How Effective are Privacy Labels at Informing Users About App Data Handling Practices?

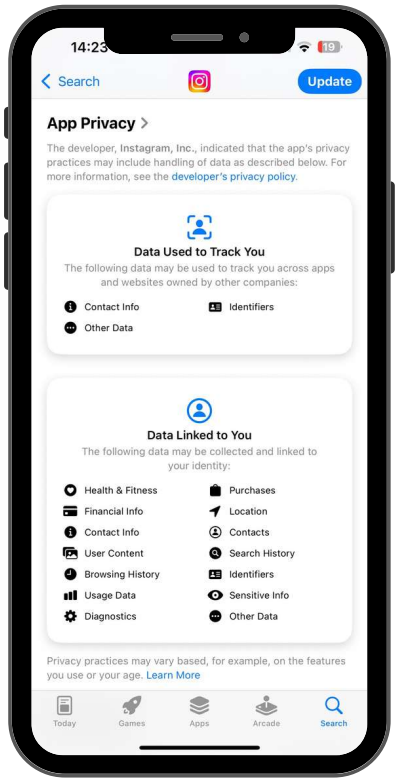
Sophia Walsh, Centre for Doctoral Training in Cyber Security
Dr. Lukasz Piwek, University of Bath
Dr. Kopo Marvin Ramokapane, University of Bristol

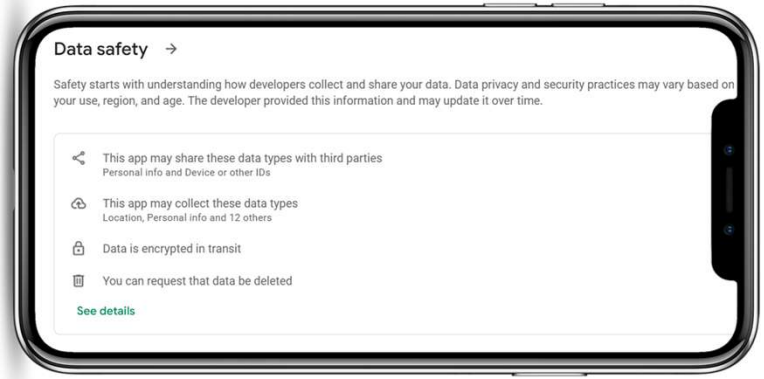


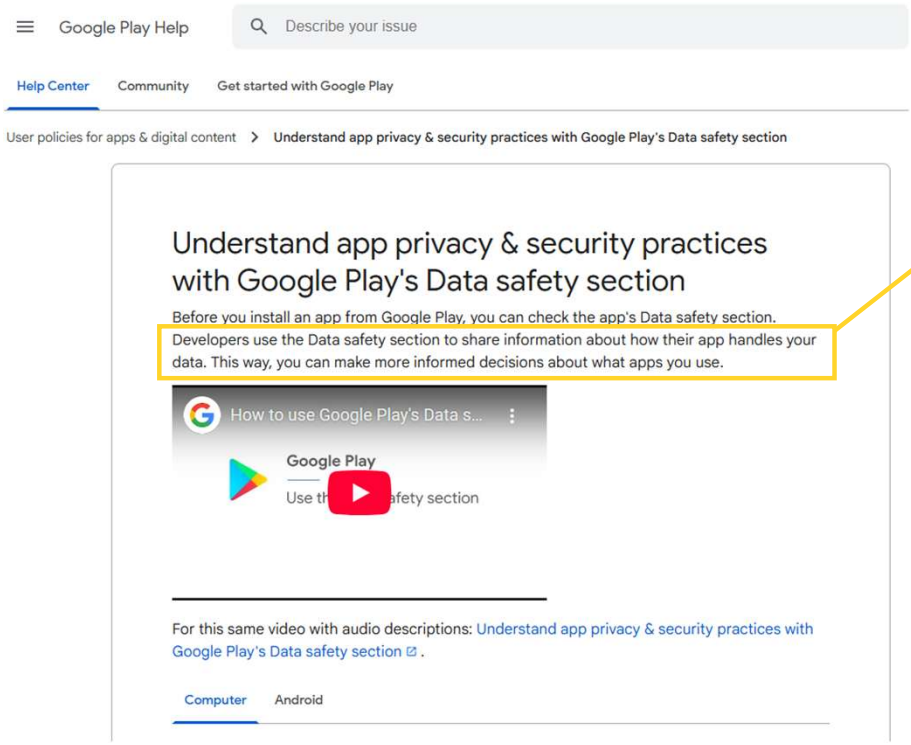




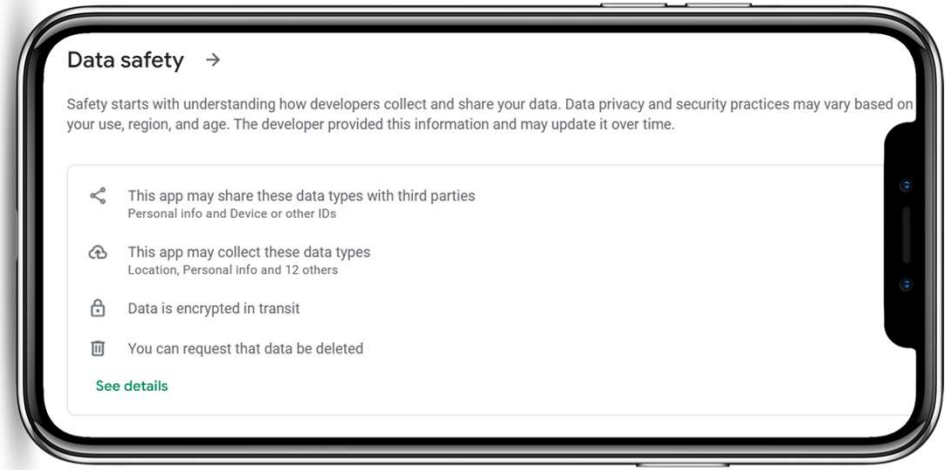
Dina Yarovinsky.







Developers use the Data safety section to share information about how their app handles your data.
This way, you can make more informed decisions about what apps you use.



Link to Google Play page

Store Mac iPad iPhone Watch Vision AirPods TV & Home Entertainment Accessories Support

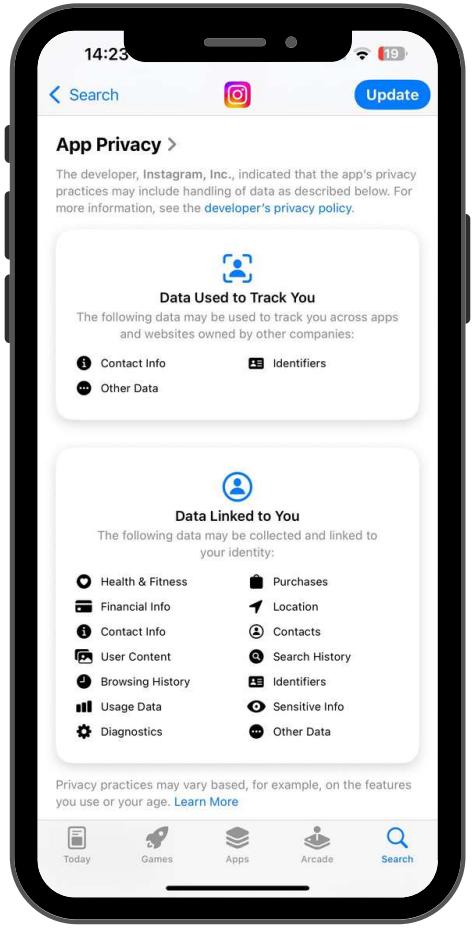
Privacy

Overview Features Control Labels Transparency Report Privacy Policy

Transparency is the best policy.

