

Lisa Rogers' Thesis Defense

# User's Perceptions of Data Ownership, Data Storage, and Their Locus of Control Over Data Generated by Smartphone Applications



“I would much prefer my whole house to have been invaded. That's what's so scary about electronic [things]. I have such fear with my phone and my computer and electronics. It's taking somebody's intellectual property but also my body. It was violating on a sexual level.”

– Jennifer Lawrence

In an interview regarding The Fappening when nude photos from her iCloud she thought she had deleted were leaked (Winfrey 2017)



## Related Work

# Prior work around data ownership has shown...

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- Non technical users have very little knowledge of how the internet works beyond the surface entities and companies they interact with (Kang et al 2015)
- Users are emotionally invested in their digital possessions, but had concerns around not being able to easily know what they own and where they are (Odom et al 2012)
- Regret messages and posts that were critical of others or reached a larger than intended audience (Sleeper et al 2013)
- Aren't quite certain if they have successfully deleted something or not (Ramokapane, Rashid & Such 2017)
- Didn't know how much information was actually being collected by applications (Weinshel et al 2019)

How does cloud storage / backup / otherwise non-local content affect people's knowledge of and ability to control and delete their phone/app data?



## RQ1

What do mobile phone users know about how and where their phone/app data is stored?

How does cloud storage / backup / otherwise non-local content affect people's knowledge of and ability to control and delete their phone/app data?



**RQ1**

What do mobile phone users know about how and where their phone/app data is stored?



**RQ2**

What do mobile phone users know about phone/app data recovery processes?



How does cloud storage / backup / otherwise non-local content affect people's knowledge of and ability to control and delete their phone/app data?



**RQ1**

What do mobile phone users know about how and where their phone/app data is stored?



**RQ2**

What do mobile phone users know about phone/app data recovery processes?



**RQ3**

What do mobile phone users know about data deletion processes on their device?



How does cloud storage / backup / otherwise non-local content affect people's knowledge of and ability to control and delete their phone/app data?



**RQ1**

What do mobile phone users know about how and where their phone/app data is stored?



**RQ2**

What do mobile phone users know about phone/app data recovery processes?



**RQ3**

What do mobile phone users know about data deletion processes on their device?



**RQ4**

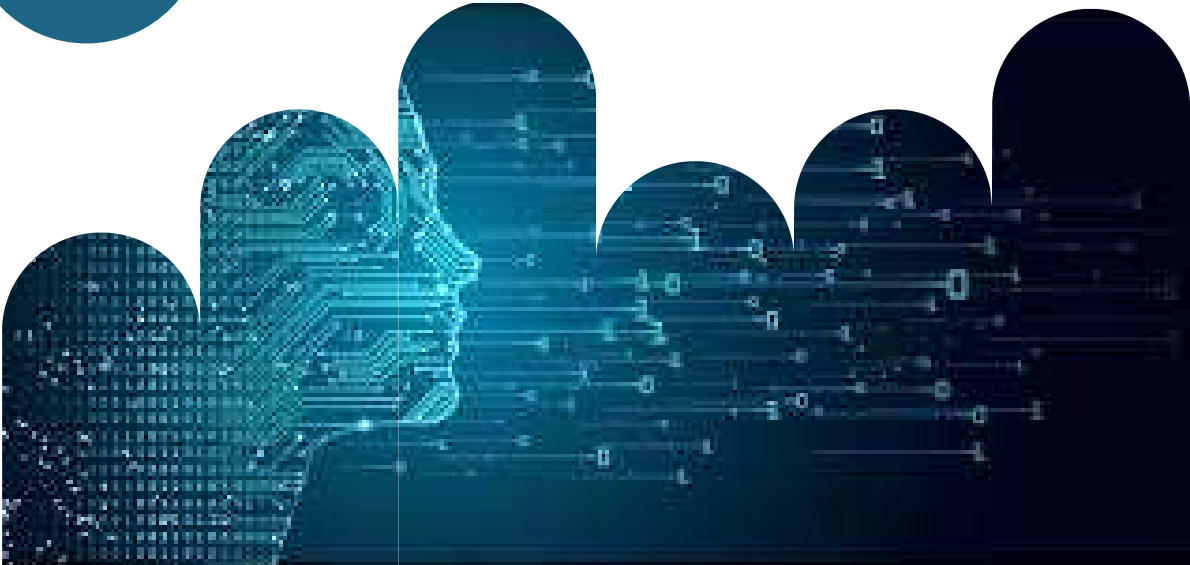
What do mobile users think companies are doing with their data and what do they think they can do about it?

