

# iOS Application Development

## Lecture 1: Introduction

Prof. Dr. Jan Borchers  
Media Computing Group  
RWTH Aachen University

Winter Semester '24/'25

[hci.rwth-aachen.de/ios](https://hci.rwth-aachen.de/ios)



**RWTHAACHEN**  
UNIVERSITY

# Team



**Prof. Dr.  
Jan Borchers**



**Kevin  
Fiedler**

[kfiedler@cs.rwth-aachen.de](mailto:kfiedler@cs.rwth-aachen.de)  
E-Mail Subject: [iOS]



# Class Goals

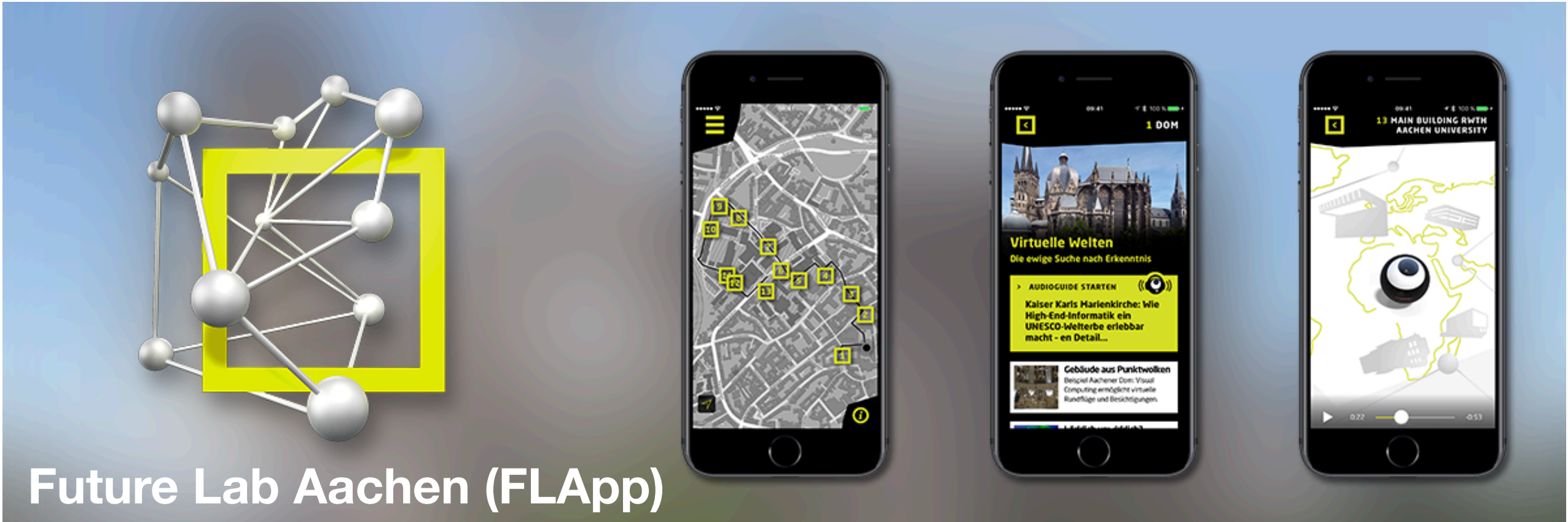
- Understand the differences between desktop and mobile development
- Learn to write iOS Apps (UIKit & SwiftUI)
- Learn how to use advanced iOS frameworks



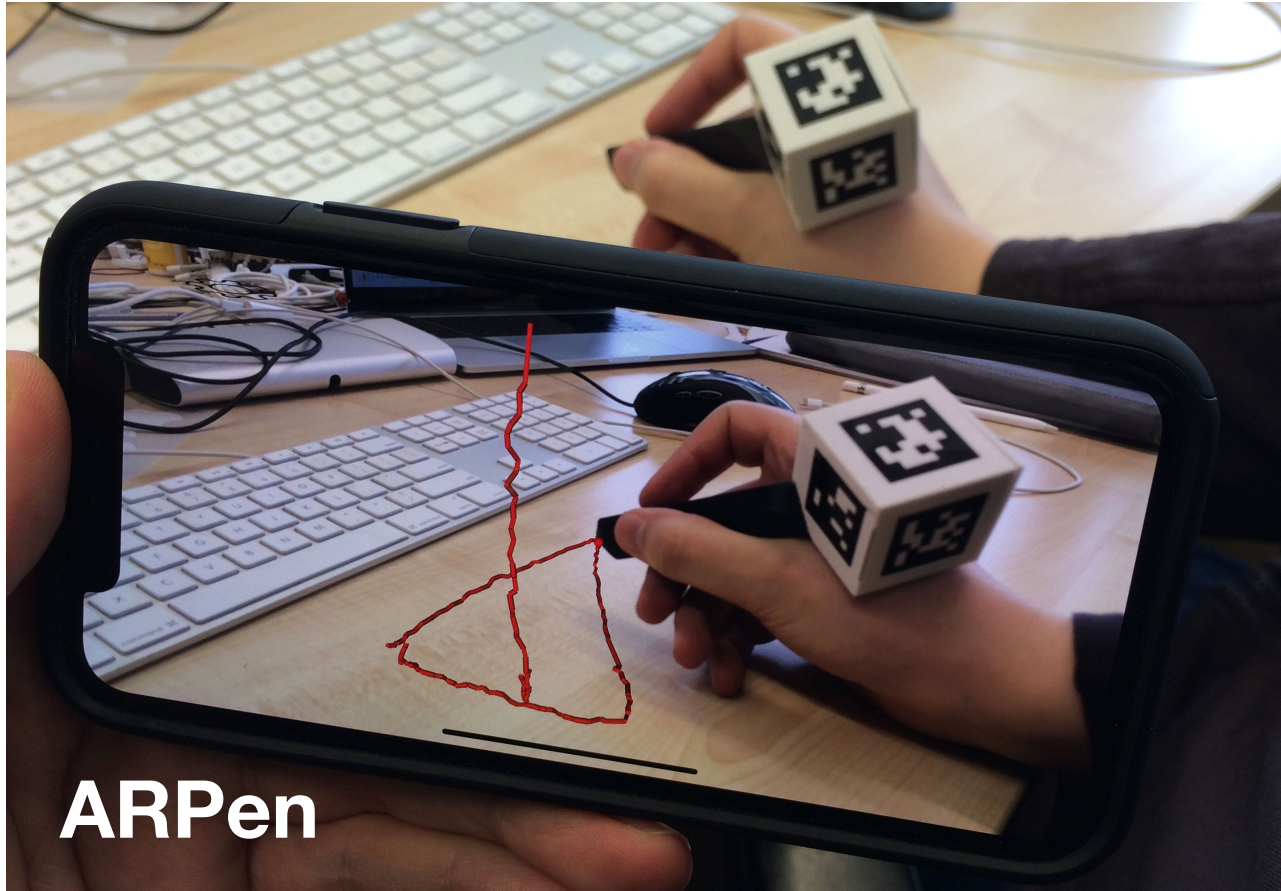
- During your project: extra focus on UX and usability
- Do lots of coding!



# Some of our iOS Projects



Future Lab Aachen (FLApp)



ARPen



**CENTRE CHARLEMAGNE**  
Neues Stadtmuseum Aachen

Centre Guide



Corona



ForcePicker



Aixplorer

# Administrivia

- 6 credit points
- Class times
  - Mondays (12:30–14:00),  
i10 seminar room 2.73
  - Tuesday (10:30–12:00),  
i10 seminar room 2.73
  - Already over 95 registrations, but 42 seats
- [hci.rwth-aachen.de/ios](http://hci.rwth-aachen.de/ios)

