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ABSTRACT

Lockdown Mode was introduced in 2022 as a hardening setting for Apple's operating systems, designed to strengthen the protection against "some of the most sophisticated digital threats". However, Apple never explained these threats further. We present the first academic exploration of Lockdown Mode based on a 3-month autoethnographic study. We obtained a nuanced understanding of user experience and identified issues that can be extrapolated to larger user groups. The lack of information from Apple about the underlying threat model and details on affected features may hinder adequate assessment of Lockdown Mode, making informed decisions on its use challenging. Besides encountering undocumented restrictions, we also experienced both too much and too little visibility of protection during Lockdown Mode use. Finally, we deem the paternalistic security approach by Apple's Lockdown Mode harmful, because without detailed knowledge about technical capabilities and boundaries, at-risk users may be lulled into a false sense of security.

KEYWORDS

Apple, iOS, Lockdown Mode, Autoethnography

1 INTRODUCTION

With annual sales numbers that have grown from around 122 million to over 1.3 billion between 2007 and 2023 [27], smartphones are the most popular mobile devices [64]. While only about 13% of global website traffic stemmed from mobile devices back in 2015, the share remained over 51% since 2019 [63]. Consequently, smartphones are playing an important role as one of the main means for participation in everyday digital life, and thus also for usage and consumer behaviour in both private and professional contexts. Precisely because of their general prevalence, however, smartphones have naturally become the target of cyber attacks just like conventional computers. Due to the widespread use of smartphones among potential high-value targets in the corporate, governmental, and political sector, strong threat actors like nation-state adversaries as well as commercial or "state-sponsored" [55] spyware such as Pegasus [40, 17] have recently come into focus within the mobile security landscape.

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Apple Inc., USA, one of the leading vendors of mobile devices which are affected by sophisticated cyber threats, introduced *Lockdown Mode* in iOS 16. Lockdown Mode is an optional hardening setting to safeguard so-called "at-risk users" from very sophisticated attacks by limiting or disabling certain functionalities of the operating system and of system apps. Yet, as we learnt as part of an associated, yet unpublished research project with interviews of international democracy activists, Lockdown Mode remains relatively unknown among at-risk user populations. Since its release on September 12, 2022, modest publicity and discussions have largely been confined to specialist tech audiences. The limited coverage of Lockdown Mode includes a small number of media articles [30, 71, 45], posts [31, 53, 51] and videos [50, 56, 66] in mostly tech-specific contexts. We are not aware of any academic study, and at the time of writing, no such studies of Lockdown Mode have been published.

We address this research gap by an explorative study investigating the impact of Lockdown Mode on day-to-day life. As a result of an interdisciplinary collaboration between computer science and anthropology, we utilised autoethnography (see Section 2.3) to document the experiences of the first author while using an iPhone with Lockdown Mode over a period of three months. Surprised that a built-in security feature by Apple seemed to be unknown to users, the first author recorded the following entry in their journal before they embarked on the exploration of Lockdown Mode as part of a structured self-test (see Section 3):

> [I] talked with [a family member] about Lockdown Mode. They wondered if their company has enabled it per default. (They did not). Was a bit hard to find in the settings since the German translation (Blockierungsmodus[; blocking mode]) is not really straightforward. Also, anyone I talked to about my project, including iOS users with high security and technical skills, did not know about this mode. (July 30, 2023, Journal)

Research Question. Our exploratory autoethnographic study of Lockdown Mode in iOS was guided by the following high-level research question:

What is the impact of Lockdown Mode on user experience in everyday use?

Contributions. The contributions of this paper are summarised as follows:

- To the best of our knowledge, we conducted the first academic study on Apple's Lockdown Mode in iOS to investigate user experience during daily usage.
- (2) Over a period of three months, the first author utilised autoethnography to document the hands-on experiences of using Lockdown Mode. Despite the subjective nature of autoethnography, and despite none of the authors being at-risk users at the time of writing, our observations can be extrapolated to achieve improvements for this user group.
- (3) We identified both conceptual and implementation issues of Lockdown Mode, and reflect on how they may affect at-risk users:
 - (a) Firstly, we think that a lack of *precise* information from Apple about the intended user group, the threat model and affected features makes it difficult for users to properly assess and understand Lockdown Mode, and to make an informed decision about using or not using it. This approach to security, sometimes referred to as "authoritarian" [2] or "paternalistic" [22], has been identified as harmful to users and to security.
 - (b) We found concrete usability problems with the thencurrent implementation of Lockdown Mode in terms of notification overload and *undocumented* blocking of some important functions, such as incoming attempts of destination sharing and contact sharing.
 - (c) Finally, the first author actually expected *more* restrictions due to Lockdown Mode than they experienced. While this can be seen as an unexpected but welcome phenomenon, at times it made them feel uneasy about the *invisibility* of protection.

Outline. Section 2 provides an overview on at-risk users, Lockdown Mode and autoethnography, including respective related work. The methodology of our autoethnographic study is presented in Section 3. Section 4, which is written from the perspective of the first author, covers their autoethnographic experiences *before* and *while* using the Lockdown Mode. Our findings are discussed in Section 5, before the paper is concluded in Section 6.

2 BACKGROUND AND RELATED WORK

This section provides background information and relevant existing work to understand Lockdown Mode in the context of digital-safety research with at-risk users. We also delve into the literature on autoethnography, as employed in the field of human-computer interaction (HCI).

2.1 Digital-Safety Research

Digital-safety research describes a growing body of work addressing "a person's or a group's state of security, privacy, safety, and autonomy, as it relates to their digital footprint" [13]. Special attention has been paid to the digital-safety needs of so-called "at-risk users", often also referred to as "high-risk users". These are users who face an elevated likelihood of a digital attack and/or would experience disproportionate harm from such an attack [70].

The realm of digital-safety research with at-risk users covers their digital security experiences [32, 44, 59], their collective information security in movement contexts [4, 14, 18, 54], and their digital-safety needs as journalists [20, 42, 43, 67], academics [65], refugees [60], quasi-public internet personas [57], sex workers [41], or survivors of intimate partner violence [12, 62, 61]. As this literature shows, it is important to identify differences in risk to avoid generalising all at-risk users under a universal banner, as this could otherwise lead to faulty or insufficient harm mitigation [13].

Recognising the need for contextualisation while upholding a common definition of at-risk users, Warford et al. [70] undertook a comprehensive systematisation study to establish a consolidated understanding of at-risk users. The study delves into 95 papers across diverse populations, ultimately unveiling 10 overarching contextual risk factors that amplify digital-safety risks. These factors include societal elements such as political context and/or marginalisation, relationship factors like dependence on a third party for digital support or having a relationship with an attacker, and personal circumstances such as prominence or access to sensitive resources.

A major challenge for technology providers is to sufficiently incorporate these contextual risk factors and provide advanced protective measures, when addressing the needs of at-risk users. Specifically, software designed for at-risk users must prioritise security. Users must be able to use their devices securely for intended purposes. Lockdown Mode aims to be such a protective feature.

2.2 Lockdown Mode

The Lockdown Mode introduced in iOS 16, which was released on September 12, 2022, is described by Apple as "an optional, extreme protection that's designed for the very few individuals who, because of who they are or what they do, might be personally targeted by some of the most sophisticated digital threats" [6]. It is specifically tailored as a security feature for at-risk users facing heightened digital risks due to their identity or professional role. The primary goal of Lockdown Mode is to reduce the potential attack surface for highly targeted malware by restricting or disabling selected system and app functionalities. Apple emphasises that the activation of Lockdown Mode is not a common necessity, stating that "most people are never targeted by attacks of this nature" [6], and that functionality limitations may be experienced when using it.

Lockdown Mode can be enabled in the device settings of iOS ("Privacy & Security"). Users are provided with an explanation of Lockdown Mode and asked to confirm their decision (see Figure 1), which ensures that the activation process is deliberate and informed. Table 1 provides an overview of Lockdown Mode features for both iOS 16 and iOS 17 as advertised by Apple. During our study, we discovered additional restrictions that were not mentioned in Apple's information, such as restrictions on contact and destination sharing (see Section 4.3).

So far, research on Apple's Lockdown Mode is rather limited and we are not aware of any academic studies on either the usability and day-to-day use of Lockdown Mode or its technical aspects. Prior to Apple's implementation of Lockdown Mode in 2022, however, Gomez-Miralles and Arnedo-Moreno [29] proposed a proof

Topics	Blocked/Unavailable Features (Literal Citations from [6, 7]) Most message attachment types are blocked, other than certain images, video, and audio. Some features, such as links and link previews, are unavailable.		
Messages			
Web Browsing	Certain complex web technologies are blocked, which might cause some websites to load more slowly or not operate correctly. In addition, web fonts might not be displayed, and images might be replaced with a missing image icon.		
FaceTime	Incoming FaceTime calls are blocked unless you have previously called that person or contact. Features such as SharePlay and Live Photos are unavailable		
Apple Services	Incoming invitations for Apple services, such as invitations to manage a home in the Home app, are blocked unless you have previously invited th person.		
Shared Albums/Photos	When photos are shared, location information is excluded. Shared albums are removed from the Photos app, and new Shared Album invitations are blocke You can still view these shared albums on other devices that do not have Lockdown Mode enabled.		
Device Connections	To connect an iPhone to an accessory or another computer, the device needs to be unlocked.		
Wireless Connectivity	Connectivity iPhone will not automatically join non-secure Wi-Fi networks and will disconnect from a non-secure Wi-Fi network when turning on Lockdown Mode. cellular support is turned off.		
Configuration Profiles	iles Configuration profiles cannot be installed, and the iPhone cannot be enrolled in Mobile Device Management (MDM) or device supervision while in Lockdown Mode.		

