

inTouch: Designing a Mobile Coordination System

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05-899: Ubicomp

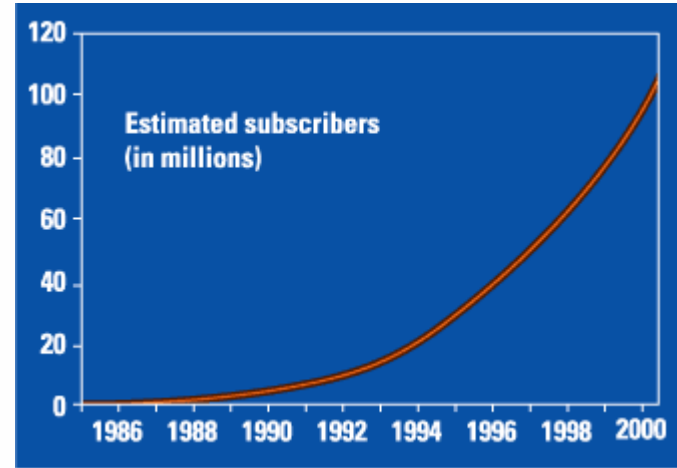
January 30, 2007



Mobile Coordination System

US cell phone subscribers:

- 1994: 16 million
- 1995: 34 million
- 2003: 159 million
- 2006: 203 million



US population: 238 million, ages 15+ (2006)

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

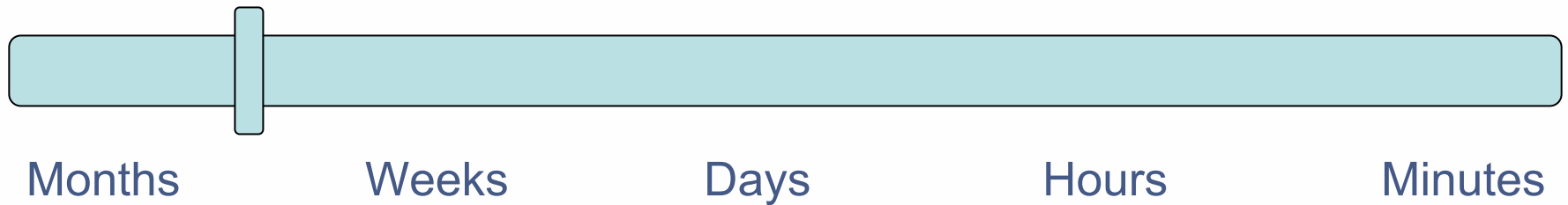
Rescheduling ...

- ... meeting times
- ... meeting places
- ... tasks



Understanding Coordination Issues

Coordination varies along time



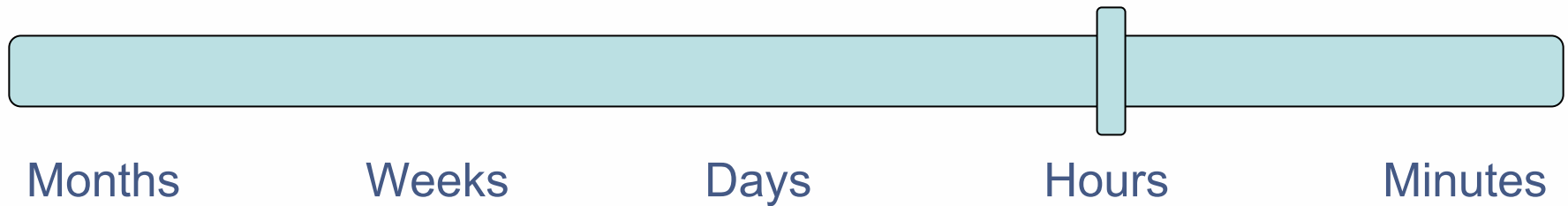
Macro-coordination:

- Planning a vacation, a reunion
- Planning your weekly advisor meetings
- Planning your project's milestones, conference timeline



Understanding Coordination Issues

Coordination varies along time



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

| | | |
|--------------|--|--|
| | | |
| Macro | planning a vacation, reunion planning weekly meetings | planning project milestones planning conference deadlines rescheduling meeting times |
| Micro | planning tonight's dinner planning "impromptu" meetings | rescheduling meeting times rescheduling meeting places rescheduling work tasks |

Implications:

- Context & mobility become more important
- More immediate responses are needed
- Location becomes more meaningful



Social & Work Coordination

| | Social | Work |
|--|--|--|
| | planning a vacation, reunion planning weekly meetings | planning project milestones planning conference deadlines rescheduling meeting times |
| | planning tonight's dinner planning "impromptu" meetings | rescheduling meeting times rescheduling meeting places rescheduling work tasks |

Implications:

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



Coordination

| | Social | Work |
|--------------|--|--|
| Macro | planning a vacation, reunion planning weekly meetings | planning project milestones planning conference deadlines rescheduling meeting times |
| Micro | planning tonight's dinner planning "impromptu" meetings | rescheduling meeting times rescheduling meeting places rescheduling work tasks |



Current Coordination Tools

| | Social | Work |
|--------------|--------------------|---------------------|
| Macro | Calendars | Groove Calendars |
| Micro | IM Phone SMS | |