Our Privacy Nutrition Labels are designed to help you understand how apps handle your data, including apps we develop at Apple. This page brings privacy labels for our iOS, iPadOS, macOS, watchOS, visionOS and tvOS apps together in one place.

Our Privacy Nutrition Labels are designed to help you understand how apps handle your data...

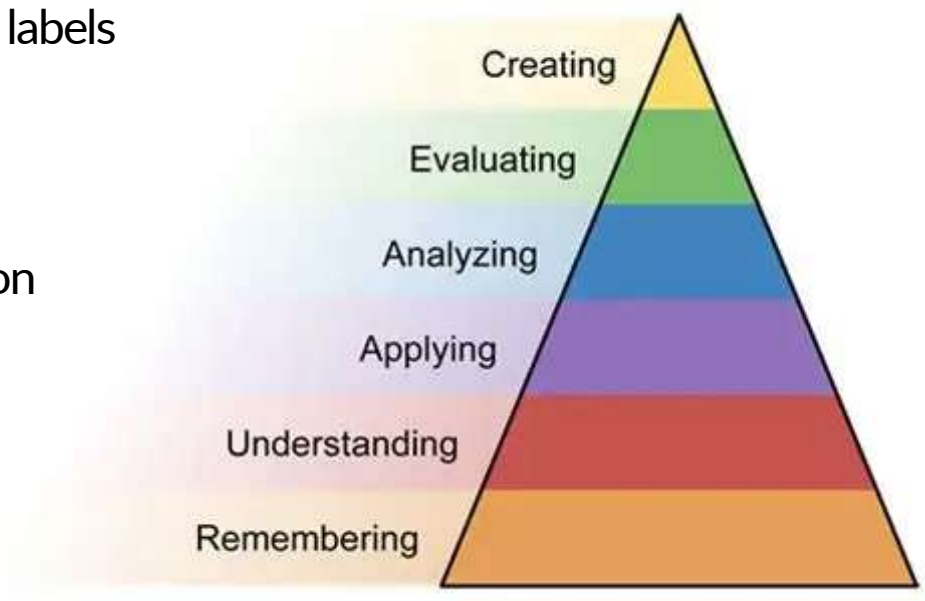


Link to Screen Grab - Apple Privacy Labels

RQ1: What do people understand about privacy labels *when asked to use them?*

RQ2: How do users *apply this knowledge?*

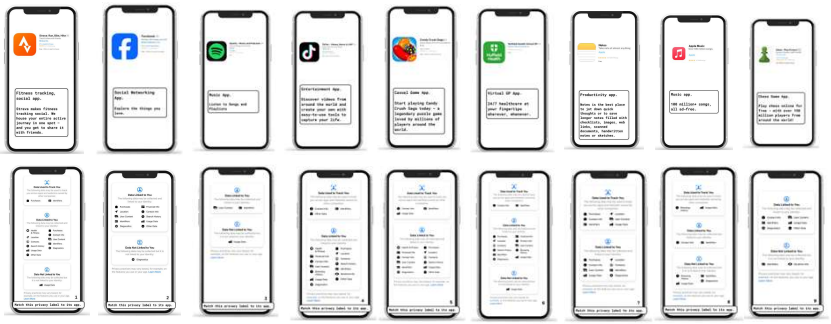
RQ3: What impact do privacy labels users have on attitudes and intentions?



Nikolić, M., & Dabić, T. (2016). The Bloom's taxonomy revisited in the context of online tools. In Sinteza 2016-International Scientific Conference on ICT and E-Business Related Research (pp. 315-320). Singidunum University.

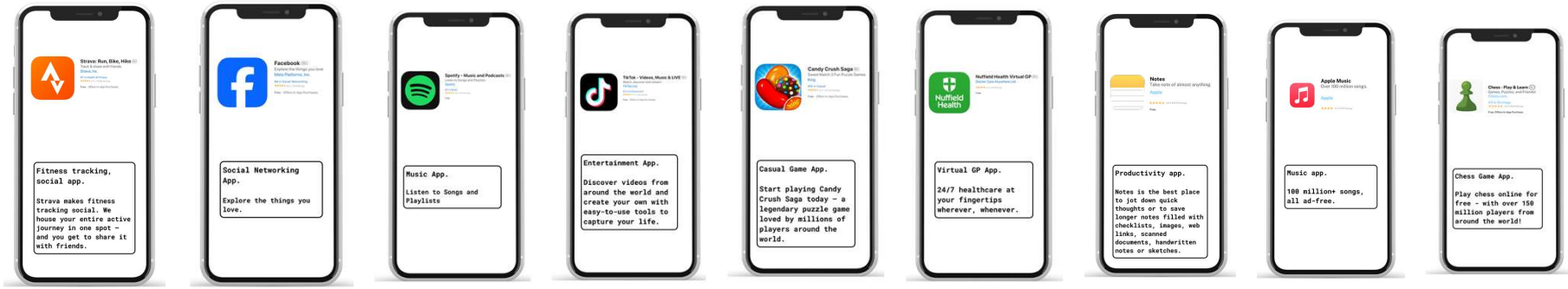
Study Design:

- App Snap*
- Think-aloud protocol
- Braun and Clarke's Reflexive Thematic Analysis**

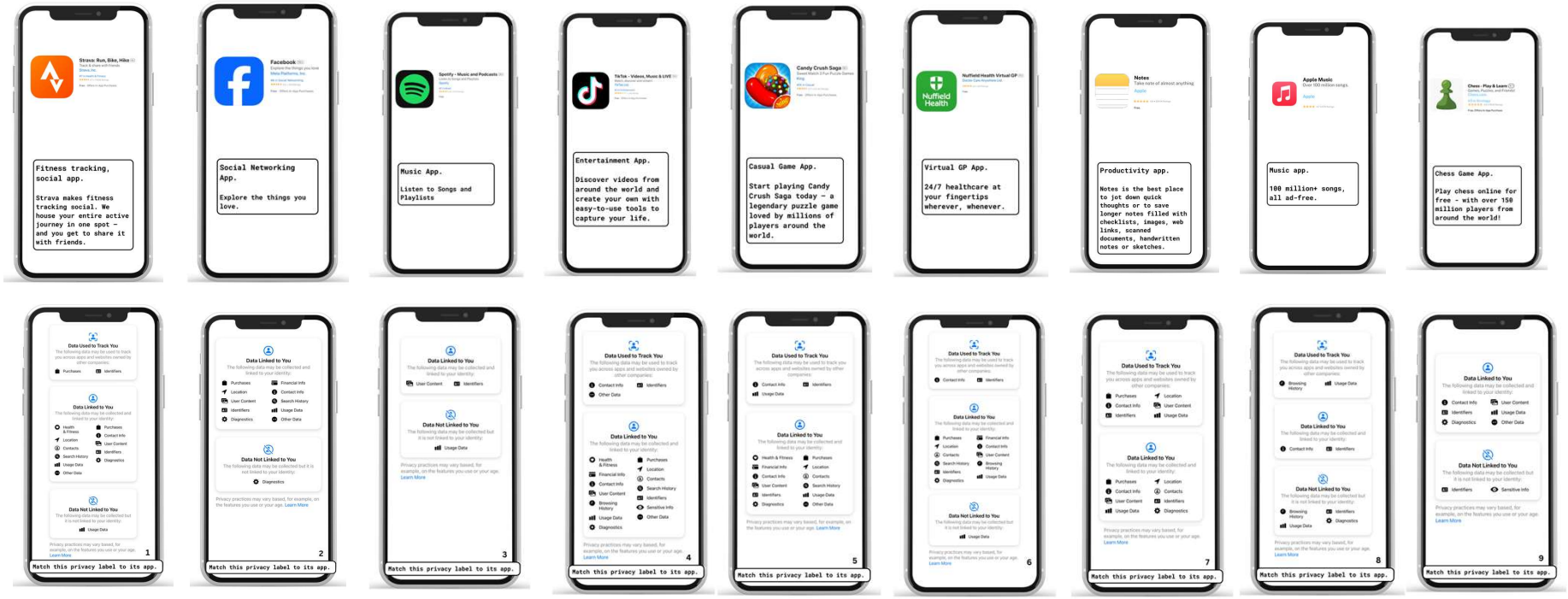


One-on-one in person sessions (*n* = 16)
Between March and September 2025
UK-based sample