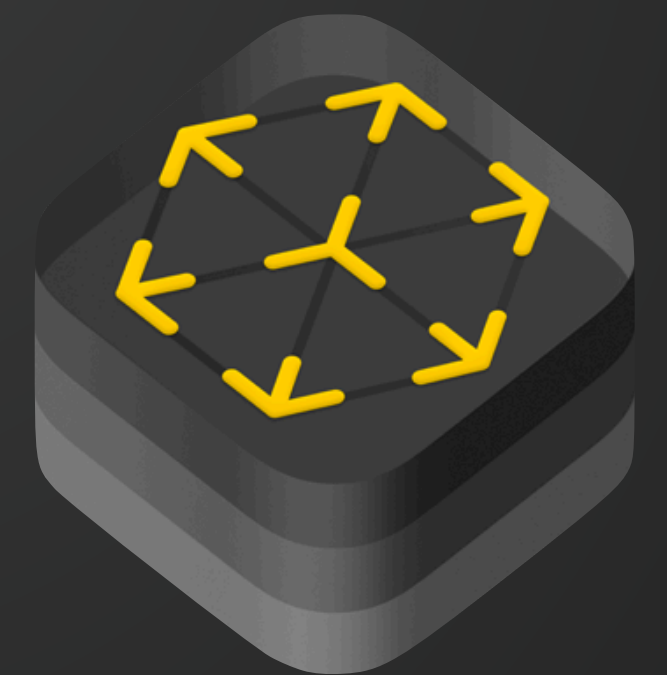


# Course Requirements

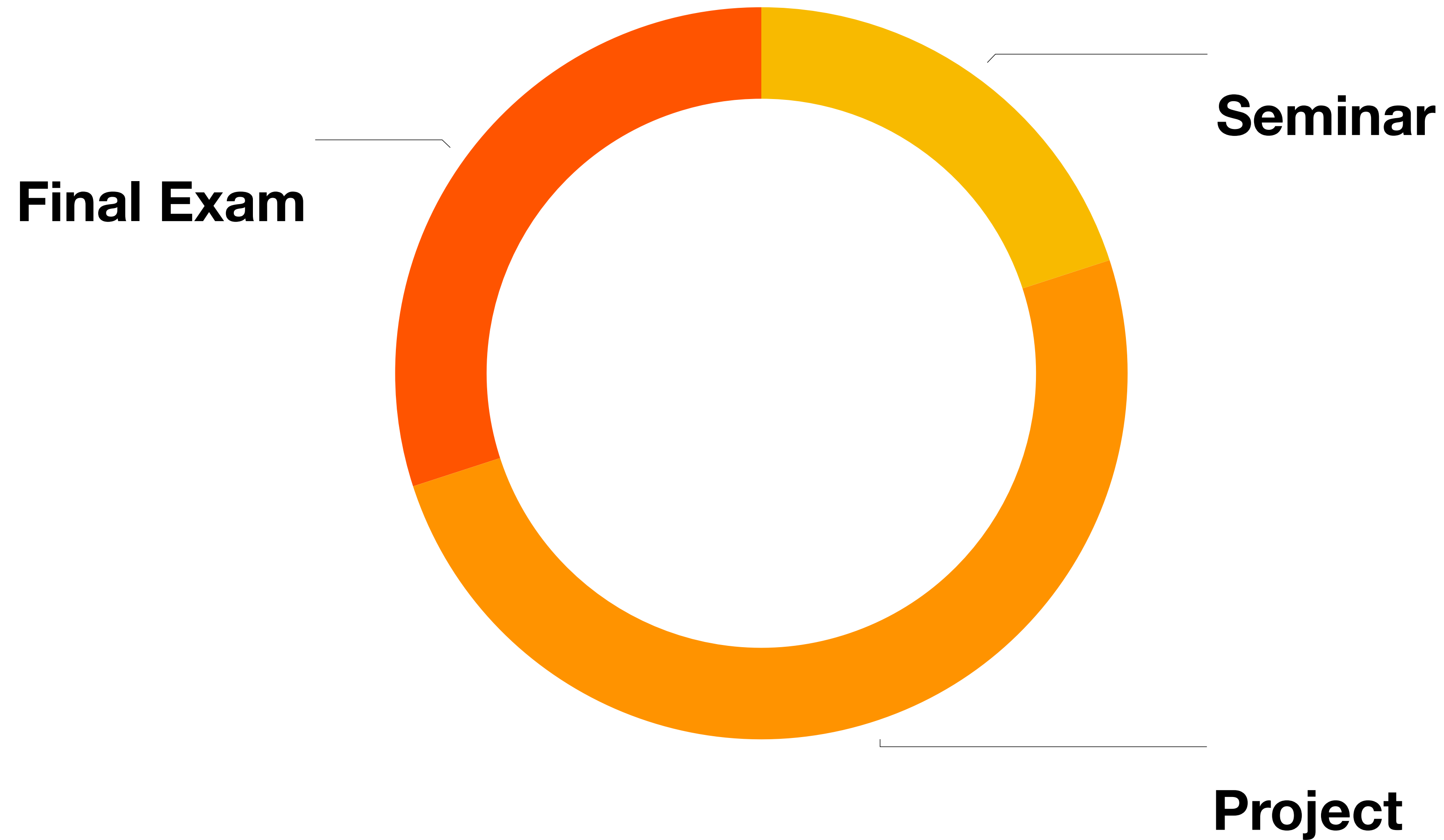
- Required
    - OOP experience
    - Apple Developer ID
    - You must be registered for this course in RWTHonline
    - Mac capable of running Xcode 16\*
  - Optional (but helpful)
    - iOS device running iOS 18\*  
(simulator sufficient for many tasks)
  - Previous experience with Swift or Objective-C
  - This course is only for students of:
    - B.Sc. and M.Sc. Computer Science
    - SSE / MI / DS / MTIK (TK)
- \* We have a **FEW** time-share devices

# Class Syllabus

- Part 1  
**Lectures: Introduction into Swift and iOS**
- Part 2  
**Seminars: iOS Frameworks**
- Part 3  
**Project: App Development**



# Your Final Grade (6 ECTS)





# Lectures

- Swift
- Xcode
- UIKit
  - Navigation, Animation, Customization
  - Collections, AutoLayout
  - Persistence and Networking
- SwiftUI

## Textbooks



Available for free on Apple Books

# Seminar

## Sample Topics:

- CoreAnimation
- Haptics and Sounds
- SpriteKit
- Working with Files
- Combine
- Debugging in Xcode
- WidgetKit and Siri
- WKWebView
- MapKit
- UIPresentationController
- CoreML & CreateML
- CoreData
- watchOS Apps
- SceneKit
- Advanced SwiftUI Layout
- Metal

- 15-minute presentations
- 18.11.2024–9.12.2024
- Overview of the framework
- Example applications
- Attendance is mandatory
- Missing 1 seminar day (>10%) is a 5.0



# Project

- Kickoff: 9.12.2024 (after the seminar talks)
- Topics announced at kickoff date
- Presentations: 27.01.2025
- 2h slot instead of 1.5h

- Submittable app
- Final presentation with live demo
- Code documentation!
- Attendance on Presentation Day is mandatory
- Missing Presentation Day (>10%) is a 5.0



# Written Exam

- Questions about:
  - Lecture content
  - All seminars

- Exam dates:
  - 1st exam: Sat. 03.02.2025
  - 2nd exam: Wed. 05.03.2025
- 60 minutes



# Limited Seating

- We only have **42 seats** available
- Attending the seminar and project presentations is **mandatory**
- **Only take this class if you are sure you can attend all classes**



# How to Get a Seat

- **Register** in RWTHonline & send the **Declaration of Compliance** before **Wednesday (09.10.2024) 13:00**
- We will invite everyone who did this to **Moodle** to **form groups**
- Form groups of **3 students** in Moodle (“Seminar Groups”)
  - There should be at least **2 students with a Mac** per group
- On **Friday 11.10.2024 13:00**, we will randomly select 14 **full** groups
  - Everyone else will be removed from RWTHmoodle



# Lecture Slides and Videos

- All slides and lecture videos will be available on RWTHmoodle



# Developing for Mobile Platforms



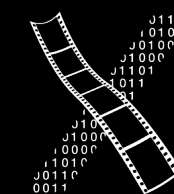




**VS.**

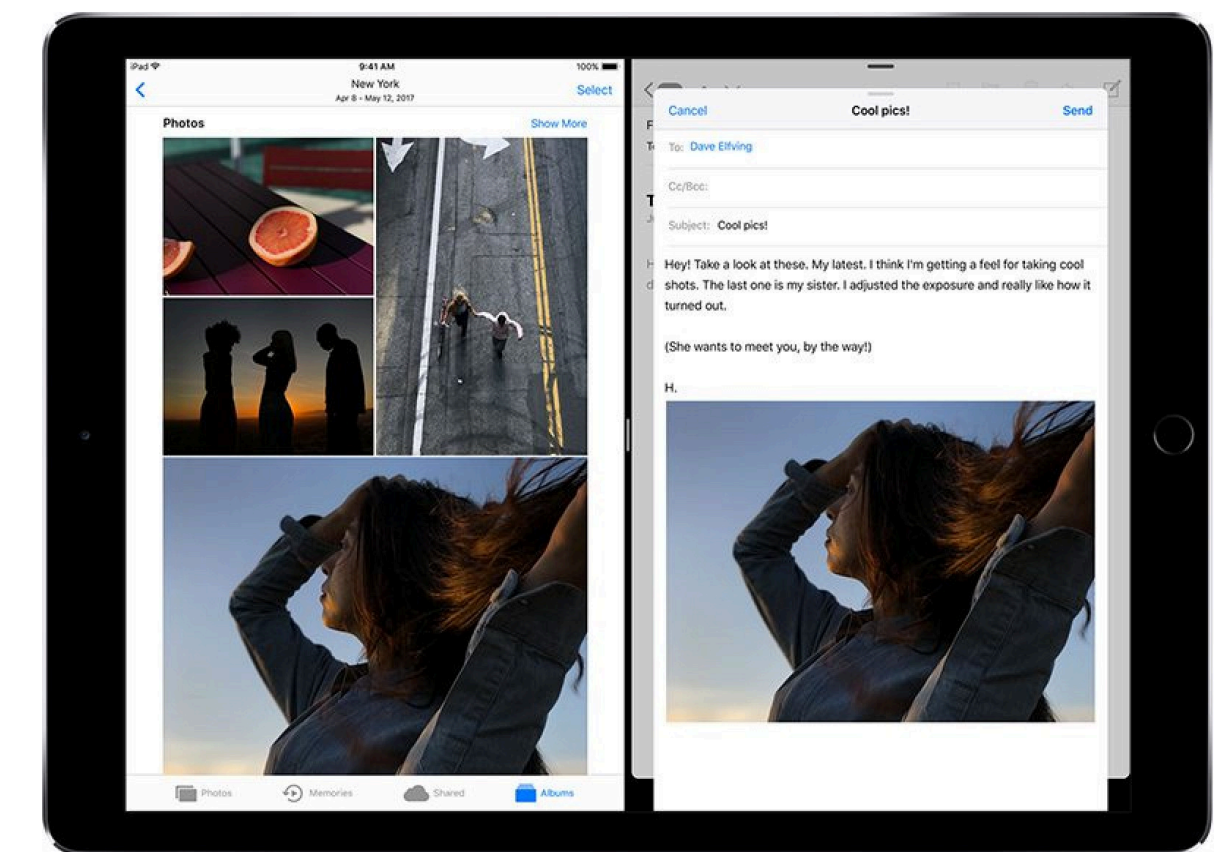






# Mobile Device Characteristics

- Context is key: task, attention split, peripheral use, movement, interaction time
- Small screens
- Users interact with one screen at a time
  - And mostly one application at a time (iPadOS allows split screen)
- Onscreen help is minimal
- Input: direct touch, pen, camera, microphone, sensors