# Methods

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## Recruitment

Used: Craigslist, Nextdoor,  
Signage at Local restaurants



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## Interviews

Semi-Structured Interview

Averaged 75 mins



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Averaged 75 mins



## Analysis

Recursive Open Coding

Qualitative



# Interview Structure

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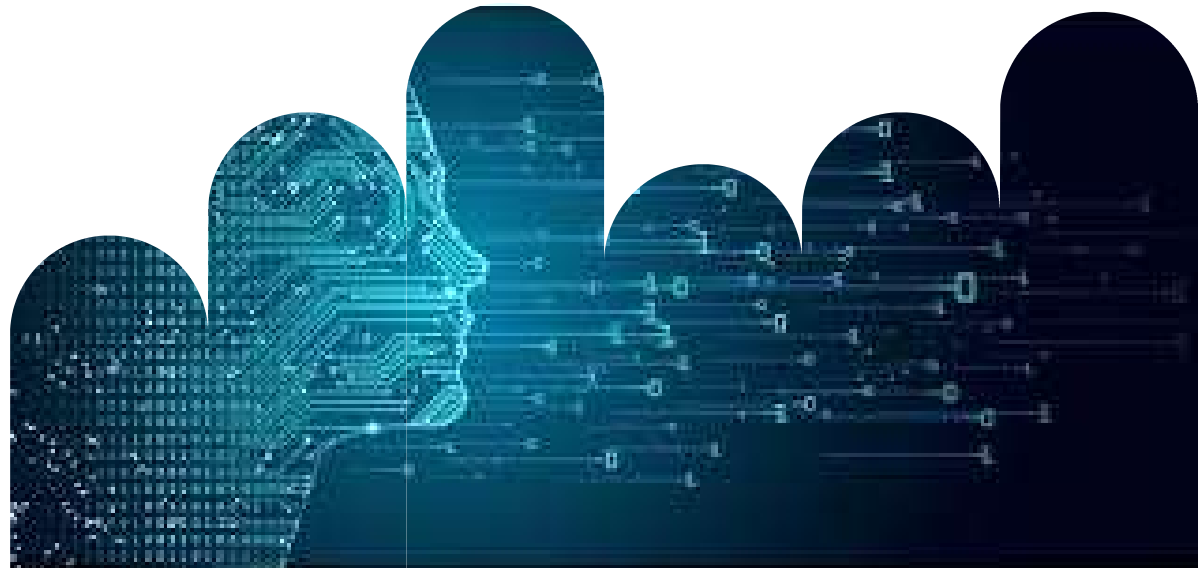
1. Introduction
2. Applications on their phone
3. Recovery
4. Content Deletion
5. Application Deletion
6. Data Access and Control
7. Privacy
8. Conclusion



# Limitations

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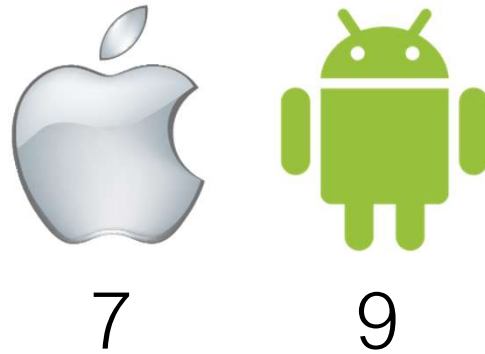
- 1 coder
- \$15 incentive
- Not geographically diverse
- Qualitative - no measure of prevalence



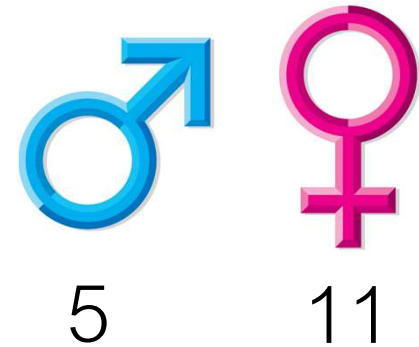
# Demographics

16 Participants...

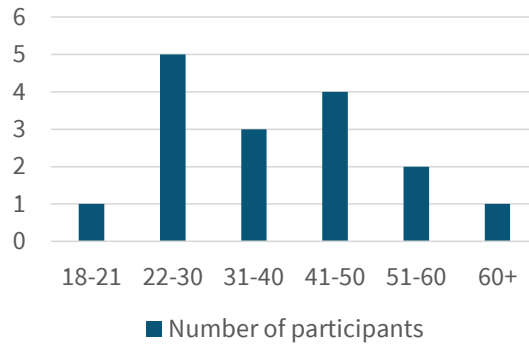
### By OS



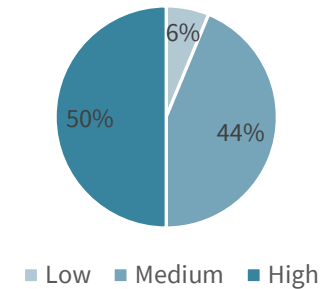
### By Gender



### By Age



### By Self Reported Usage



“I still don’t understand the cloud. You see, the cloud is supposed to be your backup storage. From what I understand. It’s supposed to free up space on any device. So you have all of this information floating around in the air, right, and it’s supposed to be free. So, the storage part of air, I really don’t think there’s any sections that say this is private, this is shared, this is semi-private, in the cloud, it's just how you direct it. So when you say “where in the cloud”, I have no idea of where in the cloud. I just know it’s not shared.”

-P6



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# Detailed Findings

# Where Does Data Live?

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RQ1: What do mobile phone users know about how and where their phone/app data is stored?



“Yeah, and I can’t figure out that cloud situation. Like I don’t know what is going on. I don’t really know what goes into the cloud and what doesn’t.”  
(P16).

## Where my data lives table

Where the data lives	Number of participants who brought this up (N = 16)
On their phone (physical storage)	12
On a company's server/mainframe	11
In a company's database	8
At Google/ On a Google Account	6
The Sim Card	5
"In the app" (app as a location)	5
Other people's phones (awareness of multiple independent files once shared)	5
On their computer	4 (3 because of centralized storage, 1 because of physical device transfer/backup)
In a cell tower	2
The website of the app they are on	2

“With the digital waves, somehow or another I don’t understand how, you can save data where, instead of it being in the repository on your phone in the app, it will save it in the cloud. So anytime you log in, it pulls all of your information.” (p6).