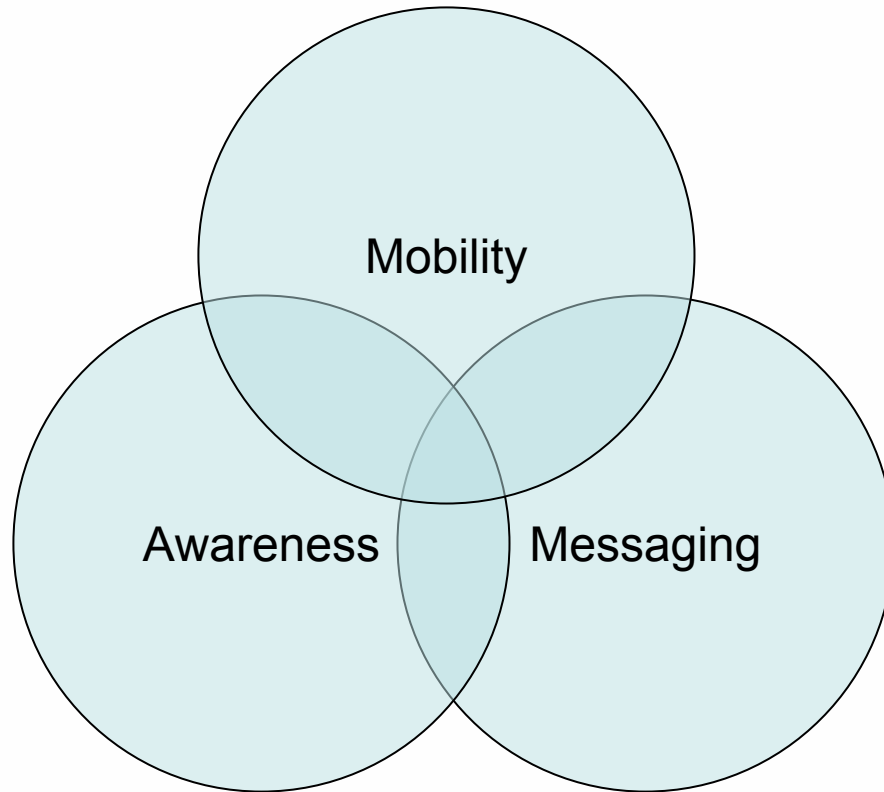


Current Coordination Tools

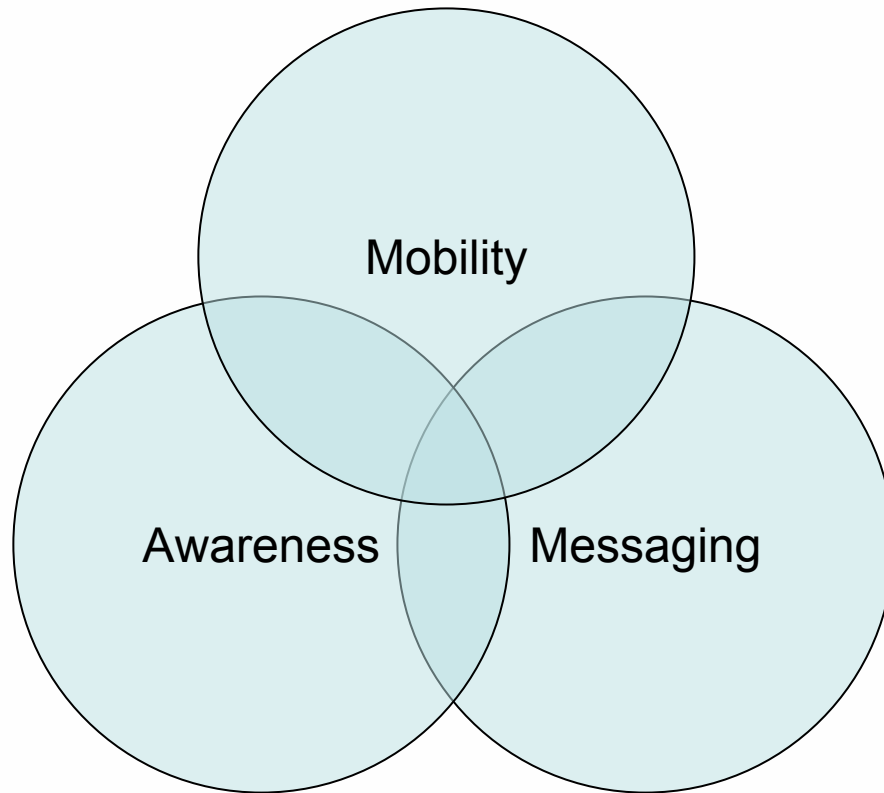
| | Social | Work |
|--------------|--------------------|---------------------|
| Macro | Calendars | Groove Calendars |
| Micro | IM Phone SMS | |



Foundation for inTouch



Foundation for inTouch



Target users:

- Groups of people
- Changing schedules
- Multiple responsibilities
- Demanding schedules

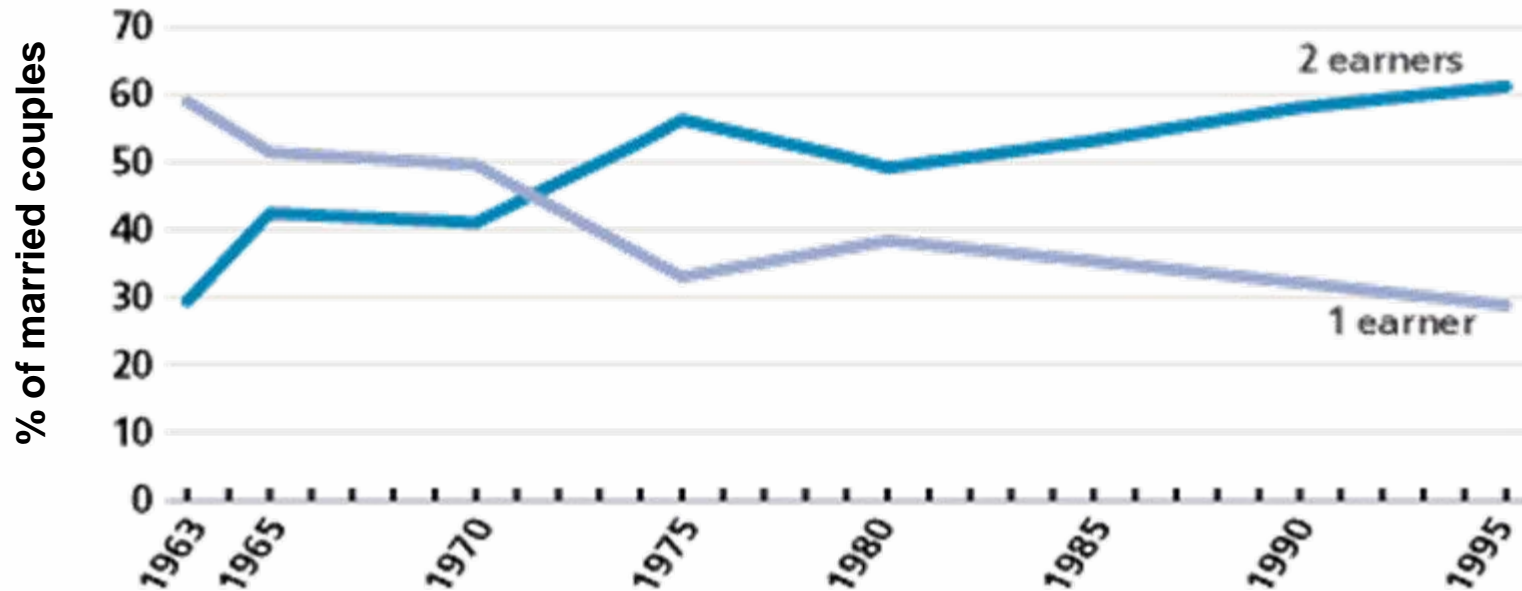
Examples:

