

EXHIBIT H



AppLens and LaunchTile: Two Designs for One-Handed Thumb Use on Small Devices



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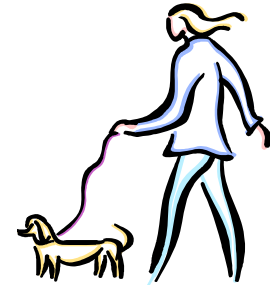


John SanGiovanni
Microsoft Research
Microsoft Corporation



Why One-Handed Interaction?

- ❑ One hand occupied



- ❑ Unstable environment

- ❑ Attention divided among tasks



- ❑ Two handed use unnatural

Input and Interaction on Existing Devices

■ Smartphones

- Input: Hardware Buttons
- Interaction: One-handed
Keypad-mapped functions
Directional navigation



■ Personal Digital Assistants (PDAs)

- Input: Touch Sensitive Display
Hardware Buttons
- Interaction: Two-handed
Small software targets
Directional navigation



Design Goal

- Scalable User Interface (ScUI)
 - Single design & interaction architecture
 - Multiple resolutions & aspect ratios
 - University of Maryland's PocketPiccolo.NET toolkit for Zoomable User Interfaces (ZUIs)



iMate Smartphone II

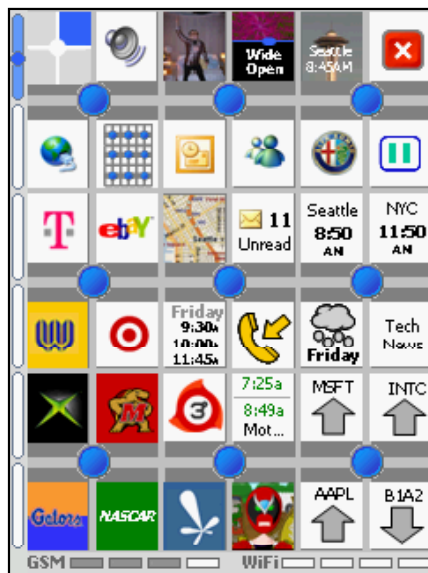
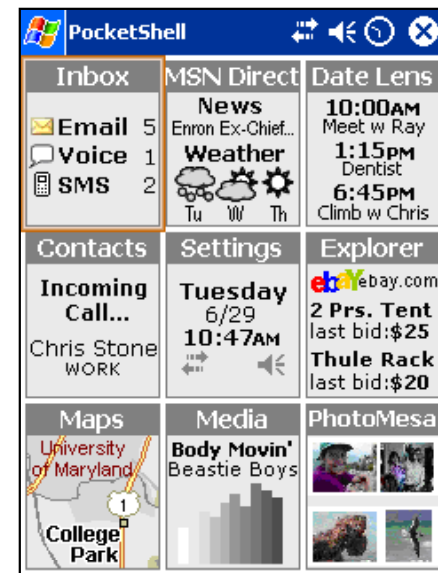