## If it has a login... I can access my data anywhere

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“

I'm very confident that I could recover the information from the applications from a number of them, partly because the application on the phone itself isn't doing a lot, the main thing I have to remember to do is load them. The ones I couldn't would be ones storing more stuff on the phone itself.

(P15)

”

Logins (unprompted)...

- Give me confidence I can recover my data from a new phone (8)
- Mean I can have the same experience on any device I log into (3)

## Storage Theme 2

### The phone is a portal apps live on

- Five of the 16 participants cited their information living “in the app” itself.
- Talked about different access points could reach information from (centralized storage) when pressed to define what “in the app” meant

**“My profile is stored in the app somewhere.** The suggested destinations are coming from the app itself. It's coming **actually from my phone, from the app,** from the uber app. **It's stored in the uber app. It's not stored in the phone,** because this is the uber app we're talking about. **The uber app is on the phone,** because I downloaded that app on my phone. **And it also is connected...** Which is the weirdest thing about uber. So, I can go on my laptop, I can go on my iPad, and look at it. But if I want to order, order the service, you have to do that from your cell phone.” (P6)



## Native apps store data to my physical device

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Native applications to the operating system were believed to behave differently from other applications. Both in where data lives and recovery.

Reasons why participants believed this

- These services existed before smartphone applications
- Come pre-installed with phone
- Past experiences recovering information on the phone

“My text conversations. When I renew my phone usually they don’t come back up. My phone history, so like if I got a phone call from someone important and never saved their number. That is gone.” (P3).

“But if it’s just something loose, you know on your own phone, it is your responsibility to back it up. Like texting would be loose.” (P2).

## The Cloud is well known but poorly understood

Confuses users:

- What is backed up
- How to control what is being backed up
- Where it is stored

iPhone users had a more robust mental model than Android users.

“I suppose if I slowed down, I could disengage that ‘cause I hate the cloud! It’s the idea of the intrusion on my personal information by some nebulous corporation, the government; whoever... So I do not really care for the whole automated. I’m not truly convinced the cloud is truly secure.” (P10).





# Data Recovery

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RQ2: What do mobile phone users know about phone/app data recovery processes?

“I’m very confident that I could recover the information from the applications from a number of them, partly because the application on the phone itself isn’t doing a lot, the main thing I have to remember to do is load them. The ones I couldn’t would be ones storing more stuff on the phone itself.” (P15).

## I can use my computer to help my old and new phone talk

Four mentioned using their computer as an intermediary when recovering their data

- All iPhone or Former iPhone users
- Cited as especially important when switching between iPhone and Android
- 2/4 also mentioned using this method to delete

“You might be able to like, I guess you could download them like some kind of Excel or CSV I don’t know what they are actually, but I think you could download another format and then try to upload it but I don’t know how that would work.” (P7).



## Recovering data from the physical device would be difficult

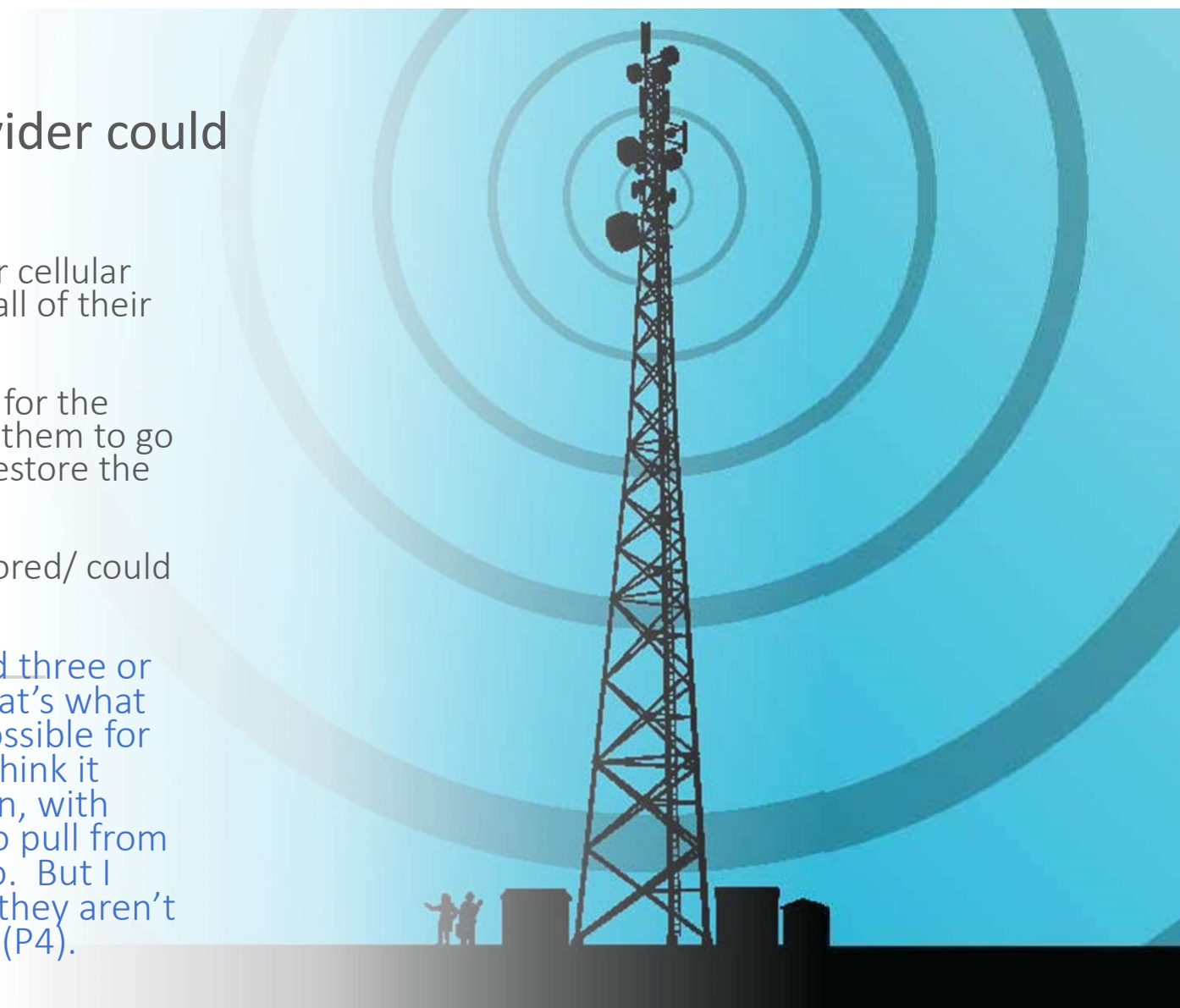
- Difficult even if in possession of a fully functional device. Last resort only if data wasn't recoverable any other way
- Any physical damage substantially increase cost and effort needed
- Only about a third (6) of participants even mentioned the phone as a place data could be recovered from. Two-thirds (12) mentioned it as a place data lived