- Dual-career families
- Work groups
- Ad-hoc groups (eg conferences)
- Carpools



Dual Career Families

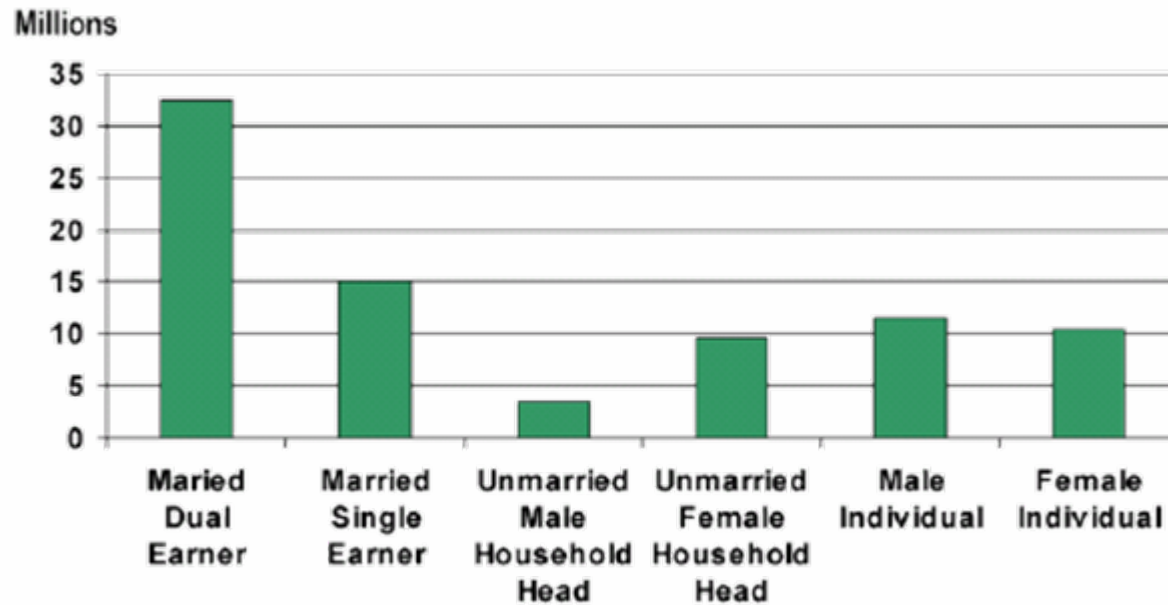
Married couples: moving away from the traditional breadwinner model to the dual earner model



Dual Career Families

Most common type of household

- 39.2% of all working civilian households (2003)



Source: Employment Policy Foundation tabulation of Current Population Survey Annual Social and Economic Study data, March 2004.



Dual Career Families

Coordination breakdowns evitable: planning & improvisation to accommodate children

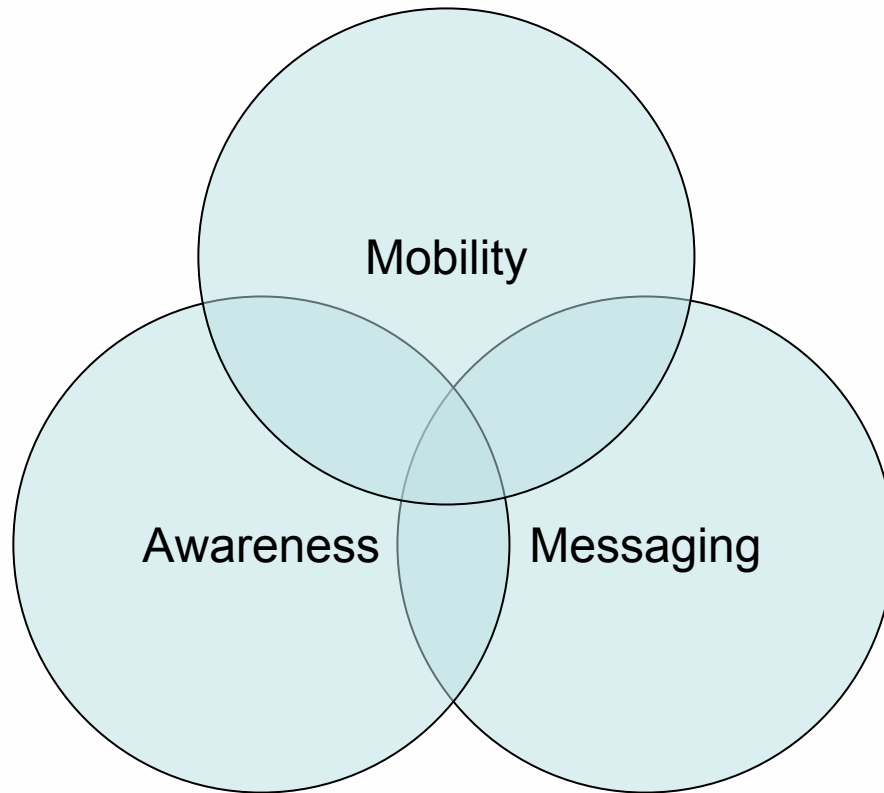
- children’s activities change without notice
- parents’ meetings run long
- impromptu appointments are scheduled
- unexpected traffic create delays

Result:

- Coordination breakdowns create heightened anxiety levels
- Some parents fear they will “forget” their children



inTouch Goals (for families)



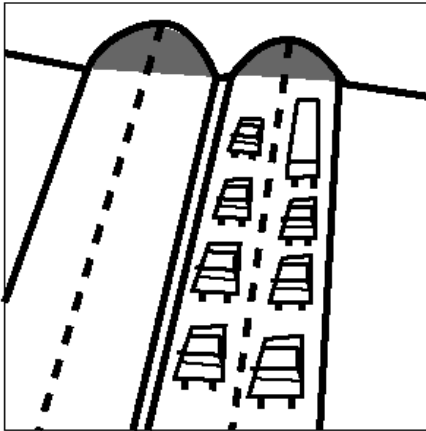
Current improvisation strategies fall short of ideal
Family scheduling: stressful
High coordination costs: from juggling home, work, kids