*Walsh, S. M., & Ramokapane, M. (2024, August). App Snap: A Versatile Tool for Engaging Children and Young People in Dialogue About Smartphone App Privacy. In Creating Engaging Security and Privacy Educational Interfaces for Educators and Families.
**Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative research in psychology, 3(2), 77-101.
Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. Qualitative research in sport, exercise and health, 11(4), 589-597.



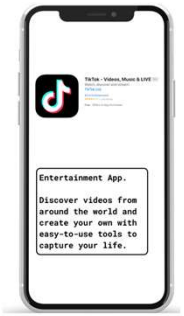
METHODOLOGY


Strava: Run, Bike, Hike
Fitness tracking, social app.
Strava makes fitness tracking social. We house your entire active journey in one spot – and you get to share it with friends.
Facebook
Social Networking App.
Explore the things you love.
Spotify – Music and Podcasts
Music App.
Listen to Songs and Playlists
TikTok - Videos, Music & LIVE
Entertainment App.
Discover videos from around the world and create your own with easy-to-use tools to capture your life.
Candy Crush Saga
Casual Game App.
Start playing Candy Crush Saga today – a legendary puzzle game loved by millions of players around the world.
Nuffield Health Virtual GP
Virtual GP App.
24/7 healthcare at your fingertips wherever, whenever.
Notes
Productivity app.
Notes is the best place to jot down quick thoughts or to save longer notes filled with checklists, images, web links, scanned documents, handwritten notes or sketches.
Apple Music
Music app.
100 million+ songs, all ad-free.
Chess - Play & Learn
Chess Game App.
Play chess online for free - with over 150 million players from around the world!
Data Used to Track You
Data Linked to You
Data Not Linked to You
Match this privacy label to its app.
1
2
3
4
5
6
7
8
9


Strava: Run, Bike, Hike
Fitness tracking, social app.
Strava makes fitness tracking social. We house your entire active journey in one spot – and you get to share it with friends.

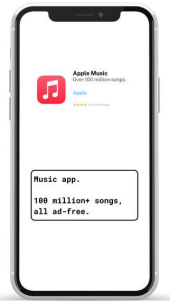

Facebook
Social Networking App.
Explore the things you love.


Music App.
Listen to Songs and Playlists

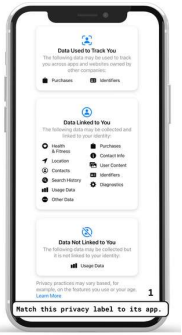

TikTok - Videos, Music & LIVE
Entertainment App.
Discover videos from around the world and create your own with easy-to-use tools to capture your life.

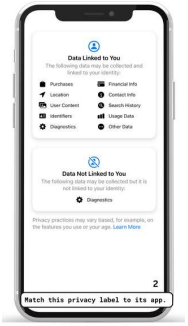

Nuffield Health Virtual GP
Virtual GP App.
24/7 healthcare at your fingertips wherever, whenever.

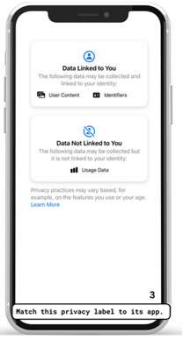

Notes
Productivity app.
Notes is the best place to jot down quick thoughts or to save longer notes filled with checklists, images, web links, scanned documents, handwritten notes or sketches.

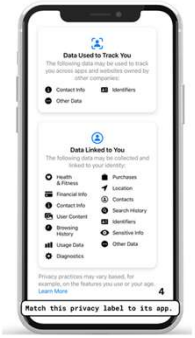

Apple Music
Music app.
100 million+ songs, all ad-free.

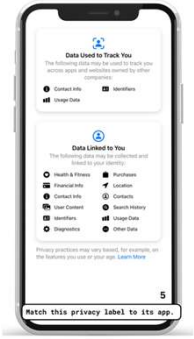

Chess - Play & Learn
Chess Game App.
Play chess online for free - with over 150 million players from around the world!

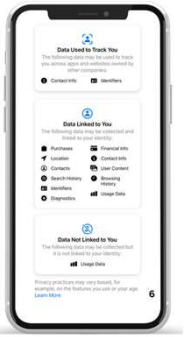

1
Match this privacy label to its app.

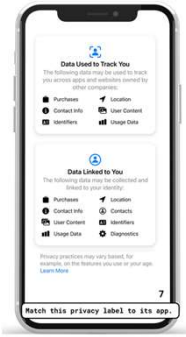

2
Match this privacy label to its app.

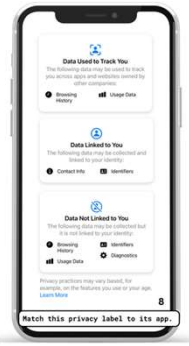

3
Match this privacy label to its app.

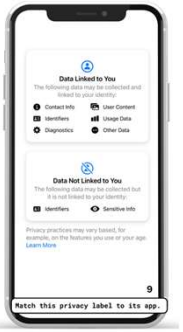

4
Match this privacy label to its app.


5
Match this privacy label to its app.


6


7
Match this privacy label to its app.


8
Match this privacy label to its app.

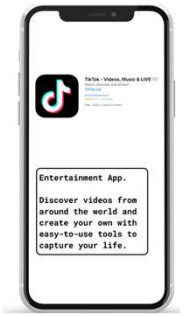

9
Match this privacy label to its app.

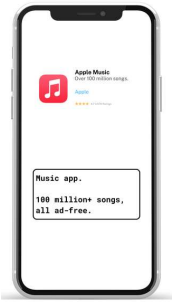

Candy Crush Saga
Casual Game App.
Start playing Candy Crush Saga today – a legendary puzzle game loved by millions of players around the world.


Strava: Run, Bike, Hike
Fitness tracking, social app.
Strava makes fitness tracking social. We house your entire active journey in one spot – and you get to share it with friends.

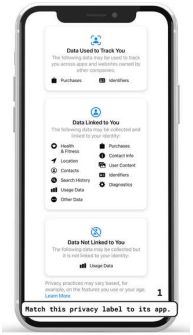

Facebook
Social Networking App.
Explore the things you love.

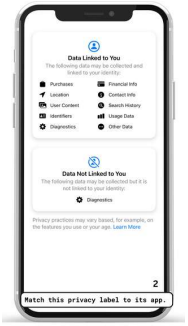

Music App.
Listen to Songs and Playlists

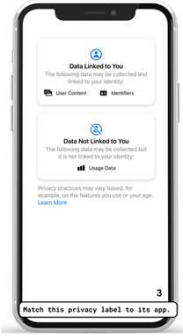

Entertainment App.
Discover videos from around the world and create your own with easy-to-use tools to capture your life.