“Depending on how damaged the phone was, but I think they would be able to somehow. But it would cost a lot.” (P11)

## My cellular service provider could help me recover data...

- 6/16 participants believed their cellular service provider could restore all of their lost data
- Consensus it would be difficult for the average consumer to convince them to go through the effort needed to restore the data
- 2/16 thought their data was stored/ could be recovered from a cell tower

“I’m thinking everything is stored three or four times in different places. That’s what T-Mobile claims, so I think it’s possible for it, it’s not that it’s really, I don’t think it disappears forever, because again, with Law Enforcement, they’re able to pull from somewhere if they really need to. But I think for us, common you and I, they aren’t going to go through that effort.” (P4).



## If I put in the SIM card I can recover a lot my phone's data

- 5/16 participants thought they could restore a substantial amount of their data from their SIM card.
- Also something they need to worry about if it gets into the wrong hands.

“Basically, almost everything gets saved to the sim card. When I say everything, it's like you're, because the phone number and everything is attached to the sim card. So anything dealing with that phone number - your security preferences, your storage, and everything like that, is on the sim card... even though the majority of your apps are on the expansion card, you have some apps that are on the expansion card. And photos are on the expansion card.” (P6).



## I don't know what is actually backed up



Participants didn't know what was backed up or not until they had to recover data

Of the 6 participants who had experience losing their phone, 3 of them weren't able to recover nearly as much as they expected.

None of our participants were motivated to go beyond calling the phone company to recover data

“At first I was pretty upset but then I said ‘everything happens for a reason’ so it’s ok. I’m just going to try different concrete methods of keeping my information and scheduling different things like that, since it’s so important. We can never tell what’s going to happen with the phone that you’re going to lose something important.” (P11)

## Reverting to physical backup methods

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- Half (3) of the participants who had experience losing a phone (6) mentioned reverting back to having physical paper backups of their data or using a low tech method to recover lost data
- In total (6/16)
  - 2 Mentioned re-adoption of physical backup
  - 5 Mentioned re-adoption of low tech recovery
  - 1 overlap who did both

“You know, especially now I’m in the process of my summer project of going back to an old fashioned Rolodex. Because if you're going to use address books any more, people ain’t going to remember a number. So I’m going back, as a backup, I’m going back to a Rolodex.” (P6).

“I could recover my contact information just like finding family members and stuff. Maybe like a note file on the cloud, but I’d probably write it down. That’s probably the easiest way. People that already are around would be easier, but people who moved away, like farther away would probably be hard. Like people that I don’t see in the area that’s probably the hardest thing.” (P1).

# Data Retention

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RQ5: What do mobile users think companies are doing with their data and what do they think they can do about it?



# How Long Do Companies Keep Data?



*“They must delete it on a regular basis, you know, because otherwise they really couldn’t function I don’t think. Like I think it would have to be about the day after you deleted it.” (P2)*

## **Most common responses:**

- At least 1 year (3)
- At least 10 years (3)
- Participant responses not held firmly – range varied wildly

# Company servers are like my home computer – they have to delete regularly

Participants believed company data storage...

- Located at company HQ (11/16)
- Space concerns – delete regularly
- UI like home computer - search button, home file structures, and other home computing UI

“Like if they have like, this is a **computer screen**, they could search me up if they wanted to. They have some **search button** and then... they find me, and they click on me. They open like another **new window** again, and it’s just me and my information stuff. And that’s it” (P14)



# Companies keep data for a long time in case a third party requests it

Reasons companies keep data

- A third party, such as law enforcement, requests it
- A user rejoins the service
  - Restore their account

“I don’t think it (my data) disappears forever, because again, with law enforcement, they are able to pull from somewhere if they really need to.” (P4).