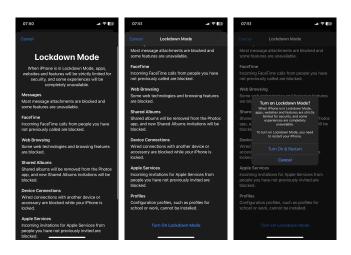


Figure 1: Screenshots of activating Lockdown Mode in iOS 16, including displayed information (left, centre) and activation prompt (right).

of concept for a security hardening of iOS in 2015, where they focused on "[c]ontrolling the device's trust relationships" [29]. Although most of the threats that Lockdown Mode attempts to address are outside the scope of this paper, the authors' solution to their particular problem (i.e., disabling certain features) appears to be similar to Apple's. The YouTube channel "Techlore" [66] conducted a two-month test to examine the impact of Lockdown Mode on everyday use. They found that the friction during usage were minimal and consequently recommend the Lockdown Mode to securityand privacy-conscious users. Newman [45] states that iPhones in Lockdown Mode function normally for the most part, although the restrictions are sometimes quite severe. They note that it takes some getting used to the behaviour of Lockdown Mode, as it is not intuitive from the start. They conclude that "if you really need Lockdown Mode for your digital safety and personal protection, it's a workable alternative to throwing your phone in the ocean" [45]. Dack [17] and Marczak et al. [40] indicated that Lockdown Mode

can prevent and reveal the "PWNYOURHOME" attack, a new generation of Pegasus that exploits Apple's HomeKit. Marczak [39] has not yet reached a clear conclusion on whether Lockdown Mode can protect against "TRIANGULATION" vulnerabilities in iOS. Cryptee [16] provided a proof of concept for detecting Lockdown Mode via browser fingerprinting. Jamf Threat Labs [35] demonstrated the possibility of simulating active Lockdown Mode to the users without providing any actual protection.

Overall, there is still a lack of knowledge about Lockdown Mode, especially from an academic point of view and with a focus on everyday usability and user experience. Therefore, to the best of our knowledge, we have conducted the first academic study on this topic.

2.3 Autoethnography

Autoethnography is a research method that involves documenting and analysing personal experiences to enhance understanding of cultural phenomena. The term itself can be deconstructed into three components: "auto" signifies the utilisation of personal narratives, "ethno" encompasses the exploration of cultural texts, experiences, beliefs, and practices, and "graphy" pertains to the descriptive and interpretive aspects of the method. It aims to handle the subjective beliefs of researchers transparently, without suggesting a false sense of objectivity. Autoethnography involves retrospectively and selectively narrating significant events tied to one's cultural participation or identity. Adhering to scientific standards of a systematic and critical approach, autoethnographers must not only recount experiences but also critically analyse them. This approach integrates personal experiences into the analysis, offering a nuanced perspective on cultural facets for both insiders and outsiders. The combination of personal narratives and scholarly analysis constitutes the depth of autoethnographic studies [24, 25].

When practising autoethnography, researchers engage in prolonged fieldwork, actively participating and observing, and generating detailed *field notes* that capture their encounters, assumptions, and potential biases. These notes serve as a raw and unfiltered record of the researcher's experiences. Following the fieldwork, the collected data is meticulously organised and structured into a coherent narrative suitable for outsiders [23, 3].

In recent years, there has been a growing trend in employing autoethnography within technical contexts. Its application has proven particularly valuable in comprehending the usability and challenges associated with technology in everyday scenarios. Especially in the field of HCI, the popularity of autoethnography has grown considerably in the last years [36]. One of the first to use autoethnography to study mobile devices were O'Kane et al. [47] in 2014. One of the authors used a blood pressure monitor twice a day for three months and documented the results with a smartphone, taking photos of the situation and adding optional text comments. They concluded that autoethnography "is additionally useful for accessing non-routine times not easily captured through user studies" [47]. North [46] used an autoethnographic approach to create and think through an imaginary study and to reflect about its design. Hine [33], Aagaard et al. [1], and De Koning et al. [19] evaluated the adoption of smart home technologies through autoethnography. Aagaard et al. [1] state that "a 20-month diary of one of the authors enabled insight into everyday scenarios, thoughts, and frustrations that arise when smart technologies move into the home" [1] and therefore deem the method useful. Bala et al. [11] utilised autoethnography to evaluate digital technologies in the context of cultural heritage sites. Lewis et al. [37] evaluated the technique of doodling for mental well-being in online spaces. Gaver and Gaver [28] used autoethnography to evaluate a simple communication device they co-designed called Light Touch. This study documents the authors' experiences of using the device and evaluates its long-term effectiveness. Väkevä et al. [69] used autoethnography to gain insights into the experiences of video gaming, while Lo [38] reflected on prompting with a chatbot that was attempting to emulate her own character.

Autoethnography has also been used to depict and make sense of the experiences of people with various abilities and health states. For example, Homewood [34] explored the possibility of reducing physical activity due to a medical condition using a smart wristband. Wu et al. [72] employed autoethnography to assess the impact of videoconferencing on individuals who stutter. Similarly, Chen et al. [15] examined the communication of individuals with mixed hearing abilities in different settings.

A systematic literature analysis of autoethnography in HCI was conducted by Kaltenhauser et al. [36]. The findings indicate that autoethnography is employed for a diverse array of subjects and technological fields. Our study appears to represent a typical application of autoethnography in HCI: The analysis revealed that mobile technologies are one of the most frequently researched technologies, often with the objective of obtaining "[i]n-depth, nuanced, and personal insights on lived experiences" and studying "[d]ifficult situations/topics", which is where we position our research. Moreover, according to Kaltenhauser et al. [36], it is a common practice for one author to conduct an autoethnography with the support of their co-authors. In addition, many studies, such as ours, are conducted over several months.

In the context of autoethnographic security-related research, we are aware of only two prior works. Turner et al. [68] utilised the method to study problems associated with smart home security practices. During the 80-day study period, the struggles of a family associated with using a smart home system were explored. Fassl and Krombholz [26] used autoethnography to understand the low adoption rate of authentication ceremonies. During a five-month

study period, a research diary to document the experiences with authentication ceremonies was kept. The authors concluded that autoethnography was a useful method for understanding the social root causes of the problem.

3 METHODOLOGY

3.1 Rationale for Autoethnographic Approach

For our study of Lockdown Mode in iOS, we chose autoethnography as our primary research method. It is particularly suitable when other methods would be unethical, dangerous, or potentially expose participants to risky investigation scenarios [36]. Since studies with at-risk users are inherently risky to both study participants and researchers [13], an autoethnographic study of a hardening setting for Apple devices constitutes a useful, yet safe approach. Given the exploratory nature of our research, our aim is to gain insights into Lockdown Mode in a safe environment.

Moreover, our aim was to understand the impact of Lockdown Mode on the everyday life of a user. We decided against a lab study, as replicating authentic user interactions in a lab setting would not have adequately reflected the spontaneous and highly personal ways in which smartphones are used, especially in the context of security. Covering these aspects with a survey would also have been difficult for the same reason. Therefore, this work describes an autoethnographic investigation which aims to study individual experiences, as explained in Section 2.3. Autoethnography is well suited to this type of study because smartphone usage is very personalised and touches on many areas of daily life. According to Kaltenhauser et al. [36], as previously stated, acquiring thorough and detailed first-hand experiences is the most common rationale for autoethnography in the context of HCI research.

3.2 First- and Second-Order Observations

Section 4 is written from the point of view of the first author. Their perspective is presented in the first person, including excerpts from their journal (English), and audio recordings (German). Spelling and punctuation errors in quoted journal entries were corrected to improve readability, while transcriptions of audio recordings were translated into English.

Throughout all research phases, we supplemented first-order observations of the autoethnographic investigator with second-order observations in weekly team meetings. As the point of autoethnographic experience is to gain insight *through a particular perspective*, these meetings allowed us to address the limits of this perspective by reflecting on how the first author observes and what they might not yet have taken into account. Second-order observations and questions in team meetings have also assisted the first author in putting diffuse streams of experience into words. Thus, these conversations have not undermined, but sharpened the first author's perceptions.

3.3 Persona

At the time of the study in the second half of 2023, the male first author was a 23-year-old graduate student in computer science in Germany. They possess a solid comprehension of technology, and consider themselves to be security- and privacy-conscious, as these topics have been one of the main focuses during their study

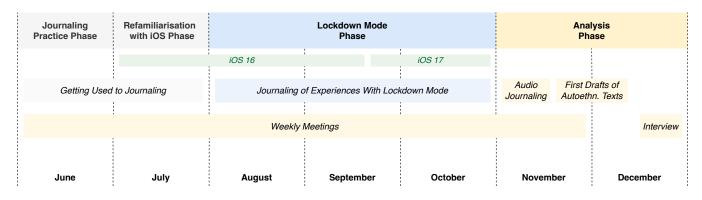


Figure 2: Road map of the different study phases and the associated actions; months on the timeline correspond to the year 2023.

programs. Moreover, they took an HCI course and a usable security course, such that they were familiar with the basics of HCI research methods and their application to security and privacy.

Their strong opposition to surveillance, both at an individual and societal level, combined with a healthy scepticism towards state agencies and corporations, highlights their commitment to safeguarding their personal security and privacy. Measures taken by the first author prior to the study include the use of Startpage as a search engine, using unique and random passwords with Bitwarden, blocking or automatically deleting cookies and trackers, and not saving their browser history. The use of a feature such as Lockdown Mode would therefore not have been atypical behaviour. However, before embarking on the autoethnographic journey, they had no prior knowledge of Lockdown Mode and had not used iOS since 2018.

In addition to the security measures taken by the first author, their smartphone use has some further characteristics that set it apart from the general public. For example, the first author is generally well informed about the overwhelming majority of their devices' functions, and they also use a minimalist interface to avoid distractions. Although the above-average level of technical expertise may lead to different experiences than less technically inclined users, there are also benefits. As Fassl and Krombholz [26] argue, technical expertise can help to better understand the phenomena being studied and to make more nuanced observations.

At the same time, the first author lacks characteristics typically associated with at-risk users who might be advised to use Lockdown Mode. They are not a public figure, do not engage in politically sensitive or controversial work, and do not participate in activities that could attract personalised targeted attacks. This absence of high-risk attributes reduces the immediate threat to the first author.

3.4 Study Phases

The study is divided into four phases (see Figure 2). The first two are for practising and familiarisation, the third and longest is for data acquisition, while the final phase is for reflection and analysis.

Journaling Practice Phase. As the first author had been using an Android smartphone privately for several years and had not previously conducted an autoethnographic study, we decided to begin with

a "Journaling Practice Phase" in June 2023. Here, the first author would use their current smartphone (OnePlus 6, OxygenOS 11.1.2.2) which they had owned since summer 2018. The purpose of this phase was to identify an appropriate journaling style to be used in subsequent phases. Prior to their Android device, the first author has owned an iPhone 6 for several years, so they already had experience with iOS, although not recently. As a personal preference of the first author, all of their smartphones are set to English by default, including the one used in this study.