# 10 Golden Rules of Interface Design (see DIS 1)

1. Keep the interface simple
2. Speak the user's language
3. Be consistent and predictable
4. Provide feedback
5. Minimize memory load
6. Avoid errors, help to recover, offer undo
7. Design clear exits and closed dialogs
8. Include help and documentation
9. Offer shortcuts for experts
10. Hire a graphics designer

# The iOS Family



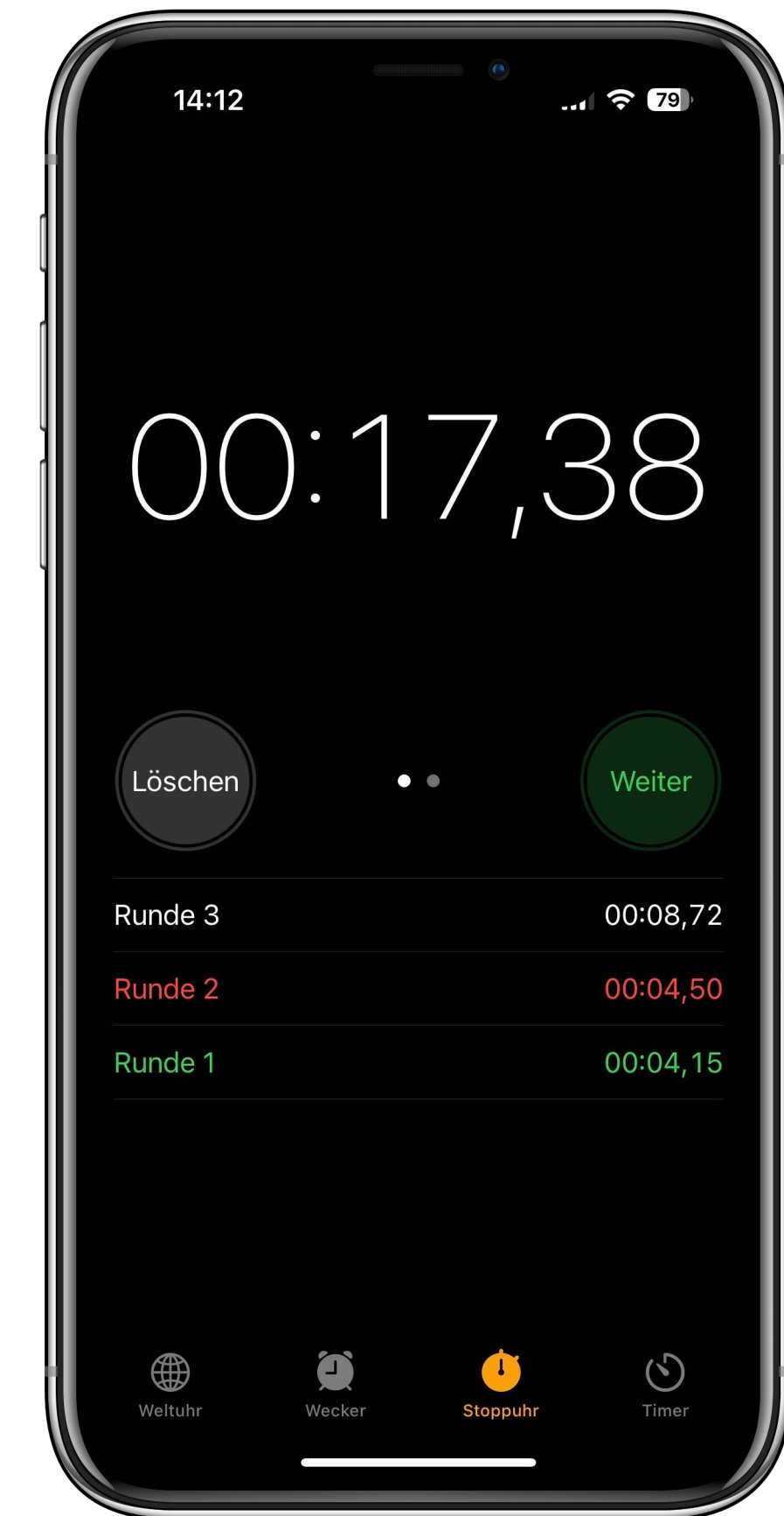
# Life as an App

- iOS is an app-centric environment
- One app per task!
  - Define the task that users want to accomplish with your app
  - Do *one* thing, but do it well
- Data is stored per app
- Exchanging data between apps is difficult



# Designing the UI

- Make it obvious how to use your application
- Sort information from top to bottom
- Use visual weight for relative importance
- Use alignment for groupings or hierarchy
- Use multiple views for different parts of the app





# Example



# Designing the UI

- Text should always be legible
- Avoid inconsistent appearances
- Provide fingertip-size targets (8 x 8 mm)
- Minimize text input

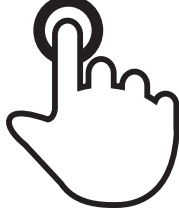
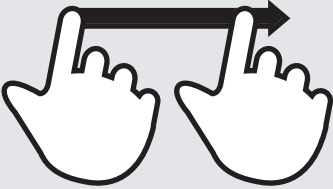




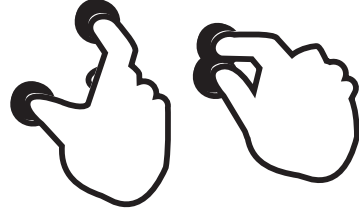
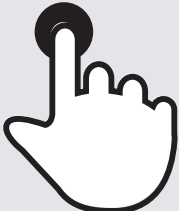


# Interaction Design

- Smartphones are mostly used with only one hand
- Not everyone is used to multitouch interaction
  - Only use multitouch if you need it
- Follow Apple's examples if possible
- If you use complex gestures, help the user



# Standard Gestures

|   |                |   |
|---|----------------|---|
|    | Tap            | To press or select a control or item (analogous to a single mouse click).                 |
|    | Drag           | To scroll or pan.   |
|    | Flick          | To scroll or pan quickly.   |
|    | Swipe          | In a table-view row, to reveal the Delete button.   |
|  | Double tap     | To zoom in and center a block of content or an image. To zoom out (if already zoomed in). |
|  | Pinch open     | To zoom in.   |
|  | Pinch close    | To zoom out.  |
|  | Touch and hold | In editable text, to display a magnified view for cursor positioning.                     |

# Designing the UI

- Several resolutions, about four aspect ratios:



- Device orientation: portrait or landscape
- Designing for the iPad requires more than increasing the resolution

Inbox

Search

Mailboxes: Inbox, VIPs, Drafts, Sent, Flagged

Sort by Date

|  |                    |
|--|--------------------|
| <b>UX / HCI Researchers</b>  | 12:51              |
| Quantified Heuristics?   | Inbox - work       |
| Is there any method for quantifying the data resulted from usability heuristics evaluation? I will be thankfu... |                    |
| <b>Lorente Ruiz, Luis</b>  | 10:40              |
| Iphone programming registration  | Inbox - work       |
| Dear Mr. Voelker, I am an exchange student coming from Spain. I am not able to register in the course IP...      |                    |
| <b>RWTH - Gründerzentrum</b>   | 09:56              |
| AC <sup>2</sup> - der Gründungswettbewerb  | Inbox - work       |
| START UP! Mit AC <sup>2</sup> - der Gründungswettbewerb zum eigenen Unternehmen. Die GründerRegion Aachen u...   |                    |
| <b>Ehsan Poor Mohammady</b>  | 09:45              |
| PDUI Results   | Inbox - work       |
| Dear Simon, I am Ehsan Poormohammady a master student of SSE who took PDUI seminar with you las...               |                    |
| <b>Willi Geffers</b>   | 09:24              |
| Re: Fragen zum Mac Lab   | Inbox - work       |
| Hallo Simon, die Macs im Pool laufen mit der vorletzten Release des OS-X. Die aktuelle Release f...              |                    |
| <b>Nina Rußkamp</b>  | Yesterday          |
| Anmeldung Proseminar   | Inbox - work       |
| Sehr geehrter Herr Völker, leider habe ich es verpasst, mich rechtzeitig für ein Proseminar anzumelden, wür...   |                    |
| <b>Alexander Theißen</b>   | 11/10/14           |
| iPhone Programming Lab   | Inbox - work       |
| Hi, I am interested in participating in the iPhone Programming Lab. My Problem is that I am not able...          |                    |
| <b>Chat Wacharamanotham</b>  | 11/10/14           |
| Re: Lab mac mini   | Inbox - work       |
| Ignore the "now". All Mac minis that are supposed to be in the pool are already in the pool. Cheers, Chat        |                    |
| <b>tomaz &amp; zrbenst</b>   | 11/10/14           |
| [appledoc] Fix EOF token crash (...)   | Inbox - GMAIL 4 >> |
| reStructuredText seems nice, but I didn't find C based parser and it's not supported on objc, s...               |                    |
| <b>Andrii Matviienko</b>   | 10/10/14           |
| Master's Thesis draft  | Inbox - work       |
| Hi, Please find attached the draft of Master's Thesis. Cheers, Andrii  |                    |
| <b>Stauch, Alexander</b>   | 10/10/14           |
| Veranstaltung am 19.03.2015: "Drittmitt...   | Inbox - work       |
| Newsletter Forschungsförderung Abt. 4.2 Sehr geehrte Damen und Herren, die Abteilung 4.2 bietet...               |                    |

**RWTH - Gründerzentrum** 13 Oct 2014 09:56 RG

To: [rwth-mm@lists.rwth-aachen.de](mailto:rwth-mm@lists.rwth-aachen.de) Cc: [social@rwth-aachen.de](mailto:social@rwth-aachen.de)  
AC<sup>2</sup> - der Gründungswettbewerb

**START UP!**

Mit AC<sup>2</sup> - der Gründungswettbewerb zum eigenen Unternehmen.