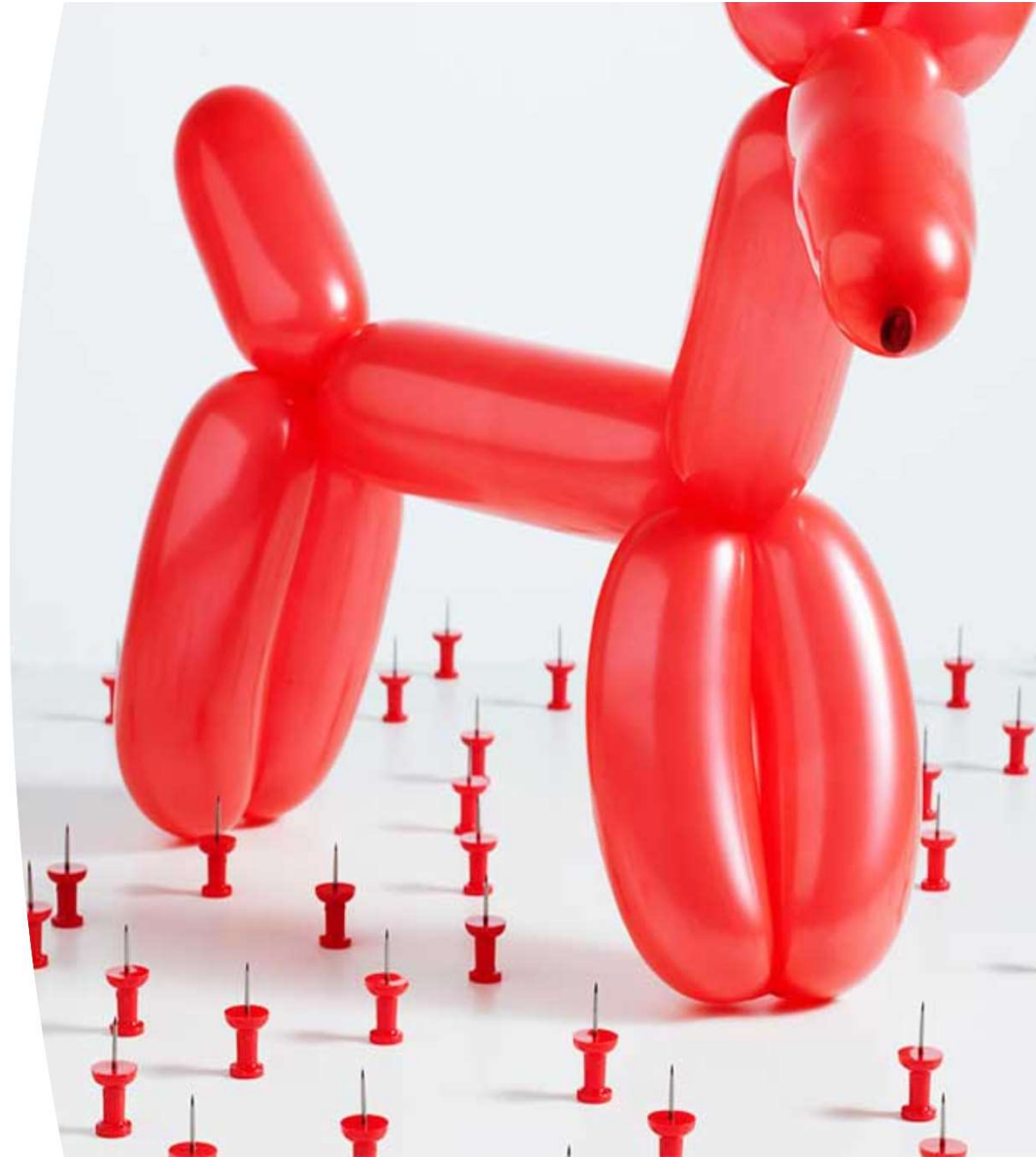
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## I know companies share data because of targeted ads

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12/16 Participants mentioned information sharing between companies unprompted

“Mostly it’s annoying with the marketing stuff like the ads and that kind of thing. Especially if they’re like making money off of like selling that data. I mean, I guess it’s kind of expected at some point.” (P7).



# Google is Omniscient

Nearly half (7) of users brought up on their own that Google has some or all of the information on their phone in their database