Refamiliarisation with iOS Phase. In July 2023, the first author began using a test device (iPhone XR) full-time. As they had previous experience with iOS, but had not used an iPhone since 2018, we decided that a month of using iOS without Lockdown Mode would be beneficial to establish a baseline of standard iOS behaviour. To ensure a seamless transition into this phase, the device was set up in the last week of June 2023. The first author attempted to use the same apps as on Android or comparable alternatives. When available, they used stock iOS apps to ensure comprehensive coverage of iOS functionality. To avoid limiting our findings with overly restrictive settings, suggested settings were selected during device setup. As no suggested option for location data was given, 'When app is used' was chosen as it is the least functionality restricting setting. One exception was that the first author opted to use Bitwarden instead of Apple's Keychain as the password manager and disabled notifications for non-crucial applications, as this mirrors their regular usage. Throughout this month, iOS versions 16.5.1 to 16.6 were utilised.

Lockdown Mode Phase. The main investigation phase lasted for three months, from August to October 2023. During this phase, the first author used the device in Lockdown Mode and recorded their experiences in a journal. This method is explained in detail in Section 3.5. In accordance to the research question, the aim was to gain a comprehensive overview of Lockdown Mode in everyday use. To ensure the best possible coverage of the impact of Lockdown Mode, a mapping of affected functionality was created. The mapping was a list of individual aspects – based on information provided by Apple, related work, and our own considerations – that should or could be affected by Lockdown Mode. If something was not used naturally,

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the first author actively tested it. A compact summary of this mapping can be found in Appendix B. During the "Refamiliarisation with iOS Phase", the first author tested all of these points for comparison. We achieved almost complete coverage using this method, with only a few aspects missing, such as testing Apple services due to the need for additional hardware like smart home devices, which were not available. In this phase, we used iOS versions 16.6 up to 17.0.3. Since the release of iOS 17, which includes additional Lockdown Mode features, was in mid-September, we were able to observe it for a similar length of time as iOS 16. The device was used full-time by the first author, except for one week where we had to replace the screen due to a mishap.

Analysis Phase. The process of reflection was an integral component of the study, occurring at various points throughout the duration of the study project. Firstly, this was done through the medium of journaling, and secondly, through the scheduled meetings held on a weekly basis. During the weekly meetings, observations were discussed with the co-authors, and potential explanations for certain design decision of Lockdown Mode were considered. Furthermore, these meetings served the additional purpose of ensuring the quality of the autoethnographic work, as the first author lacked prior experience with it. The weekly meeting helped the first author in making sense of observations. It is likely that potential users may exhibit similar behaviours and seek assistance through discussion with other individuals.

The actual "Analysis Phase" took place in November and December 2023. The first author went through the journal entries and screenshots, made audio recordings of relevant experiences and reflected on possible thematic clusters. To enhance reflection, the recordings were made in the first author's native language, German. This resulted in 56 audio recordings which were automatically transcribed using OpenAI's small model of Whisper [52, 48]. The transcriptions were summarised and clustered into a tree diagram, where each transcript acted as a leaf. Connecting themes were extracted from the summaries and acted as parent nodes. These smaller themes were then grouped into larger themes. The result can be seen in Appendix A and led to the topics for Section 4.

As a final reflection loop, the first author was interviewed by a co-author in a one-hour session in December 2023 based on questions that arose while reading a first draft of Section 4 with the aim of clarifying unclear passages and further reflecting on the experience. The interview was recorded and transcribed, and helped to reflect upon selected aspects of the first author's autoethnographic experiences and to refine the textual elaboration.

3.5 Journaling

As using a smartphone is an activity that takes place throughout the day, we decided that the first author would write a journal every evening summarising their experiences. Occasionally, this was done during the day or in the morning after. We decided on a structured approach where each activity or cluster of activities would get its own entry. Each entry answered the following questions:

- What did you do? Think about the activity and the corresponding smartphone/app usage.
- (2) At what time did this take place?
- (3) Where did it take place?

:∼\$ journaling
Already up to date.
Is this an entry for yesterday (y/n):
What did you do? Think about the activity und the corresponding smartphone/app usage.
answer1
What time did this take place? (m, n, a, e, d)
answer2
Where did it take place? (h, a, u, p, etc.)
answer3
What was the social situation? Who was involved?
answer4
Did you have any conflicts or problems?
answer5
Do you have any additional thoughts or explanations?
answer6
Do you want to continue? (y/n):
Journal entries saved successfully.
Do you have any thoughts about journaling itself?
answer-metajournal
Meta Journal entry saved successfully.
Files moved and renamed successfully.

Figure 3: Example of journaling script in action.

- (4) What was the social situation? Who was involved?
- (5) Did you have any conflicts or problems?
- (6) Do you have any additional thoughts or explanations?

For each entry, the date, and the number of the activity for the day were recorded. A set of abbreviations was created to speed up the answering of questions 2–4. Questions 4–6 could be left blank if not required.

To create these entries, we wrote a Python script that asks the user these questions and automatically appends the answers to a CSV file. A shell script calls this Python script and then commits and pushes the data to GitLab. For the first author, this script was easily accessible via a keyboard shortcut or a short terminal command. This had the advantage of keeping the barrier to journaling as low as possible, and the entries were directly digital and therefore easily searchable. The journal entries were accessible to all co-authors and could be used as input for the weekly meetings. In addition to written journal entries, the first author collected screenshots of notable situations. These were manually moved to an input folder, automatically and systematically renamed and moved to a storage folder by the script. An execution example of the full script is shown in Figure 3.

To record thoughts that were related to journaling and as a form methodological reflection, we created a secondary journal called the metajournal. It worked in the same way as the other journal, with only one input field per entry. The metajournal was also accessed by the script and could be used or skipped as needed.

Over the course of the study, the first author made 415 journal entries. 115 originated from the "Journal Practice Phase", 97 during the "Refamiliarisation with iOS Phase", and 203 during the "Lockdown Mode Phase". This equates to approximately 2.7 entries per day over the whole 153-day study period and 2.2 entries a day during the 92 days of testing Lockdown Mode specifically. The journal entries were accompanied by 127 screenshots: 6 during the "Journal Practice Phase", 37 in the "Refamiliarisation with iOS Phase", and 84 during the "Lockdown Mode Phase" (0.9 per day).

3.6 Ethical Considerations

Ethical considerations were made before and during our study. Since Lockdown Mode is supposedly intended for users who face adversaries with powerful cyber capabilities, such as state agencies or actors with comparable resources, it is highly unlikely that the first author was actually at-risk while conducting the autoethnography. Further, we needed to take precautions to protect the privacy of the first author and their social group, as conducting an autoethnographic study of smartphone usage touches on several deeply personal areas of life. To minimise invasiveness for the first author, we decided not to collect browser history. Also, the first author always had the option of omitting sensitive or embarrassing topics from their journal. However, this option was used very sparsely.

To protect their social group, the first author pseudonymised all mentions of other people who were not part of the study. The real identities of such individuals were not revealed to the co-authors. Screenshots containing real names or other identifiable information were censored, or not taken at all, if the content was deemed sensitive.

4 AUTOETHNOGRAPHIC EXPERIENCES WITH IOS AND APPLE'S LOCKDOWN MODE

As mentioned in Section 3, the following section is written from the perspective of the first author. As an autoethnographic text, it represents the thoughts and mental models during the investigation phase. It needs to be noted that some later insights, such as the more exact threat model, were not clear to them at the time.

4.1 Refamiliarisation with iOS

Setup. I had mixed feelings during switching back to the iPhone. My first impressions of setting up the iPhone were mostly good. The initial setup process was fairly straightforward, especially since the "Move to iOS" app was able to easily transfer my saved contacts, calendar, photos, and even some settings, such as my device being in dark mode, and some installed apps to the new phone. This initial good impression quickly faded. Probably because I used the minimalist LessPhone launcher on my previous phone, I found the home screen with several pages of pre-installed and transferred apps overwhelming, as well as Apple's promotion of a new feature or app. I would say that Apple has moved very far away from the simple and aesthetic interface that I appreciated during my last experience with iOS 11 until the summer of 2018. Also button positions, gestures and keyboard layouts were different.

As a result, I put off finishing the setup for a few days. During this time, I worried about how I was going to use such a system for the next four months. I finished the setup in three separate sessions. I downloaded the apps I needed, customised the look and feel of the interface, and logged into my accounts. During this phase, I was pleasantly surprised by the customisability of the new iOS version. Thanks to the App Library, I was able to remove all apps from the Home Screen that I did not need and to largely recreate the minimalist interface I was used to. Another positive surprise was how easy it was to set up synchronisation between my Nextcloud and the Calendar and Contacts applications; much easier than on Android. This was a point I was most concerned about before I started the project. I also liked the good integration of alternatives to Apple's Keychain, such as Bitwarden in my case. The only really frustrating part of the setup was that I could not transfer my Signal chat history from Android to iOS.

Getting Familiar. For the most part, I had a good time using the iPhone. Although it was irritating at first, I got used to the different user interface and to slightly differently designed apps. These

positive aspects were somewhat marred by a couple of instances where I clashed with the very controlled, I would say somewhat belittling, implementation of iOS. This is a point that also became noticeable when using Lockdown Mode. For example, when setting an alarm in the Clock app, the system told me to go to the Health app first, where I had to enter my sleep cycle, and then set the alarm. I thought this was a very bizarre design choice. The second instance was that I was unable to change the search engine of Safari to Startpage (there was a predefined list of only five search engines to choose from). I also could not disable the saving of browsing history, and had to get around this by using only private browsing tabs.

4.2 "Trust Me, Bro" – Navigating Apple's Information Void

Getting Started. One aspect that will immediately confront new Lockdown Mode users is Apple's approach to communication. As shown in Figure 1, users need to scroll through a textual overview of what features might be affected by Lockdown Mode before they can turn it on. Then, within the activation prompt that opens, users are once more asked, if they want to turn on Lockdown Mode and restart their phone, while being reminded that "apps, websites and features [will be] strictly limited for security" and that "some experiences [will be] completely unavailable".