HP iPAQ PocketPC

One Application, Two Designs

AppLens: Fisheye+Pan

- 9 Application Tiles
- Fisheye Zoom
- Command-Based Gestures

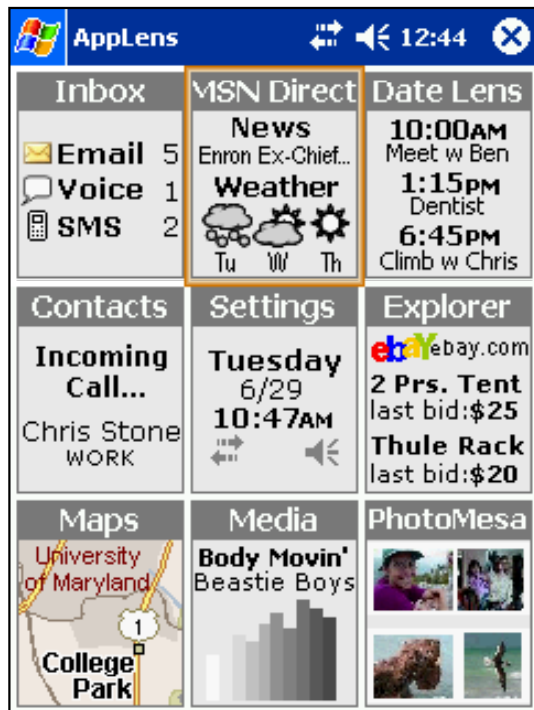


LaunchTile: Zoom+Pan

- 36 Application Tiles
- Pure Zoom
- Direct Manipulation Gestures

AppLens Visual Design

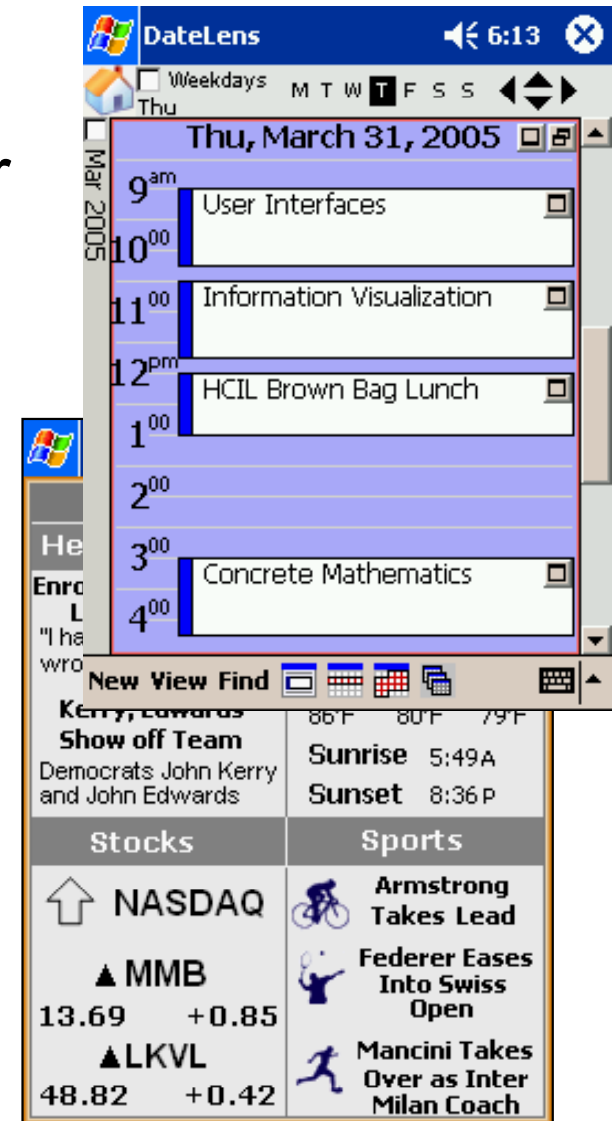
- Generalized tabular fisheye
 - Motivated by DateLens calendar
- Three fisheye zoom levels



Overview



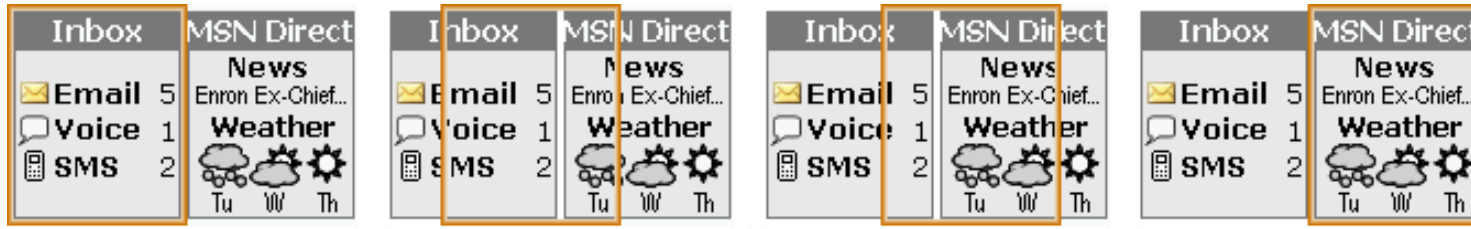
Context / Fisheye



Detail

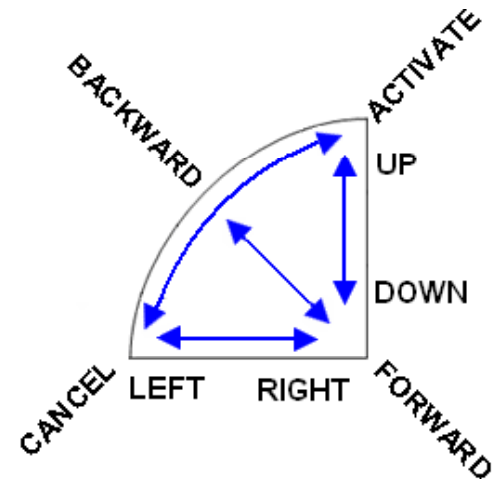
AppLens Interaction Design

■ Input cursor



■ Command gestures

- ❑ Issued anywhere
- ❑ Access distant widgets
- ❑ Don't interfere with tap



AppLens Video

Interactive prototype based on images

We thank François Guimbretière for suggesting the arc-based design

Formative Study Results: AppLens

■ Likes

- ❑ Easy to learn
- ❑ Effective to navigate
- ❑ Comfortable
- ❑ Fisheye view valuable
- ❑ Simultaneous access to apps