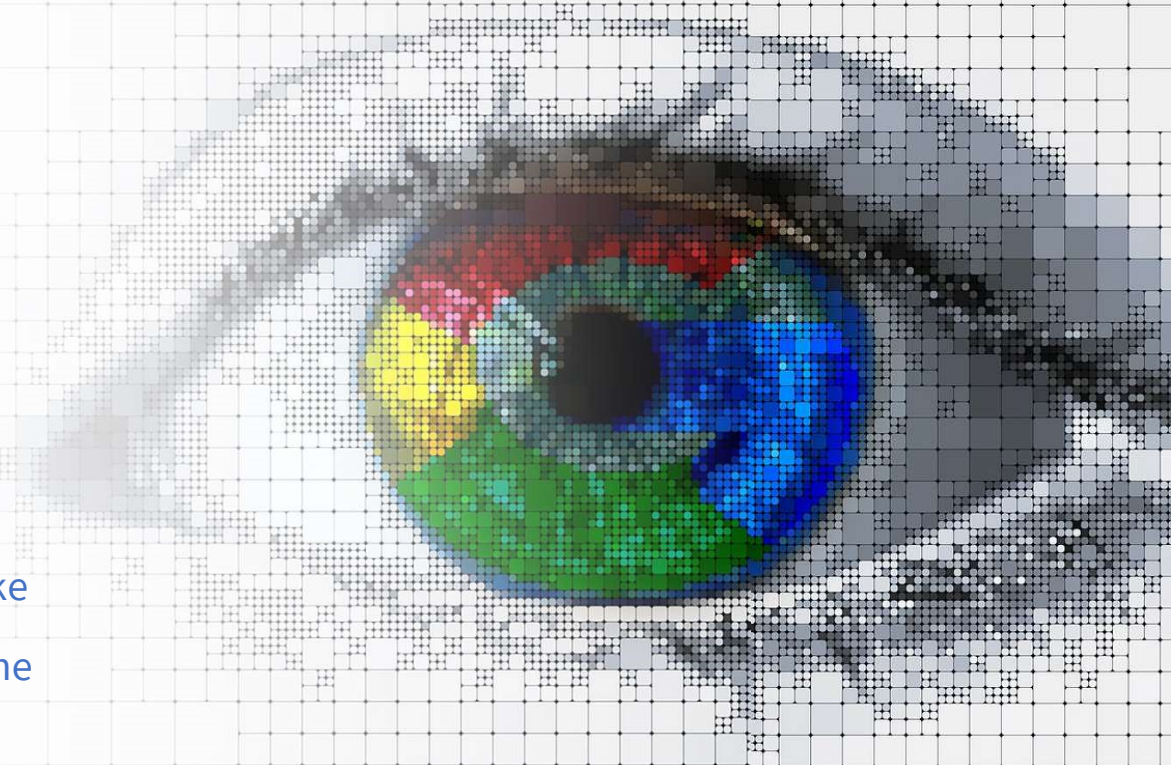
Greater sense of privacy resignation than with other companies mentioned

“I think the vast majority of data used by regular everyday people passes through Google.’ (P10).

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“Can access my data... I mean I would assume like any of the companies, so like Apple if like, **even I didn't give them my consent**, they can access the stuff. And Google. I think they're, they have the ability to do it, whether they do it without your permission is another thing.” (P7).

“I don't know why they connect my phone with Google”



# Deletion

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RQ3: What do mobile phone users know about data deletion processes on their device?



“When somebody got your information they can tell you I shredded it... but they never shred it. Once information is stored in the cloud, it is stored forever. Of course. They never delete anything.” (p13).

# How to permanently delete data – deletion themes

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1. You can never delete it (5)

“If it’s on the internet, it’s never really going away. But that’s how you can deal with it.” (p5).

## How to permanently delete data – deletion themes

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1. You can never delete it (5)
2. You can delete your account (2)

“It was easy for me, I mean my husband just deleted my account. I guess he had to choose some different settings where they delete all the comments and stuff.” (P11)

## How to permanently delete data – deletion themes

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1. You can never delete it (5)
2. You can delete your account (2)
3. You can send it to your computer and put the file in the trash can and empty the recycling bin (2)

“Well on the mac, my desktop, there is a way to show history. And then you can pull up the recent history and pull up stuff that you did that maybe you didn’t delete. But then there is a way to delete it permanently. So I think I would send it over to my mac for the sake of security and delete it that way” (P2).

## How to permanently delete data – deletion themes

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1. You can never delete it (5)
2. You can delete your account (2)
3. You can send it to your computer and put the file in the trash can and empty the recycling bin (2)
4. You can destroy the device (1)

“And then my actual phone... I mean... I guess I would physically destroy it. That is the only thing I can think of that would be foolproof. I wouldn't trust just deleting it“ (P16).

