbles would significantly enhance the perceived quality of Androids for a sizable portion of participants. However, as detailed in Appendix E.3, we find that the perceived quality of iPhones remains unchanged for over 60% of respondents when green bubbles are removed. Furthermore, Figure 3, Panel (b), shows that iPhone user utility is lower for 30% of respondents in the presence of green bubbles. At the same time, 10% of respondents rated the perceived quality of iPhones as higher with green bubbles.

For these 10% of respondents, two potential mechanisms could explain this preference: first, some individuals may value knowing whether they are communicating with an Android or an iPhone. Second, the status benefits associated with blue bubbles may enhance perceived quality. Our evidence from Figure 3 Panel (a), which shows that a majority of both users and non-users prefer the removal of green bubbles, suggests that decreases in user utility are not the dominant effect compared to increases in non-user utility resulting from the software change. Furthermore, our open-ended responses do not indicate that either of these two mechanisms is a primary driving force. As shown in Panel (b) and Panel (c) of Figure A9, only 10% and 12% of respondents mention signal detection and status benefits, respectively, as reasons for preferring not to have the software update.

We interpret these findings as evidence that green bubbles do not primarily drive demand for iPhones by increasing user utility but rather by reducing non-user utility. Moreover, this supports the idea that Apple's product feature decisions can directly influence the absolute perceived quality of the outside option—Androids. We present quantified estimates of the welfare effects in Section 3.3, which reinforce the important role of green bubbles in changing non-user utility.[13]

After reminding participants about green bubbles but before presenting information on the DOJ lawsuit, we ask: "Why do you think messages sent from Androids appear as green bubbles on iPhones?" to gauge the extent to which our sample perceives green bubbles as a

[13]Our findings on typing indicators and read receipts, which were addressed in iOS 18, suggest that these technical compatibility issues may also contribute to a decrease in non-user utility. Specifically, they indicate that Apple faced a trade-off between reducing user utility for iPhone users and decreasing non-user utility for Android users. Adding read receipts and typing indicators for Android-iPhone messaging on iPhones strictly improves the perceived quality of both devices for the majority of respondents.

marker of Androids' having a lower phone quality. Indeed, we find that some participants view the green bubbles as an indicator of the lower quality of Android devices. At the same time, we find that a large fraction of respondents think that Apple strategically created green bubbles to alienate Android users and maximize its profits.

## 3.3 Deactivation study

While the previous evidence suggests there are substantial consumer welfare costs from green bubbles, it does not involve monetary stakes and does not capture preference intensities. In this section, we address these limitations by providing incentivized evidence on the difference in utility experienced by iPhone users due to having green bubbles instead of blue ones.

### 3.3.1 Sample

**Student Sample** We recruited a sample of college students aged 18 to 25 through College Pulse, a company specializing in recruiting US college students for online surveys.[14] Since our design only applies to users with iMessage on their phones, we exclusively targeted iPhone users. Our data collection was conducted in October 2024, following the release of iOS 18 in mid-September.

**Pre-registration** Our data collection was pre-registered on AsPredicted (#195544) and includes the experimental design, hypotheses, primary and secondary outcomes, sample size, and exclusion criteria.[15]

**Sample characteristics** Among respondents who begin the survey, 83% agree to participate in our four-week deactivation study, which requires providing their phone number and screenshots of their phone settings if selected to participate in the deactivation stage. As a result, we are unable to collect incentivized data from those who do not consent to participate, and we acknowledge that our sample consists of a selected group of respondents.[16] Selection likely results in underestimating welfare losses, as those experiencing the

[14]In this experiment, we recruited respondents through College Pulse as our design requires the ability to access personally identifiable information (phone numbers) from all respondents.

[15]For details, see `https://aspredicted.org/xxyp-s8qx.pdf`.

[16]We interpret 83% selecting into participation as a relatively high number, given that the deactivation runs for a significant period of time and requires PII. In addition, it is comparable to other participation rates in related literature, such as 57% in Bursztyn et al. (2023a) and 43% in Allcott et al. (2020).

highest social costs of deactivation may be less inclined to participate in the experiment. However, we may also underestimate the privacy and hassle cost of participation for the same reason.[17] Given this, we can only speak to the average welfare loss among those who consent, which still represents the vast majority of our sample. As per our pre-registration, our sample size is 402 participants. Our sample is 57% female, with an average age of 20.5 years. Demographic summary statistics on our sample can be found in Appendix Table A4.

### 3.3.2 Design

The experimental design is summarized below. A full description is provided in Appendix Figure A5 and the survey instructions and questions are provided in Appendix J.2.

**Background on deactivation study** Before consenting to the experiment, participants are informed that we will ask about the amount of money they would require to participate in two different deactivation options. We elicit this amount of money using a BDM procedure with a multiple price list with ascending offers.[18] We provide identical information to participants across the treatment arms before they consent, in order to prevent differential selection across arms. Respondents are truthfully told that only one of the two options will be implemented for 1 out of 10 responses.[19] Respondents are randomly assigned to one of two different treatment groups: the "blue bubble deactivation" group and "privacy and hassle cost" control group.

**Blue bubble deactivation group** In Option 1, respondents indicate the amount of money they would require to agree to modify their phone's settings and deactivate blue message bubbles. Consequently, all the iMessages they send would appear as green bubbles (instead of blue) on their own and recipients' iPhones for four weeks. We emphasized that everything else about their phone remains constant.[20]

[17]Even if we assume that the 17% of respondents who opted out are indifferent between blue and green bubbles, our findings still suggest a substantial disutility associated with green bubbles.

[18]The offers range from zero to 150 in increments of 5 until 20, and then increments of 10 until 150.

[19]In practice, only Option 2 is technically feasible for all respondents, so we always implement Option 2 for respondents chosen to participate in the deactivation study. We also debrief them about this at the end of the study.

[20]It is possible that, even if we specified that everything else remains constant, some users could still believe that they would also lose the option of distinguishing others' phones. However, our survey data (discussed in Section 3.2) suggest being able to distinguish others' phones is not a primary concern for

In Option 2, respondents are assigned to one of two cross-randomized benchmark goods. Respondents specify the amount of money they would need to disable either iMessage or their phone camera for four weeks. To verify iMessage deactivation, we require a screenshot of respondents' phone settings and send them text messages at a random time each week, while for camera deactivation, we request both a screenshot of their settings and, randomly once a week, their weekly screen time. The difference between the blue bubble deactivation and the iMessage deactivation is that, under the blue bubble deactivation, participants retain iMessage functionality, but any messages they send appear as green bubbles. Even after iOS 18, iMessage and RCS differ in more ways than just bubble color (e.g., end-to-end encryption), thus, the blue bubble deactivation is needed to isolate the welfare effects of green bubbles.

**Privacy and hassle cost control** To identify an individual's utility cost of having green rather than blue bubbles separately from their privacy and hassle costs of participation, we include a control group. For this group, in Option 1, we instead ask participants for their WTA to participate in a study which involves uploading a screenshot of their phone settings and receiving a weekly text message at a random time. Participants are informed that no changes will be made to their phone during the study period.

**Borderline deception** Our design requires measuring a person's WTA to deactivate their blue bubbles. However, this option is technically infeasible. While we do not outrightly deceive participants as we truthfully say we will only implement 1 out of the 2 deactivation options, our design relies on people believing that the blue bubbles deactivation is possible. We adopted this approach because we believed that it was the only feasible way to elicit incentivized WTA to deactivate blue bubbles. In our treatment group, we debrief participants about how Option 1 is infeasible at the end of the survey.[21]

our respondents. Specifically, we find that the majority of iPhone users actually prefer removing green bubbles. Additionally, open-ended responses reveal that only 10% and 12% of all respondents cite signal detection as a reason for opposing the software update. Moreover, even with the change, participants can still differentiate between iPhone and Android users on their own devices because messages to other iPhone users continue through iMessage, a service unavailable to Android users. Furthermore, exclusive features like FaceTime and location sharing remain limited to iPhone users, maintaining this distinction.

[21] The 95% deactivation compliance rate provides suggestive evidence that people took our experimental instructions seriously.

#### 3.3.3 Results

As shown in Figure 4, iPhone users require an average of \$49 to have their messages appear as green rather than blue bubbles for four weeks. In the control, participants only require an average payment of \$18, which is approximately \$31 below the average payment required in the treatment group ($p < 0.001$). Because participants' experience remains unchanged except for their messages appearing as green bubbles, this compensating differential—above hassle costs—suggests that they are willing to pay to avoid incurring the green-bubble stigma. Thus, these results provide strong evidence on sizable negative disutility of green rather than blue bubbles, above the privacy and hassle cost of participating in the study. Taken together with our survey evidence, where we found a substantial social stigma of green bubbles with minimal evidence of status benefits, we argue that green bubbles impose welfare costs from increasing non-user disutility as opposed to decreasing user utility.

Our estimates on the valuation of avoiding green bubbles are sizeable compared to the average WTA for deactivating iMessage or the camera for four weeks. Respondents, on average, require \$69 for deactivating iMessage and \$86 for deactivating the camera.

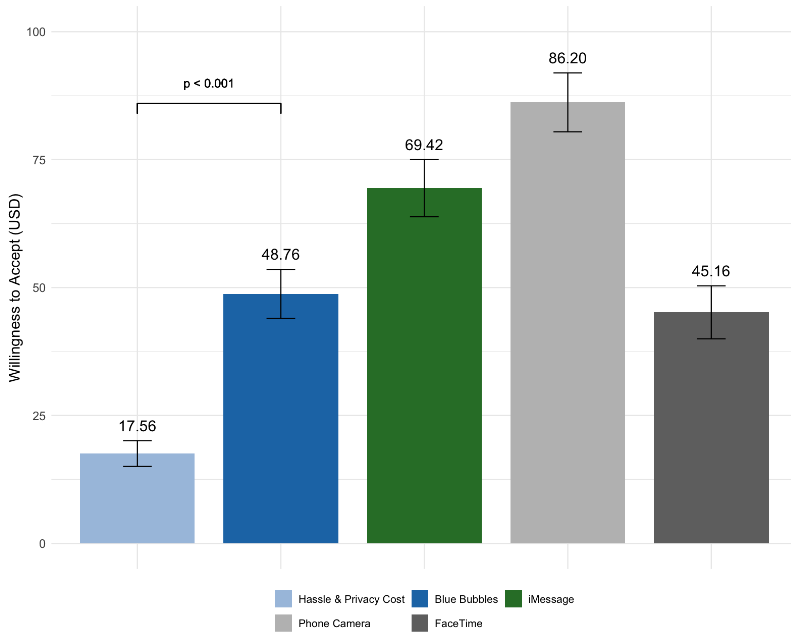
We observe some differential top-coding at our maximum value of \$150 across product features. This downward biases the estimated difference between blue bubbles and the control condition, but upward biases the estimated differences between blue bubbles and the benchmark goods.

Therefore, we benchmark the valuation of blue bubbles against these other product features, focusing on the median payment required to deactivate other features, which is unaffected by the topcoding. The median valuation of blue bubbles is \$25, compared to a valuation of \$50 for iMessage and \$95 for the phone camera. This suggests that the median valuation of blue bubbles corresponds to 50% and 26% of the median valuation of iMessage and the phone camera, respectively. Our estimates show that respondents put a relatively high value on avoiding green bubbles relative to these benchmark features, underscoring the economic significance of the welfare cost.[22] Our estimates are not sensitive to controlling for gender and the WTA for the practice option (i.e. FaceTime), as shown in Appendix Table A5.

Finally, we find minimal differences in average treatment effects by gender or relationship status (see Appendix Table A6).

[22] The finding suggests that half of the welfare cost of deactivating iMessage is solely from avoiding having green bubbles, rather than from additional iMessage features such as location sharing, end-to-end encryption, or other compatibility issues discussed earlier.

**Figure 4:** WTA to Deactivate Phone Features by Treatment




*Notes:* Figure 4 displays the average WTA to deactivate various features of participants' iPhones for four weeks. We report 95% confidence intervals.

#### 3.3.4 Robustness

**Perceived credibility** As discussed, our design relies on respondents believing that the blue bubbles deactivation is technically feasible. To evaluate respondents' perceptions, we ask them to rate the likelihood of each option being implemented. Given that each respondent is informed about two options, the benchmark probability is 50%, assuming they perceive the decision as a random coin toss. As shown in Appendix Figure A6, we find that all options have similar perceived likelihoods, ranging from 37% to 48%. The blue bubbles deactivation has the highest perceived likelihood, suggesting that participants did not view this option as infeasible. In Appendix Table A7, we also examine how treatment effects vary with perceived credibility and find little heterogeneity.

**Additional robustness** Appendix F.5 provides additional evidence on the robustness of our findings. Specifically, we demonstrate that our results remain robust to variations in top-coding thresholds and to the treatment of respondents who expressed regret over any of their valuations. Finally, Appendix F.6 provides details on the implementation and compliance of the deactivation study, noting that 95% of our selected participants successfully completed the entire deactivation.

# 4 Non-User Utility and Product Demand

Having established large negative welfare effects of green bubbles, we next turn to their market implications. Our experiment is designed to allow us to study incentivized demand under different relevant policy counterfactuals, offering insights that may be directly relevant to the ongoing lawsuit. Specifically, the experiment quantifies how green bubbles influence the demand for iPhones compared to Androids.

## 4.1 Sample

**Student sample** Similar to our previous data collections, we recruited a sample of US students aged 18 to 25 through Prolific. Data collection was carried out in November and December 2024.

**Pre-registration** This experiment was pre-registered on AsPredicted (#201569) and includes the experimental design, hypotheses, primary and secondary outcomes, sample size, and exclusion criteria.[23]

**Sample inclusion criteria** As pre-specified, we screen for individuals who are iPhone users and are actively considering purchasing a new phone, as this represents the target demographic for our experiment. We exclude anyone who fails our attention checks and regrets their phone choice twice. We also pre-specified exclusion criteria based on Qualtrics' scores of suspected fraudulent activity, reCAPTCHA scores, and duplicate IDs.[24] We discuss these criteria in more detail in Appendix G.5, including how our estimates are robust to including all collected responses.

**Sample characteristics** Our initial sample consists of 506 participants. After excluding some respondents who did not align with our pre-registration, we are left with a final sample

[23] For details, see `https://aspredicted.org/54y4-s5jj.pdf`.

[24] We also implemented a series of pre-registered bot prevention measures in Qualtrics, including randomized screening questions. In particular, we randomize validated text-input questions at the beginning of our survey.

of 468 respondents.[25] Our final sample is 60.5% female, with an average age of 21.5 years.[26] Summary statistics for our sample can be found in more detail in Appendix Table A8.

## 4.2 Design

In this section, we describe an overview of the experimental design. A full description of the structure is provided in Appendix Figure A7 and survey instructions and questions are provided in Appendix J.3.

### 4.2.1 Background and conditional choice explanation

**Background information** Respondents are informed that, following this survey, a lottery will be held where they could win a new smartphone. They are then given the option to choose between an iPhone 16 (current price of $800) or a Google Pixel 9 (current price of $650) along with $150, a comparison designed to equalize the value of the options based on market prices at the time of the experiment.[27] Participants are also informed that both phones are comparable in overall quality, including features like the camera, battery, and display.[28] One out of 500 participants wins the lottery and receives their preferred option.

**Conditional choice procedure** We then outline the lottery procedure to participants, explaining that they will select their preferred phone option under a potential future scenario. Next, participants are told that if the future scenario occurs, a lottery will be conducted, and winners will receive their preferred phone option. Participants are then told that it is in their best interest to truthfully indicate their preferred choice. We explain that—in order to preserve anonymity—the phone will be sent to an Amazon locker or PO Box near the participant's zip-code. Participants' understanding of the conditional choice

[25] We accidentally collected responses from Canadians, respondents aged 26-27 and from respondents who own a version of the iPhone 16. Our results are virtually identical when including all 506 participants, as seen in Table A14.

[26] Due to Prolific's sample availability for our pre-specified screening criteria, we prioritized maximizing sample size over balancing gender. We demonstrate the robustness of our results by showing that results for males are stronger in Table A10.

[27] Both phones are top-sellers for their brands, of similar quality, and released in fall 2024, making them a natural choice for participants considering a new smartphone. These prices were sourced directly from the phone providers' websites at the time of the experiment and reflected the Black Friday and Cyber Monday discount for the Google Pixel 9.

[28] This is reflected in expert smartphone reviews and rankings from DXOMARK, a global leader in smartphone evaluations for over 15 years.

procedure is verified with a simple comprehension question, and only those who pass are allowed to proceed with the rest of the experiment.

**Common information on the DOJ lawsuit** All respondents are first reminded of compatibility issues between Androids and iPhones. In particular, respondents are told that the messages sent between Androids and iPhones appear as green bubbles on iPhones, while texts between iPhones appear as blue bubbles. All participants are then introduced to the recent DOJ lawsuit against Apple, which accuses the company of engaging in anti-competitive practices related to its iMessage service. We inform them that the lawsuit specifically highlights green bubbles and that, as a result of the lawsuit, Apple might be compelled to eliminate green bubbles and standardize blue bubbles across all devices. Additionally, participants are informed that experts anticipate the trial to commence in the coming months and that a decision will follow shortly after.

### 4.2.2 Conditional choice of preferred phone

On the decision screen, all respondents choose between an iPhone 16 and a Google Pixel 9 plus $150. Respondents make this binary choice under one of two randomly assigned scenarios: one where green bubbles persist after the lawsuit (green bubbles treatment) and another where they are banned (blue bubbles treatment). These scenarios are described in more detail below.

