inTouch: Designing a Mobile Coordination System

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05-899: Ubicomp
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Mobile Coordination System

US cell phone subscribers:
- 1994: 16 million
- 1995: 34 million
- 2003: 159 million
- 2006: 203 million


71% of US households own ≥ 1 cell phone (2005)
- 24% households own laptops
Mobile Coordination System

Necessary & Useful
- People hate but can't live without (beating alarm clock & TV)
- 26% say it’s more important to go home to retrieve a cell phone than a wallet
- Average US cell phone user talks 13 hrs/month

Accessible
- 75% have cell phone turned on & within reach

Personal
- 59% wouldn’t lend their phones to a friend for the day
Mobile Coordination System

Mobility: more than a laptop

More than just a voice service

- 37.4% text messaging, 13.9% mobile e-mail (2005, US)
- 3.6 billion messages during Q1 2005 (T-mobile)
- 64.5 million SMS votes for American Idol (2005)

Cell phone: Use it *and* integrate it
Mobile Coordination System

Planning …
- ... a vacation, a reunion
- ... your weekly advisor meetings
- ... your next group project’s meeting
- ... logistics for tonight’s dinner
- ... your research project’s milestones
- ... how to get the next conference paper done

Rescheduling …
- ... meeting times
- ... meeting places
- ... tasks
Understanding Coordination Issues

Coordination varies along time

Macro-coordination:
- Planning a vacation, a reunion
- Planning your weekly advisor meetings
- Planning your project’s milestones, conference timeline
Understanding Coordination Issues

Coordination varies along time

Months  Weeks  Days  Hours  Minutes

Micro-coordination:
- Planning logistics for tonight’s dinner
- Scheduling a time to do “impromptu” meetings
- Rescheduling meeting places
- Re-delegating tasks
Coordination & the Mobile World

Mobile phones increase efficiency in coordinating, and make it easier to carry out everyday tasks.

- Softening of time
- Plan & re-plan activities at any time and anywhere
- Capability of instantly communicating with others

Departure from traditional time-based coordination

Result: more interactive, more flexible coordination processes → need for better tools
Macro & Micro Coordination

<table>
<thead>
<tr>
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<th>Micro</th>
</tr>
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<tbody>
<tr>
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Implications:
- Context & mobility become more important
- More immediate responses are needed
- Location becomes more meaningful
## Social & Work Coordination

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**Implications:**
- Different resources are important
- Social settings rely more on: location & calendar
- Work-oriented settings rely more on: tasks
# Coordination

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<td>Groove Calendars</td>
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<tr>
<td>Micro</td>
<td>IM</td>
<td>Phone</td>
</tr>
<tr>
<td></td>
<td></td>
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Foundation for inTouch
Foundation for inTouch

Target users:
- Groups of people
- Changing schedules
- Multiple responsibilities
- Demanding schedules

Examples:
- Dual-career families
- Work groups
- Ad-hoc groups (eg conferences)
- Carpools
Dual Career Families

Married couples: moving away from the traditional breadwinner model to the dual earner model
Dual Career Families

Most common type of household

– 39.2% of all working civilian households (2003)
Dual Career Families

Coordination breakdowns evitable: planning & improvisation to accommodate children
  – children’s activities change without notice
  – parents’ meetings run long
  – impromptu appointments are scheduled
  – unexpected traffic create delays

Result:
  – Coordination breakdowns create heightened anxiety levels
  – Some parents fear they will “forget” their children
inTouch Goals (for families)

Current improvisation strategies fall short of ideal
Family scheduling: stressful
High coordination costs: from juggling home, work, kids

Research Question: Can we create a stress-free (or stress-reducing) family coordination tool for dual career families?
Concept Scenario: Unexpected Traffic

1. Traffic jam
2. Person calling
3. Schedule
4. Person receiving call

I'm running late!
- heavy traffic jam...
- at least 20 minutes

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:00pm</td>
<td></td>
</tr>
<tr>
<td>4:30pm</td>
<td></td>
</tr>
<tr>
<td>5:00pm</td>
<td>Pick up Cindy @ ballet</td>
</tr>
<tr>
<td>5:30pm</td>
<td></td>
</tr>
<tr>
<td>6:00pm</td>
<td>Prepare dinner @ home</td>
</tr>
<tr>
<td>6:30pm</td>
<td></td>
</tr>
<tr>
<td>7:00pm</td>
<td>Dinner @ home</td>
</tr>
<tr>
<td>7:30pm</td>
<td></td>
</tr>
</tbody>
</table>
Concept Scenario: Change of Plans