## How to permanently delete data – deletion themes

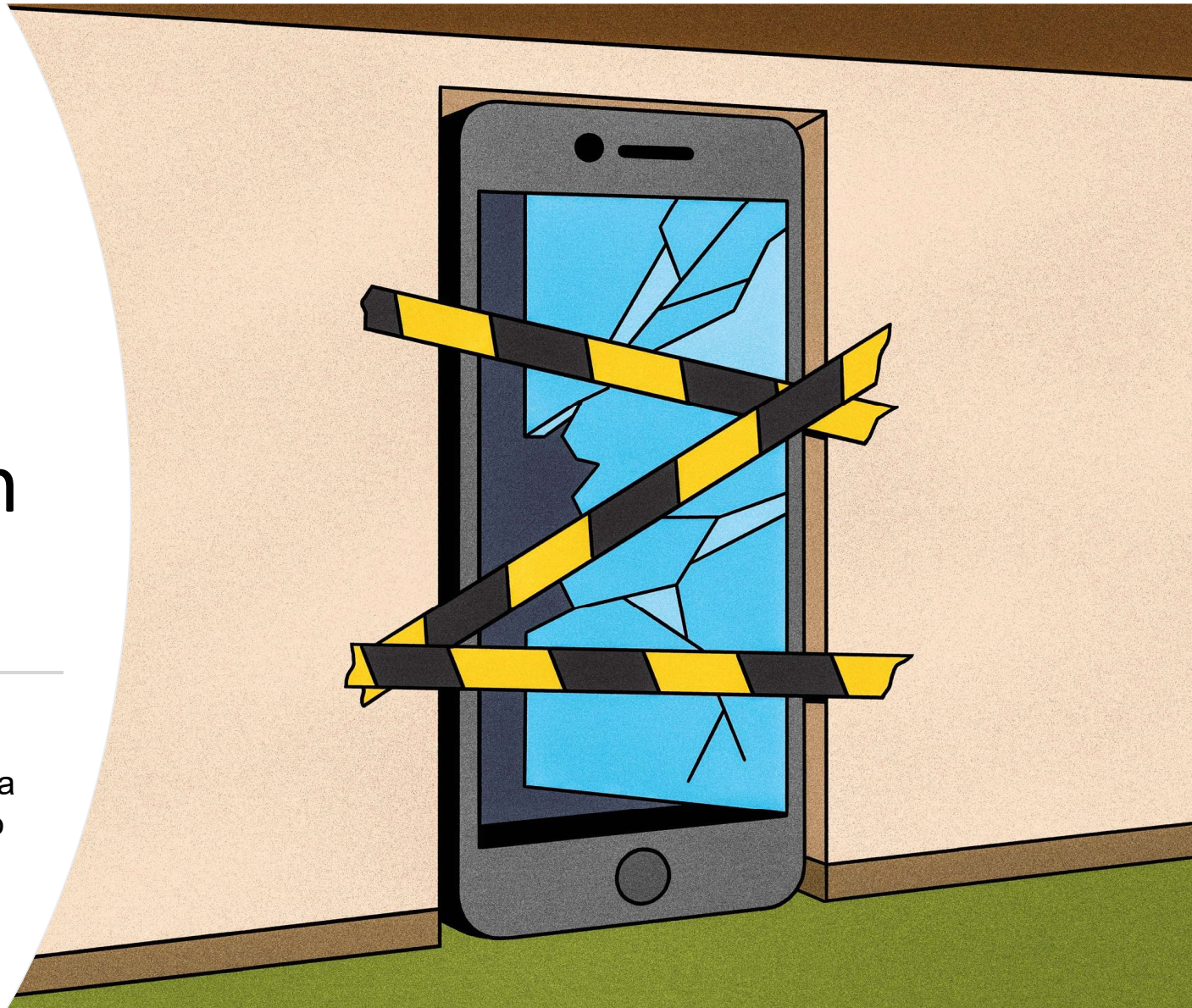
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1. You can never delete it (5)
  2. You can delete your account (2)
  3. You can send it to your computer and put the file in the trash can and empty the recycling bin (2)
  4. You can destroy the device (1)
- Not well understood
  - Lack of confirmation both for deletion and checking that something was deleted

# Control over data collection and sharing

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RQ4: What do mobile users think companies are doing with their data and what do they think they can do about it?



“I know that like there’s an option you can choose if you want them to share it or not. So, I guess if you don’t mark it, they will share it. It’s just like a check.” (P5)

# It's my fault I don't know more about technology

Participants thought they could get control of their data by:

Reading the fine print	5
I can't do anything	4
Learning more technical skills	4
Altering my account settings	3
Not using certain apps	3
Deleting Cookies or Browser History	2

But they felt most technical skills were “out of their skill range” (P15) and “I wouldn't even know how to begin to encrypt stuff, so I am sure if you are using the app it would be hard to (get them to stop selling my data).” (P7)



## I can get control of my data if I learn more about technology

A quarter of participants (4) thought they could get control of their data if they learned more technical skills

The most common thing participants thought they could do was read the terms of service (5)

“I feel that a lot of harvesting of data happens. If you’re in a system somewhere, data automatically crosses over if you say “yes” to use a particular application.” (P4)

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“I feel that a lot of harvesting of data happens. If you’re in a system somewhere, data automatically crosses over if you say “yes” to use a particular application.” (P4)

They weren’t sure where to find these settings, or where to begin learning technical skills or felt like it was “out of their skill range” (p15). “I mean, I wouldn’t even know how to begin to like encrypt stuff. So I am sure if you are using their app, it would be hard to [get them to stop selling data to advertisers].” (P7).

## I can control my data by choosing which technologies I use

I could not use certain apps (3)

I could use the website instead of the app (1)

I should control what goes into the cloud to begin with (2)

I could use local storage only (1)

“I suppose if I slowed down, I could disengage that ‘cause I hate the cloud! It’s the idea of the intrusion on my personal information by some nebulous corporation, the government; whoever... So I do not really care for the whole automated. I’m not truly convinced the cloud is truly secure.” (P10).

Control Theme 3

## There isn't anything I can do

A quarter of participants (4) didn't think there was anything they could do to control their data

“Whatever information you give to someone, they have the human right to share it with anybody that you wouldn't know they are sharing it with.” (P13).



# Implications

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# Recommendations

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More guided setup or configuration of cloud backup (RQ 1 & 2)



Ability to access media created by or used by application from somewhere in the application itself. (RQ1)



# Recommendations

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Recovery services offered by  
telecom providers or phone makers (RQ2)



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More guided setup or  
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Ability to access media created by or used  
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More robust and tangible  
deletion & confirmation UI (RQ3)

Predictive notifications  
around privacy and cloud  
storage settings (RQ 2 & 3)



# Recommendations

More transparency over what data is being collected and what is done with it (RQ4)

Recovery services offered by telecom providers or phone makers (RQ2)

Early education around data literacy (RQ4)



More guided setup or configuration of cloud backup (RQ 1 & 2)