**Green bubbles treatment** Respondents are asked to choose their preferred phone in a scenario where Apple loses the DOJ lawsuit, faces significant fines, but green bubbles are not banned. Next, they are explicitly informed that messages exchanged between Androids and iPhones would continue to appear as green bubbles, accompanied by a screenshot illustrating how green bubbles would remain in such conversations.

**Blue bubbles treatment** Respondents are asked to choose their preferred phone in a scenario where Apple loses the DOJ lawsuit, faces significant fines, and that green bubbles are banned. Next, they are explicitly informed that messages exchanged between Androids and iPhones would now appear as blue bubbles, accompanied by a screenshot illustrating this change.

**Design discussion** We offer respondents a simple binary choice revealing their phone preference under market prices at the time of the experiment. We use a binary outcome to maintain a straightforward elicitation method while capturing the market share of both operating systems, our key metric for assessing market power. We focus exclusively on iPhone and Android phones as choice options, as they account for over 99% of the overall market share. These design choices are intended to enhance the external validity of our measure in reflecting actual purchasing decisions.

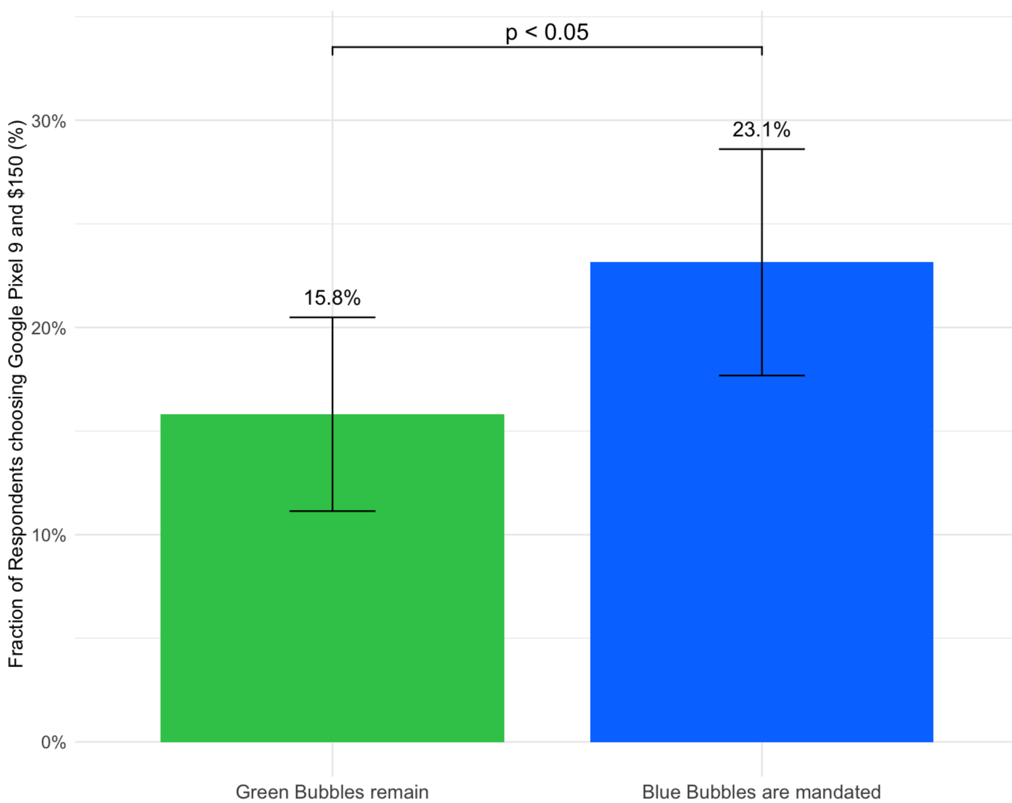
We use an active control group design in which both treatment scenarios involve Apple losing the lawsuit. This ensures that the only difference between the treatment and control groups is whether losing the lawsuit leads to a ban on green bubbles, minimizing differences in beliefs about other potential impacts of the lawsuit between treatment arms.[29] The active control design also helps mitigate concerns about differential experimenter demand effects across treatment groups (Haaland et al., 2023). Possible experimenter demand effects are further mitigated by the incentivized nature of our outcome data and appear unlikely given the heterogeneous treatment effects, which we discuss later.

## 4.3 Results

Figure 5 displays our main pre-registered results. Respondents in the blue bubble treatment choose the Google Pixel option 7.3 p.p. more compared to respondents in the green bubble treatment ($p < 0.05$) on a base of 15.8%. These effects are substantial, representing a 46% increase in the choice share of the Android phone option. The results provide strong evidence that a product feature, by reducing non-user utility, can significantly increase demand for the product. In this case, our evidence demonstrates that green bubbles contribute to the iPhone's dominant market position in the US.

[29] We cannot fully rule out the possibility that respondents interpret the removal of green bubbles as a signal that other features might also be removed, and that this interpretation differs from that of the control group.

**Figure 5:** Percentage of Respondents Choosing the Google Pixel 9 Option over the iPhone 16 Option




*Notes:* Figure 5 displays the percentage of respondents choosing the Google Pixel 9 and $150 over the iPhone 16 by treatment status. The blue bar represents the blue bubbles treatment condition, whereas the green bar is the green bubbles treatment condition. Error bars are 95% confidence intervals.

## 4.4 Mechanisms

This section examines the potential mechanisms driving the changes in phone preferences identified in our experiment.

**Social concerns** Building on the social mechanisms in Section 3.2, we analyze heterogeneous treatment effects based on relationship status. Notably, we observe the strongest treatment effects for those who are single, where the social costs of being a non-user are likely higher due to dating market concerns. This also suggests that demand effects are unlikely to be an important driver of treatment effects. The full results can be found in Appendix Table A10.

**Other equilibrium changes** One equilibrium mechanism through which the expectation of eliminating green bubbles might influence consumers' willingness to pay for iPhones over Android phones is the anticipated shift in user composition within social networks. To evaluate this, we first asked respondents about the current proportion of their friends who use iPhones versus Android devices.[30] Respondents then estimated how these proportions would change one year into the future, conditional on their assigned scenario (i.e., the DOJ either banning or not banning green bubbles). This allowed us to quantify expected equilibrium shifts within each respondent's social network.

Our findings indicate that a majority (68%) expect no changes in network size. However, respondents in the blue bubbles scenario anticipate the proportion of friends using iPhones to decline by an additional 3.8 percentage points ($p < 0.001$) compared to those in the green bubbles scenario. This represents only a 4.5% change in network size as at baseline, approximately 85% of participants' friends are iPhone users. Additionally, there is only a weak correlation (-0.09) between expected network composition changes and choosing an Android device. Hence, network effects may play some role, our data suggest they are not the primary equilibrium mechanism behind our treatment effects.

Another potential equilibrium change involves differences in perceived resale values of phones. Using the same question structure, we observe a relatively small correlation (-0.15) between expected resale value and selecting the Google Pixel 9 option. Furthermore, only 30% of respondents anticipate reselling their phones if they win the lottery, and treatment effects are stronger among respondents who do not intend to resell, as detailed in Appendix Table A11. Participants in the blue bubbles scenario anticipate the resale value of an iPhone to be $38 lower than those in the green bubbles scenario, although this difference lacks statistical significance. This suggests that resale prices do not substantially drive the observed treatment effects.

## 4.5 Robustness

**Perceived credibility** Our design relies on respondents believing that the possible future scenarios could occur. To assess the perceived stakes, we ask them to rate how likely it

[30]Due to a coding error, this data was only collected from approximately 40% of respondents.

is that their scenario will be implemented. As an example, in the green bubbles treatment we ask: "How likely do you believe it is that the DOJ lawsuit against Apple will succeed in making them pay significant fines but that green bubbles will remain in the coming months?" We find that people perceive the likelihood, on average, as 49% in the green bubbles treatment and 45% in the blue bubbles treatment, which suggests participants found the scenarios (similarly) credible. We also find stronger treatment effects among those who perceive their scenario as more likely, as shown in Appendix Table A12. This suggests that our estimates may underestimate the true change in market share that could result from a successful DOJ lawsuit removing green bubbles.

**Additional robustness** In Appendix G.5, we present additional robustness exercises. Specifically, we show that our results are robust to how we treat respondents who regret any of their choices and to different sample inclusion criteria.

### 4.6 Additional Demand Experiment

We conducted an additional pre-registered experiment that provides further evidence on how green bubbles increase demand for iPhones, using a different experimental design. In this experiment, we measure incentivized willingness to pay for an iPhone 16 Pro Max over a Samsung Galaxy S24 Ultra using a continuous BDM elicitation. Respondents are randomly assigned to either the green bubble or blue bubble treatment group. The green bubble group is informed that green bubbles will remain, while the blue bubble group learns that Android messages will appear as blue bubbles in the future—with the help of a recent technological advance that makes this change in color possible. Appendix H provides additional details on the design and data collection.

Consistent with our main findings, respondents in the blue bubbles group have a $43 lower WTP for the iPhone 16 Pro Max over the Samsung Galaxy S24 Ultra compared to our control group ($p < 0.05$). We observe an increase in the fraction of respondents preferring the Android over the iPhone, from 5.0% to 6.8%. While this represents a substantial 36% rise in Android's share, our study is not sufficiently powered to detect statistically significant effects on the extensive margin.

The intensive and extensive effect size reported in the robustness experiment should be interpreted with caution for at least four reasons: first, the Android phone used in the elicitation is not the usual outside option that iPhone users would consider as it is even more expensive than the iPhone. Second, we do not measure the first stage of expectations about text messages between Androids and iPhones appearing as blue on iMessage in the future. This likely means that we underestimate the effects of green bubbles on the demand for iPhones over Androids. Further, people may be uncertain over the relative quality of the phones as we do not provide information to benchmark quality. Indeed, we show in Appendix H that there are widespread misperceptions over the quality of the Samsung Galaxy S24 Ultra compared to the iPhone 16 Pro Max. Finally, we do not screen for respondents who are looking to buy a new smartphone and thus, this sample is less informative about how green bubbles affects new purchasing decisions.

Despite these concerns, we view these results as evidence of robustness of our main treatment effect across demand elicitation methods (i.e., WTP versus binary choice) and brand of Android phone (i.e., the result is not specific to Google Pixels).

## 5 The Strategic Creation of Non-User Utility

In this section, we review a series of case studies that extend beyond the green bubbles example, illustrating how companies systematically create non-user disutility through product features to increase market power. So far, our discussion has largely focused on how non-user utility affects the extensive margin of product choice—deterring users from switching to competitors and attracting new users. The case studies we discuss here also affect the intensive margin—enhancing engagement, revenue, and profits from existing users. Furthermore, we also highlight how companies can create non-user disutility through both social and technical mechanisms, as summarized in Table 1. Our case studies illustrate that companies with large market power are particularly well-suited to create non-user utility. A particularly striking mechanism is the amplification of social comparisons, which digital platforms facilitate at scale.

**Table 1:** Non-User Utility Case Studies

| Example | Description | Mechanism | Margin |
|---|---|---|---|
| **Live Entertainment** | Branded as must attend events, limited presales and long queues create FOMO among consumers | Social | Extensive |
| **Dating Apps** | "Missed connections" notifications and time sensitive interactions drive ongoing use among users | Social | Intensive |
| **Social Media** | Short-lived content and push notifications keep users continuously engaged | Social | Intensive |
| **Luxury Goods** | Limited edition drops attract consumers wanting to avoid social exclusion | Social | Extensive |
| **Facebook vs. Vine** | Upon launch, Facebook restricted Vine's API access, which would have allowed Vine users to find their Facebook contacts | Technical | Extensive |
| **Microsoft "AARD" Code** | Hidden code on Windows displayed false errors on rival operating systems | Technical | Extensive |
| **YouTube Browser Bias** | Google allegedly made YouTube load slower on rival browsers | Technical | Extensive |

### 5.1 Social Mechanisms: Case Studies

**Live Entertainment** Live entertainment companies regularly create a sense of exclusivity surrounding their events, using FOMO to attract potential attendees. Major music festivals, such as Coachella and Burning Man, brand themselves as must-see occasions. Burning Man even introduced expensive pre-sale tickets, called "FOMO tickets", for those willing to pay a premium to secure their spot at the festival.

As a result, Ticketmaster, the market leader in live entertainment tickets, may exploit these social concerns to drive impulsive purchases. Ticketmaster frequently has general sales that require enduring long online queues which heighten anticipation. After waiting in line, buyers then face time-sensitive decisions, pressured by the risk of losing their chance to attend the event. Often, Ticketmaster then uses dynamic pricing, which raises ticket prices above the pre-stated face value in real time. These tactics illustrate how Ticketmaster capitalizes on FOMO, leveraging the credible threat of limited supply (and implied probability of being a non-user) to increase consumer demand.

**Dating Apps** Dating apps include features plausibly aimed to create non-user disutility. For instance, many apps have notifications about "missed connections" or about other users who have previously expressed their interest by swiping right. These alerts pressure users to stay active on the platform or risk losing a potential match. While these features may suggest new potential connections, they also reinforce the concept that app inactivity equals lost opportunities, and in doing so, incentivize continuous use. In addition, dating apps are also designed to make a user's outside options more salient than their current matches. Endless swiping, time-sensitive interactions, and "spotlights" highlighting new and popular profiles create a constant sense of better opportunities beyond reach. This dynamic encourages users to keep searching rather than committing.

**Social Media** Social media platforms strategically use FOMO to compete for users' attention. For example, Instagram and TikTok include features such as short-lived content (e.g., stories that disappear after just 24 hours), push notifications (e.g., "Your friend just posted for the first time in a while"), and curated reels of trending lifestyles to heighten feelings of urgency and concerns about missing out on content. As a whole, these features tend to operate on the intensive margin of participation by encouraging habitual and frequent use of social media. Social media also intensifies social comparisons through connecting users worldwide. Therefore, it can additionally amplify the negative effects of other forms of non-user disutility, such as live entertainment previously mentioned.

**Luxury Goods** Luxury brands position their products as status goods by making them signal affluence and societal prestige (Frank, 2000). Although many users may gain positive utility from these signaling benefits, luxury brands simultaneously create a culture that can leave those not wearing the product feeling excluded, inferior, and stigmatized. To reinforce this dynamic, these brands create limited-edition "drops," exclusive collaborations, and time-sensitive launches. Gucci and Supreme are notable cases, as they use the allure of exclusivity to increase demand and charge high markups. In particular, Supreme drops regularly sell out within minutes and result in a thriving resale market with high prices.

## 5.2 Technical Mechanisms: Case Studies

**Facebook vs. Vine** Large online platforms have harmed competitors by using their existing extensive user networks. Notably, in 2013, when Twitter created Vine, a short-form video app, Facebook quickly restricted Vine's access to the Facebook API, specifically disabling the "Find Your Friends" feature that would have allowed Vine users to easily connect with their current Facebook contacts.[31] By doing so, Facebook plausibly lowered Vine's product quality. Although this case was not pursued legally, it clearly illustrates how a large incumbent platform can use its existing network to strategically harm emerging competitors and reinforce its market dominance.

**Microsoft "AARD" Code** Another example of a technical change to reduce non-user utility occurred when Microsoft added the "AARD" code to their Windows 3.1 beta.[32] This code could determine whether a certain computer was running on DR-DOS, a competing operating system. If detected, users saw a false error message that suggested fake compatibility issues with DR-DOS and may have negatively impacted its perceived quality. Microsoft's intention was plausibly to stop consumers from switching away from its DOS products to their competitors.[33]

Further, during the 1999 Caldera v. Microsoft lawsuit, "AARD" code acted as a key example of Microsoft's anti-competitive behavior. Overall, this example highlights that the strategic creation of non-user utility can also occur through covert technical changes, making such tactics especially difficult to identify for users.

**YouTube's Web Browser Bias** In the past, Google has been accused of purposefully making its own browser, Chrome, load YouTube quicker compared to competing browsers. In particular, in 2018, a Mozilla employee posted on X (formerly Twitter) that a YouTube redesign used an API only supported by Chrome. Due to this minor technical adjustment—arguably at no cost—some users reported that YouTube loaded significantly slower on other browsers such as Firefox and Edge, with tests anecdotally indicating performance was up to five times slower.[34]

This deliberate tactic arguably reduced the video streaming experience and thus user utility on non-Chrome browsers. The issue was heavily discussed among Reddit users and various online communities, although it was not legally proven. In this case, Google

[31] For press coverage on this issue, see "Mark Zuckerberg personally approved cutting off Vine's friend-finding feature" or "Facebook Is Done Giving Its Precious Social Graph To Competitors".

[32] In the end, Microsoft disabled this code segment before the main launch. However, the code itself remained present in Windows 3.1 and could easily be reactivated at no cost.

[33] For press coverage on this issue see "How MS played the incompatibility card against DR-DOS".

[34] For press coverage on this issue see "Mozilla Developer Claims Google Is Slowing YouTube on Firefox" or "Microsoft intern claims Google tried to sabotage Edge browser, Google issues denial".

may have leveraged its dominance in a complementary market – online video sharing – to reinforce Chrome's position in the browser market.

## 6 Conclusion

In this paper, we provide evidence that companies can influence demand for their products not only through increasing user utility but also through lowering non-user utility. As motivated in our conceptual framework, the mechanism through which demand is affected has significant implications for consumer welfare – firms that increase product demand by lowering non-user utility harm consumer welfare.