Die GründerRegion Aachen unterstützt mit dem Geschäftsplanwettbewerb AC<sup>2</sup> - der Gründungswettbewerb Existenzgründer auf dem Weg zur eigenen Firma, mit besonderem Fokus auf das Thema „Innovation“.

Angehende Unternehmer erhalten mit einem kostenfreien Mentor, vier Gutachter-Feedbacks, sieben Fachinformationsveranstaltungen sowie attraktiven Geld- und Sachpreisen genau die Unterstützung, um ihre Gründungsidee ins richtige Licht zu setzen.

Kommen Sie zur Auftaktveranstaltung am

Dienstag, 11. November 2014,  
in der Aachener Bank, Theaterstraße 5,  
(Zugang über Wirichsbongardstraße)  
Einlass: 18:30 Uhr, Beginn: 19:00 Uhr

und lernen Sie in ungezwungener Atmosphäre die Initiative, andere Existenzgründer, Unternehmer sowie die AC<sup>2</sup>-Experten aus Wirtschaft und Wissenschaft kennen.

Anmeldung zur Auftaktveranstaltung unter: <http://www.gruenderregion.de/gruenderkalender-alle-veranstaltungen.html>

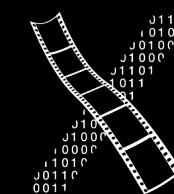
Wie ist der Ablauf von AC<sup>2</sup> - der Gründungswettbewerb?

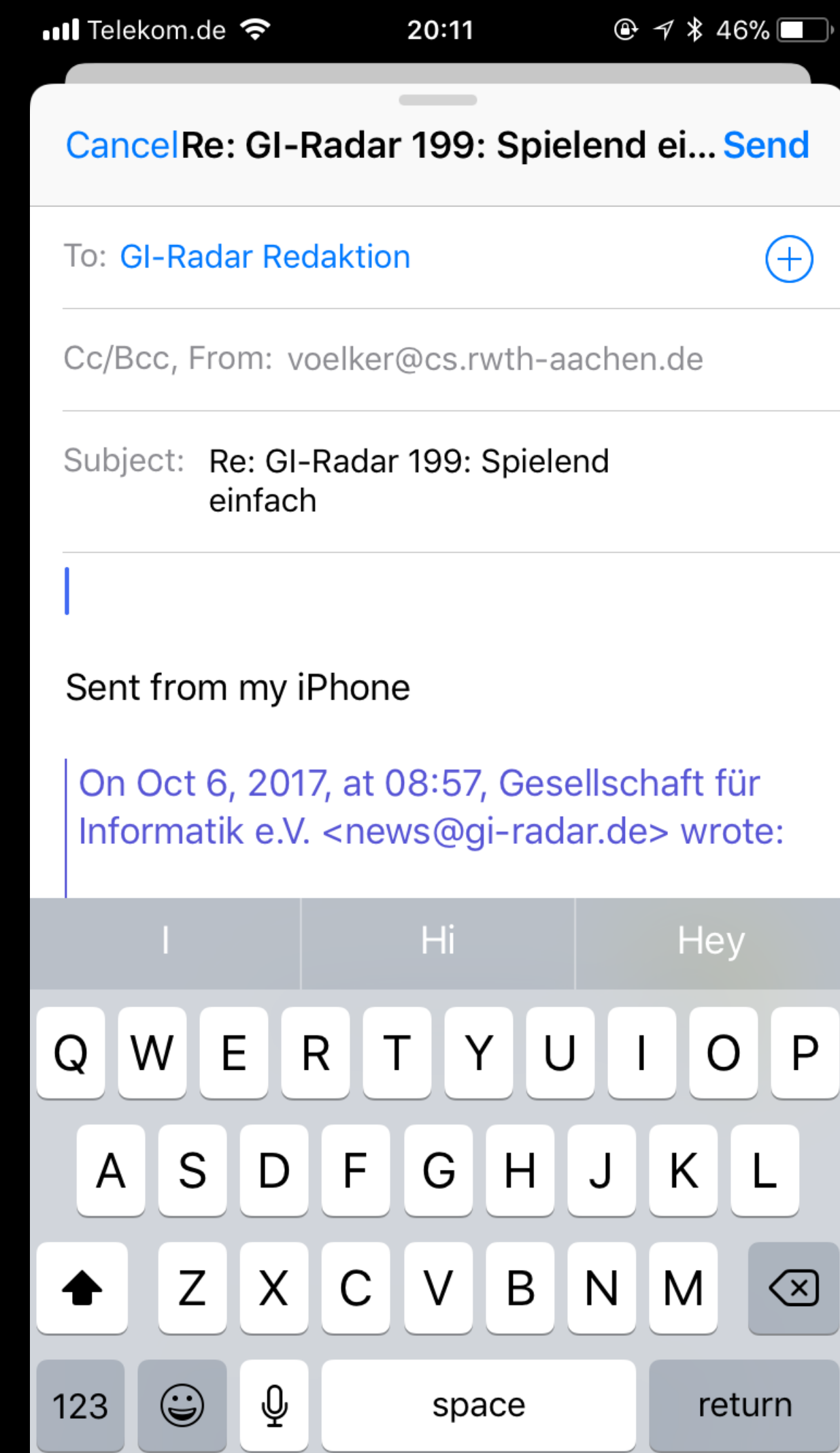
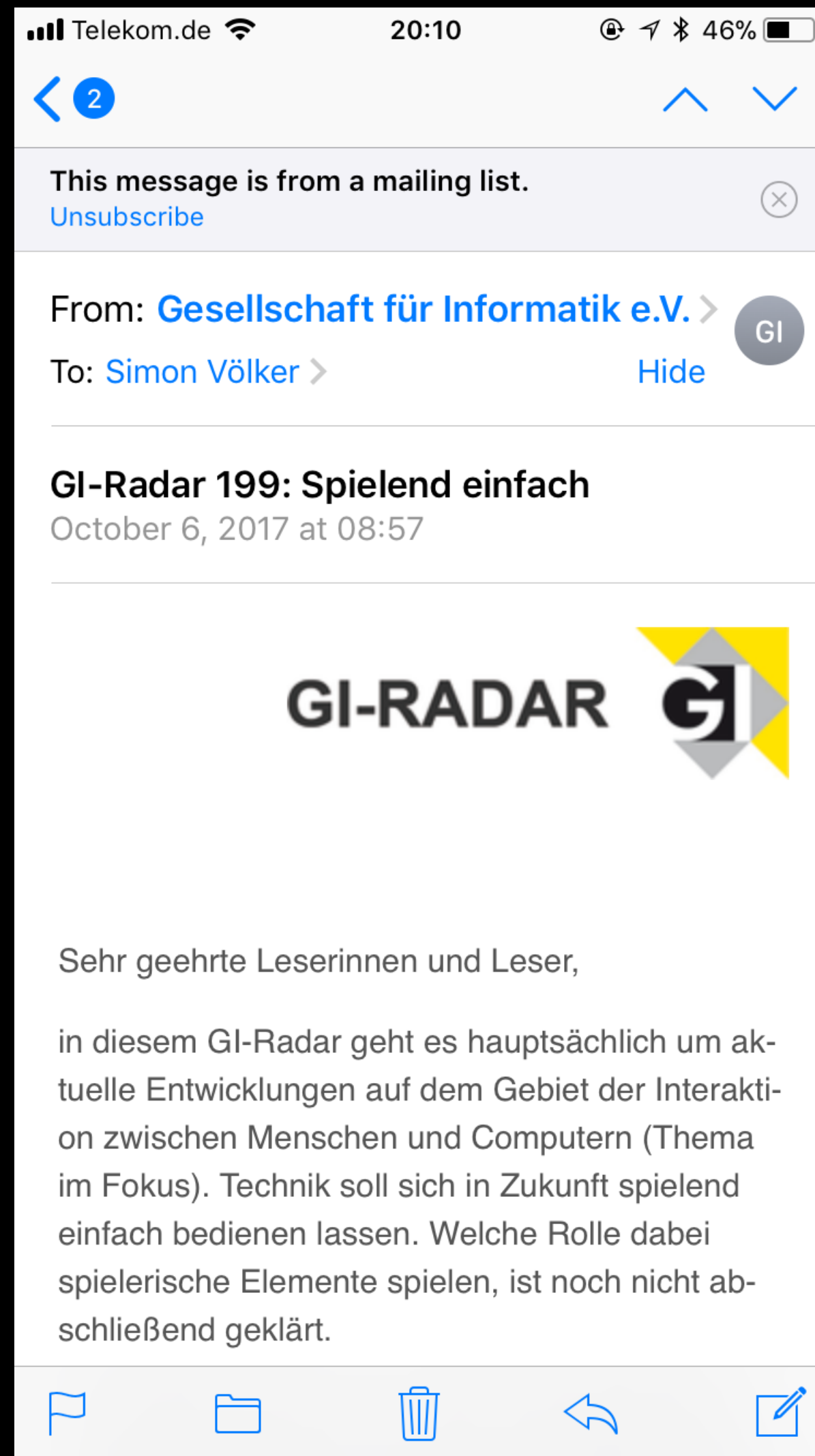
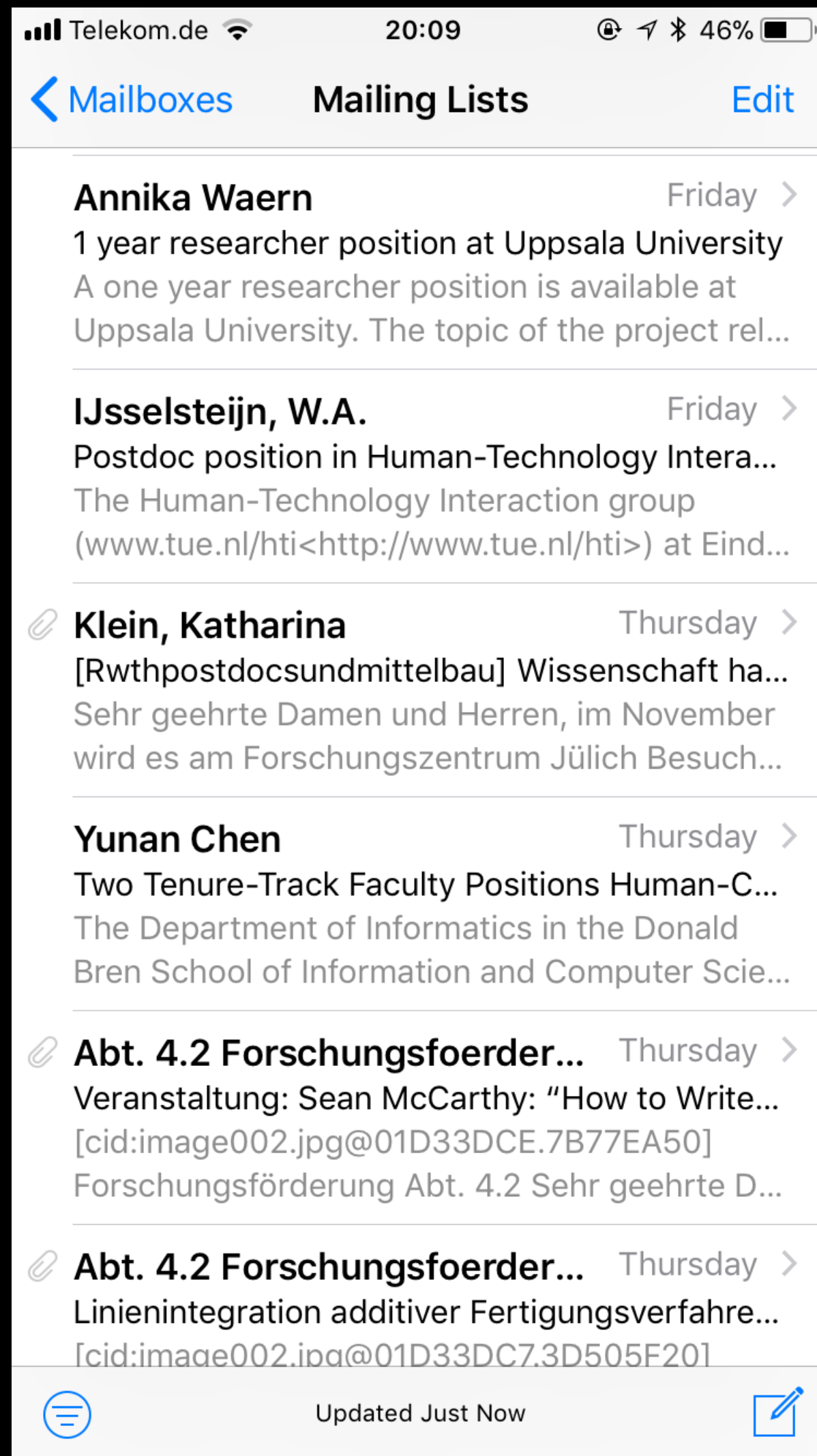
Der Geschäftsplanwettbewerb richtet sich an alle, die eine Geschäftsidee haben und eine Existenzgründung anstreben oder ein Unternehmen übernehmen möchten. Unterstützt durch einen Mentor aus dem AC<sup>2</sup> - Beraternetzwerk entwickeln Sie aus Ihrer Gründungsidee einen aussagekräftigen Geschäftsplan. Der Wettbewerb läuft in zwei Phasen ab. Grundsätzlich ist ein Einstieg in jeder der beiden Phasen möglich. In der ersten Wettbewerbsphase bis 5. Januar 2015 erarbeiten Sie mit Ihrem Mentor einen Grob-Geschäftsplan. In der zweiten Wettbewerbsphase bis 16. März 2015 entwickeln Sie diesen weiter zu einem Detail-Geschäftsplan. Am Ende jeder Phase steht die Begutachtung der eingereichten Pläne durch zwei unabhängige Gutachter. Die zehn besten Geschäftspläne der Phase 1 werden auf einer Zwischenprämierung am 10. Februar 2015 und die drei besten Geschäftspläne der Phase 2 im Rahmen der Verleihung des AC<sup>2</sup> - Innovationspreises der Region Aachen, Düren, Euskirchen, Heinsberg am 11. Juni 2015 mit Sachpreisen und Geldpreisen in einer Gesamthöhe von 32.500 Euro ausgezeichnet.