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

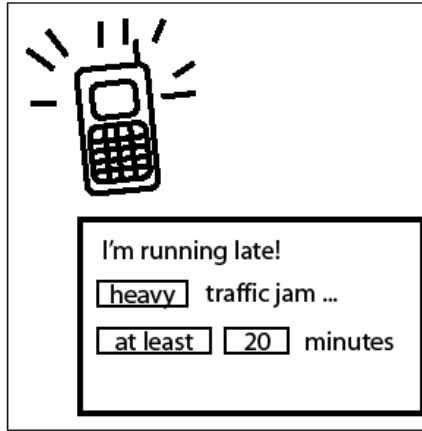


Concept Scenario: Unexpected Traffic

1



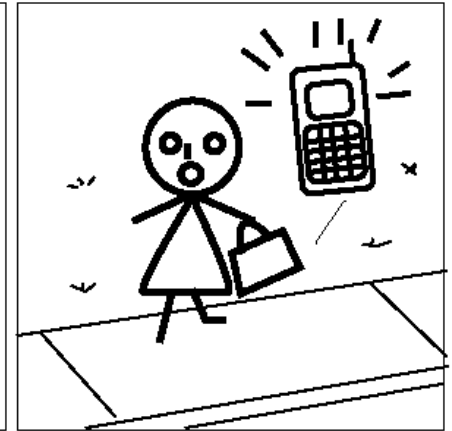
2



3

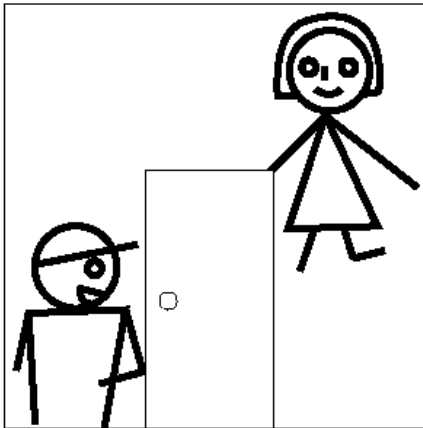
| | |
|--------|------------------------|
| 4:00pm | |
| 4:30pm | |
| 5:00pm | Pick up Cindy @ ballet |
| 5:30pm | |
| 6:00pm | Prepare dinner @ home |
| 6:30pm | Dinner @ home |
| 7:00pm | |
| 7:30pm | |

4

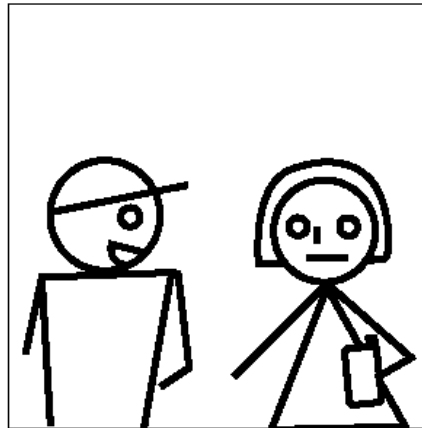


Concept Scenario: Change of Plans

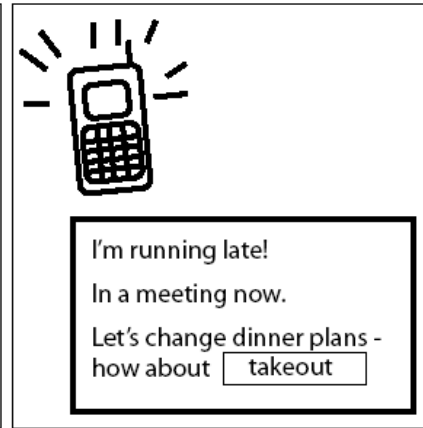
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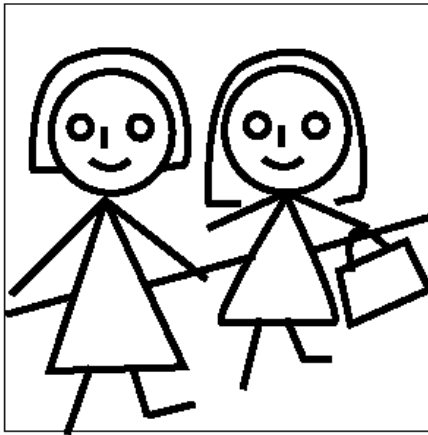


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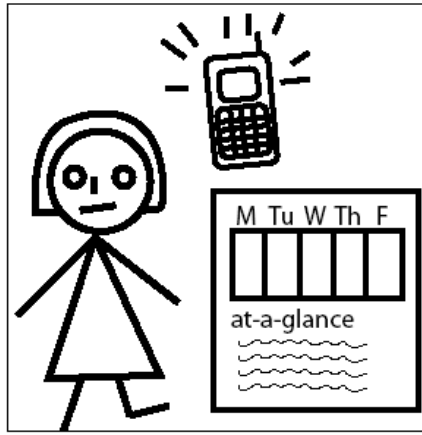


Concept Scenario: Thinking of You

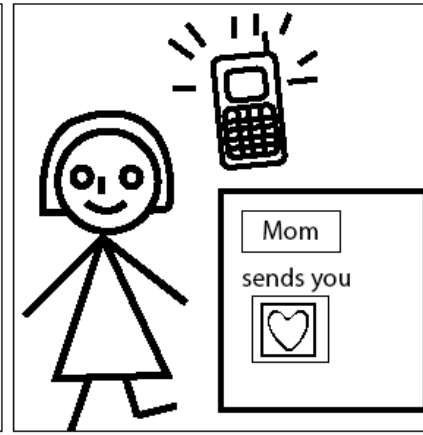
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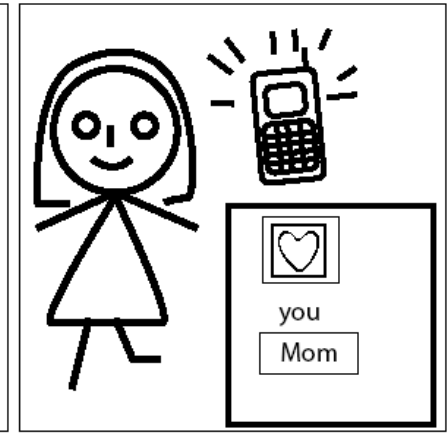
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3