We demonstrate that the green bubbles on iPhones, which raise the salience of Android ownership, increase demand for iPhones and significantly contribute to their high market share among college students in the US—the primary demographic in our samples. Using survey data, we argue that the changes in demand driven by green bubbles result from a reduction in non-user utility, achieved by creating a social stigma associated with Android owners. This stigma links Android ownership to perceptions of lower social class, such as being poorer and less attractive. We then conduct incentivized experiments to measure the welfare costs of green bubbles. Our findings show that, on average, iPhone users require a $49 payment to deactivate their blue bubbles and switch to green bubbles for four weeks – a figure significantly above the privacy and hassle costs associated with participation. When benchmarked against other iPhone features, we find that green bubbles represent 50% of the disutility from a full iMessage deactivation. We demonstrate that this mechanism significantly influences market behavior by contributing to Apple's market power; when green bubbles are expected to be removed, iPhone owners are considerably more likely to prefer an Android phone over an iPhone of comparable quality.

A promising direction for future research is to explore – both theoretically and empirically – the interplay between pre-existing market power and the strategic generation of non-user utility. A key open question is whether, and to what extent, firms with greater market power are more effective in creating non-user utility. This issue has significant welfare implications, as the creation of non-user utility is particularly detrimental if it reinforces the dominance of the most powerful firms in the market. The increase in market power can lead to less innovation and fewer incentives to develop user-centric improvements. However, if companies with low market power and small market shares create non-user disutility, the overall welfare effects could be ambiguous. This is because the welfare benefits from increased competition might outweigh any direct negative effects from the rise in non-user disutility.

Our findings address the ongoing DOJ lawsuit against Apple and its alleged anti-competitive practices, particularly those related to iMessage. Our evidence suggests that, despite the adoption of RCS in iOS 18 to address certain compatibility issues, removing green bubbles would significantly increase non-user utility and thus increase consumer welfare among US college students. By creating disutility for non-users, Apple effectively locks in consumers, making it harder for new entrants or existing competitors (e.g., Android) to gain market share. This case exemplifies how dominant firms may leverage social concerns to entrench their market power, reducing the attractiveness of rival products without necessarily improving the core functionality of their own. The stigma associated with green bubbles imposes an intangible cost on users who might otherwise prefer alternative devices, deterring competition and decreasing welfare. Traditional antitrust enforcement has struggled to address these more subtle yet powerful mechanisms of competitive restriction. As a result, Big Tech firms have been able to maintain their dominance even in markets where viable alternatives exist, not through technical superiority, but through engineered disutility. The DOJ's focus on green bubbles in its most recent case against Apple underscores growing regulatory concerns over how firms exploit behavioral and social factors to deter competition.

While the focus of this paper is on the smartphone market, we also present case studies which illustrate how companies across a variety of markets strategically create non-user disutility using technological or social mechanisms. Future research could investigate the broader effects of non-user utility across industries and over time. Such insights could provide valuable guidance for policymakers aiming to regulate and mitigate anti-competitive behaviors by firms.

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# Online Appendix: Not for publication

Our supplementary material is structured as follows. Section A provides additional details related to the conceptual framework. Section B provides background information on the smartphone market and Section C provides additional details on the antitrust cases against Apple. Section D provides the overview of our data collection activities. Section E includes additional tables and figures for the mechanism survey. Section F includes additional tables and figures for the iMessage deactivation experiment. Section G includes additional tables and figures for the market demand experiment. Section H provides a description of the experimental design and results from a supplementary demand experiment. Section I details our analysis procedure for the open-ended data, including the manual handcoding and validation process using ChatGPT. Section J presents the instructions for all experiments described in the paper.

# A Mathematical Appendix

## A.1 Main Proofs

In what follows, let $\mu_j := p_j - c$ denote the markup of firm $j$ and $\pi_j(p_j, p_{-j})$ denote its profit function.

*Proof of Lemma 1.* As it is well known, the log-concavity Assumption 1 ensures that the second-order conditions of each firm hold. To see why, note that the log-concavity of $f$ implies the log-concavity of $Q$ and $1 - Q$. In turn, the log-concavity of $Q$ implies that $Q'^2 - Q''Q > 0$ and the log-concavity of $1 - Q$ implies that $Q'^2 + Q''(1 - Q) > 0$. Focusing on firm A, note that $\partial^2 \pi_A / \partial p_A^2 = Q'' \mu_A + 2Q'$. After substituting the first-order condition, we get $-Q''Q/Q' + 2Q'$. Multiplying times $-Q'/Q$ gives $Q''Q - 2Q'^2 < Q''Q - Q'^2$, which is negative by log-concavity. A similar procedure shows that firm $B$'s second-order conditions hold.

Let $P_j(p_{-j})$ denote the best response function of $j$. Note that $P_j' \in (0, 1)$. To see why, focus on firm $A$ and use the implicit function theorem to get: $P_A' = \frac{Q'^2 - Q''Q}{2Q'^2 - Q''Q}$. A similar procedure applies to $B$'s best response. Finally, note that $P_j(p_{-j}) > c > 0$. This condition and the bounds on the derivative of $P_j$ ensure that the best responses of both firms cross at prices above marginal cost and that they so only once. ■

*Proof of Proposition 1.* Consider a marginal increase in $g$, $dg$. Applying the implicit function theorem over the first-order conditions of $A$ and $B$, we get:

$$\frac{dp_A}{dg} = \frac{Q'^2 - QQ''}{Q''(1 - 2Q) + 3Q'^2}$$
$$\frac{dp_B}{dg} = -\frac{Q'^2 + Q''(1 - Q)}{Q''(1 - 2Q) + 3Q'^2}$$

Note that the denominator of both equations is positive, since it equals the addition of three terms: $Q''(1 - Q) + Q'^2$, plus $Q'^2 - Q''Q$ (both positive due to Assumption 1), and $Q'^2$. The numerators in both expressions are positive again due to log-concavity, implying that $dp_A/dg > 0$ and $dp_B/dg < 0$. Hence, firm $A$'s equilibrium markup increases and firm $B$'s equilibrium markup decreases in response to $dg$. Moreover, note that the numerator in both cases is lower than the denominator, implying that $dp_A/dg < 1$ and $-dp_B/dg < 1$. Additionally, $(dp_A - dp_B)/dg < 1$, which implies that demand for $A$, $Q(p_A - p_B - g)$, increases, and demand for $B$ decreases. ■

*Proof of Proposition 2.* Let $\mathbf{u} = (u_A, u_B)$. Consumer welfare is given by:

$$W(g_u, g_n) := \underbrace{\int_{\mathbf{u}\colon u_A - p_A \geq u_B - p_B - g} (u_A + g_u - p_A) f(\mathbf{u}) d\mathbf{u}}_{\text{Welfare of } A\text{'s consumers}} + \underbrace{\int_{\mathbf{u}\colon u_A - p_A < u_B - p_B - g} (u_B - g_n - p_B) f(\mathbf{u}) d\mathbf{u}}_{\text{Welfare of } B\text{'s consumers}}.$$

Differentiate $W$:

$$dW = Q(dg_u - dp_A) - (1 - Q)(dg_n + dp_B).$$

Consider first the case when $A$ only creates non-user disutility; that is, when $dg = dg_n$ and $dg_u = 0$. In this case, consumers of $A$ are unambiguously worse off since they experience an increase in $p_A$ and no offsetting increase in user utility. Moreover, consumers of $B$ are also worse off since the decrease in price $p_B$ is not enough to offset the increase in $g$, so $-dg - dp_B < 0$. Thus, $dW < 0$.

Consider now the case when $A$ only creates user utility; that is, when $dg = dg_u$ and $dg_n = 0$. In this case, consumers of $A$ are unambiguously better off since they experience an increase in $g$ which is large enough to offset the increase in $p_A$, so $dg - dp_A > 0$. Moreover, consumers of $B$ are also better off since they experience a decrease in $p_B$, without a decrease in their non-user utility. Hence, $dW > 0$. ■

## A.2 Microfoundation

This subsection presents a duopoly model where firms compete in prices and where they can influence the stigma associated with consuming their products, effectively creating non-user disutility and user utility for some consumers. The purpose of the section is to microfound the model presented in Section 2, endogenizing two features that were exogenous in that model: the non-user utility term $g$ and the fact that only one company could generate non-user disutility. We will show that only the company that is relatively more associated with high types will choose to generate non-user disutility.

**Setup.** The setup is similar to the model in Section 2, but with a continuum of consumers of two types: "high," $H$, (of mass $\gamma$) and "low," $L$, (of mass $1-\gamma$). Consumers must choose which of the two products they buy. The total utility that they get from a product comes from two channels: 1) a direct utility from consuming it and 2) a social image concern.

Concretely, the value that $i$ gets from buying product $j \in \{A, B\}$ is:

$$V_j^i(p_j, \mathbf{q}, \lambda) := \underbrace{u_j^i}_{\text{Direct utility}} + \underbrace{S(q_j^H, q_j^L)(\lambda_A + \lambda_B)}_{\text{Social image}} - p_j,$$

where $q_j^\theta$ is the demand of type $\theta \in \{H, L\}$ for product $j$ and $\mathbf{q} = (q_A^H, q_A^L)$ is the vector of demands for product $A$.[35] We index consumers by the difference in their direct utility from product $A$ vs. $B$, $u^i := u_A^i - u_B^i$. We assume that $u^i$ is distributed according to a strictly increasing smooth distribution $F^\theta$ with bounded density $f^\theta$ with full support for each type.

The social image term $S(q_j^H, q_j^L)(\lambda_A + \lambda_B)$ follows the framework in Bursztyn and Jensen (2017) extended from Bénabou and Tirole (2006). The function $S$ represents how other individuals perceive $i$ given $i$'s purchase decision. This function is positive or negative whenever there are positive or negative image concerns, respectively. For simplicity, we assume the following functional form:

$$S(q_j^H, q_j^L) := (1-\gamma)q_j^H - \gamma q_j^L$$

This function takes a value of zero—the social image concern disappears—when the fraction of $H$ purchasing the product equals the fraction of $H$ in the population. That is, when the posterior likelihood of being a high type given purchase of $j$ is equal to the prior—when phone choice is uninformative of individual type. Additionally, note that $S$ is increasing in $q_j^H$ and decreasing in $q_j^L$, to capture that $i$'s image improves as more $H$ individuals purchase the same product and worsens as more $L$ individuals do.

The non-negative parameters $\lambda_A, \lambda_B$ correspond to the importance or salience of the social image concern and are determined by platforms' product choices. For example, firm $A$ can marginally increase the saliency of social image relative to an initial baseline of zero—say, by allowing its customers to distinguish which phone other customers have. In this case, $A$ customers face social image concerns vis-à-vis other $A$ customers equal to $S(q_A^H, q_A^L)\lambda_A$, and face $S(q_A^H, q_A^L)\lambda_B$ vis-à-vis $B$ customers. We have assumed, for simplicity, that firms impose the same salience of the social image concerns on both users and non-users, thereby creating user and non-user utility simultaneously. This assumption can be relaxed by allowing these parameters to differ between users and non-users, but the main implications of the model remain unchanged. Note also that our assumptions imply that only one phone—the one relatively more associated with $H$ customers—will have positive image concerns. Therefore, by increasing saliency of social image, the company that sells that phone will increase user utility and decrease non-user utility, while the other company will do the reverse.

**Timing.** The timing of the model is as follows. First, firms choose simultaneously their product design: whether to costlessly and marginally increase the salience parameter $\lambda_j$. After this decision, both firms compete in prices à la Bertrand.

[35] Note that $q_A^H + q_B^H = \gamma$ and $q_A^L + q_B^L = 1-\gamma$, so it is enough to keep track of the demand for product $A$, without loss of generality.

**Equilibrium.** Let $Q_j^{c,\theta}\left(p_j^D - S^D(q_j^H, q_j^L)(\lambda_A+\lambda_B)\right)$ denote the aggregate demand of type $\theta$ for product $j$, conditional on (expected) quantities, where $p_j^D := p_j - p_{-j}$ is the price difference and $S^D(q_j^H, q_j^L) := S(q_j^H, q_j^L) - S(\gamma - q_j^H, (1-\gamma) - q_j^L)$ is the difference in social image concerns between products. We impose an assumption that ensures that network effects are not too strong, necessary for downward-sloping demand functions.

**Assumption 2.** *The salience of the social image concerns is not too high: $\lambda_j \in \{0, d\lambda_j\}$, where $d\lambda_j \approx 0$.*

Given Assumption 2, the next lemma shows that downward-sloping demand functions exist given firm product design choices $\lambda$. Without loss of generality, we focus on the demand for $A$ since $Q_B^H = \gamma - Q_A^H$ and $Q_B^L = 1-\gamma - Q_A^L$.

**Lemma 2.** *Fix $\lambda := \lambda_A + \lambda_B$ and the price difference $p_A^D$. Under Assumption 2, there exist downward-sloping demand curves $Q_A^\theta(p_A^D, \lambda)$ which solve the following fixed-point problem:*

$$q_A^\theta = Q_A^{c,\theta}\left(p_A^D - S^D(q_A^H, q_A^L)(\lambda_A+\lambda_B)\right)$$

*Proof.* Define the mapping $\Phi(q_A^H, q_A^L) = (Q_A^{c,H}, Q_A^{c,L})$. We will show that $\Phi$ is a contraction on a compact, convex set ($[0,\gamma]\times[0,1-\gamma]$) and apply the Banach Fixed-Point Theorem.

Consider two points, $(q_A^H, q_A^L)$ and $(q_A'^H, q_A'^L)$. By the mean-value theorem,

$$\left|\Phi^\theta(q_A^H, q_A^L) - \Phi^\theta(q_A'^H, q_A'^L)\right| \le \max_x f^\theta(x)\cdot\left|S^D(q_A^H, q_A^L) - S^D(q_A'^H, q_A'^L)\right|\cdot(\lambda_A+\lambda_B).$$

Since $S$ is continuously differentiable,

$$\left|S^D(q_A^H, q_A^L) - S^D(q_A'^H, q_A'^L)\right| \le \|\nabla S^D\|_\infty\left(\left|q_A^H - q_A'^H\right| + \left|q_A^L - q_A'^L\right|\right).$$

Hence,

$$\left|\Phi^\theta(q_A^H, q_A^L) - \Phi^\theta(q_A'^H, q_A'^L)\right| \le \|f^\theta\|_\infty\cdot\|\nabla S^D\|_\infty\cdot(\lambda_A+\lambda_B)\cdot\left(\left|q_A^H - q_A'^H\right| + \left|q_A^L - q_A'^L\right|\right).$$

By Assumption 2, and since $\|\nabla S^D\|_\infty \le 2$, and $f^\theta$ is bounded, $\|f^\theta\|_\infty\cdot\|\nabla S^D\|_\infty\cdot(\lambda_A+\lambda_B) < 1$, so $\Phi$ is a contraction. To see why the resulting demands $Q_A^\theta(p_A^D, \lambda)$ are downward-sloping, use the Implicit Function Theorem to get:

$$\frac{\partial Q_A^\theta}{\partial p_A^D} = \frac{Q_A^{c,\theta\prime}}{1 + 2(\lambda_A+\lambda_B)\left[(1-\gamma)Q_A^{c,H\prime} - \gamma Q_A^{c,L\prime}\right]}. \tag{1}$$

The numerator of this expression is negative and the denominator is negative by Assumption 2. ■

We now impose a set of assumptions that will ensure that demands are log-concave.

**Assumption 3.** *The densities $f^\theta$ are strictly log concave.*

**Assumption 4.** *Demands have bounded curvatures:*

$$f^{H''}(1-F^L)+f^{L''}(1-F^H)\geq \max\left\{f^{H''}+f^{L''},0\right\}+2f^Hf^L$$

**Lemma 3.** *Under Assumptions 2 to 4, the demand curve $Q_A(p_A-p_B,\lambda):=Q_A^H(p_A-p_B,\lambda)+Q_A^L(p_A-p_B,\lambda)$ is log-concave in $p_A$ and the demand curve $Q_B:=1-Q_A$ is log-concave in $p_B$.*

*Proof.* We begin by showing that $Q_A''Q_A\leq {Q_A'}^2$, where $Q_A':=\frac{\partial Q_A}{\partial p_A}$ and $Q_A''$ is defined accordingly. Let $D_A:=(1-\gamma)Q_A^{c,H'}-\gamma Q_A^{c,L'}$ and note that ${Q_A^\theta}'=Q_A^{c,\theta'}/(1+2\lambda D_A)$ from Equation (1), where $1+2\lambda D_A$ is positive as argued above. Similarly, let $E_A:=(1-\gamma)Q_A^{c,H''}-\gamma Q_A^{c,L''}$ and note that ${Q_A^\theta}''=\frac{Q_A^{c,\theta''}}{(1+2\lambda D_A)^2}-2\lambda\frac{Q_A^{c,\theta'}E_A}{(1+2\lambda D_A)^3}$. Then $Q_A''Q_A\leq {Q_A'}^2$ can be written as:

$$\left[\frac{Q_A^{c,H''}+Q_A^{c,L''}}{(1+2\lambda D_A)^2}-2\lambda E_A\frac{Q_A^{c,H'}+Q_A^{c,L'}}{(1+2\lambda D_A)^3}\right]\left(Q_A^{c,H}+Q_A^{c,L}\right)\leq\frac{Q_A^{c,H'2}+Q_A^{c,L'2}+2Q_A^{c,H'}Q_A^{c,L'}}{(1+2\lambda D_A)^2}$$

We can rewrite this expression as:

$$\begin{aligned}&\left[\left(Q_A^{c,H''}Q_A^{c,H}-Q_A^{c,H'2}\right)+\left(Q_A^{c,L''}Q_A^{c,L}-Q_A^{c,L'2}\right)\right]\\&+\left[Q_A^{c,H''}Q_A^{c,L}+Q_A^{c,L''}Q_A^{c,H}-2Q_A^{c,H'}Q_A^{c,L'}\right]\leq 2\lambda E_A\frac{Q_A^{c,H'}+Q_A^{c,L'}}{(1+2\lambda D_A)}Q_A.\end{aligned}\tag{2}$$

The first row in Equation (2) is negative because of the log-concavity of $Q_A^{c,\theta}$ inherited from $f^\theta$ (Assumption 3). The left-hand side of the second row of Equation (2) can be rewritten as: $-f^{H'}(1-F^L)-f^{L'}(1-F^H)-2f^Hf^L$. This expression is negative by Assumption 4. Lastly, the right-hand side of Equation (2) approaches 0 by Assumption 2.