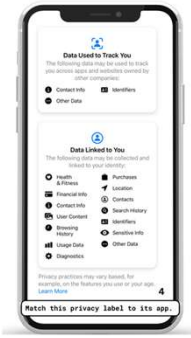

Apple Music
Music app.
100 million+ songs, all ad-free.

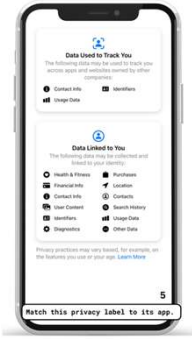

Chess - Play & Learn
Chess Game App.
Play chess online for free - with over 150 million players from around the world!

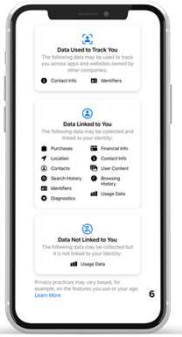

Data Used to Track You
Data Linked to You
Data Not Linked to You
1
Match this privacy label to its app.

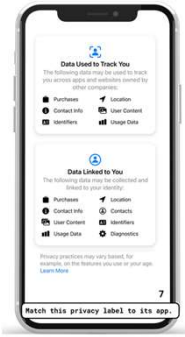

Data Linked to You
Data Not Linked to You
2
Match this privacy label to its app.

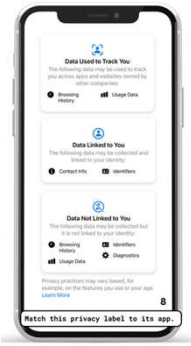

Data Linked to You
Data Not Linked to You
3
Match this privacy label to its app.

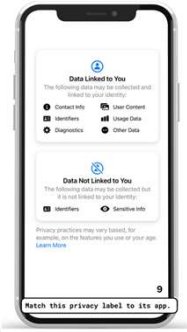

Data Used to Track You
Data Linked to You
4
Match this privacy label to its app.

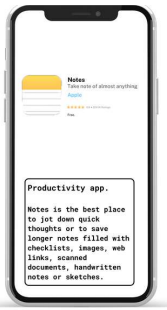

Data Used to Track You
Data Linked to You
5
Match this privacy label to its app.


Data Used to Track You
Data Linked to You
Data Not Linked to You
6


Data Used to Track You
Data Linked to You
7
Match this privacy label to its app.


Data Used to Track You
Data Linked to You
Data Not Linked to You
8
Match this privacy label to its app.


Data Linked to You
Data Not Linked to You
9
Match this privacy label to its app.

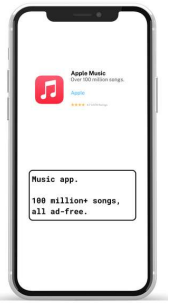

Notes
Productivity app.
Notes is the best place to jot down quick thoughts or to save longer notes filled with checklists, images, web links, scanned documents, handwritten notes or sketches.

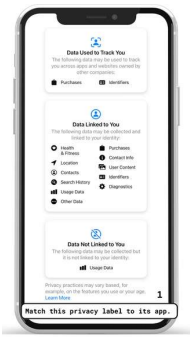

Candy Crush Saga
Casual Game App.
Start playing Candy Crush Saga today – a legendary puzzle game loved by millions of players around the world.

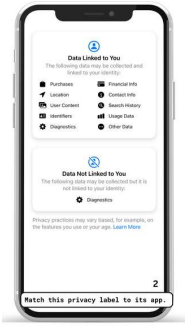

Nuffield Health Virtual GP
Virtual GP App.
24/7 healthcare at your fingertips wherever, whenever.

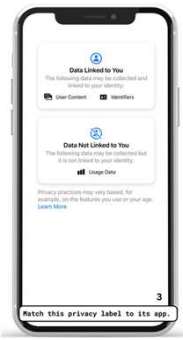

Strava: Run, Bike, Hike
Fitness tracking, social app.
Strava makes fitness tracking social. We house your entire active journey in one spot – and you get to share it with friends.

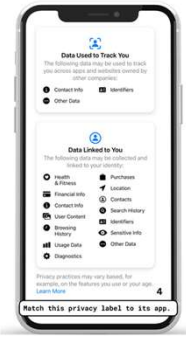

Spotify – Music and Podcasts
Music App.
Listen to Songs and Playlists

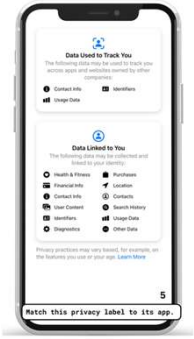

Apple Music
Music app.
100 million+ songs, all ad-free.

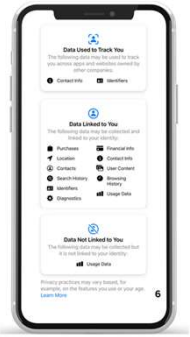

Data Used to Track You
Data Linked to You
Data Not Linked to You
1
Match this privacy label to its app.

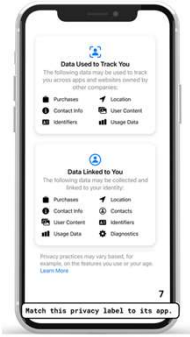

Data Linked to You
Data Not Linked to You
2
Match this privacy label to its app.

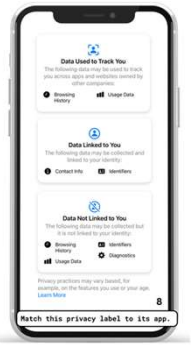

Data Linked to You
Data Not Linked to You
3
Match this privacy label to its app.

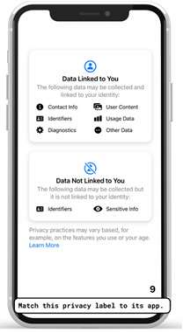

Data Used to Track You
Data Linked to You
4
Match this privacy label to its app.

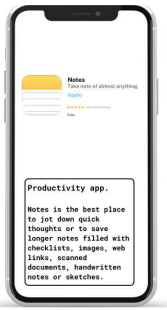

Data Used to Track You
Data Linked to You
5
Match this privacy label to its app.


Data Used to Track You
Data Linked to You
Data Not Linked to You
6


Data Used to Track You
Data Linked to You
7
Match this privacy label to its app.


Data Used to Track You
Data Linked to You
Data Not Linked to You
8
Match this privacy label to its app.


Data Linked to You
Data Not Linked to You
9
Match this privacy label to its app.


Notes
Productivity app.
Notes is the best place to jot down quick thoughts or to save longer notes filled with checklists, images, web links, scanned documents, handwritten notes or sketches.

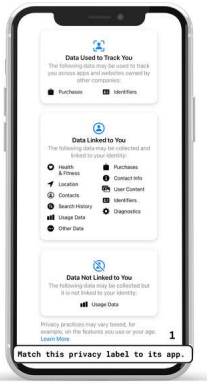

Facebook
Social Networking App.
Explore the things you love.

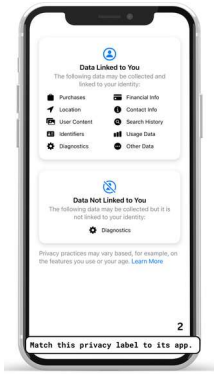

TikTok – Videos, Music & LIVE
Entertainment App.
Discover videos from around the world and create your own with easy-to-use tools to capture your life.