I think, as a high-risk user you first have a good feeling about being well-informed, about what you are getting into. And this looks secure at the first glance. But you also see that it doesn't really go into details what concretely works and doesn't work. A few points are even omitted. (Nov 09, Audio)

I think the presented information works well for a compact summary of features. Unfortunately, to find any additional detailed information about the effects of Lockdown Mode in the documentation provided by Apple [6, 7] is not easy. The support website offers the same topics with a slightly expanded description of the points. For example, "Most message attachments are blocked and some features are unavailable" is expanded to "Most message attachment types are blocked, other than certain images, video, and audio. Some features, such as links and link previews, are unavailable" [6]. Although it is an improvement, it still does not give a full picture of the exact functionality of Lockdown Mode. For example, destination sharing by others via Apple Maps is blocked in Lockdown Mode, as I further describe in Section 4.3. "That this feature was blocked, wasn't mentioned with a single point by Apple, as far as I have seen." (Nov 14, Audio) So it was only through my autoethnographic observations that I became aware of this.

Unclear Threat Model. Another point that remains rather vague is the threat model. Apple states that "Lockdown Mode helps protect devices against extremely rare and highly sophisticated cyber attacks" [6]. There is no concrete overview of the possible attackers, their capabilities, the attacks, and how the features in Lockdown Mode help against them. This ties in with the points of Section 4.3 that it is really hard to evaluate which features of Lockdown Mode are really relevant and why they are implemented the way they are.

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I summarised my frustration about the lack of information in the following excerpt from my audio reflections:

And I think one should actually do that [give concrete, detailed information]. I think Apple often has an attitude of 'trust me bro, we are doing it the right way'. But you aren't able to evaluate it for yourself at first glance. (14 Nov, Audio)

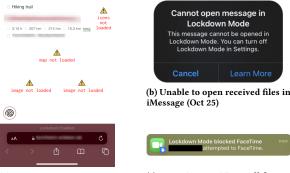
The approach of creating a good product without telling users the exact reasoning behind it may work for non-security issues and may contribute to Apple's success, but in the context of security it proves problematic. For at-risk users, it is important to know exactly how they are protected by a feature like Lockdown Mode. They need to be able to assess where Lockdown Mode provides protection, and where they may need to take further steps. A lack of this knowledge may therefore result in potential security risks for them. It also makes it difficult for researchers to evaluate the effectiveness of Lockdown Mode, as it partly acts as a black box. This reduces their ability to suggest improvements that could improve the security and usability of Lockdown Mode.

4.3 Encounters with Mysterious Design Choices

Blocking Issues. In several instances, design choices led to issues regarding blocked features and unintended consequences. Conversely, there were several situations where the implementation seemed inconsistent or left me puzzled as to its purpose. For example, although most websites worked fine during my testing phase, I encountered instances of functionality breakdown. One memorable incident occurred during a hiking trip with a friend, which I recorded in the following journal entry:

Wanted to open the website with [the] route [the friend] sent me. Lockdown Mode removed the images (not so bad) and the map (which obviously was one of the main things I wanted to see) from the website [(see Figure 4a)]. So before leaving, I opened the link on my PC and during the trip I let [them] navigate for us. Not a huge problem since I could rely on them, but alone I would have been helpless without deactivating Lockdown Mode for the website. Could have also been catastrophic, if I hadn't taken my powerbank with me so [I could] recharge their phone. (Aug 20, Journal)

It is possible to exclude websites from Lockdown Mode once the relevant setting has been located, which I had to look up online: On the left-hand side of the address bar in Safari, there is the page settings button labelled "aA" which opens a menu, where Lockdown Mode can be toggled off in the website settings. "It's not really hard, but I would not have found it by myself so easily" (Aug 01, Journal). In the above-mentioned instance, I chose not to proceed in deactivating Lockdown Mode, as at-risk users are likely to behave similarly due to the strong warning not to do so. The warning can be seen in Figure 5a and reads "Are you sure you want to turn off Lockdown Mode for [this website]? Lockdown Mode protection will be turned off for this website. This may increase security risk if you believe you may be personally targeted by a highly sophisticated cyberattack."



(a) Annotated missing website elements (Aug 20)

(c) Incoming FaceTime call from a Mac blocked (Aug 23)

Figure 4: Screenshots of encountered functionality breaking issues when using Lockdown Mode.

There are several further blocking issues. Specifically, not only are link previews disabled in iMessage, URLs are also not displayed as hyperlinks. Instead, they appear as regular text, which means that users have to copy and paste links into their browser manually in order to access them. It is *"quite annoying" (Nov 13, Audio)* if the link is in the middle of a paragraph of text since it cannot be copied individually. Furthermore, I was confused as to the purpose of this feature:

> Sure, you don't click so fast on a link, that could be a problem, or by accident. That's probably the thought behind this, but, yeah...Now you have to copy it, which is just more work. But whether this is supposed to generate a big security advantage, I don't know. (Nov 13, Audio)

Another issue affecting the usability of iMessage pertains to the blocking of some file types. Many common file types, including PDF and DOCX, are blocked from being opened. Instead, the file is only indicated as a blank file icon with a non-descriptive label "1 Message". Upon clicking on it, a notification is presented that states the file is blocked in Lockdown Mode. Unfortunately, there is no way to make an exception for a specific file, so the only solution presented by the notification is to turn off Lockdown Mode systemwide (see Figure 4b):

> I could imagine that for a high-risk user this could be a problem. If they get an important file [...] that's relevant for them, they have to turn off Lockdown Mode completely. And it might be questionable if they will return [to Lockdown Mode, I] would say, because if this is something they have to do regularly, this is quite restricting. (Nov 13, Audio)

Incoming FaceTime calls from contacts not previously facetimed with will be blocked (see Figure 4c). It may not pose a significant inconvenience for individuals with a limited network of acquaintances or family members with whom they regularly converse. However, it can be challenging for professions like reporters, who are potentially at-risk users and need to communicate with a wide range of people. Additionally, there is no option to exempt specific

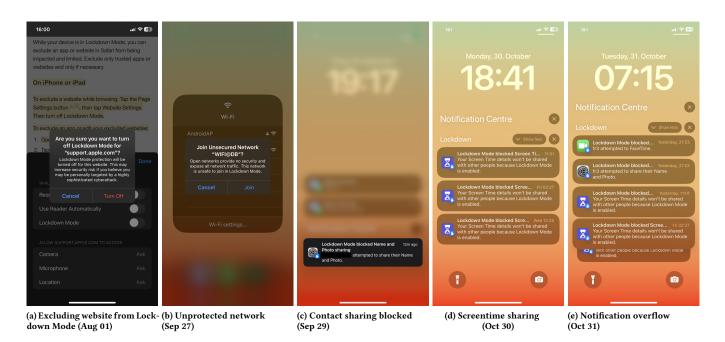


Figure 5: Screenshots of occurred notifications and warnings while using Lockdown Mode in chronological order.

calls without first making a call to the other person. Furthermore, I discovered an inconsistent design whereby calls from the same person were displayed as blocked when attempted from their Mac, but not displayed at all when attempted from an iPhone. *"[This] seemed to me more like a bug than a feature" (Aug 23, Journal)*. I also assumed that in countries like the US, where FaceTime may be used more widely, even in professional contexts, having incoming calls blocked could lead to embarrassing situations, such as when being called for a job interview by a yet unknown contact.

Missing Protection. This was not the sole example of encountering design inconsistencies. All the problems with iMessage and Face-Time "could be easily avoided by using Signal or something like that, which doesn't lack in security and privacy anyway" (Aug 16, Journal). The blocking issues are exclusive to Apple's own apps and features. However, within third-party apps, which a considerable number of users, including those at at risk, may already employ, all obstructed functionalities remain accessible. Excluding the security features from third-party apps appeared peculiar, as if links or files present a significant danger to at-risk users, they ought to be safeguarded even when they choose not to use iMessage or FaceTime for communication. Only later did I understand the reasoning behind this approach (see Section 5.2). At the time it seemed very inconsistent.

Even while using iMessage, a situation occurred where I felt less protected and questioned the implementation decisions of Lockdown Mode:

> Realised that the chat [with a friend] via iMessage switched a while back from iMessage to SMS. I find it quite bizarre, that this is not warned more clearly about. I don't know if iMessage is E2E encrypted [it is [9]], but if so, it would be more

secure than SMS. Lockdown should prevent such mistakes. (Oct 01, Journal)

I Would Have Implemented It the Other Way Round. Another instance where the design decision was perplexing was the restriction of the contact sharing feature introduced in iOS 17. It blocks other people to share their profile name and picture with users in Lockdown Mode. Sharing one's own name or picture while in Lockdown Mode is possible and even enabled per default. For me the intuitive implementation choice would have been to block users in Lockdown Mode from sharing their information while allowing them to receive the information of others. I wrote the following about that topic in my journal on the day it first occurred to me:

[A friend] tried (probably automatically) to share their profile name and picture. (New contact info feature). This was blocked by Lockdown Mode. I find this very odd, since I see no apparent risk in this behaviour. It's just a name and a picture. The only threat I could see, someone sharing a wrong name and picture, and the user accidentally discloses important information to this fake account in believe it was a trusted contact. I find it especially odd since sharing your own contact info is set to "contacts" per default. This might be much more dangerous. Perhaps a high-risk user might have given an alias to some contacts. Now it is possible to accidentally disclose your real name and photo to all your contacts. A good default option would be to set this option to "always ask" or deactivate it completely. (Sep 29, Journal)

I experienced a similar design choice, where incoming information was blocked while outgoing information was unimpeded, with destination sharing in Apple Maps. Receiving a shared navigation destination from others to myself was restricted, whereas I was permitted to share my own destination with others.

> I really don't understand where the threat lies in getting shared some information via an internal (!) interface of the operating system. Tested this feature myself now and from me, it works without problems. Shouldn't this be the thing with higher risk for me, accidentally sharing my location and destination with someone I don't know very well, or this information somehow being accessed by a person in the middle. Very mysterious design choices. (Sep 30, Journal)

After discussing with the co-authors, it became clear to me that the primary motivation for these measures is presumably to prevent threats such as zero-click exploits. These are what Apple is referring to when it says it protects against "some of the most sophisticated digital threats" [6]. It appears that Apple does not prioritise protection against social attacks. However, it is important to note that at-risk users with similar or lower levels of technical understanding may come to the same wrong conclusion as I did. Additionally, implementing protections against social attacks could still be valuable for these users.