Next, we repeat a similar procedure to show that $Q_B''Q_B\leq {Q_B'}^2$, where $Q_B':=\frac{\partial Q_B}{\partial p_B}$ and $Q_B''$ is defined accordingly. We can rewrite the relevant inequality as:

$$\begin{aligned}&\left[\left(Q_B^{c,H''}Q_B^{c,H}-Q_B^{c,H'2}\right)+\left(Q_B^{c,L''}Q_B^{c,L}-Q_B^{c,L'2}\right)\right]\\&+\left[Q_B^{c,H''}Q_B^{c,L}+Q_B^{c,L''}Q_B^{c,H}-2Q_B^{c,H'}Q_B^{c,L'}\right]\leq 2\lambda E_B\frac{Q_B^{c,H'}+Q_B^{c,L'}}{(1+2\lambda D_B)}Q_B.\end{aligned}\tag{3}$$

As above, the first row in Equation (3) is negative because of the log-concavity of $Q_A^{c,\theta}$ inherited from $f^\theta$ and the right-hand side of the inequality approaches 0 by Assumption 2.

Given that $Q_B = 1 - Q_A$, we can rewrite the left-hand side of the second row of Equation (3) as:

$$Q_A^{c,H''} Q_A^{c,L} + Q_A^{c,L''} Q_A^{c,H} - 2Q_A^{c,H'} Q_A^{c,L'} - Q_A^{c,H''} - Q_A^{c,L''}.$$

This expression is negative by Assumption 4.

■

Now, consider the subgame that follows firms' product design choices $\lambda_j$.

**Lemma 4.** *Under Assumptions 2 to 4, there exists a unique Bertrand-Nash equilibrium in the subgame that follows firms' product design choices $\lambda_j$. Let $p_j(\lambda)$ denote the equilibrium prices in that subgame.*

*Proof.* The proof follows from applying Lemma 3 to show that demands are log-concave and following the same procedure as in Lemma 1. ■

In the following proposition, we characterize the equilibria of this game. We will show that, in the more interesting case when firms are slightly differentiated, only one firm will choose to make social image concerns salient in equilibrium. In this case, the company that chooses to make social image concerns salient in equilibrium is the one that is relatively more associated with the high types in the absence of social image concerns.

Before presenting the proposition, we introduce some useful notation. Let $p_A^D(0)$ denote the equilibrium price difference between product $A$ and $B$ in the subgame when $\lambda_j = 0$. Let $Q_A^{\theta,0} := Q_A^{\theta}(p_A^D(0), 0)$ denote the equilibrium demand for $A$ by type $\theta$ in that subgame, and $S^0 := S^D(Q_A^{H,0}, Q_A^{L,0})$ denote the equilibrium difference in social image terms between $A$ and $B$. Note that $S^0 > 0$ ( $S^0 < 0$) if $A$ ($B$) is relatively more associated with high types in that subgame, while $S^0 = 0$ if both firms have the same ratio of high types and low types.

**Proposition 3.** *Let $\lambda \approx 0$. If $S^0 \neq 0$, there exists a unique subgame perfect equilibrium in this game, where only one firm—the one relatively more associated with high types—chooses to make the social image concerns salient; firm $A$ if $S^0 > 0$ and $B$ otherwise. If $S^0 = 0$, both companies are indifferent between making the social image concerns salient or not, so there are multiple equilibria.*

*Proof.* The key to this proof is to notice that, when $\lambda \approx 0$, we can write:

$$q_A = Q(p_A - p_B - g), \tag{4}$$

where $g = \lambda S^0$. Consider the profit function of firm $A$ conditional on product choices $\lambda$ (and, hence, $g$):

$$\pi_A(\lambda) := [p_A(\lambda) - c]\, Q(p_A - p_B - g(\lambda)).$$

Differentiate with respect to $\lambda$:

$$\pi_A' := p_A' \left[Q + (p_A - c)Q'\right] + (p_A - c)\left[-Q'g' - Q'p_B'\right] = (p_A - c)\left|Q'\right|\left(g' + p_B'\right),$$

where we have used that the term $Q + (p_A - c)\frac{\partial Q}{\partial p_A}$ is zero by $A$'s first-order condition in the final subgame. In Bertrand games with differentiated products, $p_A - c > 0$, as firms make strictly positive profits. Thus, the sign of $\pi'_A$ depends on $g' + p'_B$. Note that, because of Equation (4), we can use the same procedure from the proof of Proposition 1 that gives $\frac{dp_A}{dg}$ and $\frac{dp_B}{dg}$, and use that $dg = S^0 d\lambda$. Therefore,

$$p'_A = \frac{dp_A}{dg} S^0 = \frac{Q'^2 - QQ''}{Q''(1-2Q) + 3Q'^2} S^0$$
$$p'_B = \frac{dp_B}{dg} S^0 = -\frac{Q'^2 + Q''(1-Q)}{Q''(1-2Q) + 3Q'^2} S^0$$

Therefore, $g' + p'_B = S^0(1 + \frac{dp_B}{dg})$. Following a similar argument, $\pi'_B = (p_B - c)\,|Q'|\,S^0(\frac{dp_A}{dg} - 1)$. We know from the proof of Proposition 1 that $1 + \frac{dp_B}{dg} > 0$ and $\frac{dp_A}{dg} - 1 < 0$. Therefore, when $S^0$, $\pi'_A > 0$ and $\pi'_B < 0$. ∎

Thus, we have microfounded that 1) the non-user disutility term of Section 2 can arise from a model where companies choose to make social image concerns salient, and 2) in such a model, only one company chooses to make these image concerns salient: the company that is relatively more associated with high types.

# B Background information on Apple and the Smartphone Market

In this section, we present further information about the smartphone market both globally and within the United States. We then expand on compatibility issues between iPhones and Android devices.

**The Global Market for Smartphones** The global smartphone market is substantial and growing, valued at $566.12 billion (Precedence Research, 2024) with 1.24 billion smartphone shipments expected to occur in 2024 (International Data Corporation, 2024). The market is characterized by a duopoly of smartphone operating systems: Android and iOS. Globally, Android and iOS devices represent 71.65% and 27.62% of the market share of users, respectively (Statista, 2024).[36] Android market share is comprised of many differentiated brands, led primarily by Samsung(Visual Capitalist, 2024).

**Apple's Dominance in the US Smartphone Market** The US smartphone market is valued at $61 billion (Market Research Future, 2024). High smartphone penetration rates and the prevalence of iOS devices, which are typically much pricier than Androids, are the primary drivers of this trend (Designveloper, 2024). Moreover, in the US, the share of iOS devices is around twice the global average at 56% market share (StatCounter, 2024a). Android sales are mostly driven by established leader Samsung (StatCounter, 2024b) and increasingly popular Google devices (Schoon, 2024).

**Cross-country Variation in Messaging Platforms** There are drastic differences in smartphone operating system ownership across countries, even after controlling for income levels. The most striking example of this pattern is the difference between the US and Canada compared to Europe. Table A1 below illustrates this by showing iPhone market share and WhatsApp penetration levels in European and North American countries, highlighting their negative correlation. The statistics are consistent with iPhone users disproportionally using iMessage and SMS/MMS texting to communicate with other smartphones, as opposed to other third party messaging platforms. Further, it also suggests that the US and Canada's smartphone messaging norms are substantially different than the rest of Europe. It is likely that WhatsApp became much more prevalent than text messaging in Europe because the cost of text messaging was historically very high in European countries, in contrast to the unlimited texting plans that were common in the US (Zhukova, 2022). Further, there is a greater need for cross-border communication in Europe, which may have pushed people to find alternative options to expensive international messaging fees.

[36] Less than 1% of smartphones use a different operating system, comprised of many smaller systems.

**Appendix Table A1:** WhatsApp and iPhone Market Shares by Country as of 2022

| **Country** | **iPhone Market Share (%)** | **WhatsApp Market Share (%)** |
|---|---|---|
| Spain | 21.40 | 92.20 |
| Russia | 26.16 | 83.70 |
| Italy | 29.31 | 97.00 |
| Germany | 37.67 | 95.50 |
| Austria | 39.49 | 94.40 |
| Netherlands | 40.31 | 92.90 |
| United Kingdom | 51.63 | 71.30 |
| Switzerland | 55.92 | 95.90 |
| United States | 56.74 | 41.20 |
| Canada | 57.84 | 42.40 |

*Notes:* Table A1 presents iPhone and WhatsApp market shares in 2022 for selected European countries, as well as Canada and the US. iPhone market data are sourced from World Population Review (2024), and WhatsApp market data are sourced from Statista (2023).

# C Antitrust Cases Against Apple

## C.1 Department of Justice Lawsuit

In March 2024, the Department of Justice (DOJ), along with 16 other state and district attorneys general, filed a case against Apple for violating antitrust laws. The lawsuit argues that Apple has created a monopoly in the smartphone market, in violation of Section 2 of the Sherman Act, through various practices which stifle competition and innovation, while enabling the company to extract higher prices from its customer base.

Key allegations include blocking innovative super apps, which combine smaller apps and services into a singular application and could hence reduce reliance on the iOS App Store, and restricting cloud streaming services like Xbox Cloud Gaming and Google Stadia, which allow high-quality gaming on remote servers rather than powerful hardware. Other examples cited are limiting third-party apps' functionality to position Apple's services like iMessage and its digital wallet as superior, which increases the switching cost for consumers.

Another claim is that Apple has worsened the quality of cross-messaging features. Messages from non-iPhone users are displayed as green bubbles instead of blue, are not encrypted, and do not have typing or editing indicators. This could lead to perceived lower quality of non-iPhones and social stigma towards non-iPhone users, especially among teenagers.

## C.2 European Union's Digital Markets Act

The Digital Markets Act (DMA) is a piece of legislation by the European Union intended to regulate the market power of digital platforms that the act classifies as "gatekeepers". The main objectives of the DMA are to promote fair competition, allow smaller companies a level playing field to innovate, and provide consumers with greater choice of digital services.

Apple is classified as a gatekeeper under the DMA as it meets all three criteria. Firstly, it has "significant impact on the internal market", with an annual turnover above EUR 7.5 billion and an average market capitalization exceeding EUR 75 billion. Secondly, it provides a gateway between businesses and end users, through the iOS App Store which allows developers to access a large customer base and exceeds the DMA's thresholds for monthly active end users and yearly active business users. Lastly, Apple's core platform services, including the App Store and iOS, have sustained a strong economic position over time, which qualifies the company as having an "entrenched and durable position".

# D Summary of Data Collections

**Appendix Table A2:** Overview of Data Collections

| Data Collection | Sample | Treatment Arms | Main Outcomes | Pre-registration |
|---|---|---|---|---|
| **Panel A**: Welfare Evidence | | | | |
| Mechanism Survey (Aug 2024) | Prolific ($n = 476$) | None | Android Stereotypes, Preferences Over Green Bubbles, Perceived Quality | `https://aspredicted.org/r27m-69c8.pdf` |
| Deactivation Exp. (Oct 2024) | College Pulse ($n = 402$) | Blue Bubbles deactivation, Privacy and hassle cost control | WTA for deactivation | `https://aspredicted.org/xxyp-s8qx.pdf` |
| **Panel B**: Demand Experiments | | | | |
| Main Demand Exp. (Nov 2024) | Prolific ($n = 468$) | Blue Bubbles, Green Bubbles treatment | Choice: iPhone 16 or Google Pixel 9 + $150 | `https://aspredicted.org/54y4-s5jj.pdf` |
| Robustness Exp. (Aug-Sep 2024) | College Pulse, Prolific ($n = 1,388$) | Blue Bubbles, Green Bubbles treatment | WTP: iPhone 16 Pro Max vs. Samsung Galaxy S24 Ultra | College Pulse: `https://aspredicted.org/4tp9-tvzr.pdf`, Prolific: `https://aspredicted.org/4ytf-zgwq.pdf` |

*Notes:* Table A2 provides an overview of data collections, grouped by section. The mechanism survey and robustness demand experiment had a hard cutoff on Sept 16, 2024, due to iOS 18's introduction. The main demand experiment had a hard cutoff on Dec 2, 2024, due to Cyber Monday sales ending.

# E Mechanism Survey: Additional Tables and Figures

## E.1 Demographic Summary Statistics

**Appendix Table A3:** Demographics Summary Statistics for Mechanism Survey Sample

| **Variable** | **Mean** |
|---|---|
| **Panel A**: Demographics | |
| Gender (Ind. for Female) | 0.53 |
| Age | 20.39 |
| Relationship Status (Ind. for Single) | 0.63 |
| **Panel B**: Operating System | |
| iOS (Ind. for Yes) | 0.84 |
| MacBook (Ind. for Yes) | 0.51 |
| Observations | 476 |

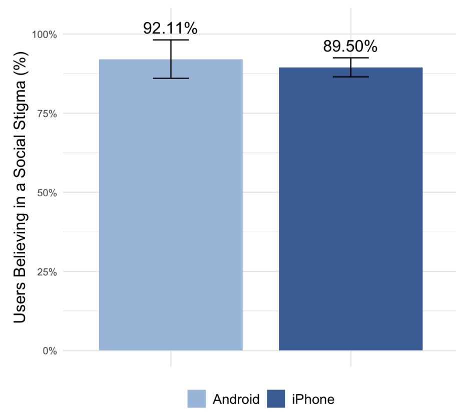
*Notes:* Table A3 summarizes key demographic statistics for the mechanism survey sample. Variables are presented with their respective means. The total number of observations is 476.

## E.2 Incentives

At the end of the survey, we ask respondents how having their answers count towards the average statistic that is featured in our widely circulated report affected both their effort levels and extremism of opinions. We find that 52% of the respondents self-report putting in more effort as a result of our incentivization strategy. 48% of people report no changes to their effort level and only one person reported putting in less effort. We then asked people how this affected how extreme they reported their opinions. Reassuringly, the vast majority of respondents (90%) reported that there was no effect to how extremely they reported their opinions. 8% reported expressing more extreme opinions, and 2% less extreme opinions. Overall, the self-reports suggest that the our incentivization strategy was effective at improving the engagement of respondents. We also find that respondents have a 57% mean perceived likelihood that the believe the results of this study will be published in a major news outlet, suggestive that our incentives were credibly perceived. Respondents also report an average of a 41% chance that the DOJ lawsuit is successful in forcing Apple to remove green bubbles.

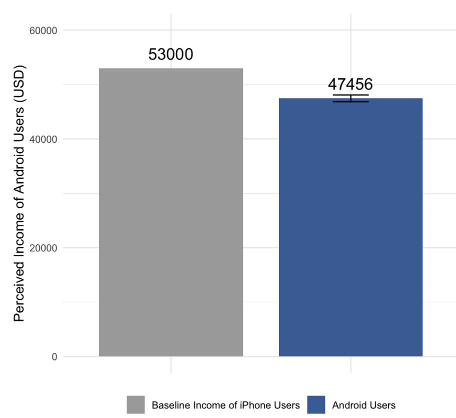
### E.3 Additional figures

**Appendix Figure A1:** Fraction of Respondents that Believe there is a Green Bubble Stigma



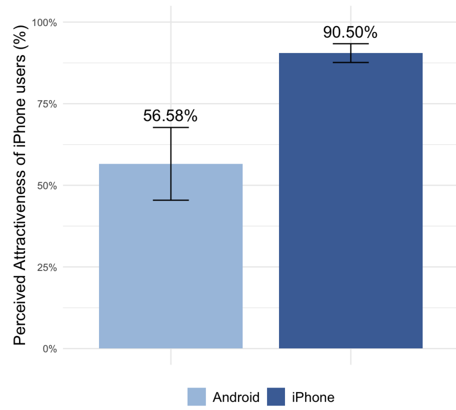

*Notes:* Figure A1 displays the percentage of respondents that agree there is a social stigma with green bubbles by operating system type. In particular, we ask "Do you think that there is a social stigma against Android users whose text messages appear as green bubbles on iPhones?". We only include respondents that pass all attention checks and bot detection protocols as per our pre-registration. We report 95% confidence intervals.

**Appendix Figure A2:** iPhone Users Believe that Android Users have Substantially Lower Income



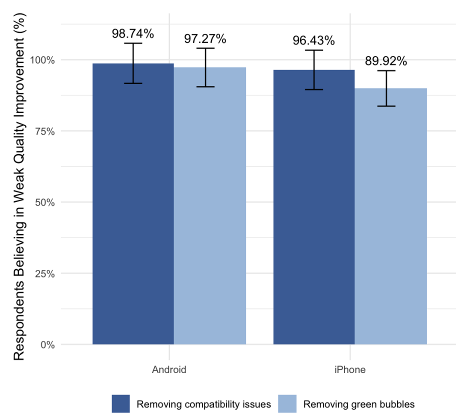

*Notes:* Figure A2 displays the the average guess amount respondents provide regarding the average income of Android users in the US, relative to iPhone users at $53,000. On average, people think the average income of Android users is $47,456. We compute the average by taking the mid-point of the various income brackets in the choice options, as per our pre-registration. We only include respondents that pass all attention checks and bot detection protocols as per our pre-registration. We report 95% confidence intervals.