1. A person is waiting in line.
2. A woman walks by and speaks to the person.
3. The woman receives a call and says, "I'm running late! In a meeting now. Let's change dinner plans - how about takeout?"
4. The person responds, "Takeout is cool. I'll pick up Chinese on my way home."
Concept Scenario: Thinking of You

1. Two people standing together.
2. Person picking up a phone and making a call.
3. Phone screen showing Monday through Friday.
4. Phone screen showing a heart symbol with the text "Mom sends you."
Concept Scenario: Making Dinner

1. [Image of person preparing dinner]
2. [Image of person calling someone with a phone]
3. [Image of person browsing through a list of contacts]
4. [Image of person in bed, yawning]

Human-Computer Interaction Institute
inTouch Themes

Dual career families can benefit from a mobile system

Awareness leads to better coordination

Contextual messaging can ease coordination burdens
Field Work

2-week field study
Notebook, Worksheets, Lofi
Six dual career families
  - Parent works ≥ 40 hrs/wk
  - Have ≥ 2 children
  - ≥ 1 child in primary or secondary school
  - ≥ 1 parent uses cell phone

<table>
<thead>
<tr>
<th>ID</th>
<th>Mother</th>
<th>Father</th>
<th>Married</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>massage therapist</td>
<td>engineer</td>
<td>2 years</td>
<td>2, daughter 15, son</td>
</tr>
<tr>
<td>B</td>
<td>technical director</td>
<td>cook</td>
<td>14 years</td>
<td>11, son 12, son 21, daughter</td>
</tr>
<tr>
<td>C</td>
<td>physician</td>
<td>computer scientist</td>
<td>18 years</td>
<td>8, daughter 14, son</td>
</tr>
<tr>
<td>D</td>
<td>physician</td>
<td>physician</td>
<td>27 years</td>
<td>12, son 17, daughter 20, son</td>
</tr>
<tr>
<td>E</td>
<td>market researcher</td>
<td>creative director</td>
<td>24 years</td>
<td>11, daughter 16, son 19, daughter</td>
</tr>
<tr>
<td>F</td>
<td>secretary</td>
<td>consultant</td>
<td>13 years</td>
<td>8, son 12, son</td>
</tr>
</tbody>
</table>
Part 1: Notebook

Instructions: Record all coordination-related tasks
Observations: missing entries & fields, duplicated efforts
Observations

Phones are the primary coordination tool of choice
Observations

Design for transition times $\rightarrow$ coordination peak times

(a) Number of messages during the day
Observations

Check, double check, and triple check

- Parents typically plan in advanced, but still constantly check their schedules

“Okayness” checkness
Other Observations

Moms do a lot of their family coordination
Moms rely on paper forms
Duplication of information
Observations

- Coordination involves a lot of back & forth:
  - Average coordination transaction: 3.3 messages
  - Longest coordination transaction: 6 messages
- Typical example:
  1. Mom talks with husband to confirm pickup time
  2. Mom calls husband a few hours before to confirm pickup
  3. Dad calls mom to confirm he has picked up their son
Observations

Need for different viewpoints

Person-centric
  – “Okayness” checking

Task-centric
  – status check, reminders, confirmation

Time-centric
  – advanced & in-the-moment planning
### Part 2: Worksheets

#### Family Activity Calendar

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 AM</td>
<td></td>
</tr>
<tr>
<td>6 AM</td>
<td></td>
</tr>
<tr>
<td>7 AM</td>
<td></td>
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<td>8 AM</td>
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<td>9 AM</td>
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<td>10 AM</td>
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<td>11 AM</td>
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<td>12 PM</td>
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<td>1 PM</td>
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<td>2 PM</td>
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<td>3 PM</td>
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<td>4 PM</td>
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<tr>
<td>11 PM</td>
<td></td>
</tr>
<tr>
<td>12 AM</td>
<td></td>
</tr>
</tbody>
</table>

**Instructions:**

Part 1: Please fill in all the activities for your whole family.