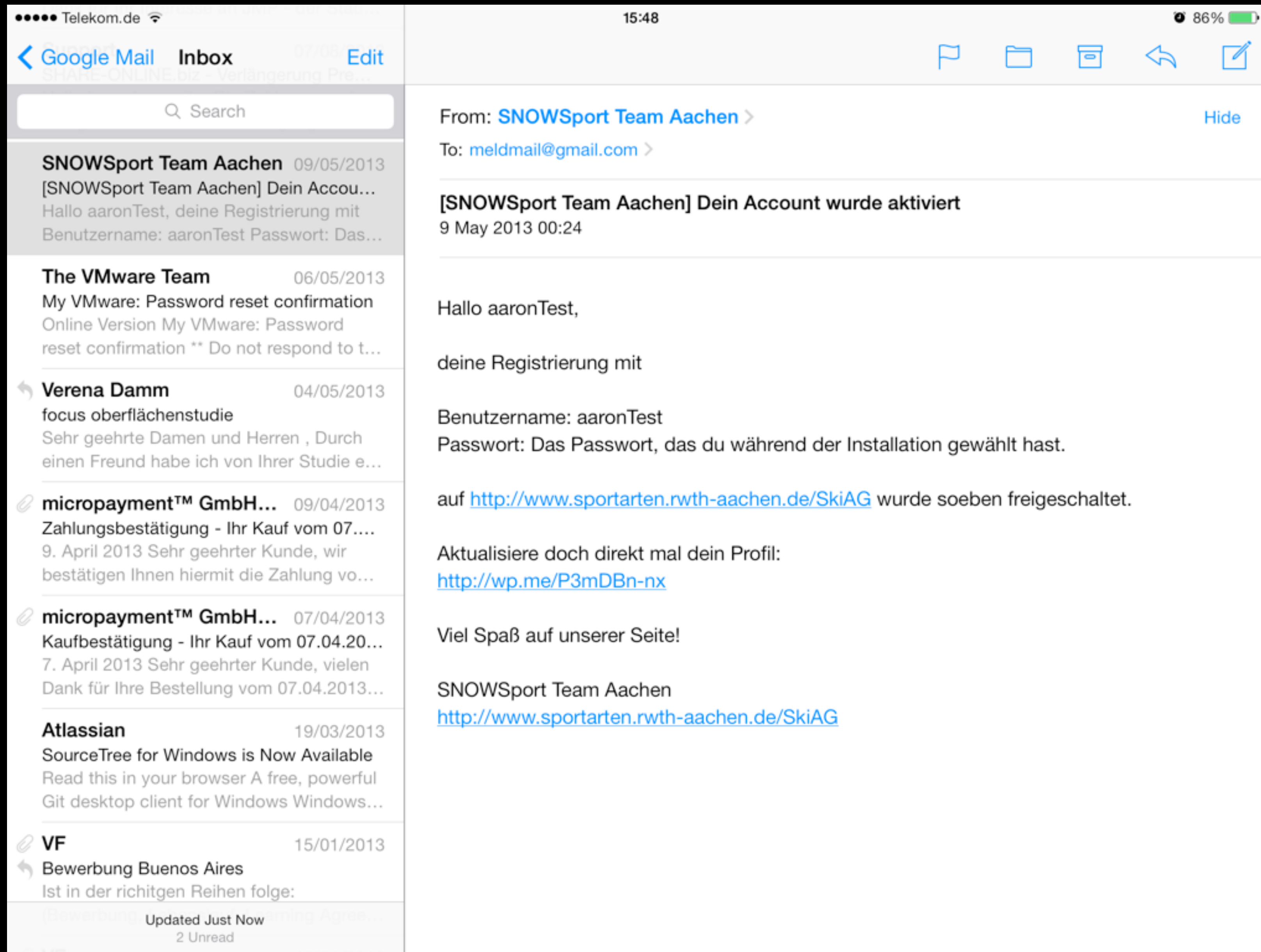
Fünf Gründerabende zu Themen wie Recht, Finanzen oder Marketing sowie zwei spezielle Veranstaltungen zum Thema Innovation runden das Programm ab. Im informellen Teil dieser Veranstaltungen besteht die Möglichkeit, mit anderen Gründern, den Mitgliedern aus dem AC<sup>2</sup> - Beraternetzwerk und Kapitalgebern in Kontakt zu treten.