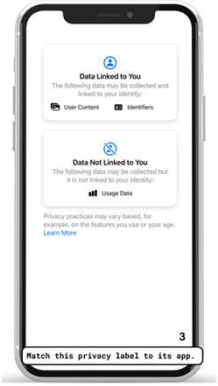

Candy Crush Saga
Casual Game App.
Start playing Candy Crush Saga today – a legendary puzzle game loved by millions of players around the world.

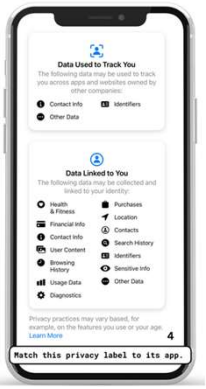

Chess - Play & Learn
Chess Game App.
Play chess online for free – with over 150 million players from around the world!

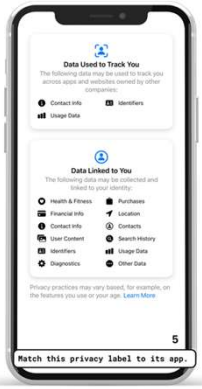

Nuffield Health Virtual GP
Virtual GP App.
24/7 healthcare at your fingertips wherever, whenever.

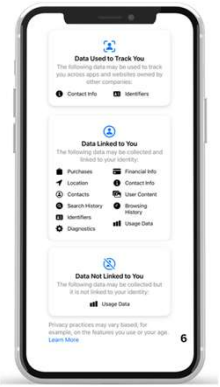

Data Used to Track You
Data Linked to You
Data Not Linked to You
1
Match this privacy label to its app.

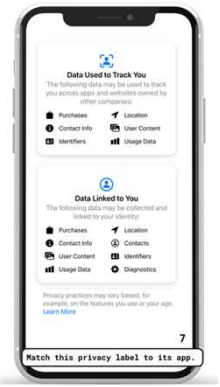

Data Linked to You
Data Not Linked to You
2
Match this privacy label to its app.

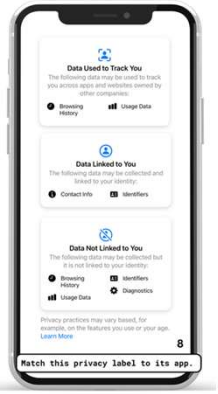

Data Linked to You
Data Not Linked to You
3
Match this privacy label to its app.

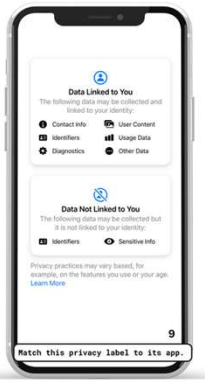

Data Used to Track You
Data Linked to You
4
Match this privacy label to its app.


Data Used to Track You
Data Linked to You
5
Match this privacy label to its app.

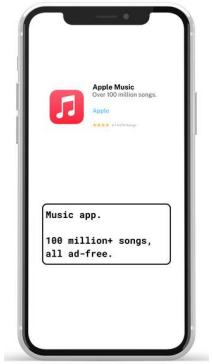

Data Used to Track You
Data Linked to You
Data Not Linked to You
6

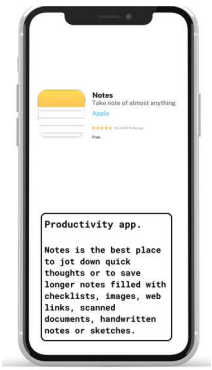

Data Used to Track You
Data Linked to You
Data Not Linked to You
7
Match this privacy label to its app.


Data Used to Track You
Data Linked to You
Data Not Linked to You
8
Match this privacy label to its app.


Data Linked to You
Data Not Linked to You
9
Match this privacy label to its app.

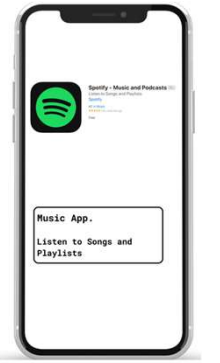

Strava: Run, Bike, Hike
Fitness tracking, social app.
Strava makes fitness tracking social. We house your entire active journey in one spot – and you get to share it with friends.


Apple Music
Over 100 million songs.
Music app.
100 million+ songs, all ad-free.


Notes
Take note of almost anything
Productivity app.
Notes is the best place to jot down quick thoughts or to save longer notes filled with checklists, images, web links, scanned documents, handwritten notes or sketches.


Facebook
Social Networking App.
Explore the things you love.

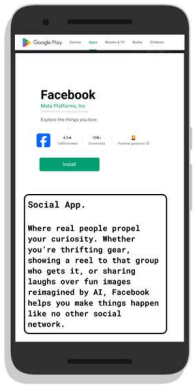

TikTok - Videos, Music & LIVE
Entertainment App.
Discover videos from around the world and create your own with easy-to-use tools to capture your life.

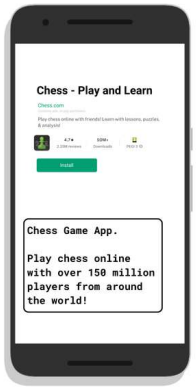

Spotify - Music and Podcasts
Music App.
Listen to Songs and Playlists

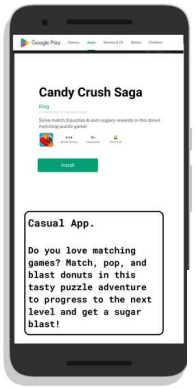

Candy Crush Saga
Casual Game App.
Start playing Candy Crush Saga today – a legendary puzzle game loved by millions of players around the world.

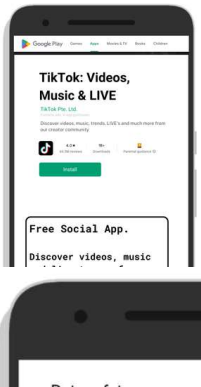

Chess - Play & Learn
Chess Game App.
Play chess online for free - with over 150 million players from around the world!

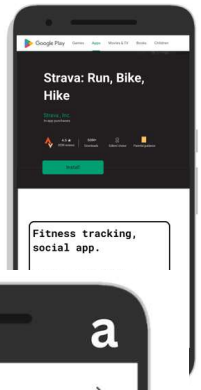

Nuffield Health Virtual GP
Virtual GP App.
24/7 healthcare at your fingertips wherever, whenever.

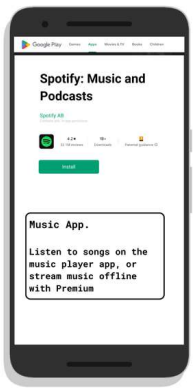

Facebook
Social App.
Where real people propel your curiosity. Whether you're thrifting gear, showing a reel to that group who gets it, or sharing laughs over fun images reimagined by AI, Facebook helps you make things happen like no other social network.


Chess - Play and Learn
Chess Game App.
Play chess online with over 150 million players from around the world!

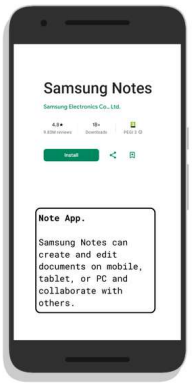

Candy Crush Saga
Casual App.
Do you love matching games? Match, pop, and blast donuts in this tasty puzzle adventure to progress to the next level and get a sugar blast!