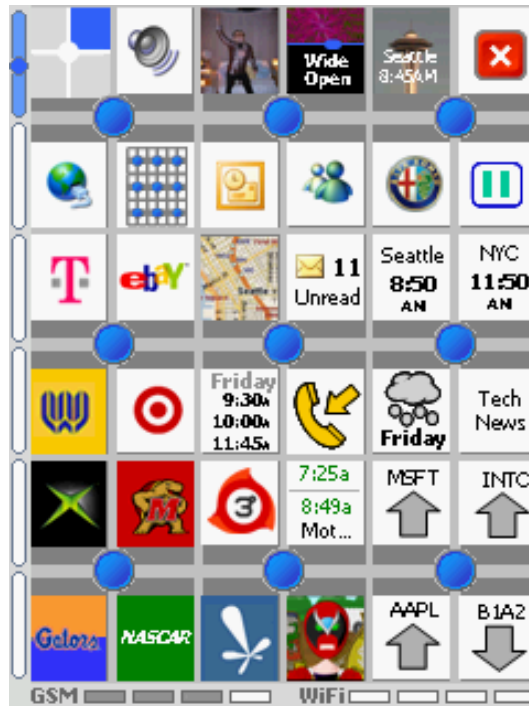
AppLens Fisheye View

■ Usability Issues

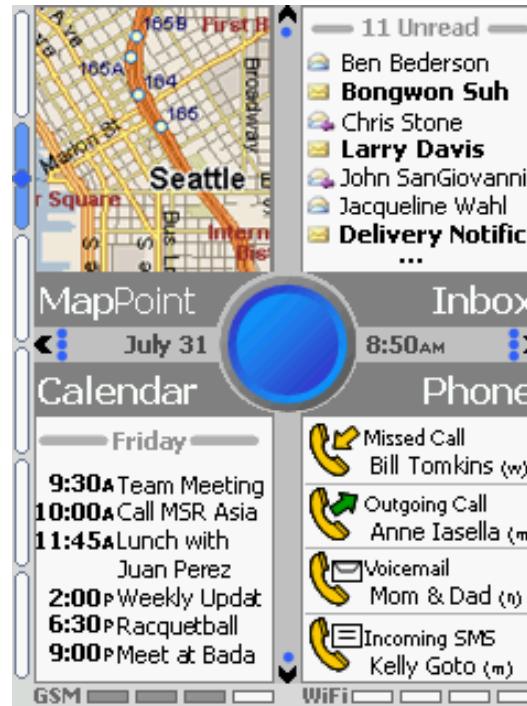
- ❑ Gestures were hardest part

LaunchTile Visual Design

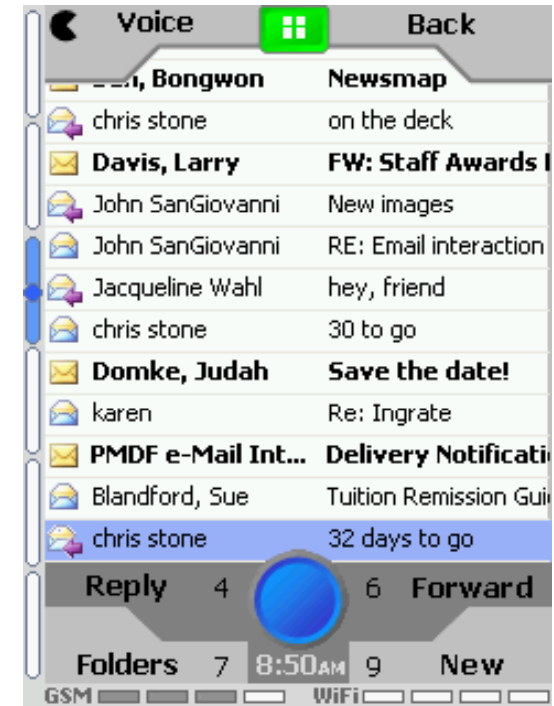
- Three pure zoom levels



Overview



Context / Zone



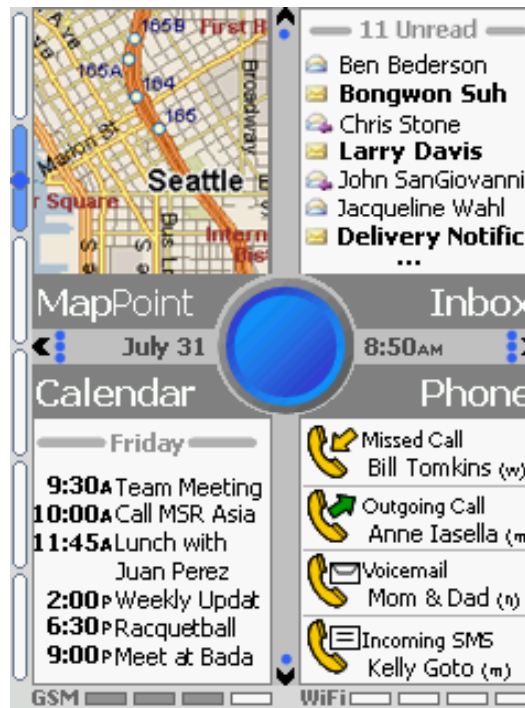
Detail

LaunchTile Visual Design

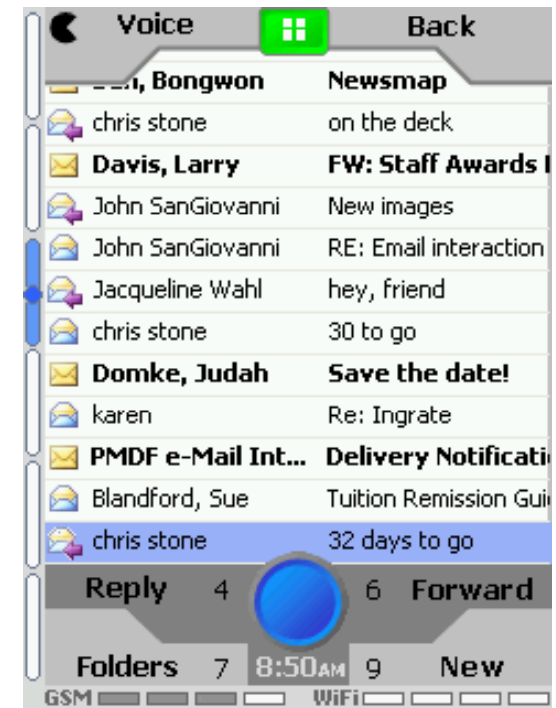