Informationen und Anmeldung unter:

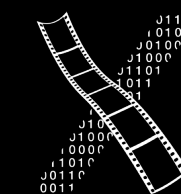
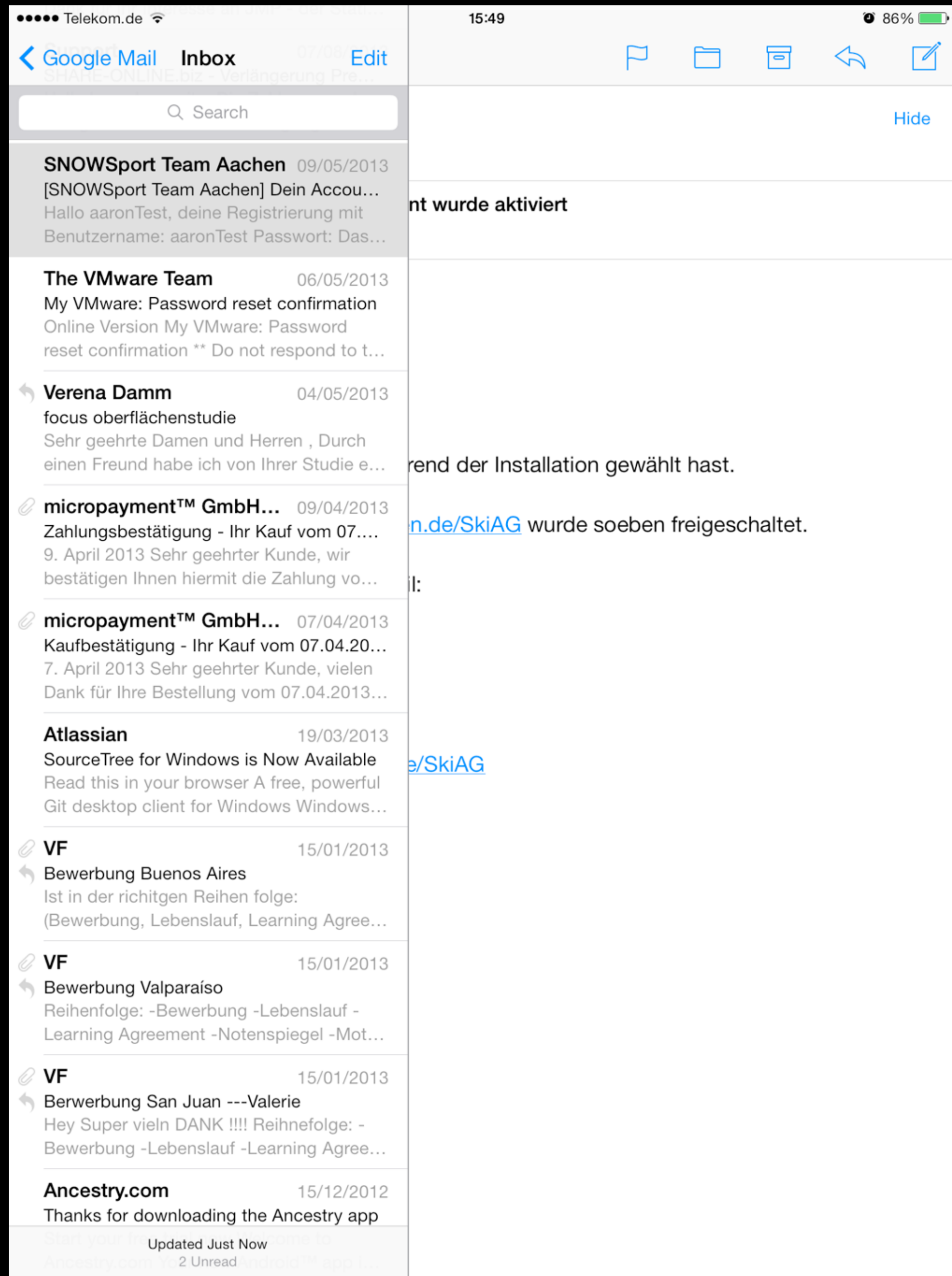
Internet: [www.ac-quadrat.de](http://www.ac-quadrat.de)  
E-Mail: [info@ac-quadrat.de](mailto:info@ac-quadrat.de)  
Telefon: 0241 4460-350











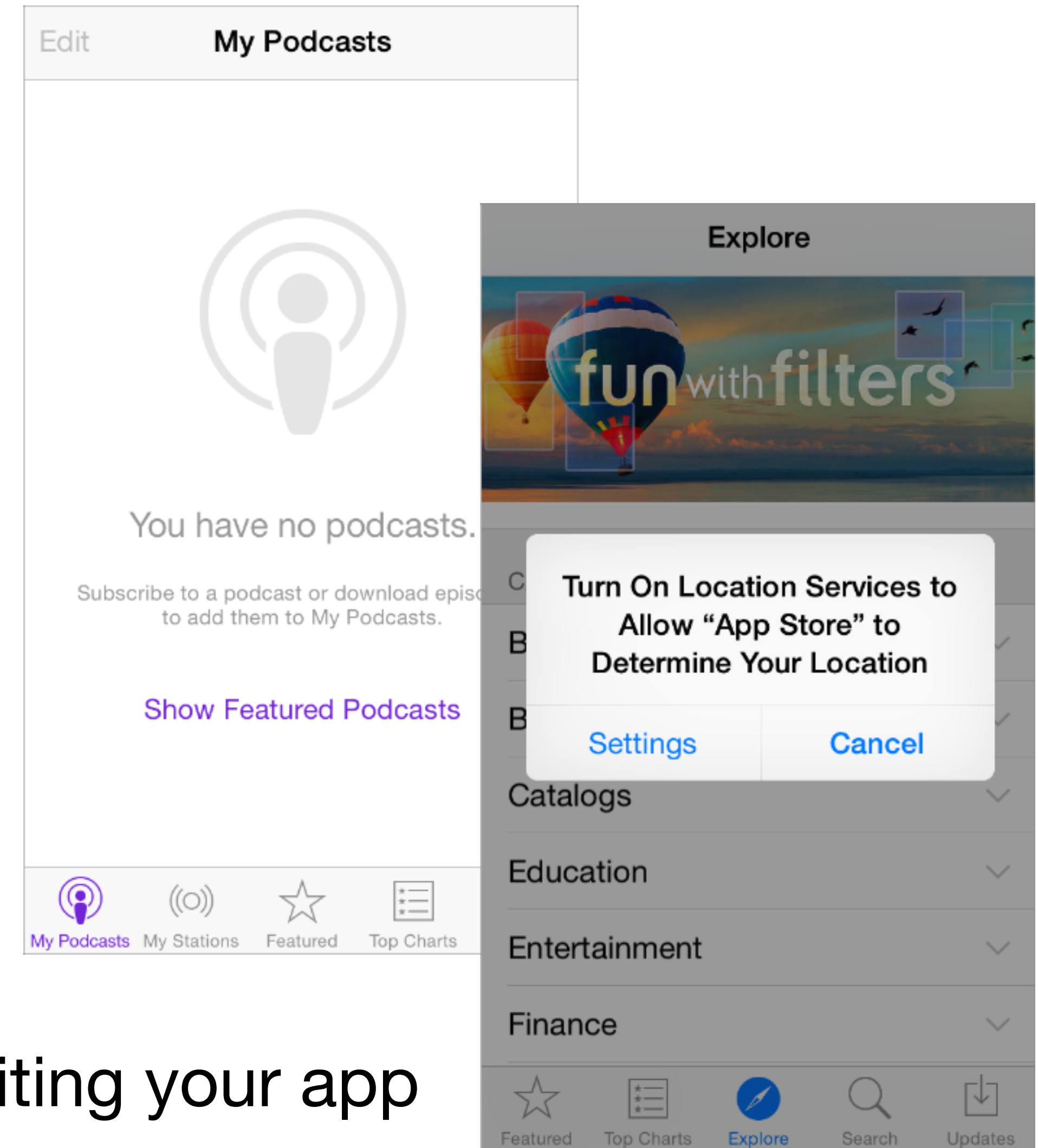
# Launching

- Apps should start quickly to provide a fluid user experience
- Show a launch image that closely resembles the first screen of your app (launch file) — no splash screens
- Restore the state of last run (minimize user input)
- Delay a login requirement for as long as possible
- By default, launch in device's current orientation
- Think carefully before providing an onboarding experience
- See **Apple's Design Patterns: Launching**



# Stopping

- No Quit button or menu item
- Be prepared to quit at any time
- Program flow interrupted by external events
  - Incoming phone call
- Store state when stopping
- Application moved to background
- Notify users what feature are unavailable and limiting your app