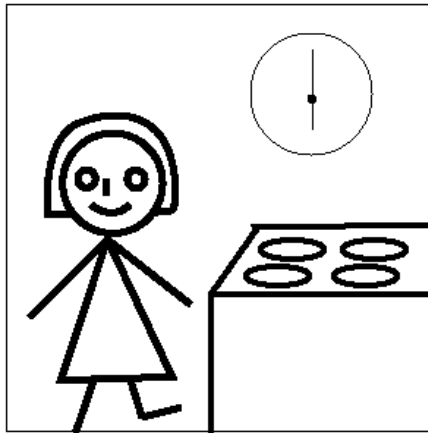


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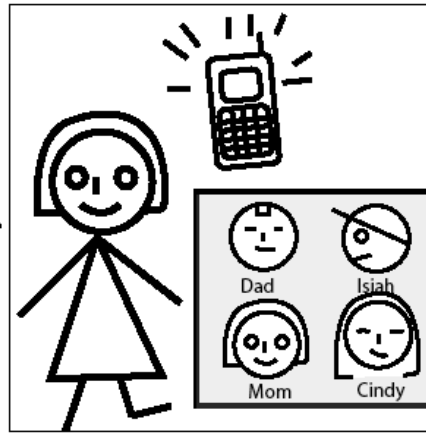


Concept Scenario: Making Dinner

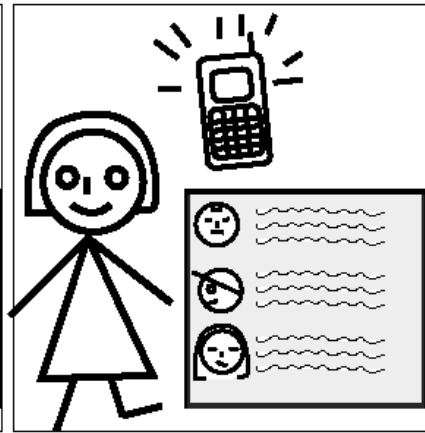
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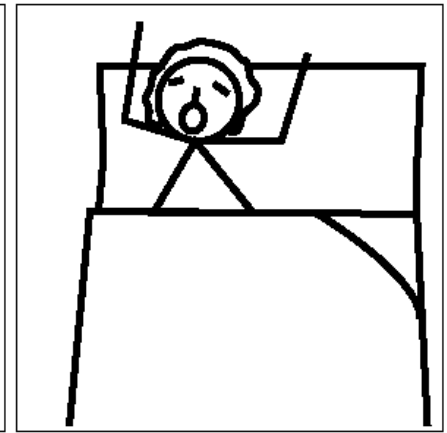
2



3



4



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

| ID | Mother | Father | Married | Children |
|----|--------------------|--------------------|----------|---|
| A | massage therapist | engineer | 2 years | 2, daughter 15, son |
| B | technical director | cook | 14 years | 11, son 12, son 21, daughter |
| C | physician | computer scientist | 18 years | 8, daughter 14, son |
| D | physician | physician | 27 years | 12, son 17, daughter 20, son |
| E | market researcher | creative director | 24 years | 11, daughter 16, son 19, daughter |
| F | secretary | consultant* | 13 years | 8, son 12, son |



Part 1: Notebook

| | | | | | | | |
|---|--------------------------------------|---|----|---|----|----|-----------------------------|
| M | Tu | W | Th | F | Sa | Su | <input type="checkbox"/> am |
| / / /2006 | | | | | | | <input type="checkbox"/> pm |
| meeting with <input type="text" value="#"/> of people | | | | | | | |
| <input type="text" value="#"/> you ↔ | | | | | | | |
| <input type="checkbox"/> in person | <input type="checkbox"/> SMS | | | | | | |
| <input type="checkbox"/> phone | <input type="checkbox"/> unreachable | | | | | | |
| <input type="checkbox"/> IM | <input type="checkbox"/> waiting | | | | | | |
| <input type="checkbox"/> other: | | | | | | | |
| you're at: | | | | | | | |
| describe situation: | | | | | | | |
| was this resolved? <input type="text" value="yes"/> <input type="text" value="no"/> | | | | | | | |

| | |
|--|--|
| What would be helpful now? | |
| <input type="checkbox"/> todo list | keep track of tasks |
| <input type="checkbox"/> location | where is everyone? |
| <input type="checkbox"/> calendar | what's scheduled? |
| <input type="checkbox"/> mood | how do they feel? how did their day go? |
| <input type="checkbox"/> proximity | what's close? who's nearby? |
| <input type="checkbox"/> group | who's with them? i'm talking with ppl |
| <input type="checkbox"/> activity | watching tv now? is he running? |
| <input type="checkbox"/> interruptible | can i call now? are they busy? |
| <input type="checkbox"/> history | what happened last year? |
| <input type="checkbox"/> photos | i forgot what it looks like |
| <input type="checkbox"/> maps | where am i? |
| <input type="checkbox"/> directions | how do i get there? |



Instructions: Record all coordination-related tasks

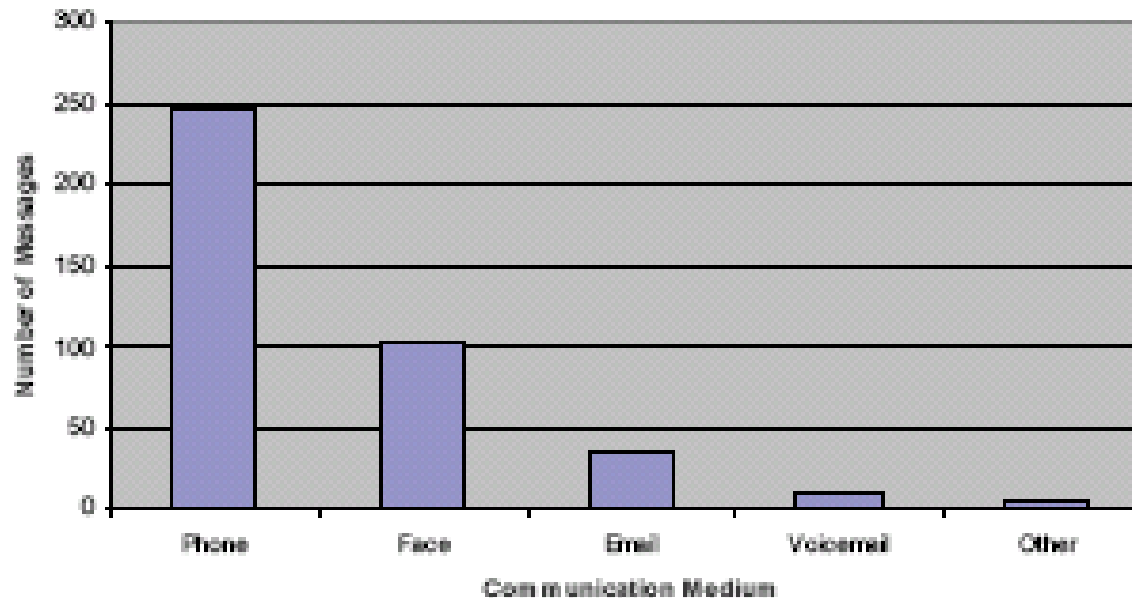
Observations: missing entries & fields, duplicated efforts