Part 2: Please fill in if you met all the activities you listed before.
Winning Concept Scenarios

Dependencies are critical
Contextual reminders
"Efficiamcy"

<table>
<thead>
<tr>
<th>type</th>
<th>concept scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Change of Plans</strong>: Alerts users of trickling plans as they evolve due to unexpected schedule changes</td>
</tr>
<tr>
<td>2</td>
<td><strong>Still on Track?</strong>: Allows users to easily check of deviations, if any, from the planned schedule</td>
</tr>
<tr>
<td>3</td>
<td><strong>Got to Go Now</strong>: Alerts users when they need to get ready, considering traffic, dependent tasks, etc.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Dependency Alerter</strong>: Alerts users at scheduling time if it will potentially affect someone else</td>
</tr>
<tr>
<td>5</td>
<td><strong>Where Are You? Are You Busy?</strong>: Gives users a high-level view of others’ contextual information</td>
</tr>
</tbody>
</table>

Table 3. Top 5 concept scenarios as chosen by the participants based on their own coordination experiences.
Lofi Prototype: Awareness
Lofi Prototype: Contextual Messaging

- Location
- Time
- Calendar Event

Template Message → User History → Sent Message

Auto-response

Human-Computer Interaction Institute
Instant Hoot

Improve relevance using contextual information
Minimize disruption by piggyback off existing messages
Reducing overload using context
Uncharted territory…

- Policies for disclosing contextual information
  - Privacy not a big issue for families
  - Workgroups, ad-hoc groups
- Coordination patterns of other types of groups
- Understanding context without “hard” sensors
  - NLP, vision, etc.
Questions? Comments?
Phone Development

Hardware & OS
Development IDE & Tools
Useful Toolkits

This just barely scratches the surface!
Phone Hardware & OS

Microsoft Smartphone
- Audiovox 5600 SMT: Windows Mobile 2003
- Cingular 2125: Windows Mobile 5.0

Other options:
- Motorola: Motorola (proprietary) OS
- Nokia: Symbian OS
WM 5: Multimedia APIs

**DirectShow**: Integrated camera APIs (pics & video)
**Integrated Windows Media Player 10**

**Direct3D**: 3D graphics

**DirectDraw**: faster, more flexible 2D rendering
WM 5: Messaging APIs

Telephony API: initial calls within your app

Pocket Outlook API:
- Access PIM data within your app
- Create your own Outlook application

Email & SMS API:
- Send email, supports attachments
- Choose contacts from Outlook
- Intercept SMS based on sender, receiver, content
WM 5: Other Interesting State Information

- The active application
- The device's ActiveSync status
- Current battery level
- Whether a camera is connected to the device
- Whether a headset is plugged in
- The name of the song currently playing in Media Player
- Number of unread SMS messages
- Number of unread e-mail messages
- Whether a call is currently in progress
- Whether a conference call is currently in progress
- Whether GPRS connectivity is currently available
- Whether the device is currently connected to a VPN
- Number of missed phone calls
- The name of the phone's mobile operator
- Number of tasks due today
WM 5: Other Useful APIs

GetDeviceUniqueID: get the phone’s unique identifier
ExitWindowsEx: turn off, reboot device from your app
DrawFocusRectColor: draw using the current “theme”
Development IDE & Tools (for WM)

Visual Studio 2005 (available from SCS Help Desk)
Built-in emulators
Remote debuggers
Remote screencapture
Scripting tools

Also:
Application unlock
SIM unlock
Toolkits for Phones

Intel Research: POLS
- Privacy Observant Location System
- Small Oakland dataset (accuracy is not great)

OpenNETCF: SDF
- Smart Device Framework
- Customizable widgets that are normally hidden
- Integrated into Visual Studio 2005
Questions? Comments?
Discussion Question

Can we solve the text messaging “problem” on phones? Is it even a problem? Is the solution simply the QWERTY thumb keys? Or do we need a new input method? Will contextual messaging give SMS an edge?

What other scenarios might (contextual) messaging be useful? Is the killer app for SMS for social or work purposes? Will it be functional or for fun?
Discussion Question

What will it take for everyone to switch to a digital lifestyle? How do we wean users off paper-based and/or mechanical-based prototypes?
Discussion Question

Are we putting too much emphasis on the phone? Ten, fifteen years from now – will the cell phone be the only thing you carry on you?