# Application Styles

## Productivity



Photos

## Utility



Weather

## Immersive



Seadragon

# Productivity Applications

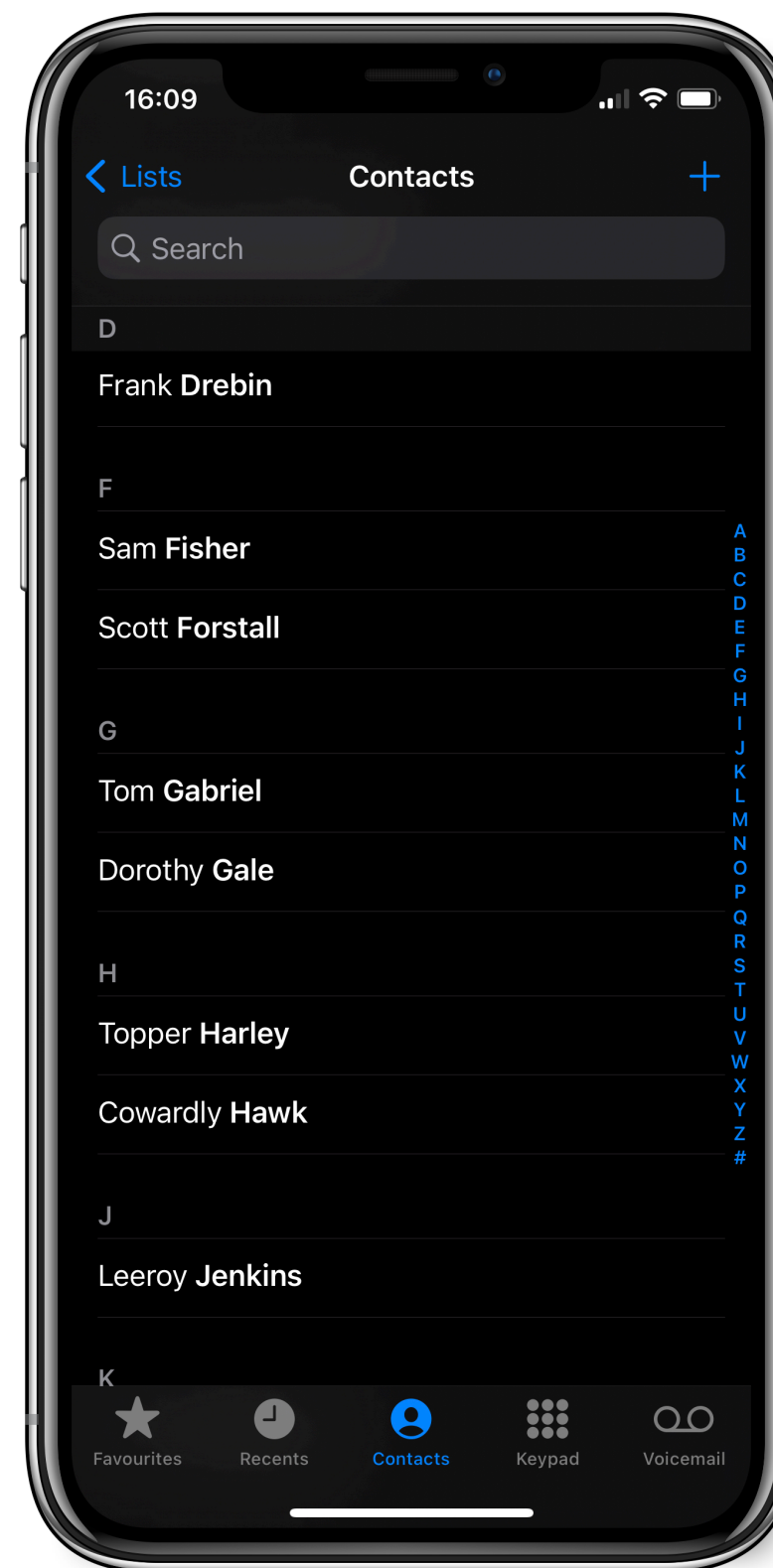
- Organizing and managing detailed information
- Often organize data hierarchically
- Organizing the list, add or remove items



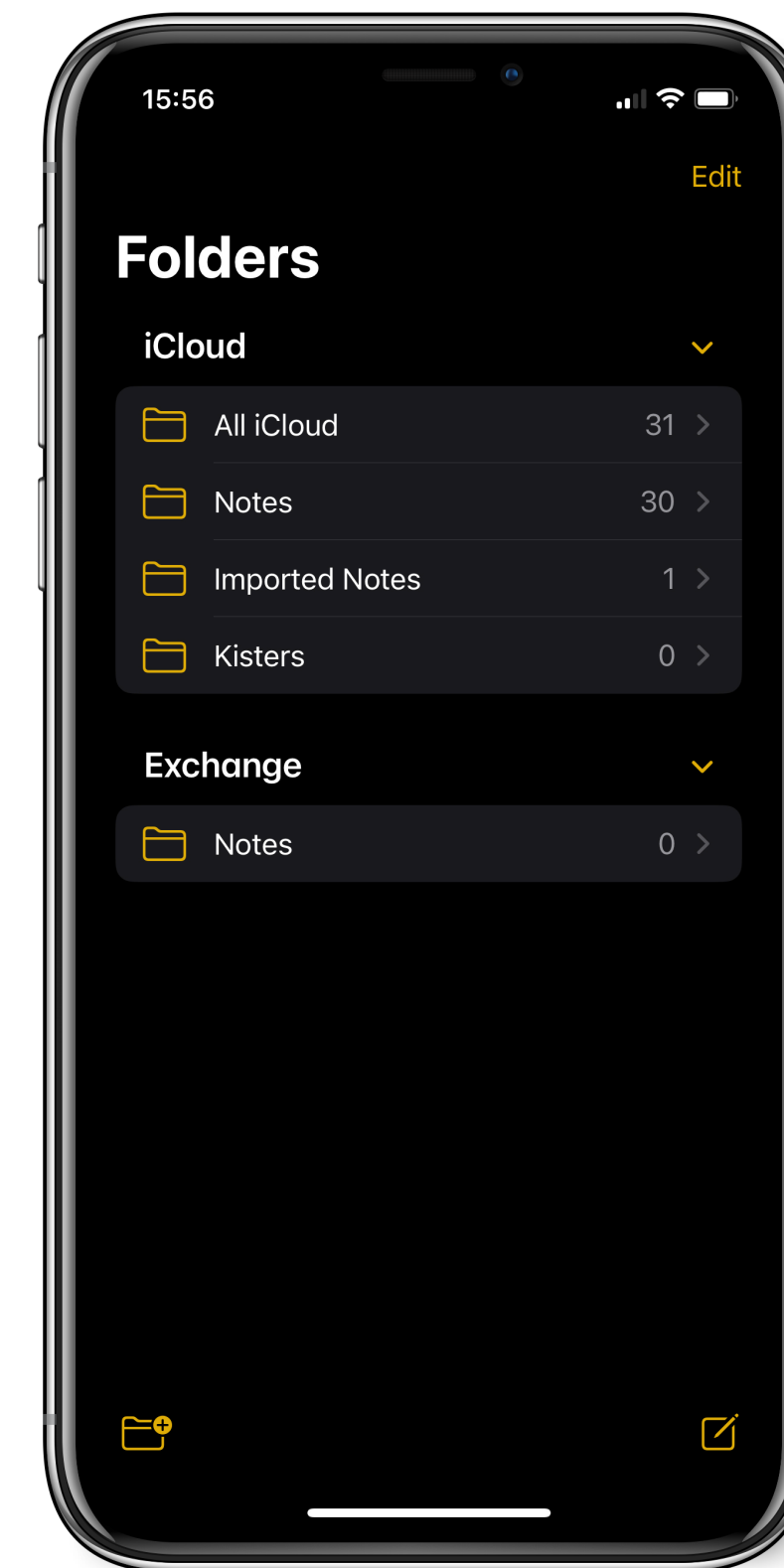
# Productivity Applications: Examples



Photos



Contacts



Notes

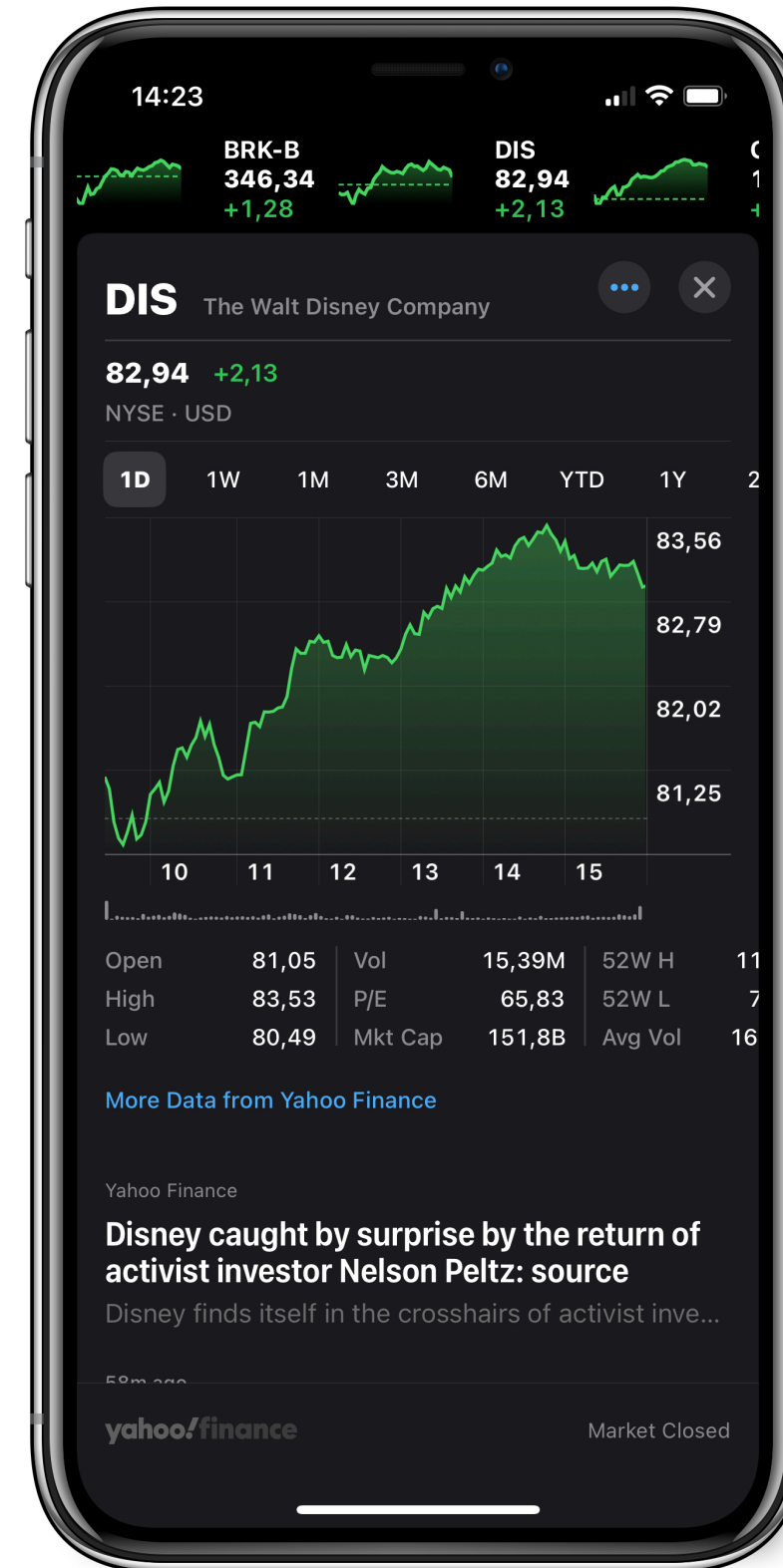
# Utility Applications

- Simple task, minimum user input
- Customized, visually attractive UI that enhances the displayed information
- Data is organized in flattened list of items