**Appendix Figure A3:** Fraction of Respondents Believing iPhone Users are More Attractive




*Notes:* Figure A3 displays the percentage of respondents that think the average iPhone user is more attractive than the average Android user. In particular, we ask "Do you think that the average iPhone user is more or less attractive than the average Android user?". We only include respondents that pass all attention checks and bot detection protocols as per our pre-registration. We report 95% confidence intervals.

**Appendix Figure A4:** The Effect of Green Bubbles on Perceived Quality




*Notes:* Figure A4 presents the results for how removing compatibility issues or green bubbles affect the perceived quality of Androids and iPhones. We plot the percentage of people that think there is a weak quality improvement (3, 4 or 5 on a 1-5 Likert scale). We only include respondents that pass all attention checks and bot detection protocols as per our pre-registration. We report 95% confidence intervals.

# F Deactivation Study

## F.1 Sample Summary Statistics

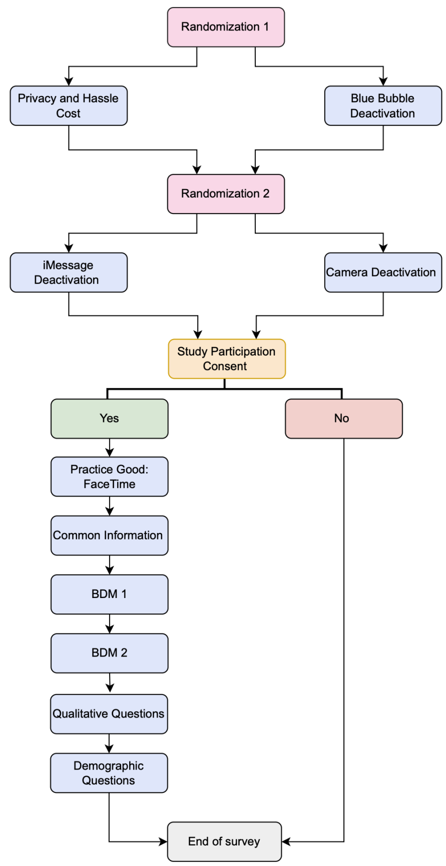
**Appendix Table A4:** Demographics Summary Statistics for Deactivation Study Sample

| **Variable** | **Mean** |
|---|---|
| **Panel A**: Demographics | |
| Gender (Ind. for Female) | 0.57 |
| Age | 20.45 |
| Relationship Status (Ind. for Single) | 0.56 |
| Observations | 402 |

*Notes:* Table A4 summarizes key demographic statistics for the deactivation study sample. Variables are presented with their respective means. The total number of observations is 402.

## F.2 Structure of Experiment

**Appendix Figure A5:** Structure of Experiment: Deactivation Study




*Notes:* Figure A5 displays the structure of the experiment. Participants are randomized into either the privacy and hassle cost control or the blue bubble deactivation, and then randomized into either the iMessage deactivation or camera deactivation option. Participants then consent to participating in the experiment before their deactivation options are revealed to them. Participants who consent proceed with the practice good for the BDM elicitation, receive common information on green bubbles, and then do the BDM elicitation for their two deactivation options, as determined by treatment status. The experiment concludes by collecting responses to qualitative questions and demographic characteristics. The yellow boxes indicate embedded data, the blue boxes indicate question blocks, and the pink box indicates randomization. We include several attention checks in our survey to ensure attentive respondents and proper comprehension of our deactivation study. 78.3% of respondents fail at least one attention check and we do not collect data for this group as pre-registered.

### F.3 Results

**Appendix Table A5:** Regression Results: Blue Bubbles Deactivation vs. Control

| | (1) | (2) |
|---|---|---|
| Blue Bubbles | 31.52*** | 30.45*** |
| | (4.03) | (3.50) |
| Practice WTA Final | | 0.37*** |
| | | (0.04) |
| Male | | 4.42 |
| | | (3.24) |
| Constant | 17.12*** | -0.88 |
| | (1.73) | (2.10) |
| Observations | 402 | 402 |
| R-squared | 0.143 | 0.365 |
| Controls | No | Yes |

*Notes:* Table A5 displays the regression results for our main specification without (Column 1) and with (Column 2) control variables. Both of these regressions were pre-specified. The coefficients on Blue Bubbles represent the difference in deactivation WTA between the Blue Bubbles group versus the privacy and hassle cost control. Robust standard errors are in parentheses. Stars indicate significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

### F.4 Heterogeneity

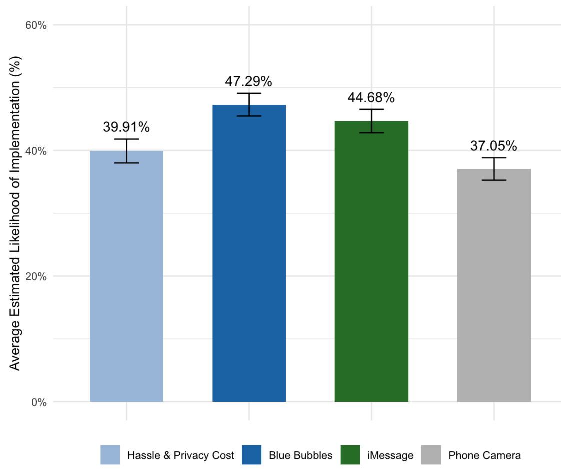
**Appendix Table A6:** Heterogeneity for Regression Results: Blue Bubbles Deactivation vs. Control

| | In a Relationship | Single | Males | Females |
|---|---|---|---|---|
| Blue Bubbles | 35.29*** | 28.53*** | 31.82*** | 30.42*** |
| | (6.07) | (5.41) | (6.34) | (5.25) |
| Constant | 16.24*** | 17.81*** | 19.31*** | 15.56*** |
| | (2.25) | (2.54) | (3.01) | (2.08) |
| Observations | 177 | 225 | 172 | 228 |
| R-squared | 0.176 | 0.119 | 0.135 | 0.145 |

*Notes:* Table A6 displays the regression results for our main specification for different demographic subgroups of our sample, which were not pre-specified. Robust standard errors are in parentheses. Stars indicate significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

## F.5 Robustness

**Appendix Figure A6:** Perceived Credibility of Deactivation Options




*Notes:* Figure A6 displays the average perceived credibility that each of the deactivation options would be implemented. In particular, we ask "For those respondents who are chosen to get their choices implemented, how likely do you think it is that the study just described in Option 1 will be the one selected for implementation?". We only include respondents that pass all attention checks and bot detection protocols as per our pre-registration. We report 95% confidence intervals.

**Appendix Table A7:** Regression Results: Blue Bubbles Deactivation by Perceived Likelihood

| | Above Median Perceived Likelihood | Equal or Below Median Likelihood |
|---|---|---|
| Blue Bubbles | 29.61*** | 33.54*** |
| | (5.34) | (6.26) |
| Constant | 18.10*** | 16.40*** |
| | (2.53) | (2.37) |
| Observations | 200 | 202 |
| R-squared | 0.124 | 0.159 |

*Notes:* Table A7 displays the regression results for our main specification for respondents below or above the median perceived likelihood for the implementation of Option 1. Robust standard errors are in parentheses. Stars indicate significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

**Top-coding** We find differential top-coding at our maximum value of \$ 150 between the treatment and control condition, which suggests our estimate of the welfare cost of green bubbles is conservative. However, at the same time, we find significant differences in top-coding between the blue bubbles, iMessage, and camera deactivation, which make our benchmark valuations likely understated. To overcome these issues, we conduct a bounding exercise where we assume a top value of \$200 instead of \$150. Under these more conservative assumptions, we find a \$37.77 treatment effect, with a WTA of \$55.12 for the blue bubbles, \$82.76 for the iMessage, and \$105.28 for the camera deactivation, which still suggests a large economic significance to the consumer welfare costs of green bubbles compared to our benchmarks.

**Regret** We allow our respondents to regret their valuations to ensure accurate data quality. After completing the MPL, we ask them if they would agree to participate in the deactivation for their implied valuation. Specifically, we ask whether they agree with the valuation implied by their answers to the MPL "According to your answers to the previous questions, you would need at most \$$X$ to participate and deactivate iMessage rather than not participate in the study". If they disagree, they are redirected to the start of the MPL and allowed to complete their decisions a second time. We asked them if they regret their choice a second time, but everyone proceeds with the next step regardless of their answer. In Option 1, we find that 5% of people regret their choice once and 0% of people regret their choice twice. In Option 2, we find that 6% of people regret their choice once and 0% of people regret their choice twice. In accordance with our pre-registration, we exclude anyone that regrets their choice twice, which is no respondent in our sample. Our low values of regret are likely helped by including a practice deactivation option for FaceTime, where we also allow for regret and see 26.6% of people regret once and 1.5% of people regret twice.

## F.6 Implementation and Compliance

As pre-specified, we selected 1 out of 10 respondents to be in the deactivation study, for a total of 40 participants. We exclude anyone with valuations outside our bounds, as well as anyone with a negative WTA as these are not incentive compatible. We then conduct the random computer draw, where we end up with 30 participants (14 iMessage and 16 camera) that we invite to participate in the deactivation study. We received a response indicating interest in participation from 22 (73%) people.[37]. The deactivation period started on Monday, November 4th and ended on Sunday, December 1st. We find that 95 %, or 21 out of 22, of our participants successfully completed the deactivation, for an average payout of \$93. These results are comparable to previous large-scale deactivation experiments (Allcott et al., 2020) and provide further support that our design was perceived as credible.

[37] An additional person expressed interested in participating but encountered technical difficulties with their phone not receiving text messages so opted to not begin the deactivation.

# G Main Demand Experiment: Additional Tables and Figures

## G.1 Sample Characteristics

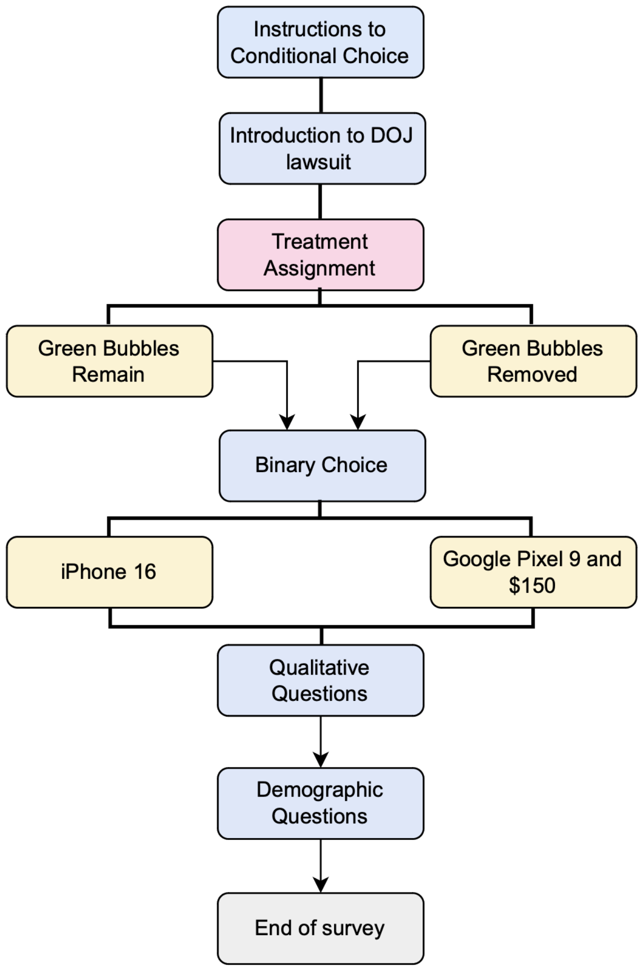
**Appendix Table A8:** Demographics Summary Statistics for Demand Experiment Sample

| Variable | Mean |
|---|---|
| **Panel A**: Demographics | |
| Gender (Ind. for Female) | 0.6 |
| Age | 21.45 |
| Relationship Status (Ind. for Single) | 0.54 |
| Observations | 468 |

*Notes:* Table A8 summarizes key demographic statistics for the demand experiment sample. Variables are presented with their respective means. The total number of observations is 468.

## G.2 Structure of Experiment

**Appendix Figure A7:** Structure of Experiment: Product Demand




*Notes:* Figure A7 displays the structure of the experiment. Participants are first told about the incentivized phone choice between the iPhone 16 and the Google Pixel 9 and $150. Next, participants are informed about the ongoing DOJ lawsuit. Next, treatment assignment takes place and each respondents is brought their respective decision screen for the binary choice. The experiment concludes by collecting responses to qualitative questions and demographic characteristics. The yellow boxes indicate embedded data, the blue boxes indicate question blocks, and the pink box indicates randomization.

## G.3 Main Result

**Appendix Table A9:** Regression Results: iPhone vs Android Choice

| | (1) |
|---|---|
| Android Share | 0.073** |
| | (0.037) |
| Constant | 0.158*** |
| | (0.024) |
| Observations | 468 |
| R-squared | 0.008 |

*Notes:* Table A9 displays our main pre-registered regression. The coefficient represents the effect of our treatment on the choice of the Google Pixel 9 and $150 over the iPhone 16. Robust standard errors are in parentheses. Stars indicate significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

## G.4 Heterogeneity

**Appendix Table A10:** Heterogeneity for Regression Results: iPhone vs Android Choice

| | Males | Females | Single | In a Relationship |
|---|---|---|---|---|
| Android Share | 0.087 | 0.067 | 0.114** | 0.024 |
| | (0.062) | (0.045) | (0.049) | (0.054) |
| Constant | 0.181*** | 0.143*** | 0.138*** | 0.180*** |
| | (0.040) | (0.030) | (0.031) | (0.037) |
| Observations | 180 | 283 | 254 | 214 |
| R-squared | 0.011 | 0.008 | 0.020 | 0.001 |

*Notes:* Table A10 displays the regression results for our main specification for different demographic subgroups of our sample, which were not pre-specified. For the first two columns, we exclude five individuals who identify as ”third gender.” Robust standard errors are in parentheses. Stars indicate significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

**Appendix Table A11:** Regression Results: iPhone vs Android Choice by Resale Lottery Phone Response

| | Plan to sell preferred phone | Do not plan to sell preferred phone |
|---|---|---|
| Android Share | -0.083 | 0.130*** |
| | (0.082) | (0.040) |
| Constant | 0.244*** | 0.112*** |
| | (0.048) | (0.026) |
| Observations | 113 | 355 |
| R-squared | 0.008 | 0.027 |

*Notes:* Table A11 displays our main pre-registered regression based on whether or not participants planned to resell the phone if they win the lottery. We place respondents in the same group who say they do not plan to sell or their plans to sell depend on which phone wins, as we assume these people would not plan to re-sell their preferred phone. The coefficient represents the effect of our treatment on the choice of the Google Pixel 9 and $150 over the iPhone 16. Robust standard errors are in parentheses. Stars indicate significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

**Appendix Table A12:** Regression Results: iPhone vs Android Choice by Likelihood

| | Above Median Likelihood | Below Median Likelihood |
|---|---|---|
| Android Share | 0.148*** | 0.001 |
| | (0.053) | (0.051) |
| Constant | 0.136*** | 0.183*** |
| | (0.031) | (0.037) |
| Observations | 234 | 234 |
| R-squared | 0.0336 | 0.0000 |

*Notes:* Table A12 displays our main pre-registered regression based on whether or not participants are above or below the median perceived likelihood of their future scenario occurring. The coefficient represents the effect of our treatment on the choice of the Google Pixel 9 and $150 over the iPhone 16. Robust standard errors are in parentheses. Stars indicate significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

### G.5 Robustness

**Regret** We allow our respondents to regret their valuations to ensure accurate data quality. If they disagree with their initial choice, they are redirected to the decision screen and allowed to complete their decision a second time. We asked them if they regret their choice a second time, but everyone proceeds with the next step regardless of their answer. We find that 2% of people regret their choice once and 0% of people regret their choice twice. Our low values of regret are likely helped by including several attention and comprehension checks before participants proceed to the decision.

**Appendix Table A13:** Regression Results: iPhone vs Android Choice (Excluding All Regretters)

| | (1) |
|---|---|
| Android Share | 0.078** |
| | (0.037) |
| Constant | 0.153*** |
| | (0.024) |
| Observations | 459 |
| R-squared | 0.010 |
| Root MSE | 0.393 |

*Notes:* Table A13 displays our main pre-registered regression when we exclude respondents who regretted their valuations at least once. The coefficient represents the effect of our treatment on the choice of the Google Pixel 9 and $150 over the iPhone 16. Robust standard errors are in parentheses. Stars indicate significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

**Robustness to Sample Restrictions**

As stated in the pre-registration, we take several precautions to avoid bots and fraudulent accounts from being included in our sample. This includes making strict restrictions on the levels of reCAPTCHA scores required to increase the likelihood all bot responses are dropped. We exclude 59, or 12.6%, of responses based on the reCAPTCHA and fradulenent meta-data scores from Qualtrics. Our results are robust to including these responses. If we do so, we get to $N = 527$, with a point estimate of 6.9 pp ($p < 0.05$). We also show in Table A14 that including Canadians, respondents aged 18-27, and iPhone 16 users doesnt change our results.

**Appendix Table A14:** Regression Results: iPhone vs Android Choice (Including all respondents)

| | (1) |
|---|---|
| Android Share | 0.073** |
| | (0.035) |
| Constant | 0.161*** |
| | (0.023) |
| Observations | 506 |
| R-squared | 0.008 |
| Root MSE | 0.397 |

*Notes:* Table A14 displays our main regression including all collected responses. The coefficient represents the effect of our treatment on the choice of the Google Pixel 9 and $150 over the iPhone 16. Robust standard errors are in parentheses. Stars indicate significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

# H Additional Demand Experiment: Design and Results

In this section, we describe the additional demand experiment that we conducted around the release of iOS 18 in further detail.