Good Design Choices. While some choices regarding blocking seemed less than ideal to me, there were also instances of good design choices. A prime example is the deactivation of 2G, which is set as default in iOS 17 when Lockdown Mode is active, but could be toggled back on, if necessary. Giving users the option to turn off certain protections if they become too restrictive is, in my opinion, a very good design choice that should be available for more aspects of Lockdown Mode. Furthermore, although it is possible to accidentally switch from iMessage to SMS and lose the benefits of end-to-end encryption, SMS offers link and file protection as well.

4.4 Notification Overflow

Lockdown Mode introduces a host of new notifications to iOS. Sometimes, they provide useful information or warnings. However, their high volume can significantly diminish user experience. The most frustrating example in my experience arose after joining my iCloud family group. Regular notifications informed me that my Screen Time data would not be shared with them. The timing of these notifications seemed random to me. As shown in Figure 5d, I received 3 warnings within 6 days. A journal entry reveals my irritation with the number of notifications:

> I now got this notification multiple times. It's really annoying since there does not exist a method to turn it off. My notifications for Screen Time are already off...Really annoying if this persists. Really bad implementation. (Sep 07, Journal)

To me, showing the notification so many times appears poorly planned. I comprehend the benefit of informing the user once about the feature restriction, but the persistent reminders are unnecessary and hinder the primary tasks users wish to perform on their device. The new contact sharing feature in iOS 17 presents a comparable situation. I have already questioned the general implementation of it in Section 4.3. Furthermore, I believe the notifications' execution is suboptimal as the default setting is to automatically share your name and picture with all contacts, meaning users with Lockdown Mode can get tons of notifications that sharing attempts were blocked. So if Alice has contact sharing enabled, Bob, who uses Lockdown Mode, receives a notification stating name and photo sharing has been prevented every time Alice attempts to contact Bob via calling, iMessage or FaceTime (see Figure 5c). This proved to be rather annoying, because while I can see the benefit of being notified of blocked incoming FaceTime calls, I cannot see the benefit of frequently receiving a message that their profile information has been blocked. General information on the feature being blocked would be entirely satisfactory for my needs.

Also, I did not quite understand the reasoning behind the unsecured Wi-Fi warning shown in Figure 5b:

> I got a warning, but this one was not very intimidating like the ones when disabling Lockdown for a website. Although the text was quite extreme, red wasn't used and the connect-anyway-button was the default (right) button. (Sep 25, Journal)

Although I acknowledge the usefulness of the unprotected Wi-Fi warning, I remain unconvinced of its effectiveness as it is a frequently encountered notification and may be simply clicked through.

One example of the many warnings a user might be exposed to is shown in Figure 5e. Overall, I am not of the opinion that increasing the notification load is a good strategy for increasing perceived security or improving user experience.

4.5 "Could As Well Not Be Active" – Tension Between Expectation and Experience

Not Really Noticeable. A theme that emerged during my observations of Lockdown Mode was the overall lack of noticeable big changes. Although there were a few noteworthy changes to the user experience, as discussed above, for the most part my impression of Lockdown Mode during my day-to-day use was that the changes were minor to unnoticeable. This is supported by entries in my journal, which lack observations specific to Lockdown Mode for most days and activities. Following the first few days, I formulated this impression in the following entry:

> Since the initial impressions of Lockdown Mode, haven't had any different experiences the past days. Could as well not be active. (Aug 05, Journal)

This experience may be a result of my inaccurate expectations prior to the study. My expectations were that the changes would be more noticeable and have a big impact on everyday use. I have reflected on my experience as follows:

> I think that was also a bit in our discussion, that there are somehow greater restrictions in real dayto-day use, that there are somehow major things that don't work, that it's kind of frustrating. You just couldn't experience this. I don't think you

could tell at that point in time. You could see in individual apps that Lockdown Mode was on because of the notification, and then nothing else actually happened. (Nov 09, Audio)

As indicated in the last sentence, I blame Apple in part for my false expectations. Most apps showed me when I first opened the app that functionality might be limited. So I was expecting problems, but in fact the biggest limitation I experienced was that the first page of my regional mobility provider's app did not load the first time I opened it, and I am not entirely sure that it was really due to the Lockdown Mode. All the other apps that displayed the warning worked fine. I was conflicted whether the lack of friction while using the Lockdown Mode would be beneficial to at-risk users, or whether they might feel vulnerable:

> On the one hand a smooth experience is beneficial for the usability of the device. But users might also be unsatisfied that not much really changes [...] and don't really feel more secure therefore. (Aug 16, Journal)

Wrongly Attributed Problems. A side effect of my expectations was that I sometimes attributed problems to Lockdown Mode, although they had nothing to do with it. Problems related to the web browser or WebSheet, that is used by many third-party apps, were particularly prone to this effect, as these are the places where I expected the Lockdown Mode to cause problems. One example was trying to buy a public transport ticket. The process failed, and I only found out later that it was a problem in the app and not related to Lockdown Mode:

I wanted to buy the [...] ticket. [...] However, the payment process ended shortly after I had entered everything with a non-descriptive error message, and so I couldn't buy the ticket. That was another [...] case of 'this could have been Lockdown Mode' I didn't quite know. It had really turned out that it wasn't Lockdown Mode because, for one thing, I tried it again a few days later, and it worked, and I also learnt from many other people around me that they had problems with the payment, with buying the ticket, that they also had exactly the same errors as me, even though they weren't using Lockdown Mode or iOS at all. That was a problem on the [side of my mobility provider]. You can see a bit again, yes, people really like to blame errors first of all on Lockdown Mode and then only later realise that it is or isn't actually a Lockdown Mode problem at all. (Nov 15, Audio)

The problem of misattribution is related to the problems with Apple's communication strategy mentioned in Section 4.2. If Apple were to communicate more clearly which features are affected by Lockdown Mode, it would be clearer to users which problems are related to Lockdown Mode and which are not. In my opinion, this leads to a worse user experience of Lockdown Mode, because people might think that more functionality is negatively affected than is actually the case.

Non-Lockdown Features That Made Me Feel Uneasy. In a few instances, I found Apple could improve trust in Lockdown Mode by removing a few features and notification that are not directly security and Lockdown Mode related. An implementation issue that presents a challenge is the recent modification to shared albums. Once, I attempted to accept a shared album from a family member, only to discover that activation of iCloud Photos was a requirement. Activating iCloud Photos has the effect of uploading one's entire photo library to iCloud. I was disinclined to undertake such an action due to personal reasons and the cost it would have caused. Similarly, I anticipate that many at-risk users might endorse my perspective. Perhaps they do not want all their private, potentially incriminating, photos stored in iCloud, especially given instances of leaks in the past. A prominent example is the leak of nude photos of multiple female celebrities in 2014 [49]. Another example are Siri's suggestions, which made me feel under surveillance:

> Got a Siri-suggestion about opening a specific note I accessed every evening. Although it's probably a very basic system, it freaked me out. So I deactivated it in the settings. (Sep 07, Journal)

A comparable situation occurred when I reinstalled Instagram and found that the system remembered my account, due to the information being stored in iCloud. Both occurrences made me feel watched and I can envision that an at-risk user might experience the same feelings. Despite their lack of malicious intent, both features could lead users to believe that their device is covertly monitoring and recording their actions. It could potentially make at-risk users feel uncomfortable. Especially affected could be those at-risk users who are inclined towards legitimate paranoia, due to being victims of high-intensity surveillance, or users who do not have a good understanding of technology.

5 DISCUSSION

5.1 Visibility of Protection: Too Much and Too Little At the Same Time

Our autoethnographic study of Apple's Lockdown Mode in iOS sheds light on significant gaps in information disclosure by the company, particularly concerning the specific features of Lockdown Mode and its threat model. The lack of clarity hindered the first author's ability to comprehensively assess the necessity of certain feature restrictions, and they identified gaps in protection in certain domains. Our discussions during our weekly meetings have led us to a critical realisation that Lockdown Mode primarily targets technical attacks from external sources, but provides limited defence against social attacks relying on user information disclosure. Furthermore, the first author's experiences have revealed a frustration triggered by an overflow of notifications, frequently attributed to suboptimal interactions between Lockdown Mode and other features. The introduction of new notification-intensive features in iOS 17, such as contact sharing, served to reinforce this perception. The notification overflow occasionally overwhelmed the first author, while at other times, a sense of vulnerability arose due to low visibility or the absence of meaningful changes in the system. The first author felt unprotected in these situations, highlighting the nuanced balance between technical constraints, visibility, or

lack thereof, and seamless usability. This study underscores the significance of transparency and user-centric design in security features. Like Distler et al. [21], who found that their users felt reassured by the mentioning of encryption in the user interface of a voting system, we think that overall explicit and calibrated visibility of the Lockdown Mode's presence, as implemented in Safari (see "Lockdown Enabled" indicator above address bar in Figure 4a), would have improved user experience in general. While there were times when the first author suffered from notification overflows, in other cases (see Section 4.5), the invisibility of protection did make the first author uneasy, as they had no sense of assurance whether they are currently protected. Here, a standardised, non-intrusive, yet visible assurance that Lockdown Mode is active would benefit users.

5.2 Intended Users and Threat Model

One of the most critical shortcomings of Lockdown Mode is the absence of an explicit statement about intended users and a comprehensive threat model. The statement provided by Apple on their website that Lockdown Mode is "an optional, extreme protection that's designed for the very few individuals who, because of who they are or what they do, might be personally targeted by some of the most sophisticated digital threats" [6] is very vague. It appears evident that Apple is referring to users who are deemed to be at risk. Nevertheless, as we elaborate in Section 2.1, the population of at-risk users is heterogeneous, and the precise definition of these users remains elusive.

It should be noted that Lockdown Mode primarily protects against technical attacks, not social attacks. This is, however, not apparent from Apple's description. The first author's reaction in Section 4.3 highlighted the lack of clarity on this issue. Providing explicit information about the covered functionalities, as well as those intentionally excluded, and the reasons behind these design choices, is vital for at-risk users to self-assess whether to use Lockdown Mode or not. Finding reasons for specific implementations was time-consuming for us and involved a lot of guesswork.