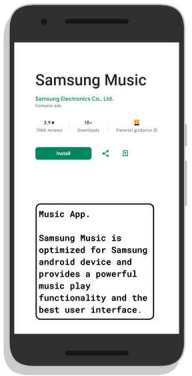

TikTok: Videos, Music & LIVE
Free Social App.
Discover videos, music

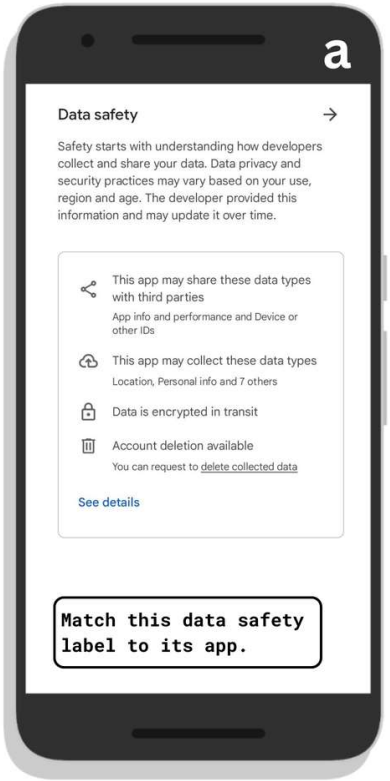

Strava: Run, Bike, Hike
Fitness tracking, social app.

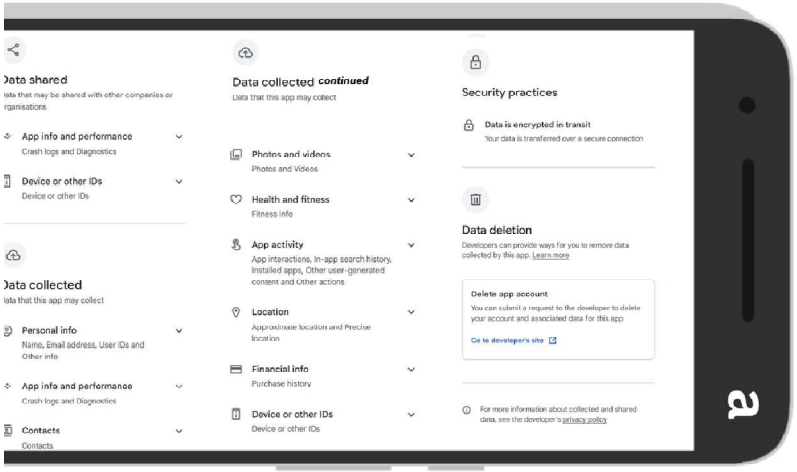

Spotify: Music and Podcasts
Music App.
Listen to songs on the music player app, or stream music offline with Premium

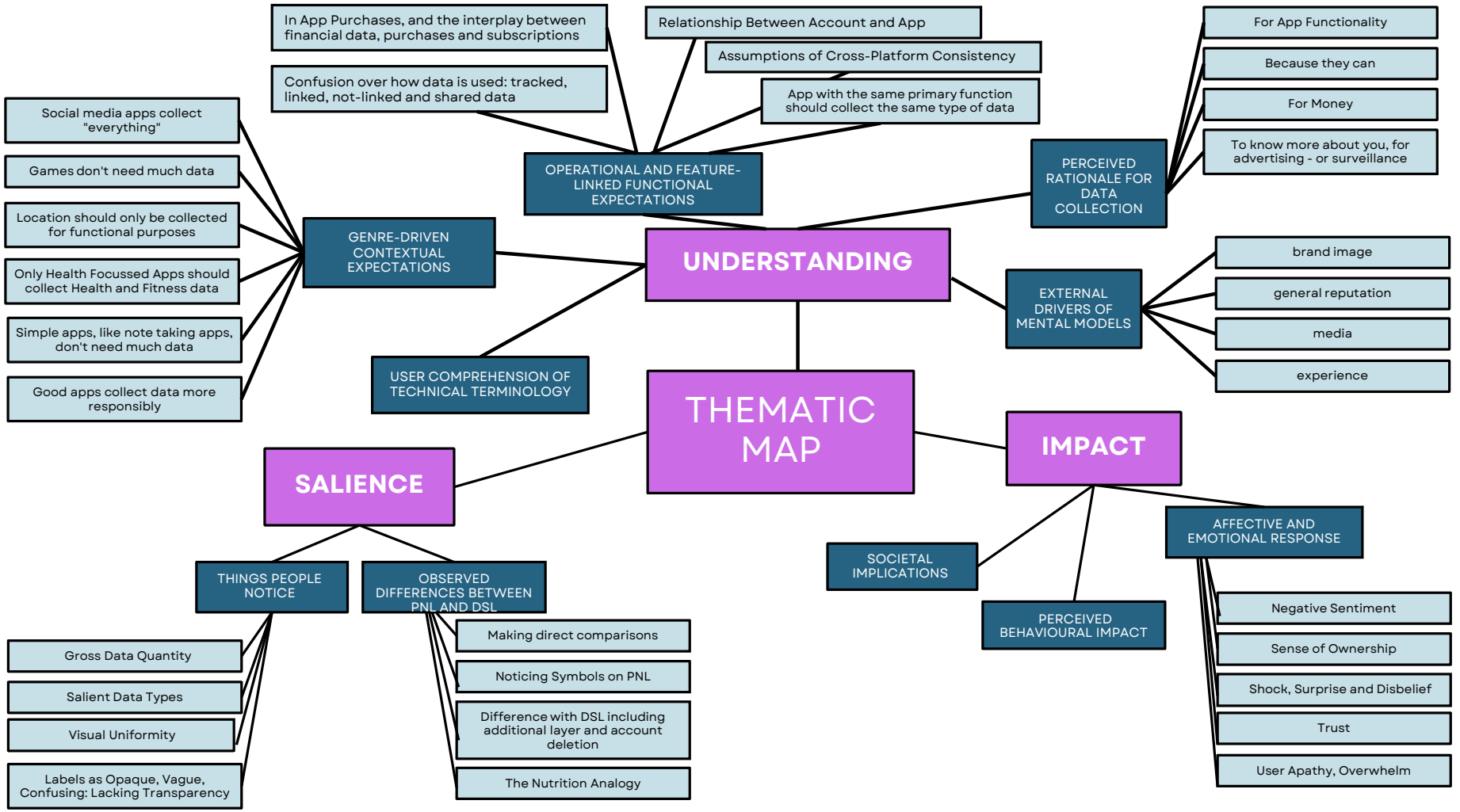

Nuffield Health Virtual GP
Medical App.
Nuffield Health Virtual GP is a private digital healthcare service designed for the way you live and work today.