Observations

Phones are the primary coordination tool of choice

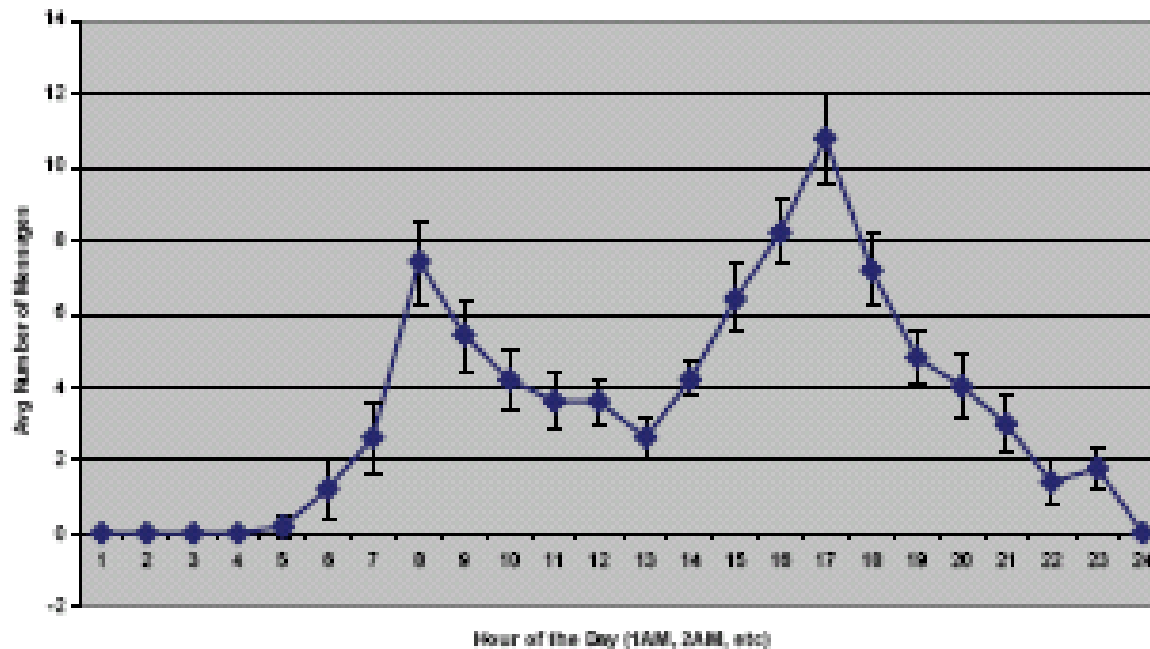
(c) Breakdown of Communication Mediums



Observations

Design for transition times → coordination peak times

(a) Number of messages during the day



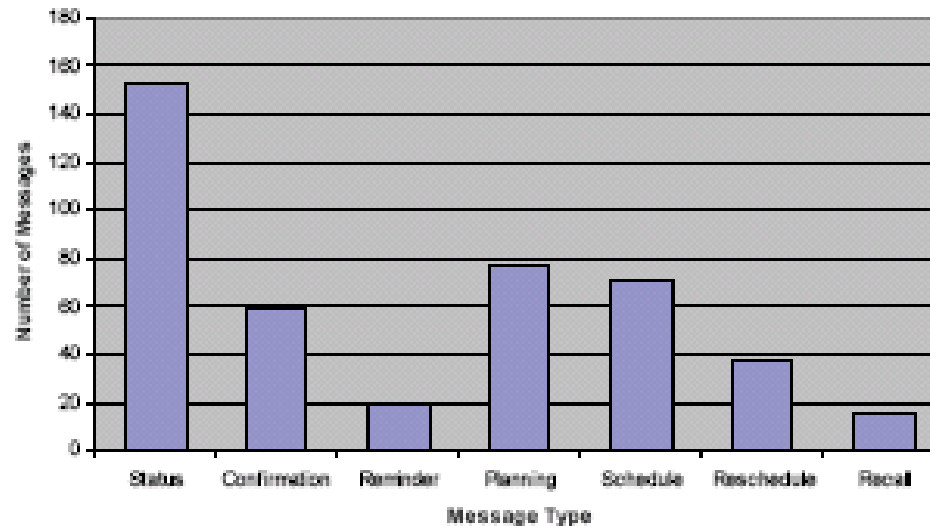
Observations

Check, double check, and triple check

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

“Okayness” checkness

(b) Breakdown of Message Types



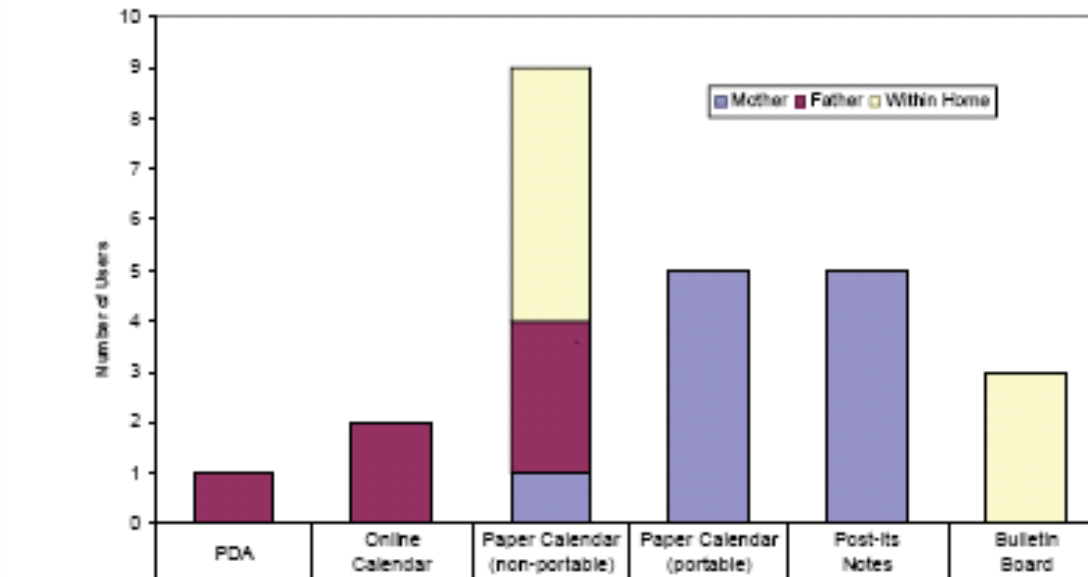
Other Observations

Moms do a lot of their family coordination

Moms rely on paper forms

Duplication of information

Current Coordination Tool, by Owner



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

_____ : August ____, 2006

| | |
|-------|-------|
| 5 AM | ----- |
| 6 AM | ----- |
| 7 AM | ----- |
| 8 AM | ----- |
| 9 AM | ----- |
| 10 AM | ----- |
| 11 AM | ----- |
| 12 PM | ----- |
| 1 PM | ----- |
| 2 PM | ----- |
| 3 PM | ----- |
| 4 PM | ----- |
| 5 PM | ----- |
| 6 PM | ----- |
| 7 PM | ----- |
| 8 PM | ----- |
| 9 PM | ----- |
| 10 PM | ----- |
| 11 PM | ----- |
| 12 AM | ----- |

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.