- Three pure zoom levels



Overview



Context / Zone



Detail

LaunchTile Visual Design

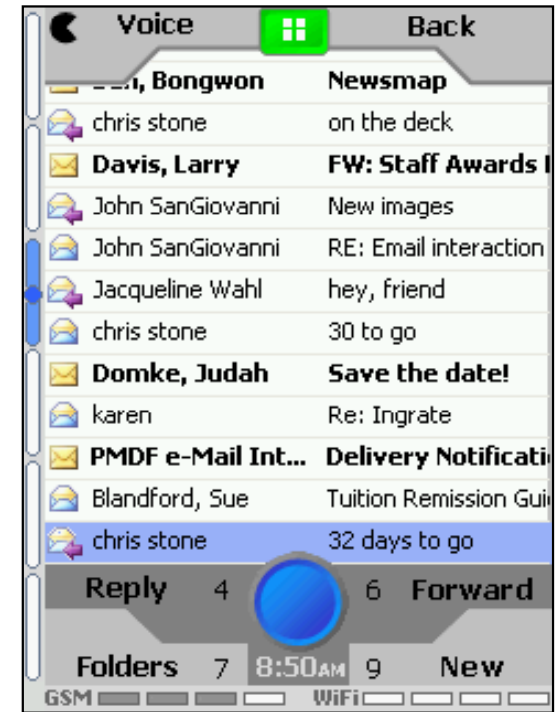
- Three pure zoom levels



Overview



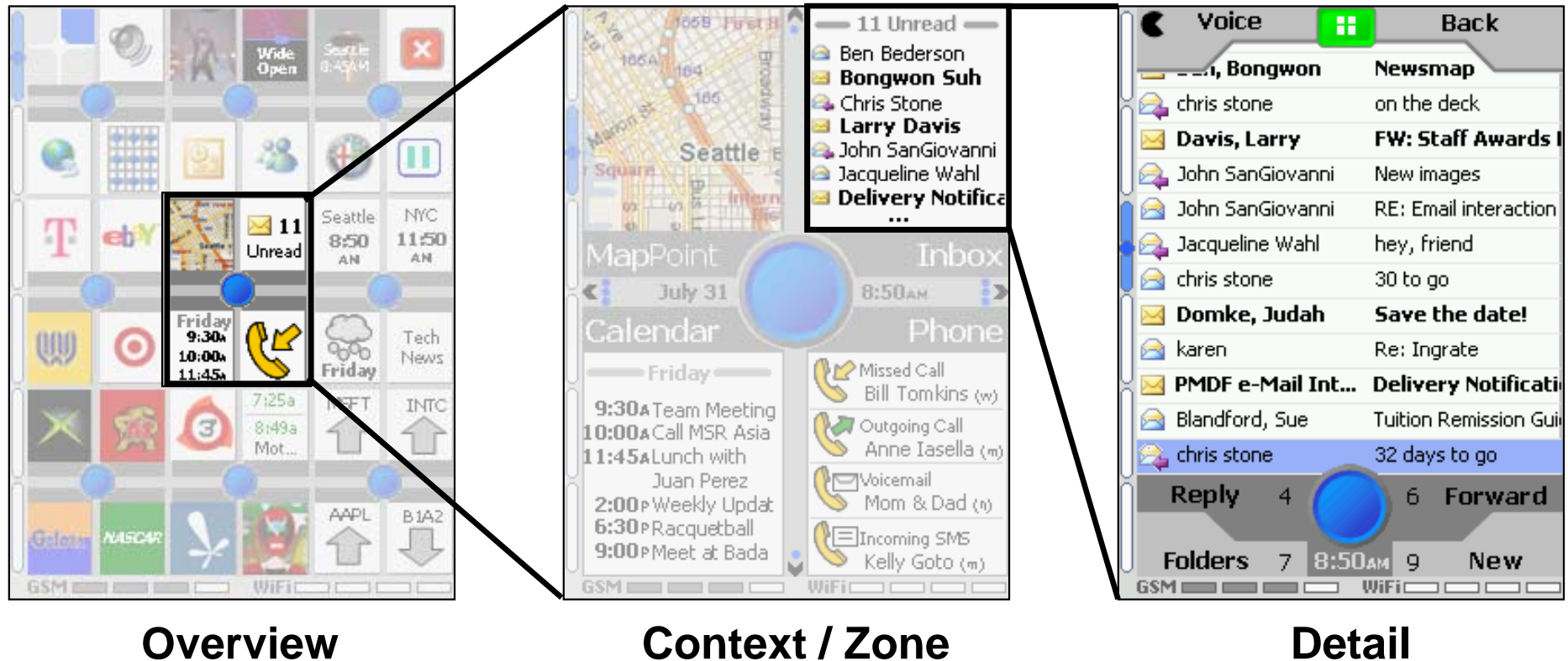
Context / Zone



Detail

LaunchTile Visual Design

- Three pure zoom levels



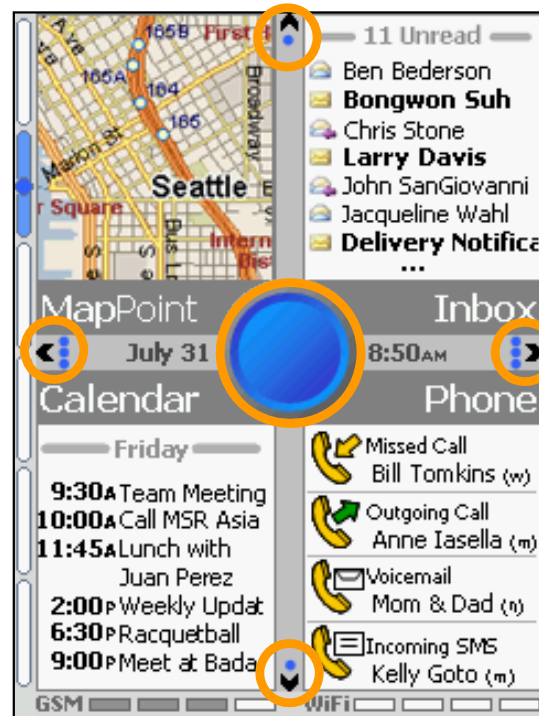
- Animated zooming to transition between views