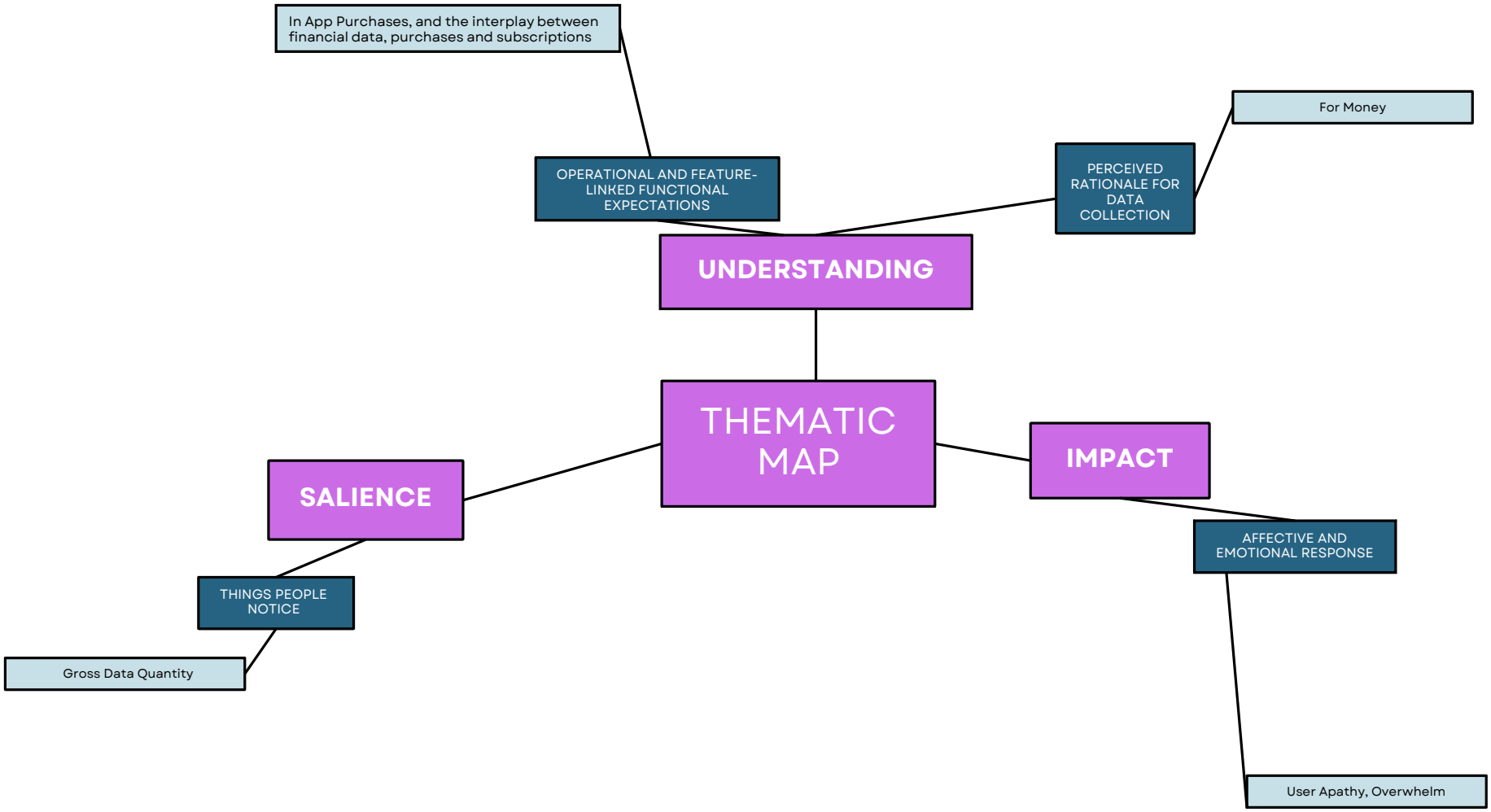

Samsung Notes
Note App.
Samsung Notes can create and edit documents on mobile, tablet, or PC and collaborate with others.

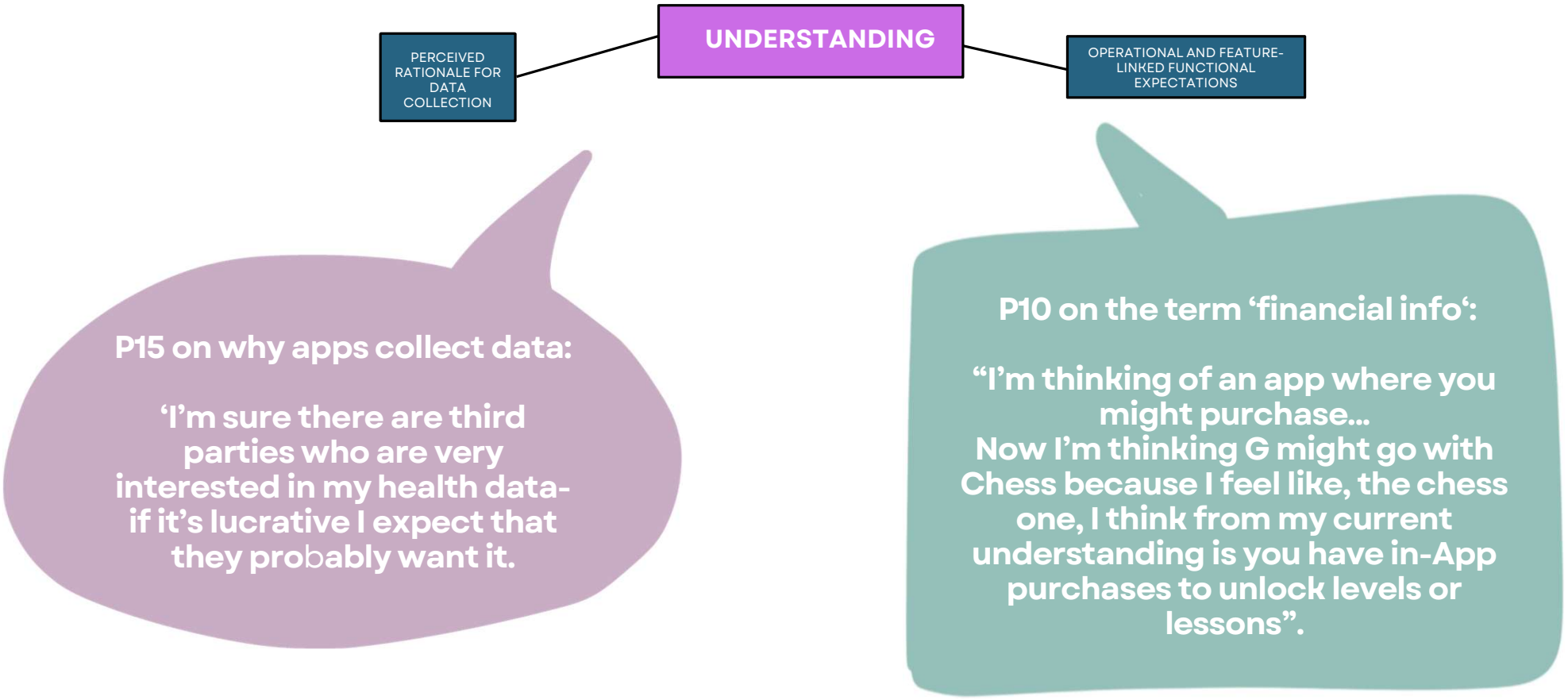

Samsung Music
Music App.
Samsung Music is optimized for Samsung android device and provides a powerful music play functionality and the best user interface.


Data safety
Safety starts with understanding how developers collect and share your data. Data privacy and security practices may vary based on your use, region and age. The developer provided this information and may update it over time.
This app may share these data types with third parties
App info and performance and Device or other IDs
This app may collect these data types
Location, Personal info and 7 others
Data is encrypted in transit
Account deletion available
You can request to delete collected data
See details
Match this data safety label to its app.