For instance, we only later understood the lack of restrictions on third-party messengers, which the first author complained about in Section 4.3. We first believed that the restrictions imposed by Lockdown Mode are likely intended for system apps because these apps have known vulnerabilities that attackers could exploit. For example, features like iMessage's link previews can enable zeroclick attacks with automated executions of malicious payloads. However, we now believe the focus on these apps is a result of their much higher level of permissions. This means that third-party apps are less appealing targets since they have a smaller attack surface, because they lack the privileged "entitlements" (i.e., permissions of the type "com.apple.private.*") [8] that system apps have. From this viewpoint, Apple's design choice seems logical, but it is difficult for users to fully understand the technical reasons behind it.

5.3 Improving Lockdown Mode

To enhance the effectiveness and user experience of Lockdown Mode, it is essential to consider several aspects for refinement.

Better Information Policy. We believe that one of the most important areas of improvement concerns Apple's information policy. One

aspect of this, as elaborated in Section 5.2, is missing explanation of the kind of users the Lockdown Mode is intended for, and the exact threat model. The users are first encouraged to use Lockdown Mode if they are at risk from "some of the most sophisticated digital threats", and then discouraged from activating the Lockdown Mode in the next sentence, because "[m]ost people are never targeted by attacks of this nature". So the users are expected to autonomously decide to which kind of users they belong to with very little information from Apple. This can be very tricky for non-tech-savvy users, to whom people who are likely to attract targeted attacks from governments and similar opponents may well belong.

This seems to be an instance of the information policy that is called "need-to-know' in the military context, which Adams and Sasse describe in their classical paper [2]: The users are provided with the absolute minimum of information about a security measure, because more information is deemed to facilitate attacks. They additionally call this approach "authoritarian" and show that badly informed users develop "wildly inaccurate" mental models of threats and security measures, which in turn undermines security. Later, Dodier-Lazaro et al. [22] call this approach "paternalistic": Security goals and measures are set by security experts without considering user values. Our 1-person-experience already shows that, apart from wanting to be technically safe, the users may value many other aspects, including but not limited to:

- Exact information on affected and non-affected features.
- · An understanding of principles behind the Lockdown Mode.
- Exact attribution of problems with apps to Lockdown Mode or not, because if a problem is not connected to Lockdown Mode, it can be solved by app developers.
- A standardised, non-intrusive, visible manifestation that Lockdown Mode is active.
- Being protected from accidental disclosures of valuable information, such as when automatically sharing the real name and photo via the contact sharing feature.
- Communicating without obstacles, which is still possible by using, e.g., Signal that is not restricted in Lockdown Mode, but not apparent from Apple's description.

This is a conceptional weakness of Lockdown Mode, which is independent of individual features. It is our contention that a more transparent information policy on the part of Apple would serve to empower at-risk users, enabling them to make well-informed decisions with regard to their security, and thus enhance the level of user acceptance by people who really would profit from Lockdown Mode.

More Control for Users. Blocking certain features can lead to several problems, as discussed in Section 4.3. While there is an option to exclude certain websites, there is no such option for iMessage or FaceTime. The restriction that only known contacts can call you can be circumvented by calling the other person first. However, it would be more convenient to have an option to exclude certain contacts from this restriction. Although the removal of hyperlinks in iMessage is annoying, the blocking of most file types is probably the biggest obstacle for users, as there is no way to exclude certain files or contacts. It is not even possible to know which file the user is restricted from opening, as the filename is also excluded. The only workaround suggested by iOS is to disable Lockdown Mode,

which defeats the purpose of security. Giving users a more granular level of control and allowing them to make specific exceptions to Lockdown Mode may improve the user experience. In situations where alternative secure options are available, iOS could also indicate these. This might help users avoid having to choose between staying in Lockdown Mode or turning it off completely.

Reducing Notification Load. As described in Section 4.4, the first author frequently encountered notifications, often related to the blocking of sharing functionality (contact sharing, destination sharing, family sharing). The first author found this annoying as most of these notifications were redundant. An improvement to the Lockdown Mode would be to redesign this system so that each type of notification (e.g., that a contact's photo and name are not shared) is only shown once and the user is only reminded occasionally that it is still in place. On the other hand, notifications such as warnings about adding websites to a whitelist or joining an insecure network seem to be designed to scare and bully users into submission, as criticised by Sasse [58], rather than helping them. It should also be possible for users to disable the above notifications, for example in a special section of the notifications or in the Lockdown Mode settings. By making the Lockdown Mode a smoother, less distracting experience, this measure could go a long way to improving user experience.

5.4 Methodological Learnings

The autoethnographic approach in this study facilitated a detailed exploration of the day-to-day usage of Lockdown Mode, offering an in-depth perspective that would have been difficult to achieve through a traditional user study. Therefore, similar to various prior studies covered in the literature review by Kaltenhauser et al. [36], we also come to the conclusion that autoethnography is a suitable method for exploring everyday scenarios and gaining a deeper understanding of the issues related to specific technologies.

The journaling process via a command-line script and proactively asked questions has certainly helped us to collect autoethnographic field notes in a simple and structured way. In hindsight, we believe that a traditional pen-and-paper approach would have been equally suitable, but would probably have required the first author to have more prior experience with autoethnography. Starting to create audio recordings and to transcribe them automatically at earlier stages of our study would have been beneficial. In retrospect, the first author deemed the conservation of experiences, thoughts and situational details via spoken (native) language easier than via exclusively written notes and potentially even more thorough. The weekly meetings with the research team and the interview with one co-author were valuable to deepen the first-order observations of the first author.

5.5 Limitations

The nature of autoethnography, being rooted in individual experiences, inherently limits the generalisability of the results to a broader population of users. The first author, not being an at-risk user, may have approached and interacted with Lockdown Mode differently than users facing more substantial security threats. Additionally, as a computer science student, the first author possessed an above-average understanding of technology, potentially influencing the perceptions and behaviours observed during the study. However, this may have allowed them to better understand the technical reasons behind different design decisions behind Lockdown Mode and to make better observations.

The objective of this study was not to conduct a comprehensive testing of all possible use cases, but rather to investigate the impact of Lockdown Mode on an individual. Given that each user, including the first author, has their own unique usage patterns, it was not feasible to include all possible apps and websites in the study. Moreover, we were unable to test features like Apple Cash and HomeKit due to Apple Cash only being available in the US [10] and a lack of personal smart home devices, respectively. As the first author did not possess any additional Apple products, such as a MacBook or an Apple Watch, it was not possible to examine the interaction between these devices and an iPhone in Lockdown Mode.

This study examined a snapshot of Lockdown Mode as shipped in the two recent major versions of iOS at the time of writing, but its features and capabilities may evolve with subsequent updates and advancements. Despite our findings on current issues regarding the user experience as well as conceptual matters, follow-up investigations of Lockdown Mode are therefore inevitable.

5.6 Future Work

Future work might explicitly focus on technical evaluations of Lockdown Mode. Tracing the past and future evolution of Lockdown Mode as a protective iOS feature through longitudinal studies could bring into view user needs and developer responses. Whether Lockdown Mode actually reaches its intended user group, and effectively delivers the kind of protection it promises, still needs to be thoroughly assessed. While direct involvement of at-risk users is desirable, all such efforts must always centre *their* needs and safety concerns [13]. As protagonists and beneficiaries of this line of research, at-risk users could share their reasoning for (non-)adoption and experiences of Lockdown Mode through interviews or in the form of diary studies. Research of this kind might benefit from cooperation with frontline organisations, such as the Electronic Frontier Foundation (EFF) and Citizen Lab.

6 CONCLUSION

We conducted an autoethnographic study of the everyday impact of Apple's Lockdown Mode in iOS 16/17. Our study identified problems in Apple's communication strategy and implementation of Lockdown Mode. The first author frequently questioned the inclusion or exclusion of certain features, which led to their decrease in trust in Lockdown Mode. Furthermore, at times, they were frustrated by the number of warnings, while at other times they felt unprotected because of the lack of perceptible changes.

Autoethnography was a valuable method for investigating the benefits and problems of Lockdown Mode in a natural setting. It allowed for an analysis beyond the purely technical implementation, providing a nuanced understanding of a user's experiences and perceptions, and thus valuable insights into possible improvements to Lockdown Mode. It is acknowledged that autoethnography involves subjective insights, and therefore, our study can only be seen as a first exploration of this topic. To gain a comprehensive understanding of the impact of Lockdown Mode on users, further research is required with participants from diverse backgrounds, especially real-life at-risk users.