Concept Scenario Checklist

Instructions:

Read through the scenarios, and check the ones that you think you might have found useful today

PLANNING & SCHEDULING

| | |
|--|---|
| <input type="checkbox"/> Change of Plans Alerts of trickling plans as they evolve. Ex: Kids get alerted when parents run late, so they don't worry. | <input type="checkbox"/> Still on Track? Easily check if plans are still on track. If there are no deviations, lets you know if resolutions are in place. |
| <input type="checkbox"/> Dependency Alerter Alerts you when you try to schedule something that could potentially affect other people's schedule. | <input type="checkbox"/> Got to Go Now Alerts you when to get ready. Takes into account factors like traffic conditions, errand running, etc. |
| <input type="checkbox"/> Automatic Coordinator Replace lengthy phone calls with quick, easy messaging. Ex: No need to call, instead query calendars automatically. | |

REMEMBERING

| | |
|--|--|
| <input type="checkbox"/> Shared Address Book Share contacts across the family. Now you don't have to call the spouse to find a number only she knows. | <input type="checkbox"/> Remind Me When I Go To... Get reminded when you pass by a place. Ex: To get groceries when passing the store on the way home |
| <input type="checkbox"/> Thinking of You Send "hallmark"-like messages without worrying about interrupting their busy routines. | <input type="checkbox"/> Remind Me When I See... Get reminded when you see or talk to a person. Ex: when you see your spouse, remember to tell him ... |
| <input type="checkbox"/> Retracing Everyone's Footsteps Keep track of everyone's tasks. Ex: Check if your spouse already went to the store; see who last filled up the car's gas | |

GOING PLACES

| | |
|---|---|
| <input type="checkbox"/> Did You Arrive Yet? Get alerts when people arrive at a place. Ex: Parents alerted when kids arrive at home, a friend's house, etc. | <input type="checkbox"/> I'm Lost! Replace hard-to-read text with visual routes shown on a map, with your current location. |
| <input type="checkbox"/> Where are You? Are You Busy? Allows you to check availability, activity, and location of other family members, anywhere & anytime. | <input type="checkbox"/> Pickup Coordinator Sends out requests on your behalf, based on availability. Could include neighbors & friends if family members cannot make it. |
| <input type="checkbox"/> Don't Hold Up the Carpool Get alerts when your carpool is on its way, when it's your week to drive, or who doesn't have to be picked up for today. | |

DINNER

| |
|--|
| <input type="checkbox"/> Late for dinner Find out when members are planning to be home, or receive alerts when they're on their way. |
| <input type="checkbox"/> What's for dinner? Easily poll for eating preferences beforehand, so family doesn't feel rushed for dinner. |

MISCELLANEOUS

| |
|--|
| <input type="checkbox"/> Show Me Which One Get answers to questions with photos. Ex: Unsure which color to get? Use photos & ask the spouse! |
| <input type="checkbox"/> Operator Call-in to check the status (location, activity, busyness, etc) of other family members. |



Winning Concept Scenarios

Dependencies are critical

Contextual reminders

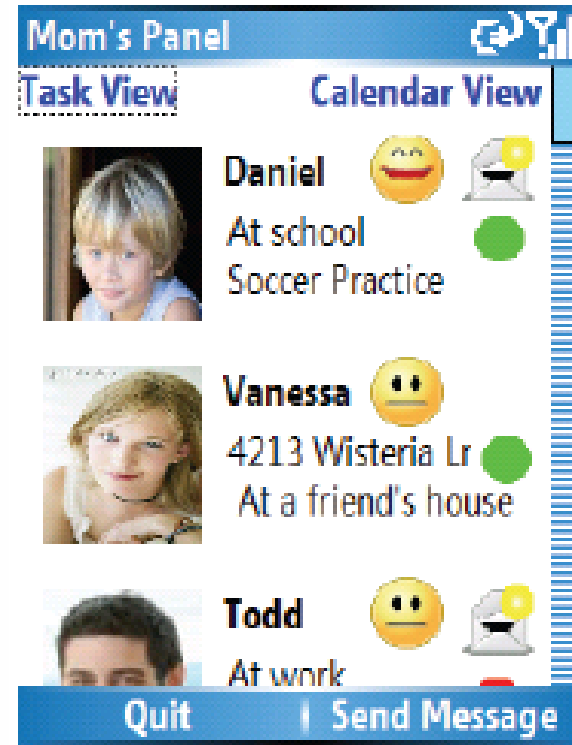
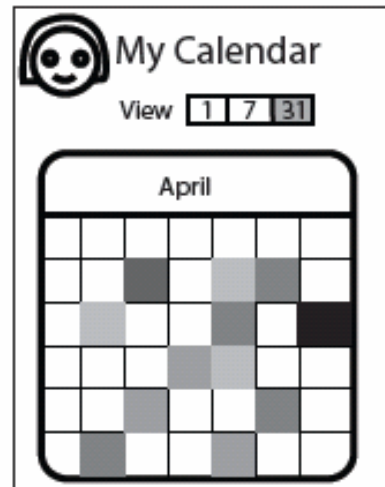
”Efficiamacy”