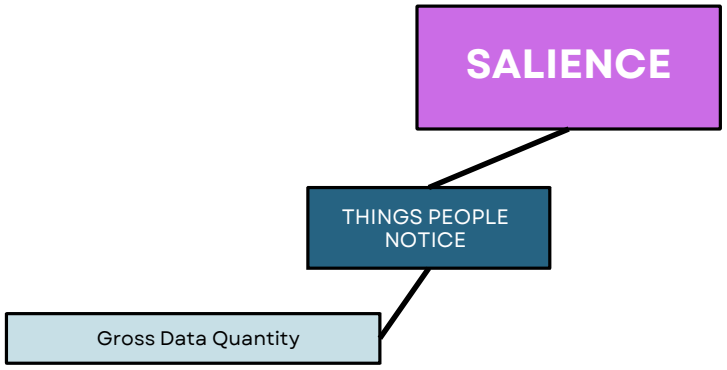

Data shared
App info and performance
Crash logs and Diagnostics
Device or other IDs
Device or other IDs
Data collected
Personal info
Name, Email address, User IDs and Other info
App info and performance
Crash logs and Diagnostics
Contacts
Contacts
Data collected continued
Photos and videos
Photos and Videos
Health and fitness
Fitness info
App activity
App interactions, In-app search history, Installed apps, Other user-generated content and Other actions
Location
Approximate location and Precise location
Financial info
Purchase history
Device or other IDs
Device or other IDs
Security practices
Data is encrypted in transit
Your data is transferred over a secure connection
Data deletion
Developers can provide ways for you to remove data collected by this app. Learn more
Delete app account
You can submit a request to the developer to delete your account and associated data for this app
Go to developer's site
For more information about collected and shared data, see the developer's privacy policy

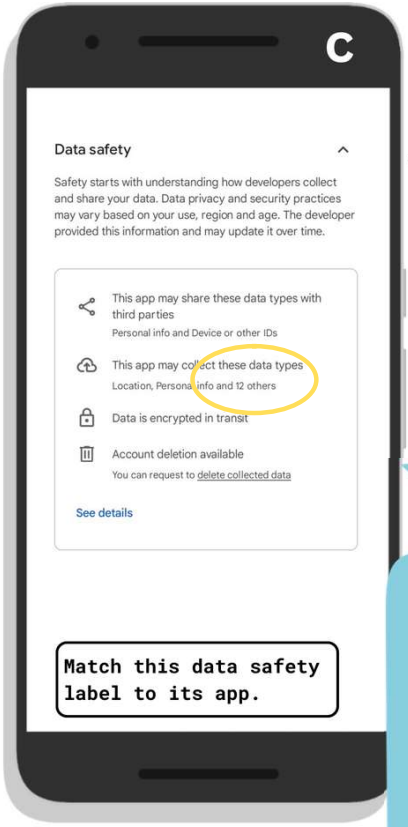

THEMATIC MAP
UNDERSTANDING
SALIENCE
IMPACT
OPERATIONAL AND FEATURE-LINKED FUNCTIONAL EXPECTATIONS
In App Purchases, and the interplay between financial data, purchases and subscriptions
Relationship Between Account and App
Assumptions of Cross-Platform Consistency
Confusion over how data is used: tracked, linked, not-linked and shared data
App with the same primary function should collect the same type of data
GENRE-DRIVEN CONTEXTUAL EXPECTATIONS
Social media apps collect "everything"
Games don't need much data
Location should only be collected for functional purposes
Only Health Focussed Apps should collect Health and Fitness data
Simple apps, like note taking apps, don't need much data
Good apps collect data more responsibly
USER COMPREHENSION OF TECHNICAL TERMINOLOGY
PERCEIVED RATIONALE FOR DATA COLLECTION
For App Functionality
Because they can
For Money
To know more about you, for advertising - or surveillance
EXTERNAL DRIVERS OF MENTAL MODELS
brand image
general reputation
media
experience
THINGS PEOPLE NOTICE
Gross Data Quantity
Salient Data Types
Visual Uniformity
Labels as Opaque, Vague, Confusing: Lacking Transparency
OBSERVED DIFFERENCES BETWEEN PNL AND DSL
Making direct comparisons
Noticing Symbols on PNL
Difference with DSL including additional layer and account deletion
The Nutrition Analogy
SOCIETAL IMPLICATIONS
PERCEIVED BEHAVIOURAL IMPACT
AFFECTIVE AND EMOTIONAL RESPONSE
Negative Sentiment
Sense of Ownership
Shock, Surprise and Disbelief
Trust
User Apathy, Overwhelm


In App Purchases, and the interplay between financial data, purchases and subscriptions
OPERATIONAL AND FEATURE-LINKED FUNCTIONAL EXPECTATIONS
For Money
PERCEIVED RATIONALE FOR DATA COLLECTION
UNDERSTANDING
THEMATIC MAP
SALIENCE
THINGS PEOPLE NOTICE
Gross Data Quantity
IMPACT
AFFECTIVE AND EMOTIONAL RESPONSE
User Apathy, Overwhelm



Transparency barrier - cognitive gap

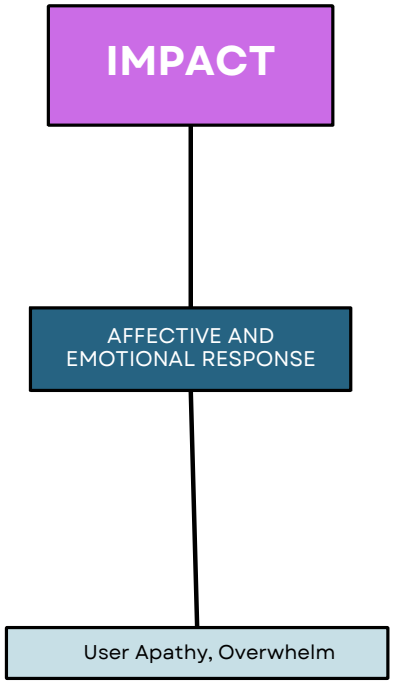




P9 looking at a label describing lots of data handling: "I'm assuming that Facebook take as much information as possible, so it's going to be one of these ones. "

P2: "As soon as I saw there's like 14 data types that Facebook gets and 11 for TikTok I kind of knew that those are the right pairings."

Dual Process Theory
Ecological Rationality



P10 when confronted with unknown technical terms:

“I’m not too sure what IMEI number or device ID is... I would probably read that and just be like: Ok. I don’t really undersatnd, but I kind of want to use Spotify anyway and still get (download) it...”

P3:
‘it’s hard to sort of process this information at a glance ’

KEY TAKEAWAYS

1. Highlighting the Transparency Barrier and Cognitive Gap.
2. Heuristic Engagement as Rational Adaptation to Privacy Complexity
3. Impact >> Negative Affect

DESIGN RECOMMENDATIONS

1. Toward Heuristic-Led Privacy Label Design
2. Use Standard, Validated Mechanism for Evaluating Usefulness and Impact of Non-Legalistic Privacy Disclosures



USENIX

THE ADVANCED COMPUTING SYSTEMS ASSOCIATION

How Effective are Privacy Labels at Informing Users About App Data Handling Practices?

Sophia Walsh, *University of Bristol;* Lukasz Piwek, *University of Bath;* Kopo Marvin Ramokapane, *University of Bristol*

https://www.usenix.org/conference/soups2026/presentation/walsh

This paper is included in the Proceedings of the Twenty-Second Symposium on Usable Privacy and Security.

August 24–26, 2026 • Hannover, Germany

ISBN 978-1-939133-59-5

Open access to the Proceedings of the Twenty-Second Symposium on Usable Privacy and Security is sponsored by USENIX.

with thanks to

All our participants

Dr. Kopo Marvin Ramokapane and Dr. Lukasz Piwek

sponsored by

UKRI EPSRC CDT in Cyber Secuirty (TIPS-at-scale)

Research Institute for Socio-Technical Cyber Security

University of Bristol Alumni Fund

sophia.walsh@bristol.ac.uk



THANK YOU