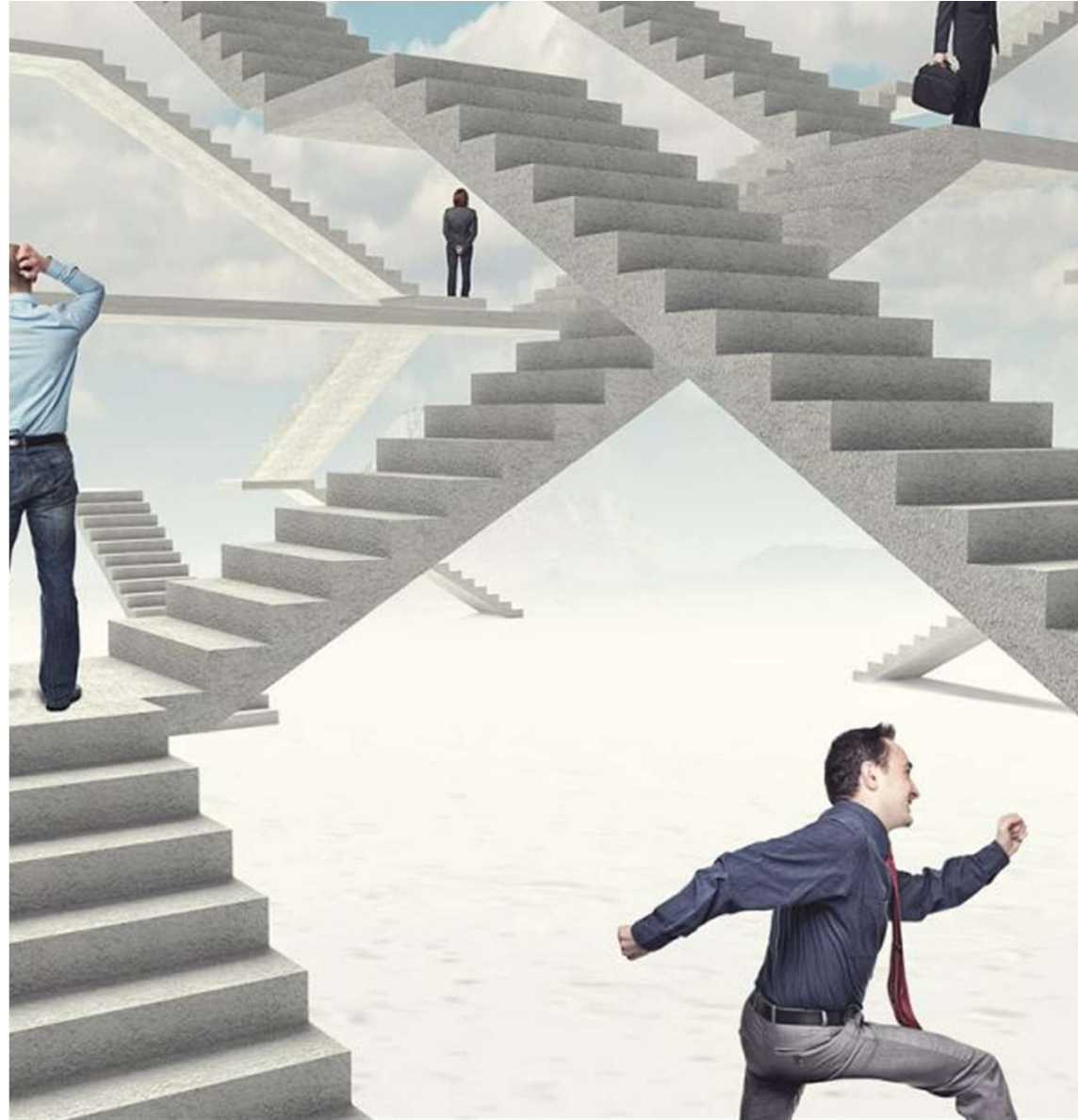
More robust and tangible deletion & confirmation UI (RQ3)

Ability to access media created by or used by application from somewhere in the application itself. (RQ1)

Predictive notifications around privacy and cloud storage settings (RQ 2 & 3)

# SUMMARY

- 16 Qualitative Semi Structured Interviews around smartphone data and recovery
- We found a deficit in users' understanding of cloud storage and other recovery methods
- Users thought there were ways to get control of their data, but required them to learn technical skills they didn't feel capable of
- Need for improved UI for cloud storage and deletion



THANK YOU

<b>PID</b>	<b>Gender</b>	<b>Age</b>	<b>Type of smartphone</b>	<b>How much time do you spend on your smartphone in a day?</b>
P1	Male	22-30	Android Phone	Most of the day
P2	Female	51-60	Apple iPhone	Most of the day
P3	Female	22-30	Apple iPhone	Hours
P4	Female	22-30	Android Phone	Hours
P5	Female	22-30	Apple iPhone	Most of the day
P6	Female	51-60	Android Phone	Most of the day
P7	Female	31-40	Apple iPhone	Hours
P8	Male	60+	Android Phone	Minutes
P9	Female	22-30	Apple iPhone	Most of the day
P10	Female	41-50	Android Phone	Hours
P11	Female	31-40	Android Phone	Hours
P12	Female	41-50	Android Phone	Hours
P13	Male	41-50	Apple iPhone	Most of the day
P14	Female	18-21	Android Phone	Most of the day
P15	Male	41-50	Android Phone	Hours
P16	Male	31-40	Apple iPhone	Most of the day