LaunchTile Visual Design

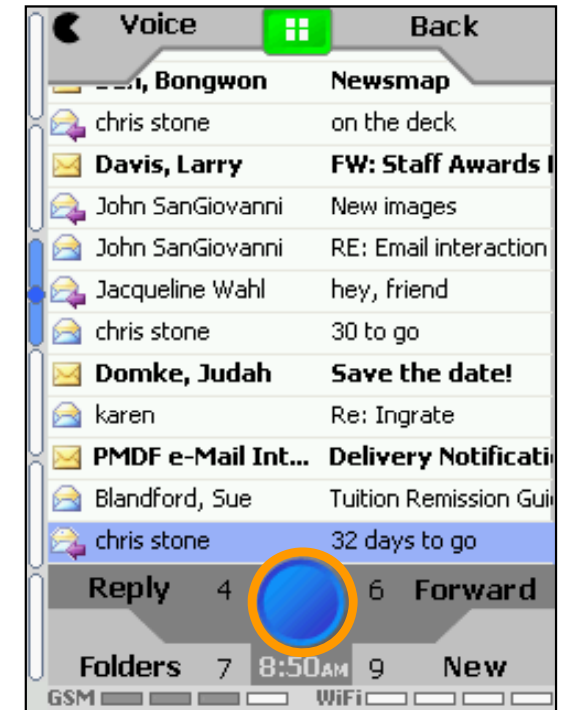
- Three pure zoom levels



Overview



Context / Zone

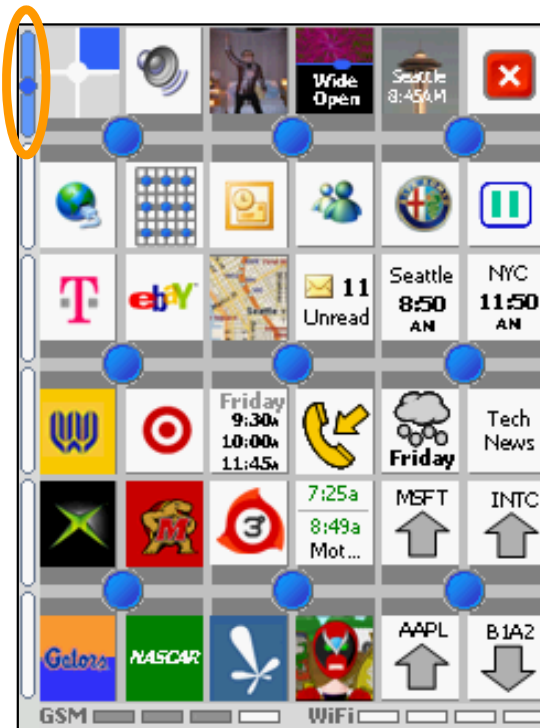


Detail

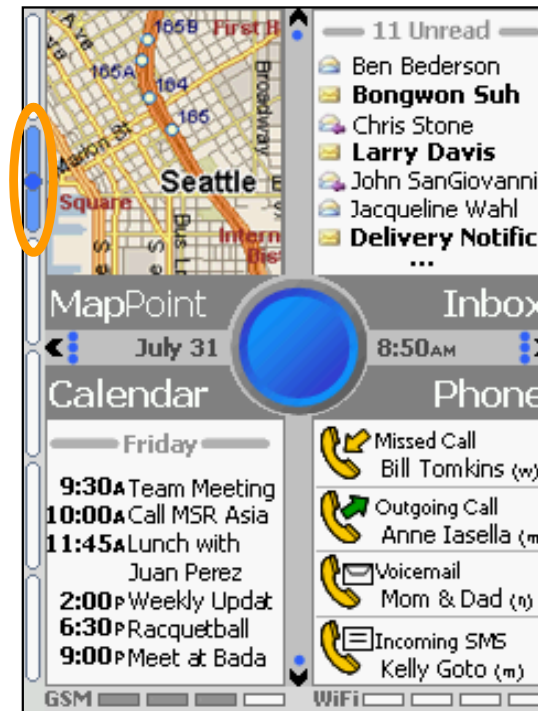
- Animated zooming to transition between views
- Visual landmarks