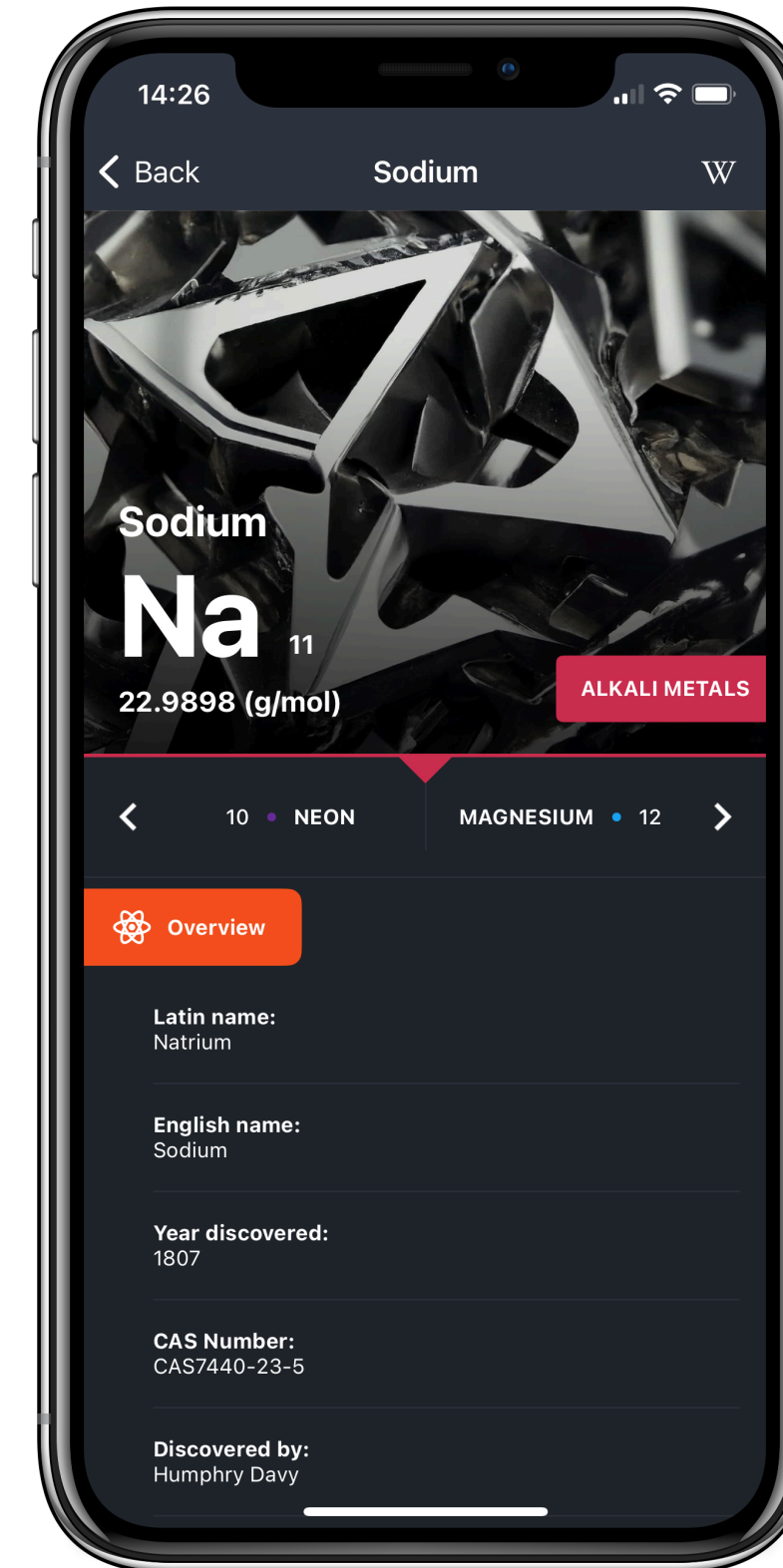
# Utility Applications: Examples



Weather



Stocks



Periodic Table



# Immersive Applications

- Full-screen, visually rich UI
- Focussed on content and user experience
- Tends to hide much of the device's user interface
- Custom navigational methods



# Immersive Applications: Examples

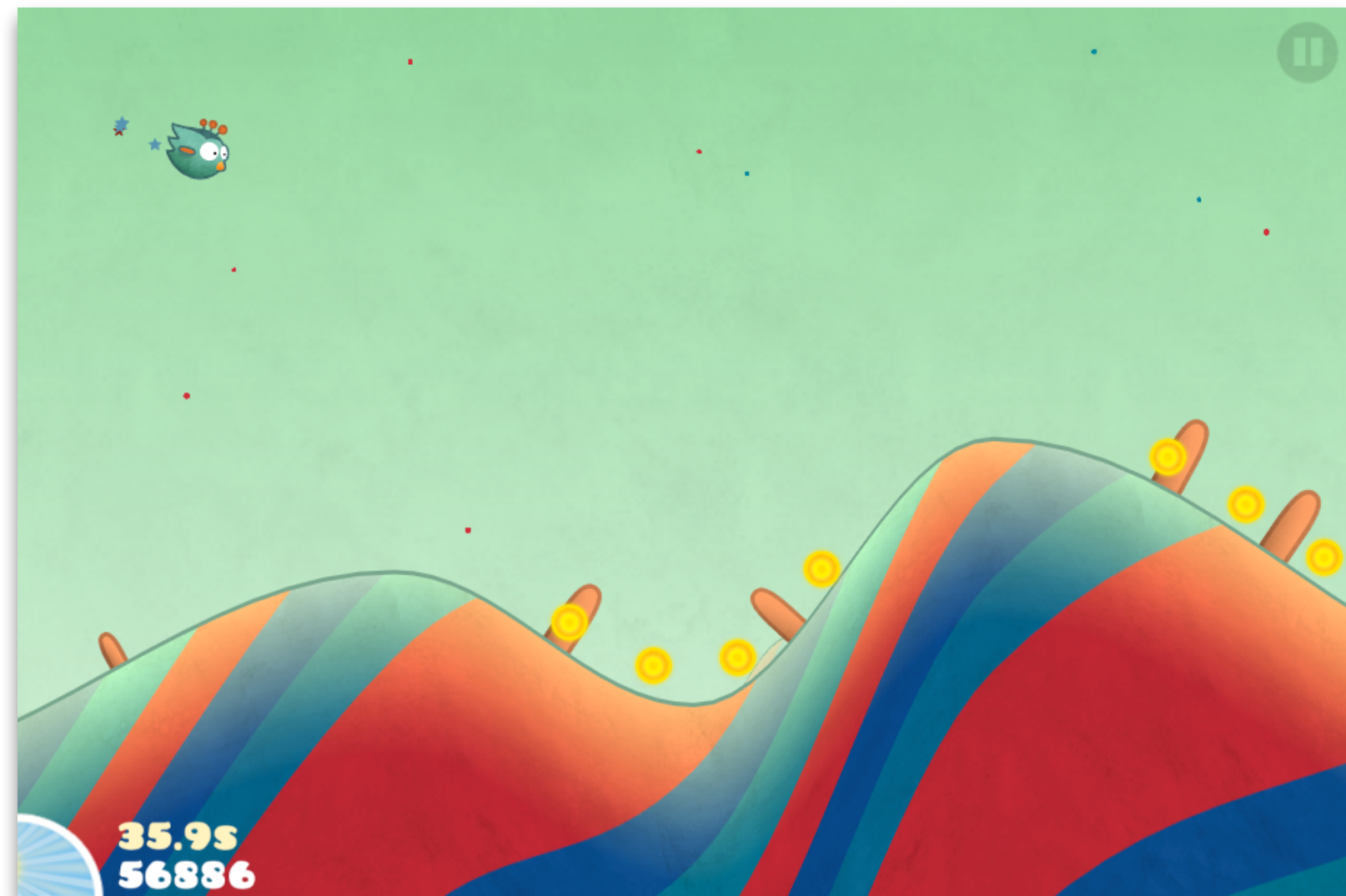


Weather Now



Tape Measure

# Immersive Applications: Examples



Tiny Wings



Super Mario Run



The Machines

# Summary

- Mobile vs. desktop apps: user, **task**, **context**
- Keep hardware restrictions in mind
- App-centric vs. document-centric
- Application styles: productivity, utility, immersive
- Further reading:
  - iOS Human Interface Guidelines:  
<https://developer.apple.com/design/human-interface-guidelines>



# What's Next?

- Register, and sign the Declaration of Compliance and upload it to the sciebo folder.
- Next lecture: Tomorrow, 08.10.2024 10:30–12:00
  - Presentation of seminar topics
  - Introducing Swift
- Remember the class page: [hci.rwth-aachen.de/ios](https://hci.rwth-aachen.de/ios)