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REFERENCES

- Line Kryger Aagaard, Toke Haunstrup Christensen, and Kirsten Gram-Hanssen. 2023. My smart home: an auto-ethnography of learning to live with smart technologies. *Personal and Ubiquitous Computing*, 27, 6, 2121–2131. DOI: 10.100 7/S00779-023-01725-0.
- [2] Anne Adams and Martina Angela Sasse. 1999. Users are not the enemy. Communications of the ACM, 42, 12, 40–46.
- [3] Tony E. Adams, Carolyn Ellis, and Stacy Holman Jones. 2017. Autoethnography. The International Encyclopedia of Communication Research Methods, 1–11. DOI: 10.1002/9781118901731.iecrm0011.
- [4] Martin R. Albrecht, Jorge Blasco, Rikke Bjerg Jensen, and Lenka Mareková. 2021. Collective Information Security in Large-Scale Urban Protests: the Case of Hong Kong. In 30th USENIX Security Symposium (USENIX Security '21), 3363– 3380.
- [5] Apple. 2024. About alternative app distribution in the European Union. (May 13, 2024). Retrieved Aug. 20, 2024 from https://web.archive.org/web/202408202309 46/https://support.apple.com/en-us/118110.
- [6] Apple. 2023. About Lockdown Mode. (Aug. 16, 2023). https://web.archive.org /web/20230816053100/https://support.apple.com/en-us/HT212650.
- [7] Apple. 2023. About Lockdown Mode. (Nov. 7, 2023). https://web.archive.org/w eb/20231107020829/https://support.apple.com/en-us/HT212650.
- [8] Apple. 2024. Documentation: Entitlements. (2024). Retrieved June 6, 2024 from https://developer.apple.com/documentation/bundleresources/entitlements.
- [9] Apple. 2023. Privacy: Features. (Dec. 11, 2023). https://web.archive.org/web/20 231211081936/https://www.apple.com/privacy/features/.
- [10] Apple. 2024. Set up and use Apple Cash in Wallet on iPhone. (May 31, 2024). Retrieved June 6, 2024 from https://support.apple.com/en-ph/guide/iphone/ip h385cf0980/ios.
- [11] Paulo Bala, Pedro Sanches, Vanessa Cesário, Sarah Leão, Catarina Rodrigues, Nuno Jardim Nunes, and Valentina Nisi. 2023. Towards Critical Heritage in the Wild: Analysing Discomfort through Collaborative Autoethnography. In CHI Conference on Human Factors in Computing Systems. ACM, 771:1–771:19. DOI: 10.1145/3544548.3581274.
- [12] Rosanna Bellini, Kevin Lee, Megan A. Brown, Jeremy Shaffer, Rasika Bhalerao, and Thomas Ristenpart. 2023. The Digital-Safety Risks of Financial Technologies for Survivors of Intimate Partner Violence. In 32nd USENIX Security Symposium (USENIX Security '23), 87–104.
- [13] Rosanna Bellini, Emily Tseng, Noel Warford, Alaa Daffalla, Tara Matthews, Sunny Consolvo, Jill Palzkill Woelfer, Patrick Gage Kelley, Michelle L. Mazurek, Dana Cuomo, Nicola Dell, and Thomas Ristenpart. 2023. SoK: Safer Digital-Safety Research Involving At-Risk Users. In *IEEE Symposium on Security and Privacy (SP)*, 71–71.
- [14] Maia J. Boyd, Jamar L. Sullivan Jr., Marshini Chetty, and Blase Ur. 2021. Understanding the Security and Privacy Advice Given to Black Lives Matter Protesters. In CHI Conference on Human Factors in Computing Systems. ACM, 549:1–549:18. DOI: 10.1145/3411764.3445061.
- [15] Si Chen, James M. Waller, Matthew Seita, Christian Vogler, Raja S. Kushalnagar, and Qi Wang. 2024. Towards Co-Creating Access and Inclusion: A Group Autoethnography on a Hearing Individual's Journey Towards Effective Communication in Mixed-Hearing Ability Higher Education Settings. In CHI Conference on Human Factors in Computing Systems. ACM, 55:1–55:14. DOI: 10.1145/3613904.3642017.
- [16] Cryptee. 2023. iOS Lockdown Mode Detection Test Proof of Concept. (2023). Retrieved June 6, 2024 from https://crypt.ee/ios-lockdown-mode-test.

- [17] Carter Dack. 2023. Pegasus: A Technical Look at Highly Advanced Mobile Spyware. (2023). Retrieved June 6, 2024 from https://www.carterdack.com/Peg asus/Pegasus.html.
- [18] Alaa Daffalla, Lucy Simko, Tadayoshi Kohno, and Alexandru G. Bardas. 2021. Defensive Technology Use by Political Activists During the Sudanese Revolution. In IEEE Symposium on Security and Privacy (SP), 372–390.
- [19] Piet De Koning, Lenneke Kuijer, and Joep Frens. 2023. A Sensory Autoethnography of Energy Practices in the Home: An Exploration of Combining Smart Meter Data with Situated accounts of What Energy is For. In *Extended Abstracts* of the CHI Conference on Human Factors in Computing Systems. ACM, 13:1–13:7. DOI: 10.1145/3544549.3585710.
- [20] Philip Di Salvo. 2021. We Have to act Like our Devices are Already Infected: Investigative Journalists and Internet Surveillance. *Journalism Practice*, 1849– 1866.
- [21] Verena Distler, Marie-Laure Zollinger, Carine Lallemand, Peter B. Roenne, Peter YA Ryan, and Vincent Koenig. 2019. Security-visible, yet unseen? In CHI Conference on Human Factors in Computing Systems, 1–13.
- [22] Steve Dodier-Lazaro, Ruba Abu-Salma, Ingolf Becker, and M Angela Sasse. 2017. From paternalistic to user-centred security: putting users first with valuesensitive design. In CHI 2017 Workshop on Values in Computing. Values In Computing.
- [23] Dennis Eckhardt. 2023. Ethnografisches Feldnotieren in digitalen Feldern: Perspektiven einer Wissens-und Arbeitspraxis. Kulturanthropologie Notizen, 85, 52–77.
- [24] Carolyn Ellis. 2004. The ethnographic I: A methodological novel about autoethnography. Vol. 13. Rowman Altamira.
- [25] Carolyn Ellis, Tony E. Adams, and Arthur P. Bochner. 2011. Autoethnography: An Overview. Historical Social Research / Historische Sozialforschung, 36, 4 (138), 273–290.
- [26] Matthias Fassl and Katharina Krombholz. 2023. Why I Can't Authenticate - Understanding the Low Adoption of Authentication Ceremonies with Autoethnography. In CHI Conference on Human Factors in Computing Systems. ACM, 72:1–72:15. DOI: 10.1145/3544548.3581508.
- [27] Gartner. 2023. Number of Smartphones Sold to End Users Worldwide from 2007 to 2023. (Jan. 2023). Retrieved June 6, 2024 from https://www.statista.com /statistics/263437/.
- [28] William Gaver and Frances Gaver. 2023. Living with Light Touch: An Autoethnography of a Simple Communication Device in Long-Term Use. In CHI Conference on Human Factors in Computing Systems. ACM, 633:1–633:14. DOI: 10.1145/3544548.3580807.
- [29] Luis Gomez-Miralles and Joan Arnedo-Moreno. 2015. Lockup: A Software Tool to Harden iOS by Disabling Default Lockdown Services. In 10th International Conference on P2P, Parallel, Grid, Cloud and Internet Computing (3PGCIC). IEEE, 718–723. DOI: 10.1109/3PGCIC.2015.57.
- [30] Dan Goodin. 2022. Got Attack Surface? Why Lockdown mode from Apple is one of the coolest security ideas ever. (July 7, 2022). Retrieved June 6, 2024 from https://arstechnica.com/information-technology/2022/07/introducing-l ockdown-from-apple-the-coolest-defense-youll-probably-never-use/.
- [31] Hacker News. 2022. About Lockdown Mode. (Sept. 14, 2022). Retrieved June 6, 2024 from https://news.ycombinator.com/item?id=32842749.
- [32] Franziska Herbert, Steffen Becker, Annalina Buckmann, Marvin Kowalewski, Jonas Hielscher, Yasemin Acar, Markus Dürmuth, Yixin Zou, and M. Angela Sasse. 2024. Digital Security – A Question of Perspective: A Large-Scale Telephone Survey with Four At-Risk User Groups. In *IEEE Symposium on Security* and Privacy (SP), 1–27.
- [33] Christine Hine. 2020. Strategies for reflexive ethnography in the smart home: Autoethnography of silence and emotion. *Sociology*, 54, 1, 22–36.
- [34] Sarah Homewood. 2023. Self-Tracking to Do Less: An Autoethnography of Long COVID That Informs the Design of Pacing Technologies. In CHI Conference on Human Factors in Computing Systems. ACM, 656:1–656:14. DOI: 10.1145/354454 8.3581505.
- [35] Jamf Threat Labs. 2023. Fake Lockdown Mode: A post-exploitation tampering technique. (Dec. 5, 2023). Retrieved June 6, 2024 from https://www.jamf.com/b log/fake-lockdown-mode/.
- [36] Annika Kaltenhauser, Evropi Stefanidi, and Johannes Schöning. 2024. Playing with Perspectives and Unveiling the Autoethnographic Kaleidoscope in HCI - A Literature Review of Autoethnographies. In CHI Conference on Human Factors in Computing Systems. ACM, 819:1–819:20. DOI: 10.1145/3613904.3642355.
- [37] Makayla Lewis, Miriam Sturdee, Mafalda Gamboa, and Denise Lengyel. 2023. Doodle Away: An Autoethnographic Exploration of Doodling as a Strategy for Self-Control Strength in Online Spaces. In Extended Abstracts of the CHI Conference on Human Factors in Computing Systems. ACM, 414:1–414:13. DOI: 10.1145/3544549.3582747.
- [38] Priscilla Y. Lo. 2024. An Autoethnographic Reflection of Prompting a Custom GPT Based on Oneself. In Extended Abstracts of the CHI Conference on Human Factors in Computing Systems. ACM, 40:1–40:9. DOI: 10.1145/3613905.3651096.