## H.1 Sample

We collaborated with College Pulse and Prolific to recruit US iPhone owners, aged between 18 and 25, for our experiments. Our data collection took place in August and September 2024.[38]

**Pre-registration** Our data collection was pre-registered on AsPredicted (#188626 and #189888) and includes the experimental design, hypotheses, primary and secondary outcomes, sample size, and exclusion criteria.[39] We pool the results across Prolific and College Pulse to maximize power and to reach close to our pre-specified target sample size of 1500.[40]

## H.2 Design

### H.2.1 Background and BDM explanation

**Background information** Our survey begins by asking respondents to specify which phone model they currently own. We then inform respondents that after this survey we will hold a lottery about a smartphone and a monetary payment. We then explain to respondents that they can choose to win an iPhone 16 Pro Max or a Galaxy S24 Ultra. Further, they are informed that 1 out of 200 participants will be the winner of the lottery.

**BDM explanation** We then explain the BDM procedure to our respondents. They first choose the phone they like better. Next, we ask them to specify the minimum amount of extra money they would need to switch from their preferred phone to the other one.[41] We emphasize that it is in the respondent's best interest to be truthful about what phone

[38] We conducted the experiment using College Pulse, CloudResearch, and Prolific. Due to concerns about data quality, we excluded all responses from CloudResearch, as the majority appeared to be bot-generated. The high proportion of bots on CloudResearch cast doubt on the reliability of the remaining responses from that platform, although our results remain consistent even when including responses not explicitly flagged as bots. Similarly, we identified and removed a subset of College Pulse responses flagged as bots. Our final sample consists solely of respondents from College Pulse and Prolific who were not flagged as bots.

[39] For details, see https://aspredicted.org/4tp9-tvzr.pdf and https://aspredicted.org/4ytf-zgwq.pdf.

[40] We used multiple survey providers to increase collection speed as our data collection had to be completed by the end of the iOS 18 launch day on September 16th. Due to slight differences in pre-registrations between samples, we relax the exclusion criteria to make the inclusion criteria between samples consistent.

[41] To ensure that respondents understand that choices are incentive-compatible, we inform them that a computer will generate a random monetary offer. If the offer is less than the minimum amount they specified to switch to their less preferred phone, they will get the phone they prefer. If the computer's offer is at least as high as the amount, they will get the other phone and the extra money.

they like better and the extra amount of money they would need to switch. We verify participants comprehension of the BDM mechanism with a simple comprehension question.

**Example good** To enhance comprehension, we start with a hypothetical example good (Dizon-Ross and Jayachandran, 2022). We measure respondents' preferences over two laptops (a 16-inch, M2 MacBook Pro and a Lenovo ThinkPad X1 Extreme Gen 4) that are both priced around $2300 and then ask them to specify the minimum amount they would require to switch from their preferred laptop to the other one.

**Common information about interoperability issues** All respondents are first reminded of the interoperability issues between Androids and iPhones. In particular, respondents are told that Android users do not have access to read receipts or typing indicators and can only send low-quality pictures and videos to iPhones and vice versa. They are further told that the messages sent between Androids and iPhones appear as green bubbles on iPhones, even in group chats, while texts between iPhones appear as blue bubbles.

To illustrate how all of the compatibility issues affect the user experience of Android users we also provide our respondents with a video. This video format might also result in more engagement among college students who are used to consuming information in the form of videos. As a next step, all respondents complete a comprehension question about the content of the video, and only those who pass this comprehension question can proceed with the rest of the experiment.

### H.2.2 Treatment groups

In our experiment we randomly assign respondents to one of two treatment groups: A green bubble group and a blue bubble group.

**Green bubbles treatment** Respondents in the green bubbles treatment are informed about Apple's announcement that the new iOS 18 operating system, coming in mid-September, will fix most of the compatibility issues between Androids and iPhones. In particular, respondents learn that Apple will use Rich Communication Service (RCS) to enable Android users to have read receipts and typing indicators, and be able to send high quality pictures and videos when sending texts to iPhones and vice versa. Respondents are further told that messages sent between Androids and iPhones will still appear as green bubbles. We again illustrate what this change means through a video which illustrates people's messaging experience under iOS 18.[42]

[42] We use an iPhone with the iOS 18 Public Beta to record this video between an iPhone using RCS and an Android with RCS.

**Blue bubbles treatment** Respondents in the Blue bubbles treatment receive the same information about iOS 18 eliminating interoperability issues as respondents in the Green bubbles treatment. Respondents are further told that more recent technological advancements also make it possible that messages sent between Androids and iPhones appear as blue bubbles.[43] As in the green bubbles treatment, we show respondents a video which illustrates people's messaging experience under iOS 18 and with blue bubbles.[44]

### H.2.3 WTP for receiving the preferred phone

Subsequently, all respondents move to the main outcome measure, a respondent's incentivized willingness to pay to receive their preferred phone. In particular, respondents first decide whether they prefer a Galaxy S24 Ultra or an iPhone 15 Pro Max, both of which cost around $1250[45]. We then remind respondents about some basic features of the BDM elicitation and inform them they will receive the phone in October, should they win the lottery. After respondents' choice of which phone they prefer, we ask them for the smallest amount of money that would make them choose the less preferred phone. We then ask respondents whether they agree with their stated choices.

## H.3 Discussion of the design

One concern revolves around misunderstandings about the BDM elicitation. To mitigate concerns we took a number of steps. We include a comprehension question about the BDM mechanism, an example good, and we ask respondents whether they regret their choices in the practice example and phone BDM elicitation. In particular, we ask them whether they agree with a statement about what their choices mean in terms of their preferences over the two phones and the minimum monetary payment required for them to receive the less preferred phone. For example, in the case of the practice good, a respondent with an excess valuation of an MacBook of $300 is asked whether they agree with the statement that "According to your answers to the previous questions, you would be willing to forgo $300 to get a MacBook Pro (16-inch, M2 Pro) instead of a Lenovo Think Pad X1 Extreme Gen 4." If respondents do not agree with this statement, they are asked to complete the elicitation one more time. Prior to the redirection, we inform participants that this will be their last chance to modify their answers. Our main sample is restricted to respondents

[43] We debrief participants of our experiment at the very end of the survey and explain that this is made possible by a new app called BlueBubbles. We do so in order to avoid respondents mistakenly believing that Green bubbles will be eliminated as a result of iOS 18.

[44] This video is recorded by an iPhone using the iOS 18 beta and messaging with an Android using the BlueBubbles app. The common information video can be viewed at: `https://youtu.be/ZUE1LOZQJHU`, the green bubbles treatment at: `https://youtu.be/hQHmg9zufDg`, and the blue bubbles treatment at: `https://youtu.be/VODjJ-rja1M`.

[45] This represents the average of the two phones. Specifically, at the time of the experiment, the Samsung Galaxy S24 Ultra was priced around $1300 while the iPhone 15 Pro Max was priced around $ 1200.

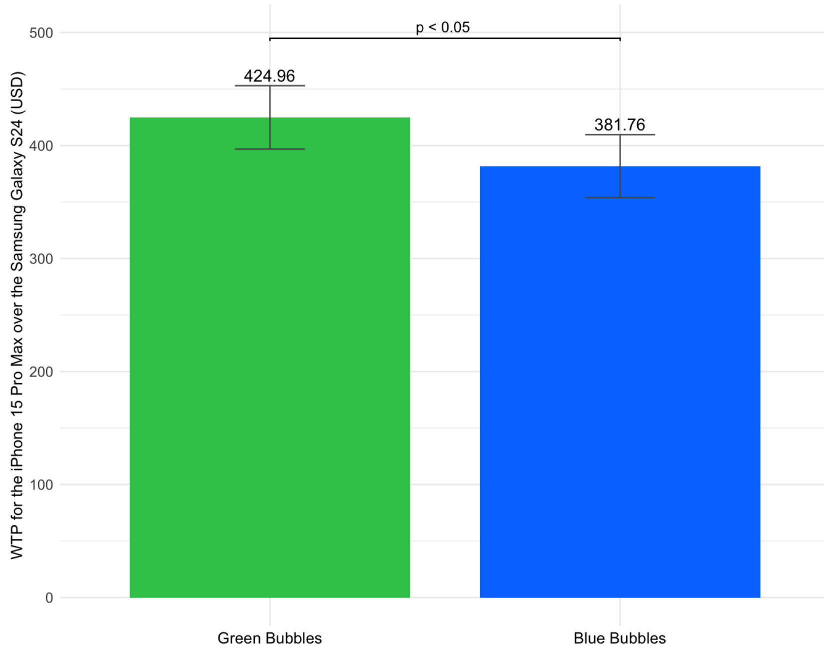
who do not regret their final answers (i.e., we drop two-time regretters in the phone BDM elicitation).

**Borderline deception** A key challenge for our design lies in creating the expectation that blue bubbles will be eliminated. The instructions in our experiment rely on language suggesting to participants that blue bubbles will replace green bubbles for all users. In particular, we use language that makes use of the fact that there are new technological advances that would allow users to get blue bubbles, e.g. by installing the BlueBubbles app. While we do not lie to participants, our approach may come close to the boundary of deception. We decided to adopt this approach because it appeared to us as the only practically feasible way to elicit incentivized willingness to pay for the scenario that green bubbles are replaced by blue bubbles for everyone in the iOS 18 update.

### H.4 Results

Figure A8 illustrates our main pre-registered results. Respondents in the Blue Bubble treatment have a $43 lower WTP for the iPhone 15 Pro Max compared to respondents in the Green Bubble treatment ($p < 0.05$). These effects are substantial in magnitude and correspond 4% of the cost of the iPhone.

**Appendix Figure A8:** Average Incentivized Willingness to Pay for the iPhone 16 Pro Max over the Samsung Galaxy S24 Ultra




*Notes:* Figure A8 displays the average WTP for the iPhone 16 Pro Max over the Samsung Galaxy S24 Ultra by treatment status. Error bars are 95% confidence intervals.

## H.5 Non-User Utility and Quality Misperceptions

Non-user utility can create "lock-in" effects that may contribute to misperceptions of the quality of the outside option, possibly from lack of information acquisition. To investigate this mechanism, we conducted a pre-registered survey collection on the perceptions of Android quality relative to iPhones as part of the iMessage deactivation study.

We find that 68% of our sample respondents underestimate the display quality (as measured through display resolution) of the Galaxy S24 Ultra compared to the iPhone 16 Pro Max. Similarly, 51% of people underestimate the camera quality of the Galaxy S24 Ultra (as measured through camera megapixels) compared to the iPhone 16 Pro Max. We interpret this as suggestive evidence that our effects are capturing a lower bound of the treatment effect size as increasing non-user utility may result in quality perceptions being updated through either more information acquisition or through social network spillovers as Android market share increases.

# I Coding of Open Ended Responses

Similar to the approach in Bursztyn et al. (2023a), our mechanism survey included open-ended questions to provide further evidence on the existence of and mechanisms behind the green bubble stigma. We follow best practices as outlined in Haaland et al. (2024) and Haaland et al. (2023). Our first open-ended question is at the beginning of the survey to avoid priming respondents and limit concerns surrounding experimenter demand effects. Our three additional questions were asked after informing participants about the green bubbles that appear on iPhones when messaging Androids and existing compatibility issues. The survey instructions can be found in J.1. We hand-coded the open-ended responses in a non-mutually exclusive way, based on defined categories. Our open-ended question are:

- "When you think of someone who owns an Android instead of an iPhone, what comes to mind?"
- "Why do you think messages sent from iPhones to Androids appear as green bubbles on iPhones?"
- A binary question "Imagine a scenario where after the release of the iOS 18 update, an additional messaging feature could eliminate green bubbles by making all messages, from both iPhones and Androids, appear as blue bubbles on all iPhones. Would you want all iPhone and Android users, including yourself, to have this additional messaging feature?" and independent of the answer "Please explain why in full sentences."
- A binary question "Do you think that there is a social stigma against Android users whose text messages appear as green bubbles on iPhones?" and independent of the answer "Please explain in full sentences why you think that."

**OpenAI API Coding** We use ChatGPT 4o through the OpenAI API in order to classify open-ended responses into the various pre-defined categories. We provide ChatGPT with the following prompt: "You will be supplied with a list of responses. These responses reflect thoughts on Android users versus iPhone users. Please classify responses based on the coding scheme below. Each open-ended response can fall into multiple categories or none." Then, we provide the different categories and examples of responses that would fit into each category. The categories are not mutually exclusive.

**Hand-Coding** We hand-coded the open-ended responses based on our seven categories and definitions. We had two independent research assistants review each response and reconcile any differences in the handcoding. We find that there is a high correlation between the two hand coded responses for each category for both open-ended questions as seen in Table A19 which confirms our manual handcoding. In the process of handcoding we exclude less than 2% of respondents due to their answers being nonsensical.

**Appendix Table A15:** Overview of hand-coding scheme for what comes to mind when thinking of an Android user compared to an iPhone user

| Category | Definition | Examples |
|---|---|---|
| Stigma and Social Status | Responses that reflect perceptions of social judgment, peer pressure, or a perceived lower or higher social status or income associated with owning an Android. These responses may also describe Android users' perceived hatred for Apple, or annoyance at compatibility issues between Android phones and iPhones. | "It's kind of embarrassing to own an Android. It strikes me as odd." *or* "I kind of gives me the ick when I see someone not using an iPhone since my whole life iPhone was always the top of the line and if you didn't use one you were below everyone else who did." |
| Demographic Perceptions | Responses that discuss at least one of age, profession, income, family, education, geographic region / nationality, or ethnicity, without implying personality judgments nor mentioning stigmatization. | "I feel like Android users are more old people." *or* "An average person wealthier maybe with some nicer clothes." |
| Neutral or Indifference | Responses that show indifference, neutrality, or no specific judgment regarding the use of Android over iPhone. | "I don't have much an opinion on it. I just see it as they have a phone." *or* "Nothing really comes to mind, everybody has their own phone brand preferences." |
| Financial and Practical Considerations | Responses that emphasize cost, affordability, or practical reasons for choosing an Android over an iPhone. | "When I think of someone who owns an Android instead of an iPhone, I often imagine they might value flexibility and customization in their device" *or* "Someone who's trying to save more money. Someone is trying to get more value out of what they buy. Someone who needs something more versataile and customizable for their ambition." |
| Technical Differences | Responses that focus on the technical features, functionality, or quality of Android devices compared to iPhones. | "Lower functionally when it comes to iMessages. Namely, they won't be able to see the same emojis that I do and they will not have the same group chat functionality. In addition, no FaceTime" *or* "Some features will not be able to be shared between people if one has an iPhone and the other has android. Newer Android phones seem to typically have a better camera than iPhones." |
| Green Bubbles | Responses that specifically mention the green bubble color that appears on iPhones when messaging Androids. | "Someone who texts with green text bubbles." |
| Personality Traits | Responses that attribute positive personality characteristics, behaviors, or values to Android users, and that do not mention stigmatization. "Personality Traits" are internal qualities that reflect someone's character. Note that responses that are explicitly about negative personality traits of Android users should be coded as "Social Status and Stigma" instead. | "I perceive them as caring less about social pressure, instead focusing on personal preference and specific functionality." *or* "I believe a person who owns an Android would be more tech savvy." |

*Notes:* The table provides an overview of the hand-coding scheme used to categorize open-ended responses to the question, "When you think of someone who owns an Android instead of an iPhone, what comes to mind?" This question was asked without any priming and was posed to all participants, regardless of their operating system.

**Appendix Table A16:** Overview of hand-coding scheme for why the green bubbles appear on iPhones when messaging Androids

| **Category** | **Definition** | **Example** |
|---|---|---|
| Technical/Protocol | Attribute the green/blue bubble distinction to differences in the underlying messaging systems, protocols, or technical incompatibilities between iOS and Android. These responses emphasize the mechanics, such as SMS/MMS vs. iMessage, encryption differences, or system-level incompatibilities. | "Apple uses iMessage to secure data, however this cannot be done with Android phones." *or* "Blue bubbles on iPhones use the iMessage app, while the green bubbles indicate that the messages are just text messages. iPhones also have the option to send green bubbles but I assume its only done when there is poor reception." |
| Feature Differentiation | Responses that highlight that green bubbles are used to signal differences in available messaging features, quality, or functionality when texting non-Apple users | "I believe Android users don't have all the capabilities that iPhone users have over text which is why they highlight it green to show the difference in user." *or* "It lets you know if you're able to FaceTime the person/is a special feature" |
| Identification or Distinguishing Device Type | The response focuses on the green bubble as a simple identifier, without any suggestion of stigmatization or deliberate branding. The distinction is presented as a way for iPhone users to quickly recognize whether they are messaging another iPhone user or someone using a different device. | "To clarify to the iPhone user that an Android user is messaging them." *or* "Because blue is trademark for Apple. Green represents the android color green." |
| Branding, Marketing or Ecosystem Lock-in | Suggest Apple uses the green bubble distinction as part of a deliberate strategy to create exclusivity, social pressure, or brand loyalty. These responses often reference psychological tactics, group dynamics, or Apple's intention to market iPhones as superior | "I think apple probably wanted to disincentivize people from getting androids by making the experience of texting those with them unideal." *or* "I think it is a marketing scheme to create a brand identity and group that those who text iPhones and show blue bubbles are one and the same and Andriod users are excluded from that." |
| Uncertainty/Other | Reasoning is unclear, speculative, or does not neatly fit into the other categories. These might express doubt, confusion, or provide vague explanations without much detail. | "I am not sure, maybe for uniqueness sake" *or* "They look green because the Android company wanted it that way." |

*Notes:* The table provides an overview of the hand-coding scheme used to categorize open-ended responses to the question: 'Why do you think messages sent from iPhones to Androids appear as green bubbles on iPhones?' This question was asked after informing participants about the existing compatibility issues that mark iPhone-to-Android communication and was asked to all participants irrespective of their operating system.