LaunchTile Visual Design

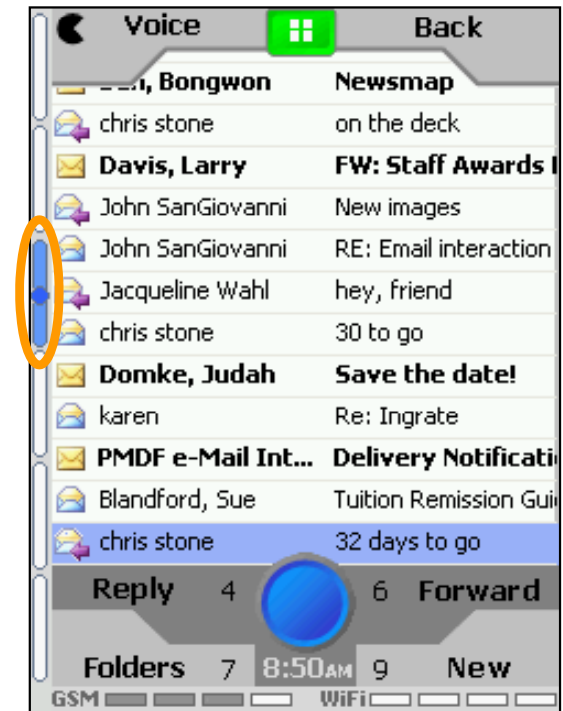
- Three pure zoom levels



Overview



Context / Zone

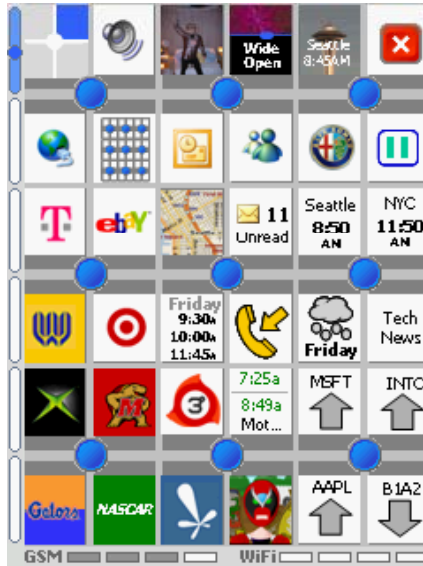


Detail

- Animated zooming to transition between views
- Visual landmarks

LaunchTile Interaction Design

- Thumb-sized, keypad-mapped targets



Overview

LaunchTile Interaction Design

- Thumb-sized, keypad-mapped targets



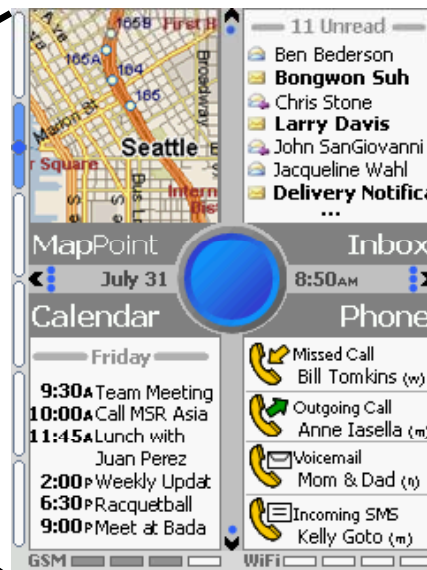
Overview

LaunchTile Interaction Design

- Thumb-sized, keypad-mapped targets



Overview



Context / Zone

LaunchTile Interaction Design

- Thumb-sized, keypad-mapped targets



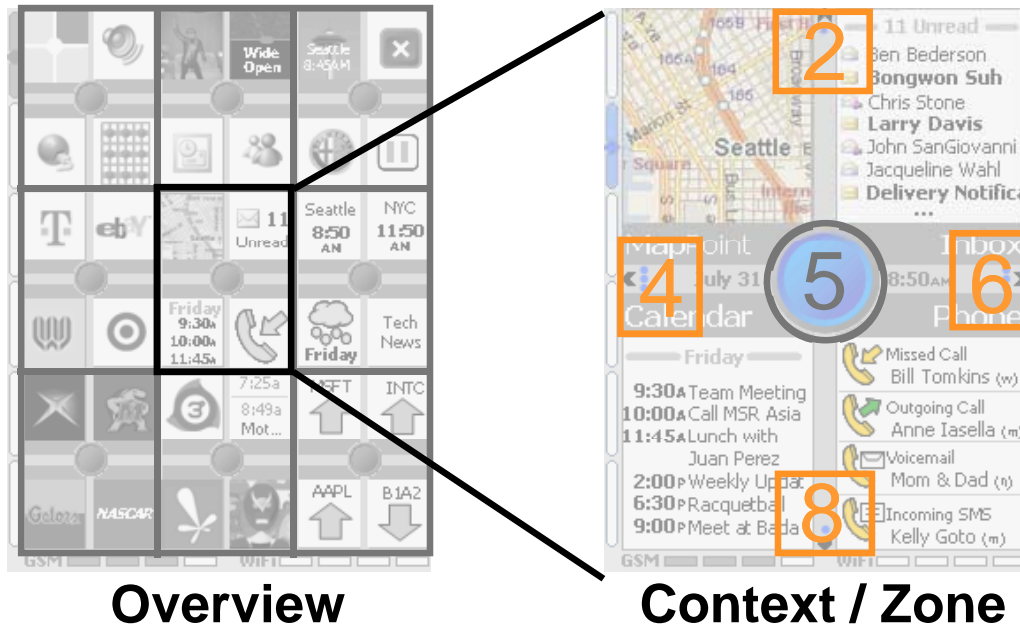
Overview



Context / Zone

LaunchTile Interaction Design

- Thumb-sized, keypad-mapped targets



Overview

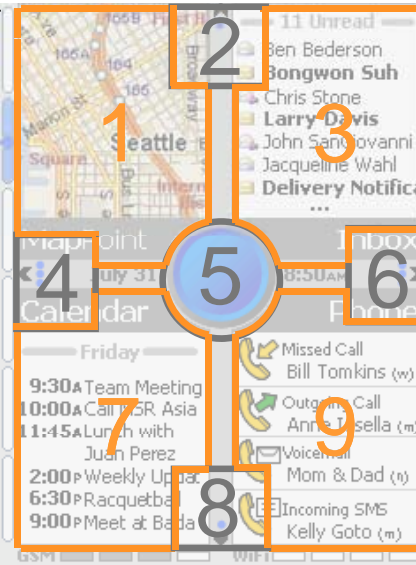