- [39] Bill Marczak. 2023. Triangulation: Did the NSA fail to learn the lessons of NSO? (June 3, 2023). Retrieved June 6, 2024 from https://medium.com/@billmarczak /triangulation-did-the-nsa-fail-to-learn-the-lessons-of-nso-5f36d251d02e.
- [40] Bill Marczak, John Scott-Railton, Bahr Abdul Razzak, and Ron Deibert. 2023. Triple Threat: NSO Group's Pegasus Spyware Returns in 2022 with a Trio of iOS 15 and iOS 16 Zero-Click Exploit Chains. (Apr. 18, 2023). Retrieved June 6, 2024 from https://citizenlab.ca/2023/04/nso-groups-pegasus-spyware-returnsin-2022/.
- [41] Allison McDonald, Catherine Barwulor, Michelle L. Mazurek, Florian Schaub, and Elissa M. Redmiles. 2021. It's stressful having all these phones: Investigating Sex Workers' Safety Goals, Risks, and Practices Online. In 30th USENIX Security Symposium (USENIX Security '21), 375–392.
- [42] Susan E. McGregor, Polina Charters, Tobin Holliday, and Franziska Roesner. 2015. Investigating the Computer Security Practices and Needs of Journalists. In 24th USENIX Security Symposium (USENIX Security '15), 399–414.
- [43] Susan E. McGregor, Elizabeth Anne Watkins, Mahdi Nasrullah Al-Ameen, Kelly Caine, and Franziska Roesner. 2017. When the Weakest Link is Strong: Secure Collaboration in the Case of the Panama Papers. In 26th USENIX Security Symposium (USENIX Security '17), 505–522.
- [44] Shishir Nagaraja and Ross Anderson. 2009. The snooping dragon: socialmalware surveillance of the Tibetan movement. Tech. rep. University of Cambridge, Computer Laboratory.
- [45] Lily Hay Newman. 2024. What It's Like to Use Apple's Lockdown Mode. (Jan. 2, 2024). Retrieved June 6, 2024 from https://www.wired.com/story/apple-lockdo wn-mode-hands-on/.
- [46] Steve North. 2019. Imaginary Studies: A Science Fiction Autoethnography Concerning the Design, Implementation and Evaluation of a Fictional Quantitative Study to Evaluate the Umamimi Robotic Horse Ears. In Extended Abstracts of the CHI Conference on Human Factors in Computing Systems. ACM, 3:1–3:11. DOI: 10.1145/3290607.3310428.
- [47] Aisling Ann O'Kane, Yvonne Rogers, and Ann E. Blandford. 2014. Gaining Empathy for Non-Routine Mobile Device Use Through Autoethnography. In Conference on Human Factors in Computing Systems. ACM, 987–990. DOI: 10.11 45/2556288.2557179.
- [48] OpenAI. 2023. Whisper. (2023). Retrieved June 6, 2024 from https://github.com /openai/whisper.
- [49] Andrea Peterson, Emily Yahr, and Joby Warrick. 2014. Leaks of nude celebrity photos raise concerns about security of the cloud, (Sept. 1, 2014). Retrieved June 6, 2024 from https://www.washingtonpost.com/59dcd37e-3219-11e4-8f02 -03c644b2d7d0_story.html.
- [50] Petri IT Knowledgebase. 2022. Apple iOS 16 Lockdown Mode Boosts Security But It Comes at a Price. (July 13, 2022). Retrieved June 6, 2024 from https://ww w.youtube.com/watch?v=I0uwWZyPUsk.
- [51] Privacy Guides. 2023. Apple's Lockdown Mode is nothing special. (Dec. 20, 2023). Retrieved June 6, 2024 from https://discuss.privacyguides.net/t/15743/1.
- [52] Alec Radford, Jong Wook Kim, Tao Xu, Greg Brockman, Christine McLeavey, and Ilya Sutskever. 2022. Robust Speech Recognition via Large-Scale Weak Supervision. en, (Sept. 2022). Retrieved Sept. 11, 2024 from https://cdn.openai.c om/papers/whisper.pdf.
- [53] Reddit. 2022. Review of lockdown mode. (Sept. 21, 2022). Retrieved June 6, 2024 from https://www.reddit.com/r/ios/comments/xjushk/review_of_lockdown_m ode/.
- [54] Thomas Reisinger, Isabel Wagner, and Eerke Albert Boiten. 2023. Unified Communication: What do Digital Activists need? In IEEE European Symposium on Security and Privacy Workshops (EuroS&PW), 141–149. DOI: 10.1109/EUROS PW59978.2023.00021.
- [55] Reuters. 2024. Apple drops term 'state-sponsored' attacks from its threat notification policy. (Apr. 11, 2024). Retrieved June 6, 2024 from https://www.reuter s.com/technology/cybersecurity/apple-warns-users-mercenary-spyware-att ack-91-countries-including-india-et-2024-04-11/.
- [56] Rene Ritchie. 2022. Lockdown Mode comes to iOS 16! (July 6, 2022). https://w ww.youtube.com/watch?v=JycrqFbahkc.
- [57] Patrawat Samermit, Anna Turner, Patrick Gage Kelley, Tara Matthews, Vanessia Wu, Sunny Consolvo, and Kurt Thomas. 2023. Millions of people are watching you: Understanding the Digital-Safety Needs and Practices of Creators. In 32nd USENIX Security Symposium (USENIX Security '23), 5629–5645.
- [58] Angela Sasse. 2015. Scaring and Bullying People into Security Won't Work. IEEE Security & Privacy, 13, 3, 80–83. DOI: 10.1109/MSP.2015.65.
- [59] John Scott-Railton. 2016. Security for the High-Risk User: Separate and Unequal. IEEE Security & Privacy, 14, 2, 79–87. DOI: 10.1109/MSP.2016.22.
- [60] Lucy Simko, Ada Lerner, Samia Ibtasam, Franziska Roesner, and Tadayoshi Kohno. 2018. Computer Security and Privacy for Refugees in the United States. In *IEEE Symposium on Security and Privacy (SP)*, 409–423. DOI: 10.1109/SP.2018 .00023.
- [61] Julia Slupska and Megan Lindsay Brown. 2022. Aiding Intimate Violence Survivors in Lockdown: Lessons about Digital Security in the Covid-19 Pandemic. In Extended Abstracts of the CHI Conference on Human Factors in Computing Systems. ACM, 1–5. DOI: 10.1145/3491101.3503548.

- [62] Julia Slupska and Leonie Maria Tanczer. 2021. Threat Modeling Intimate Partner Violence: Tech Abuse as a Cybersecurity Challenge in the Internet of Things. In *The Emerald International Handbook of Technology-Facilitated Violence and Abuse*. Emerald Publishing Ltd. DOI: 10.1108/978-1-83982-848-520211049.
- [63] StatCounter. 2024. Percentage of Mobile Device Website Traffic Worldwide from 1st Quarter 2015 to 4th Quarter 2023. (Jan. 2024). Retrieved June 6, 2024 from https://www.statista.com/statistics/277125/.
- [64] Statista. 2023. Global Mobile Device Market Share in 2017 and 2022 by Shipments of Device Type. (Feb. 2023). Retrieved June 6, 2024 from https://www.st atista.com/statistics/183530/.
- [65] Leonie Maria Tanczer, Ronald J. Deibert, Didier Bigo, MI Franklin, Lucas Melgaço, David Lyon, Becky Kazansky, and Stefania Milan. 2020. Online Surveillance, Censorship, and Encryption in Academia. *International Studies Perspectives*, 21, 1, 1–36. DOI: 10.1093/isp/ekz016.
- [66] Techlore. 2023. I Used Apple's Lockdown Mode So You Don't Have To. (Jan. 11, 2023). Retrieved June 6, 2024 from https://www.youtube.com/watch?v=ENu GWhz10UY.
- [67] Lokman Tsui and Francis Lee. 2021. How journalists understand the threats and opportunities of new technologies: a study of security mind-sets and its implications for press freedom. *Journalism*, 22, 6, 1317–1339. DOI: 10.1177/1464 884919849418.
- [68] Sarah Turner, Jason RC Nurse, and Shujun Li. 2022. It was hard to find the words: Using an Autoethnographic Diary Study to Understand the Difficulties of Smart Home Cyber Security Practices. In Extended Abstracts of the CHI Conference on Human Factors in Computing Systems. ACM, 34:1–34:8. DOI: 10.1145/3491101.3503577.
- [69] Jaakko Väkevä, Elisa D. Mekler, and Janne Lindqvist. 2024. From Disorientation to Harmony: Autoethnographic Insights into Transformative Videogame Experiences. In CHI Conference on Human Factors in Computing Systems. ACM, 808:1–808:20. DOI: 10.1145/3613904.3642543.
- [70] Noel Warford, Tara Matthews, Kaitlyn Yang, Omer Akgul, Sunny Consolvo, Patrick Gage Kelley, Nathan Malkin, Michelle L. Mazurek, Manya Sleeper, and Kurt Thomas. 2022. SoK: A Framework for Unifying At-Risk User Research. In IEEE Symposium on Security and Privacy (SP), 2344–2360. DOI: 10.1109/SP46214 .2022.9833643.
- [71] Zack Whittaker. 2022. Hands-on with Lockdown Mode in iOS 16. (Aug. 12, 2022). Retrieved June 6, 2024 from https://techcrunch.com/2022/08/12/apple-lo ckdown-mode-ios-16/.
- [72] Shaomei Wu, Jingjin Li, and Gilly Leshed. 2024. Finding My Voice over Zoom: An Autoethnography of Videoconferencing Experience for a Person Who Stutters. In CHI Conference on Human Factors in Computing Systems. ACM, 916:1–916:16. DOI: 10.1145/3613904.3642746.

A CLUSTERING OF AUDIO RECORDINGS ABOUT JOURNAL ENTRIES

Figure 6 shows the visual structure of the clustering process described in Section 3.4: The bottom row represents individual audio recordings corresponding to noteworthy journal entries, the middle row shows the connecting themes that emerged from the coding of the bottom row, and the top row shows the final overarching themes which led to the topics presented in Section 4:

- "Communication" resulted in "Navigating Apple's Information Void" (Section 4.2),
- "Security vs. Usability" resulted in "Encounters with Mysterious Design Choices" (Section 4.3),
- "Attention vs. Invisibility" resulted in "Notification Overflow" (Section 4.4), and
- "Expectation vs. Experience" resulted in "Tension Between Expectation and Experience" (Section 4.5).

B TESTING OF LOCKDOWN MODE RELATED FEATURES

Table 2 presents a list of features impacted by Lockdown Mode that were covered during the study, either because they were advertised by Apple [6, 7] or because they were encountered during the study and deemed relevant. The list was compiled in preparation for the

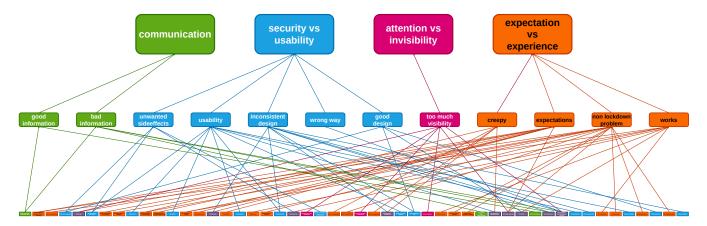


Figure 6: Visualisation of the clustering process of audio recordings regarding journal entries.

Table 2: List of specific iOS features covered during our autoethnographic study of using Lockdown Mode

Features	Coverage
AirDrop	covered
AirPlay	covered
AirPods	covered
Attachments (iMessage)	covered
Bluetooth	covered
Configuration profiles	covered
Contact sharing	covered
Destination sharing	covered
Device connections	covered
FaceTime	covered
Family sharing	covered
FindMy	covered
iMessage	covered
Insecure network	covered
Links (iMessage)	covered
Metadata (photos)	covered
Photo classification (search function)	covered
Shared Albums	covered
SMS	covered
Web browsing	covered
Whitelist (web browsing)	covered
Wi-Fi hotspot	covered
2G networks	not covered ^a
3rd party App Store	not covered ^b
Apple Cash	not covered ^o
HomeKit (Apple Services)	not covered ⁶

^a Uncertain whether fallback to 2G ever occurred
 ^b Not available during study period, only available since iOS 17.4 [5]
 ^c Only available in the US [10]

^d Necessary smart home devices not available

autoethnographic phases and subsequently updated throughout the course of the study.