**Appendix Table A17:** Overview of hand-coding scheme for why people want or don't want an additional software update that makes bubbles blue for everyone

| Category | Definition | Example |
|---|---|---|
| Maintaining Brand Identity | Suggest that the color difference is a deliberate marketing tool by Apple to reinforce brand identity, exclusivity, and superiority. They see the color distinction as a business strategy rather than a technical necessity. Includes the belief that Apple has the right to maintain its brand identity. | "There was no reason not to have these features available to Android users to begin with, It is anti-consumer to have features withheld from the consumer when it is clearly easy and possible to implement them." |
| Social Stigma and Inequality | These responses either view the color distinction as fueling classism, bullying, or prejudice, and believe that by making all bubbles the same color, it would remove social pressure, end perceived snobbery, and create a more equal and accepting environment for all phone users. Or these responses reflect perceptions of social judgment, peer pressure, or a perceived lower social status associated with owning an Android. | "It would be better to eliminate the negative connotation associated with android users by eliminating bubbles." *or* "Because it would create equality and get rid of the stigma against android users." |
| Indifferent | These responses express that the entire debate is unimportant to them. The color of the message bubbles does not affect their day-to-day texting experience, so they remain neutral or uninterested in the issue. | "I don't think that the color difference is a big deal." *or* "Who really cares since its just texting and if it works why not include everyone". |
| Available Features | Knowing if the other person has an iPhone or Android helps anticipate which features are possible, such as FaceTime, emojis, iMessage games, voice messages, or high-quality file transfers. | "I like to see the different colors for the different phone users. This allows me to know whether I can communicate in certain ways, (i.e., FaceTime, emojis, etc...)." *or* "I feel like knowing that a person has an android based on this green bubble helps us know if we are able to use features like FaceTime or are able to send certain emojis." |
| Identification | Responses that argue that bubble colors serve a practical purpose by acting purely as a simple identifier for the type of device someone uses, without referencing underlying differences in features that can be used while messaging. | "I think that the green and blue messages should stay to let an iPhone user know if they are messaging with an Android or an iPhone." *or* "I wanna know the type of device i am receiving messages from." |
| Other | Do not fall into any of the other categories. | "I think that leaving it up to the user is a good idea. Just let the color of the chat be customized by the user to however they see fit." or "I believe it would just be far more simple this way than force different types of messing depending on phone. Type of phone should not matter while messaging anyone" *or* "I don't really know why, but it feels awkward to have the same colored bubble if you have a different phone type." |
| Aesthetic | These responses express a like or dislike for green bubbles based on aesthetic preferences. | "I like things to be uniform, so I would like all my messages to have the same appearance." *or* "You might as well have a cohesive design no matter the phone type." |

*Notes:* The table outlines the hand-coding scheme used to categorize responses to a two-part question. The first part required a binary response regarding a hypothetical scenario—whether respondents would support an additional software feature that eliminates green bubbles by rendering all messages as blue bubbles on iPhones. Regardless of their binary choice, respondents were then asked to explain their reasoning.

**Appendix Table A18:** Overview of hand-coding scheme for why people believe that there is a social stigma associated with green bubbles/Androids

| **Category** | **Definition** | **Example** |
|---|---|---|
| Social Exclusion | Descriptions of Android users facing extreme forms of exclusion such as being left out of group chats, communication inconveniences, or feeling excluded due to green bubbles in a way that is not simply a joke or a meme. | "I have personally been discriminated against because I use an android device. I have been excluded from a group project and now I have to figure something out before the due date." *or* "I have personally experienced group members in university upset that they would not have an iMessage group chat when conducting projects, aiming their dismay at me for being the sole one out." |
| Class and Wealth Perceptions | Associations of green bubbles with being "poor," "lower class," or less financially capable. | "The common perception of Android phones is that it is cheaper than an iPhone and people who may not have the funds to purchase an iPhone will buy certainly buy an Android instead." *or* "I have seen people who use non Apple products be deemed as lower class." |
| Brand and Status Symbol | Viewing iPhones as a premium brand or a marker of social status, with green bubbles perceived as a lack of prestige. Includes responses which perceive this as a deliberate strategy by Apple. | "Is a way to create a brand identity and separate one another." *or* "Yes, because some iPhone users believe that Android users are different and inferior simply because of the type of phone they have. The green text bubble signifies inferiority." |
| Technical Issues | Complaints about functionality differences such as picture quality, group messaging compatibility, or integration issues. | "There is an idea that androids are lower quality and do not possess the same capabilities as iPhones do." *or* "iPhone users get annoyed at android users because of the lack of integration between the 2 systems. Photo sharing is difficult especially" |
| Other | Do not fall into any of the other categories. | "People are judgemental of others choices" *or* "Most people have iPhones, so seeing something different always has an implied stigma." |
| Indifference | These responses express that the entire debate is unimportant to them. Can include acknowledgments that the stigma exists but is dismissed as insignificant. | "I do not think the color of a text message matters" *or* "What does it matter that someone uses SMS over iMessage? Who actually cares about that sort of thing?" |
| Joke | Acknowledgments that the stigma exists but is seen as a joke or meme, or that people are made fun of for using Androids. | "There are many jokes and memes about, for example, meeting someone you really like, getting their number, texting them and it's green, and saying ew nevermind. I think deep down no one really cares." *or* "On social media, it's a running joke for iPhone users to make fun of Android users." |

*Notes:* The table summarizes the hand-coding scheme used to categorize responses to the two-part question: "Do you think that there is a social stigma against Android users whose text messages appear as green bubbles on iPhones?" In the first part, respondents provided a yes/no answer, and in the second part, they explained their reasoning. Again, this question was asked to all respondents.

**Appendix Table A19:** Validation of hand-coded data from Large Language Model

**Panel A**: Motives for social media consumption despite a preference to live in a world without it

| | **Stigma** | **Demographics** | **Neutral** | **Financial/ Practical** | **Technical** | **Green** | **Personality** |
|---|---|---|---|---|---|---|---|
| **Correlation coefficient** | 0.7502 | 0.7452 | 0.7761 | 0.7579 | 0.7262 | 0.9886 | 0.7115 |
| | (0.0304) | (0.0306) | (0.0290) | (0.0300) | (0.0316) | (0.0069) | (0.0323) |
| *Hand-coded responses:* | | | | | | | |
| Mean | 0.3340 | 0.2353 | 0.1345 | 0.2458 | 0.2374 | 0.1008 | 0.2185 |
| Std. dev. | 0.4721 | 0.4246 | 0.3415 | 0.4310 | 0.4259 | 0.3014 | 0.4137 |
| *GPT-coded responses:* | | | | | | | |
| Mean | 0.2794 | 0.1597 | 0.1576 | 0.2878 | 0.2710 | 0.1029 | 0.2920 |
| Std. dev. | 0.4492 | 0.3667 | 0.3647 | 0.4532 | 0.4449 | 0.3042 | 0.4552 |
| **Observations** | 476 | 476 | 476 | 476 | 476 | 476 | 476 |

**Panel B**: Reasons for why messages sent from iPhones to Androids appear as green bubbles on iPhones

| | **Technical** | **Features** | **Identification** | **Branding** | **Other** |
|---|---|---|---|---|---|
| **Correlation coefficient** | 0.7902 | 0.7409 | 0.7797 | 0.9238 | 0.4811 |
| | (0.0281) | (0.0308) | (0.0288) | (0.0176) | (0.0403) |
| *Hand-coded responses:* | | | | | |
| Mean | 0.2458 | 0.1639 | 0.1282 | 0.2647 | 0.0357 |
| Std. dev. | 0.4310 | 0.3705 | 0.3346 | 0.4416 | 0.1858 |
| *GPT-coded responses:* | | | | | |
| Mean | 0.2878 | 0.1534 | 0.1702 | 0.2521 | 0.0588 |
| Std. dev. | 0.4532 | 0.3607 | 0.3762 | 0.4347 | 0.2355 |
| **Observations** | 476 | 476 | 476 | 476 | 476 |

**Panel C**: Reasons for supporting/opposing an additional software feature that eliminates green bubbles for all

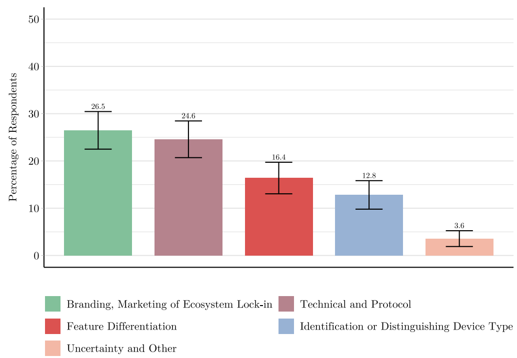
| | **Brand** | **Stigma** | **Indifferent** | **Identification** | **Features** | **Other** | **Aesthetic** |
|---|---|---|---|---|---|---|---|
| **Correlation coefficient** | 0.7536 | 0.8640 | 0.7456 | 0.7727 | 0.7707 | 0.4701 | 0.7644 |
| | (0.0302) | (0.0231) | (0.0306) | (0.0292) | (0.0293) | (0.0405) | (0.0296) |
| *Hand-coded responses:* | | | | | | | |
| Mean | 0.1008 | 0.3004 | 0.1639 | 0.1029 | 0.1345 | 0.1513 | 0.1660 |
| Std. dev. | 0.3014 | 0.4589 | 0.3705 | 0.3042 | 0.3415 | 0.3587 | 0.3724 |
| *GPT-coded responses:* | | | | | | | |
| Mean | 0.0840 | 0.2899 | 0.1471 | 0.1303 | 0.1765 | 0.1218 | 0.2059 |
| Std. dev. | 0.2777 | 0.4542 | 0.3545 | 0.3369 | 0.3816 | 0.3275 | 0.4048 |
| **Observations** | 476 | 476 | 476 | 476 | 476 | 476 | 476 |

**Panel D**: Justifications for Social Stigma associated with Android users

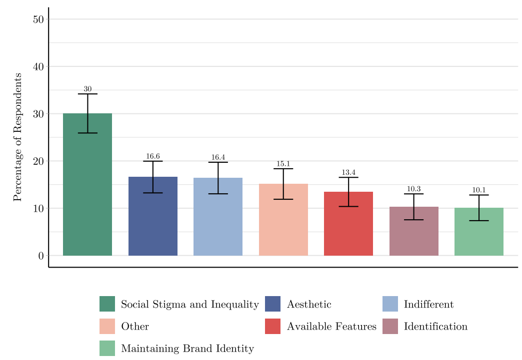
| | **Exclusion** | **Class** | **Status** | **Technical Issues** | **Indifference** | **Other** | **Joke** |
|---|---|---|---|---|---|---|---|
| **Correlation coefficient** | 0.6275 | 0.9377 | 0.6799 | 0.8508 | 0.7351 | 0.6067 | 0.7675 |
| | (0.0358) | (0.0160) | (0.0337) | (0.0241) | (0.0311) | (0.0365) | (0.0294) |
| *Hand-coded responses:* | | | | | | | |
| Mean | 0.1197 | 0.1828 | 0.1239 | 0.0966 | 0.0546 | 0.1450 | 0.0903 |
| Std. dev. | 0.3250 | 0.3869 | 0.3299 | 0.2958 | 0.2275 | 0.3524 | 0.2870 |
| *GPT-coded responses:* | | | | | | | |
| Mean | 0.1555 | 0.1891 | 0.1828 | 0.0882 | 0.0693 | 0.1029 | 0.1071 |
| Std. dev. | 0.3627 | 0.3920 | 0.3869 | 0.2839 | 0.2543 | 0.3042 | 0.3096 |
| **Observations** | 476 | 476 | 476 | 476 | 476 | 476 | 476 |

*Notes:* This table shows correlation coefficients between our manual and GPT-4o categorization of open-ended responses, with each column representing a classification category. Correlations are based on dummy variables set to 1 whenever a response was assigned to a given category under each coding method. The panels display, in chronological order, the results from our open-ended questions as described above. Standard errors are shown in parentheses. Correlation coefficients are computed using the Pearson correlation formula.

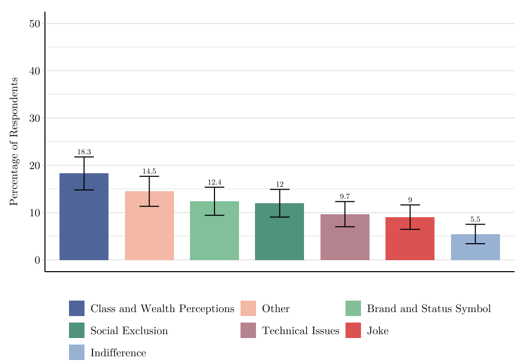
**Appendix Figure A9:** Handcoding Results of Open-Ended Questions




**(a)** Reasons for the existence of green bubbles on iPhones when messaging Androids




**(b)** Reasons for/against software update that makes bubbles blue on all devices




**(c)** Reasons for why respondents do/do not believe in the existence of a stigma against Android users

# J Experimental Instructions

We present the main experimental instructions and decision screens for each of our four data collections.

## J.1 Mechanism Survey

When you think of someone who owns an Android instead of an iPhone, what comes to mind?

Please respond in full sentences.

Are you aware that messages sent between Androids and iPhones appear as green bubbles on iPhones, while texts between iPhones appear as blue bubbles?

- ◯ Yes
- ◯ No

Participants who answer this question correctly will be entered into a draw for a **$100 bonus payment.**

According to a sample from the US, iPhone users have an average annual income of **$53,000**. Do you think the average income of **Android users** is **higher or lower** than **iPhone users** ?

- ◯ I think the average income of Android users is **lower** than iPhone users
- ◯ I think the average income of Android users is **higher** than iPhone users

Participants who choose the most accurate bracket will be entered into a draw for a **$100 bonus payment.**

Please specify how much **lower** than $53,000 in US dollars you believe the average income of **Android users** is compared to **iPhone users.**

- ◯ $0-$4,999 lower
- ◯ $5,000-$9,999 lower
- ◯ $10,000-$14,999 lower
- ◯ $15,000-$19,999 lower
- ◯ $20,000-$24,999 lower
- ◯ More than $25,000 lower

**Texting between Androids and iPhones**

Currently, texting between Androids and iPhones involves certain limitations due to **compatibility issues.**

Android users do not have access to **read receipts** or **typing indicators**, and can only send **low-quality pictures and videos** to iPhones and vice versa.

Moreover, the messages sent between Androids and iPhones appear as **green bubbles** on iPhones, while texts between iPhones appear as blue bubbles. Further, any group chats containing an Android user display green text bubbles.


Why do you think messages sent from Androids appear as green bubbles on iPhones?

Please respond in full sentences.

**Department of Justice (DOJ) lawsuit against Apple**


The Department of Justice (DOJ) has recently filed a lawsuit against Apple. This lawsuit focuses on the **anti-competitive practices** associated with Apple's iMessage service, including the impact of the green bubbles between iPhones and Androids.

This lawsuit could result in Apple being forced to **eliminate green bubbles** and implement blue bubbles regardless of the device.

We're conducting this survey to gather information about the representative opinion of everyday users. We plan to publish a report on these findings and circulate it widely on social media and in conferences.

Previous research conducted by members of our team on policy debates, such as banning social media, has been featured in several prominent news outlets, including the Washington Post and the Financial Times.

You have the **opportunity to share your perspective on this case**. Your insights are crucial in understanding how people feel about these issues and might shape the public debate surrounding this lawsuit.

We have no agenda in this case and are simply interested in your true preferences. Your responses will remain completely **anonymous** and will be reported only in **aggregate form**.

During this survey we will be collecting your opinion for different scenarios that will be used in our report.

We will report average statistics for the different questions we ask.

The **higher** your rating of certain product features, the **higher** the average covered in the report.

Will your individual responses to the questions in this survey contribute to the average in our widely circulated report on the DOJ lawsuit against Apple?

- ◯ Yes
- ◯ No

## iOS 18 Update

Apple has announced that the new **iOS 18** operating system, set to be released in mid-September, will **fix most of the compatibility issues** between Androids and iPhones. Apple will use Rich Communication Service (RCS) to enable Android users to have read receipts, typing indicators and send high quality photos and videos when sending texts to iPhones and vice versa.

However, Apple has announced that messages sent between Androids and iPhones will **remain as green bubbles** on iPhones.


Imagine a scenario where after the release of the iOS 18 update, an additional messaging feature could eliminate green bubbles by making all messages, from both iPhones and Androids, appear as blue bubbles on all iPhones.

Would you want all iPhone and Android users, including yourself, to have this additional messaging feature?

Reminder: Your preferences will be included in our report and might therefore influence the public debate. Please respond truthfully.

- ◯ Yes
- ◯ No

Do you think that there is a social stigma against Android users whose text messages appear as green bubbles on iPhones?