Context / Zone

LaunchTile Interaction Design

- Thumb-sized, keypad-mapped targets



Overview



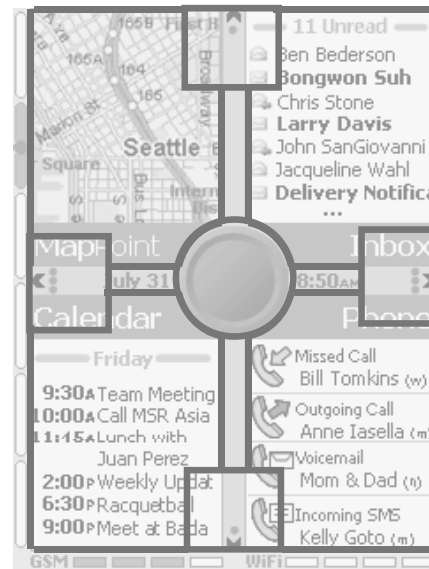
Context / Zone

LaunchTile Interaction Design

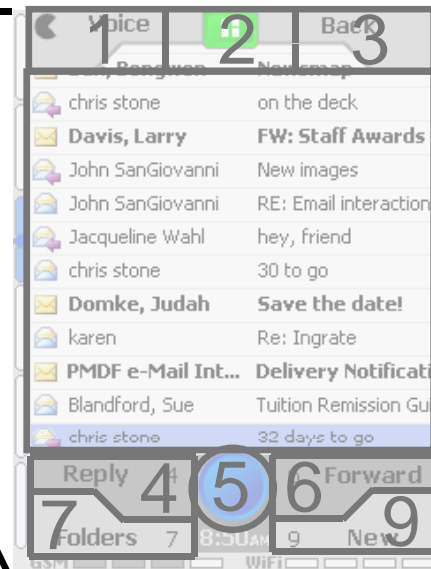
- Thumb-sized, keypad-mapped targets



Overview



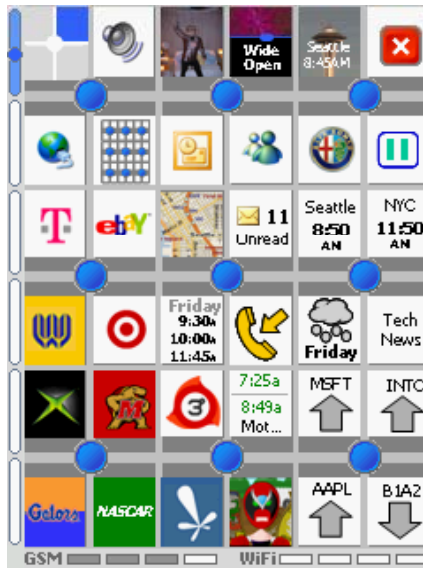
Context / Zone



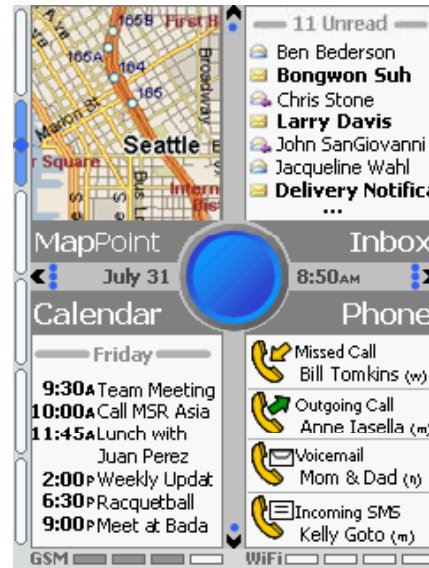
Detail

LaunchTile Interaction Design

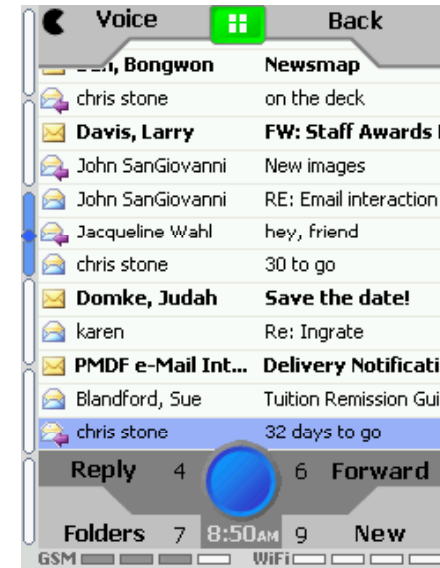
- Thumb-sized, keypad-mapped targets



Overview



Context / Zone



Detail

- Direct Manipulation Drag Gestures

- Zoomspace
- Application content
- Toolglass

LaunchTile Video

Interactive prototype based on images

Formative Study Results: LaunchTile

■ Likes

- ❑ Effective to navigate
- ❑ Comfortable
- ❑ Blue dot