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

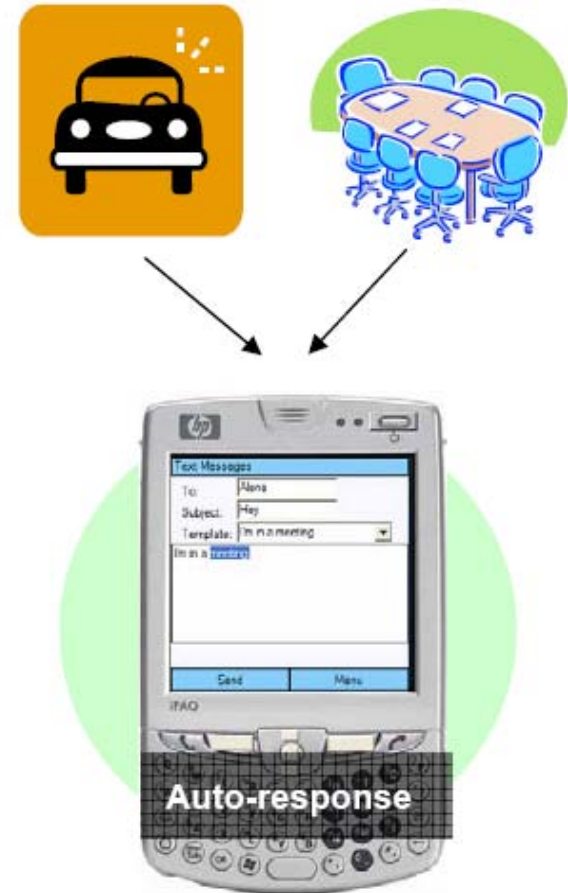
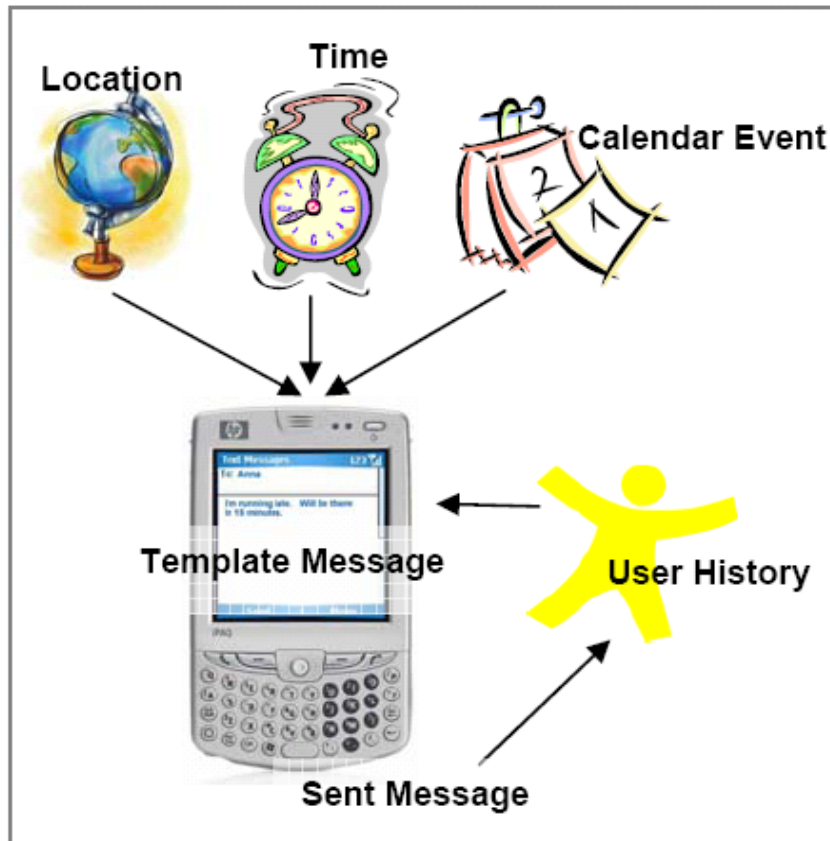
Table 3. Top 5 concept scenarios as chosen by the participants based on their own coordination experiences.



Lofi Prototype: Awareness



Lofi Prototype: Contextual Messaging



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



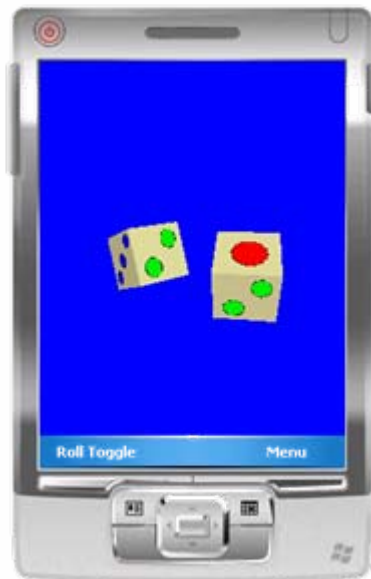
WM 5: Multimedia APIs

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

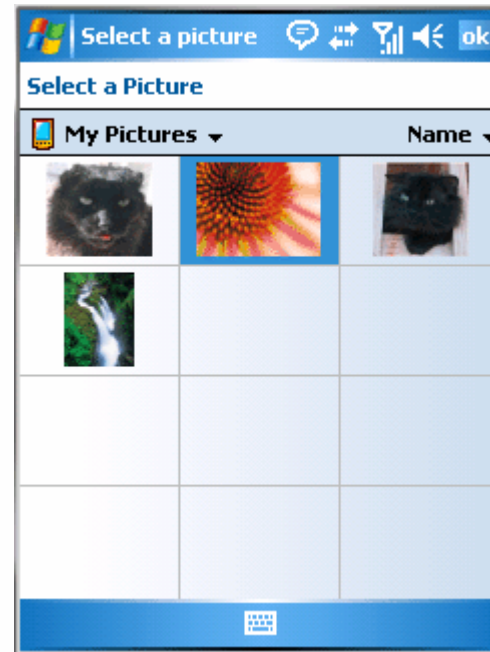
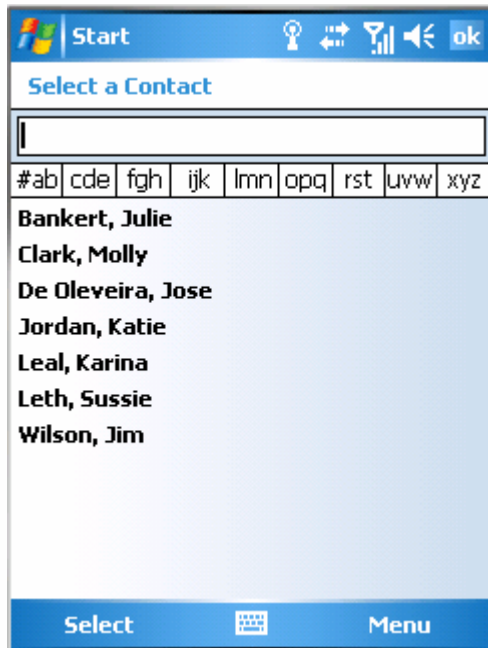


WM 5: Other Useful APIs

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?