- ◯ Yes
- ◯ No

How does **fixing the compatibility issues** of read receipts and typing indicators between Androids and iPhones **change the quality of Apple products?**

| Strongly decreases quality | Decreases quality | No change in quality | Increases quality | Strongly increases quality |
|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ |

How does **fixing the compatibility issues** of read receipts and typing indicators between Androids and iPhones **change the quality of Android products?**

| Strongly decreases quality | Decreases quality | No change in quality | Increases quality | Strongly increases quality |
|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ |

How does enabling messages sent from Androids to iPhones to appear as **blue bubbles change the quality of Android products?**

| Strongly decreases quality | Decreases quality | No change in quality | Increases quality | Strongly increases quality |
|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ |

How does enabling messages sent from Androids to iPhones to appear as **blue bubbles change the quality of Apple products?**

| Strongly decreases quality | Decreases quality | No change in quality | Increases quality | Strongly increases quality |
|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ |

Do you think that the average iPhone user is more or less attractive than the average Android user?

- ○ The average iPhone user is more attractive than the average Android user
- ○ The average iPhone user is less attractive than the average Android user

How likely do you believe it is that the results of this study will be published in a major news outlet (such as the New York Times or the Washington Post)?

very unlikely ... very likely

0 10 20 30 40 50 60 70 80 90 100

Please select a value.

Recall that your answers are counting towards the average which will be featured in our report, **which we plan to widely circulate** on social media and in conferences.

How did this influence the effort you put into your responses?

- ◯ It did not affect the amount of effort I put into answering the questions.
- ◯ It made me put less effort into answering the questions.
- ◯ It made me put more effort into answering the questions.

Recall that your answers are counting towards the average which will be featured in our report, **which we plan to widely circulate** on social media and in conferences.

How did this influence how you expressed your opinions?

- ◯ It didn't affect how extremely I reported my opinions
- ◯ It made me report my opinions as more extreme
- ◯ It made me report my opinions as less extreme

## J.2 Deactivation Study

We are interested in conducting an experiment where we ask participants to deactivate or keep active certain mobile phone features **for four weeks from November 4th to December 1st, 2024.**

We will compensate individuals for their participation with a monetary payment.

Should participants want to leave the study during the four weeks they can, but they will then forgo any monetary payment. To verify that participants deactivate or keep active certain features of their phone, **we will require them to upload one screenshot of their settings and may periodically send out one text per week**. **For that purpose, we would have to collect your phone number**. If you consent to participating and are selected to deactivate or keep active certain mobile phone features, College Pulse will provide us with your phone number.

If a participant fails these checks, they will not receive any monetary payment. Texts will be sent at a random time during the day once a week. It will not be at night when the participant may be asleep.

Are you willing to participate in this study?

- ◯ Yes
- ◯ No

This question will be used for a $100 Amazon gift card lottery for correct respondents.

How will we verify that selected users deactivate or keep active certain features? **Please select all that apply.**

- ☐ By asking them to upload one screenshot of their settings.
- ☐ By calling people to ask them.
- ☐ By periodically sending out a text message once a week.

This question will be used for a $100 Amazon gift card lottery for correct respondents.

For how long will we ask selected users to deactivate or keep active certain features?

- ○ Ten weeks
- ○ Eight weeks
- ○ Four weeks
- ○ One week

Before we proceed, we will give you a hypothetical example to explain how we will determine your compensation.

Suppose that we ask you to deactivate your FaceTime for four weeks.

**Here's how it works:**

1. We will ask you multiple questions to determine the smallest amount of money you would need to deactivate FaceTime for four weeks. We refer to this amount as your valuation below.
2. The computer will randomly generate an amount of money to offer you to deactivate FaceTime for four weeks.
3. If your valuation is lower than the computer's offer, we will ask you to deactivate FaceTime for four weeks and give you the computer's offer.
4. If your valuation is higher than the computer's offer, we will not ask you to deactivate FaceTime and you will not receive any payment in that case.

This rule means that the higher the amount you require to deactive FaceTime on your iPhone, the lower the chance that you will be chosen to be in the study and receive the computer's offer.

To make sure you get the best option for you, it is important to be **truthful** about the amount of **money** you would need to deactivate FaceTime.

We will now ask you a comprehension question based on the text above. This question will be used for a $100 Amazon gift card lottery for correct respondents.

Which of the following statements is **true** about the minimum amount of money you would require to deactivate FaceTime on your iPhone?

- ○ Requiring a higher amount of money to deactivate FaceTime makes it more likely that I will be chosen to deactivate FaceTime and receive the extra payment.
- ○ The minimum amount of money required to deactivate FaceTime does not affect the chance that I will be chosen to deactivate FaceTime.
- ○ Requiring a higher amount of money to deactivate FaceTime makes it less likely that I will be chosen to deactivate FaceTime and receive the extra payment.

**Texting between Androids and iPhones**

Texting between Androids and iPhones has historically involved certain limitations due to **compatibility issues.**

Android users did not have access to **read receipts** or **typing indicators**, and could only send **low-quality pictures and videos** to iPhones and vice versa.

Some limitations still persist today. In particular, the messages sent between Androids and iPhones appear as **green bubbles** on iPhones, while texts between iPhones appear as blue bubbles. Further, any group chats containing an Android user display green text bubbles.

This question will be used for a $100 Amazon gift card lottery for correct respondents.

Which of the following has **NOT** been a longstanding compatibility issue for texting between Androids and iPhones?

- ◯ Texting between Androids and iPhones is marked by messages appearing in green bubbles on iPhones
- ◯ No read receipts or typing indicators
- ◯ Low-quality pictures and videos
- ◯ Androids cannot send pictures to iPhones

**Texting between Androids and iPhones**

Apple's new **iOS 18** operating system, released on September 16th, **fixes most of the compatibility issues** between Androids and iPhones. Apple uses Rich Communication Service (RCS) to enable Android users to have read receipts, typing indicators and send high quality photos and videos when sending texts to iPhones and vice versa.

However, messages sent between Androids and iPhones will **remain as green bubbles** on iPhones.

**Option 1**

The first option for the study requires **no changes to your phone** for the next four weeks.

To participate, you would simply need to upload one screenshot of your settings and receive one text message per week.

Please note that your phone would remain unchanged throughout the study.

Below is a picture of the current message display in iMessage.


**Option 1**

The first option for the study involves **deactivating your blue bubbles on iMessage** for the next four weeks. During this time, your messages would **appear as green bubbles,** the **same color as standard text messages,** both to you and to others.

In this option, your messages may appear to others **as if they were sent from an Android phone.** This change would affect group conversations as well, turning the entire chat green when you send messages.

To participate, you would also need to upload one screenshot of your settings and receive one text message per week.

Please note that nothing about your phone would change except for deactivating blue bubbles.

Below is a picture that displays how messages would look like once blue bubbles are deactivated.

**Option 2**

The second option for the study involves adjusting your phone settings to **deactivate your phone camera** for the next four weeks.

To participate, you would also need to upload one screenshot of your settings and one screenshot of your Screen Time settings per week.

Please note that nothing about your phone would change other than your camera being turned off.

Below is a picture that shows how your settings would look like if the phone camera is deactivated.


**Option 2**

The second option for the study involves adjusting your phone settings to **deactivate iMessage** for the next four weeks. You would still be able to use text messaging and other messaging platforms, such as WhatsApp, Instagram, Snapchat, etc.

To participate, you would also need to upload one screenshot of your settings and receive one text message per week.

Please note that nothing about your phone would change except for deactivating iMessage.

Below is a picture that shows how RCS messages would look like once iMessage is deactivated.

Please assess the statement below.

| Unlikely |  |  |  |  |  |  |  |  |  | Very likely |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

For those respondents who are chosen to get their choices implemented, how likely do you think it is that the study just described in Option 1 will be the one selected for implementation?

Please compare the Galaxy S24 Ultra and the iPhone 16 Pro Max in all aspects listed below to the best of your knowledge.

|  | Galaxy S24 Ultra is much better | Galaxy S24 Ultra is better | They are the same | iPhone 16 Pro Max is better | iPhone 16 Pro Max is much better |
|---|---|---|---|---|---|
| Main Camera Megapixels | ○ | ○ | ○ | ○ | ○ |
| Display Resolution | ○ | ○ | ○ | ○ | ○ |

## J.3 Demand Experiment

After this survey, we will hold **a lottery** to win a smartphone!

You can choose to win an **iPhone 16 or a Google Pixel 9 and $150**. Currently, the iPhone 16 costs $800 and the Google Pixel 9 costs $650.

Both recently released, the iPhone 16 and the Google Pixel 9 are **similar in terms of overall phone quality,** including camera, battery, and display quality.

Approximately 1 out of 500 participants will win the lottery.

**Here's how it works:**

1. For a possible scenario, we will ask you to choose which phone you like better: the iPhone 16 or the Google Pixel 9 and $150.
2. If the future scenario occurs, the lottery will be held.
3. To make sure you get the best option for you, it is important to be **truthful** about what **choice** you like better under the scenario we describe.
4. If you win the lottery, we will ask for your zipcode and send the phone and possible cash reward to a pickup location near you (such as an Amazon Locker or PO Box). This allows you to collect the prize privately and securely at your convenience.

Which of the following statements is correct regarding how you should answer the lottery questions? This question will be used for the **$100** bonus payment.

- ◯ Since the future scenario could occur, it is important to answer truthfully about which option you prefer.
- ◯ Since the scenario involves a future possibility, it does not matter which option you choose.
- ◯ The choice you make influences the probability of winning the lottery.

**Texting between Android and Apple Devices**

Currently, SMS/MMS texting between Androids and iPhones involves certain limitations due to **compatibility issues.**

In particular, the messages sent between Androids and iPhones appear as **green bubbles** on iPhones, while texts between iPhones appear as blue bubbles. Further, any group chats containing an Android user display green text bubbles.

**Department of Justice (DOJ) lawsuit against Apple**


The Department of Justice (DOJ) has recently filed a lawsuit against Apple, alleging **anti-competitive practices** related to its iMessage service. The lawsuit specifically highlights the impact of the green bubbles that appear in messages between Androids and iPhones as opposed to the blue bubbles that appear in messages between iPhones.

If successful, the lawsuit could force Apple to **remove the green bubbles** and standardize blue bubbles across all devices, regardless of the platform.

Experts anticipate that the trial is expected to begin **in the coming months**, with a decision in the case likely to follow shortly after.

According to this survey, what could Apple be forced to do because of the DOJ lawsuit? This question will be used for the **$100** bonus payment.

- ◯ Remove green bubbles for messages between Android and Apple devices
- ◯ Force Apple to discontinue the iMessage service entirely
- ◯ Introduce a separate app exclusively for Android users to message iPhones
- ◯ There is no risk of Apple being forced to make any changes

**Scenario: DOJ doesn't ban green bubbles**

Assume that Apple loses the lawsuit in the coming months, resulting in significant fines, but **green bubbles remain**.

This means messages exchanged between Android and iPhone users would still **appear as green bubbles** on iPhones, and this would also apply to group chats, where any group containing an Android user would display green text bubbles on iPhones.


In this scenario, which of the following options would you prefer to receive?

- ◯ iPhone 16
- ◯ Google Pixel 9 and $150

**Scenario: DOJ bans green bubbles**

Assume that Apple loses the lawsuit in the coming months, resulting in significant fines and the **removal of green bubbles** that appear on iPhones when messaging Android devices.

Messages exchanged between Android and iPhone users would now **appear as blue bubbles**, making Android users indistinguishable from iPhone users when texting. This change would also extend to group chats, where all users would now have blue bubbles.


In this scenario, which of the following options would you prefer to receive?

◯ Google Pixel 9 and $150

◯ iPhone 16

## J.4 Additional Demand Experiment

Additionally, after the study, we will conduct a **lottery** where 1 participant out of every 200 will win either an **iPhone 16 Pro Max** or a **Galaxy S24 Ultra** (both valued between around $1250) under different cash payment scenarios.

If you win a phone, we will ask for your zipcode and send the phone to a pickup location near you (such as an Amazon Locker or PO Box). This allows you to collect the phone privately and securely at your convenience.

After this survey, we will hold **a lottery** to win a smartphone plus a monetary payment!

You can choose to win an **iPhone 16 Pro Max or a Galaxy S24 Ultra**. Both smartphones are in the same price range.

1 out of 200 participants will be the winner of the lottery.

**Here's how it works:**

1. Choose which phone you like better: the iPhone 16 Pro Max or the Galaxy S24 Ultra.
2. Next, we will ask you to choose between:

- Receiving the phone you prefer.
- Receiving the phone you do not prefer, plus extra money.

We want to know the smallest amount of extra money you would need to switch from your preferred phone to the other one.

Here's how we will decide if you win the lottery:

1. A computer will randomly pick an amount of money to offer you to switch.
2. Before we tell you the computer's offer, we will ask you the smallest amount of money you would be willing to accept.
3. If the offer is less than your amount, you will get the phone you prefer.
4. If the computer's offer is at least as high as your amount, you will get the other phone and additionally the computer's monetary offer.
5. Therefore, reporting a higher amount of money required to switch from the preferred phone to the other one decreases the likelihood of receiving the non-preferred phone and extra payment.

To make sure you get the best option for you, it is important to be **truthful** about what **phone** you like better and the **extra amount of money** you would need to switch.

We will now ask you a comprehension question based on the text above. This question will be used for the **$100 bonus payment lottery**.

Which of the following statements is **true** about the minimum amount of money you would require to switch from your preferred phone to the other one?

- ○ Reporting a higher amount of money I require to switch makes it more likely that I will get the phone I do not prefer and the extra payment.
- ○ The minimum amount of money I require to switch does not affect the chance that I will get the phone I do not prefer and the extra payment.
- ○ Reporting a higher amount of money I require to switch makes it less likely that I will get the phone I do not prefer and the extra payment.

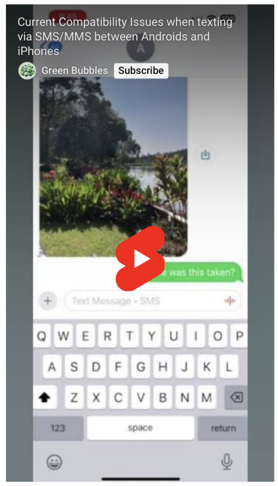
**Texting between Androids and iPhones**

Currently, texting between Androids and iPhones involves certain limitations due to **compatibility issues.**

Android users do not have access to **read receipts** or **typing indicators**, and can only send **low-quality pictures and videos** to iPhones and vice versa.

Moreover, the messages sent between Androids and iPhones appear as **green bubbles** on iPhones, while texts between iPhones appear as blue bubbles. Further, any group chats containing an Android user display green text bubbles.

Please watch the video below, which highlights the compatibility issues that occur when messaging between Androids and iPhones. We may ask you questions about it later for the **$100 Amazon gift card lottery**.




This question will be used for the **$100 bonus payment lottery**.

Which of the following is **NOT** a current compatibility issue for texting between Androids and iPhones?

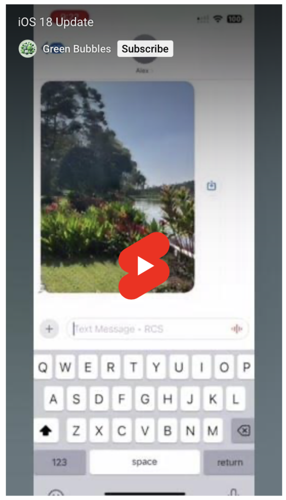
- ◯ Low-quality pictures and videos
- ◯ Androids cannot send pictures to iPhones
- ◯ Texting between Androids and iPhones is marked by messages appearing in green bubbles on iPhones
- ◯ No read receipts or typing indicators

**Texting between Androids and iPhones**

Apple has announced that the new **iOS 18** operating system, set to be released on September 16th, will **fix most of the compatibility issues** between Androids and iPhones. Apple will use Rich Communication Service (RCS) to enable Android users to have read receipts, typing indicators and send high quality photos and videos when sending texts to iPhones and vice versa.

However, Apple has announced that messages sent between Androids and iPhones will **remain as green bubbles** on iPhones.

Please watch the demonstration video of the new iOS 18 Beta update below. We may ask you questions about it later for the **$100 Amazon gift card lottery**.



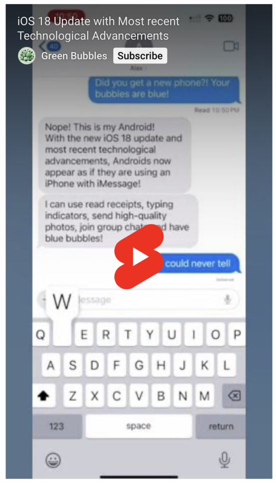

**Texting between Androids and iPhones**

Apple has announced that the new **iOS 18** operating system, set to be released on September 16th, will **fix most of the compatibility issues** between Androids and iPhones. Apple will use Rich Communication Service (RCS) to enable Android users to have read receipts, typing indicators and send high quality photos and videos when sending texts to iPhones and vice versa. Moreover, the most recent technological advancements further **eliminate** compatibility issues.

With these advancements, messages sent between Androids and iPhones **appear as blue bubbles**.

In this case, Android users will now appear **as if they use an iPhone** and have a more similar, seamless, and unified messaging experience when interacting with iPhones.

Please watch the demonstration video of the new iOS 18 Beta update with the most recent technological advancements below. We may ask you questions about it later for the **$100 Amazon gift card lottery**.




The following two devices are both priced around $1250.

Please note that you will not receive the phone from the lottery until October.

Which of the following do you prefer?

- ◯ iPhone 16 Pro Max
- ◯ Galaxy S24 Ultra

Thank you for participating in our study.

Note that the upcoming iOS 18 update does not eliminate green bubbles **by itself**. Recent technological advancements, such as a new app called Blue Bubbles, are needed.

The app can be downloaded using the following link: https://bluebubbles.app

Your responses are greatly appreciated and contribute valuable insights to our research. If you have any questions or would like more information about the study, please feel free to contact us.