- ❑ Access to many apps

■ Dislikes

- ❑ Too many apps

■ Usability Issues

- ❑ Multi-modal “Blue”



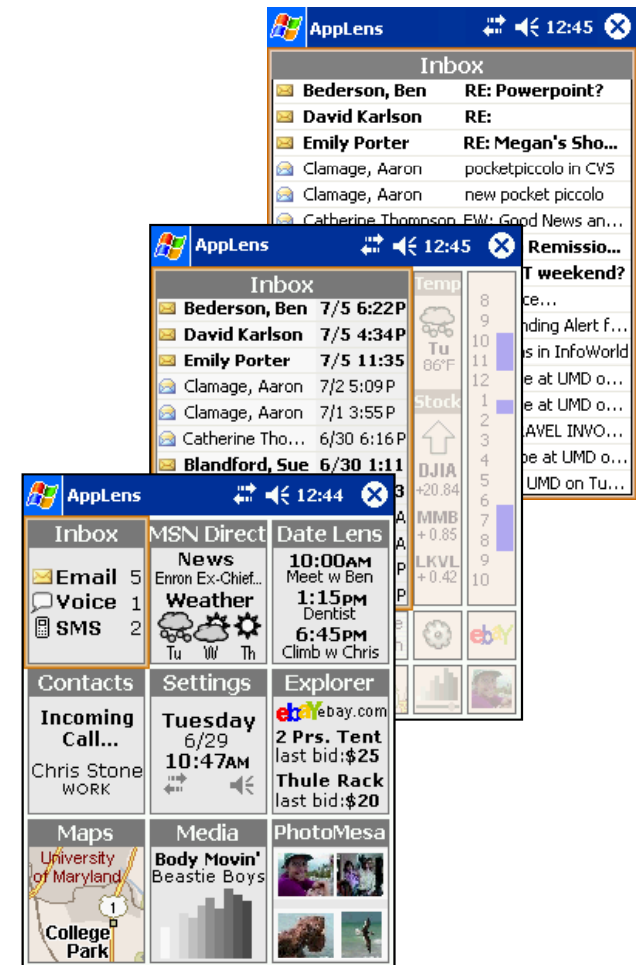
LaunchTile Context / Zone View

- ❑ Disorienting

- ❑ Panning in Zone view

Results: AppLens vs. LaunchTile

- With minimal training, AppLens preferred
 - Easier to use
 - Faster application access
 - Better at-a-glance value
- But...
 - Simpler design, fewer apps
- For both designs, users liked
 - Tap over gestures
 - Application summaries





Lessons Learned

- **Promising Interfaces:**
 - One-handed
 - Notification-based
 - Tappable

 - **Cross-Device Implementation:**
 - Different sizes and aspect ratios
 - Different input features

 - **Potential Challenge:**
 - Gesture-based interfaces
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