



Context Awareness

Boris Smus

try this

“To suppose that the eye with all its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light, and for the correction of spherical and chromatic aberration, could have been formed by natural selection, seems, I freely confess, absurd in the highest degree.”

– Charles Darwin

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What do we conclude from this quote?
Darwin was secretly a creationist!
What's the problem? It's out of context

... now in context

“To suppose that the eye with all its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light, and for the correction of spherical and chromatic aberration, could have been formed by natural selection, seems, I freely confess, absurd in the highest degree.

Yet reason tells me, that if numerous gradations from a perfect and complex eye to one very imperfect and simple, each grade being useful to its possessor, can be shown to exist...”

– Charles Darwin

definition

linking changes in the environment with computer systems, which are otherwise static.



meh. who cares about context awareness?

ubiquitous computing: embed computing into the real world

real world is rich and full of useful contextual information

tech is increasingly pervasive and needs to be keep under control

structure of the lecture

definitions (schilit-94)

research (schilit-02)

objections (erickson-02)

challenge questions (satyanaraynan-02)

motivation

Bill Schilit: mobile people, not just mobile computing

- broad hardware configurations are changing
- location is changing
- groups of interaction are changing

detect context changes and act on them

what is context?

location of use

nearby people

nearby devices

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people: also, social situations. with boss != drinking with friends
devices: also, lighting, ambient noise, network connectivity

how can context be used?

proximate selection (show things that are near, ranking by proximity)

contextual reconfiguration (change view depending on context)

contextual commands (filter action set based on context)

context-triggered actions (automatic actions based on context changes)

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ex. google maps search

ex. time servers for travelers

ex. print command automatically prints to nearest printer

ex. android app locale, changes system settings on location

ParcTab

a proto-smartphone

wireless, palm-sized computer

used as a prototyping platform at
PARC for ubicomp research



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weiser refined his original vision focusing on the concept of calm computing
sort of what Apple's been up to in the last decade. iPhone, iPad are steps in that direction

location, location, location

state of the art of the most popular kind of context today

technology

GPS	cell triangulation	Wi-Fi	ultra wide band
5m outdoors	120m in/outdoors	20m in/outdoors	0.1m indoors

location as context

tons of startups in it

- loopt, foursquare
- twitter, gowalla

Google Buzz, Latitude

Facebook



research directions beyond location

example: context-aware communication

classifying context-aware communication

automatic

context acquisition



Active Badge
Context-Aware Mailing List
Whiteboard
AwareNex



Contextual Reminders
Watchdog



Etherphone
Active Messenger

manual

communication action

automatic

call routing

blast from the past

PARC Etherphone: intelligent office which routes calls to the room you're in

Olivetti Active Badge: informs receptionist of people's locations in the office to facilitate call routing



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one automates communication, another automates context

addressing

who to reach?

Context-aware Mailing List (Anind Dey) sends mail only to those in an area or building

MIT Active Messenger monitors, prioritizes and forwards email

- falls back to phones, pagers, fax machines



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again, one automates communication, another automates context

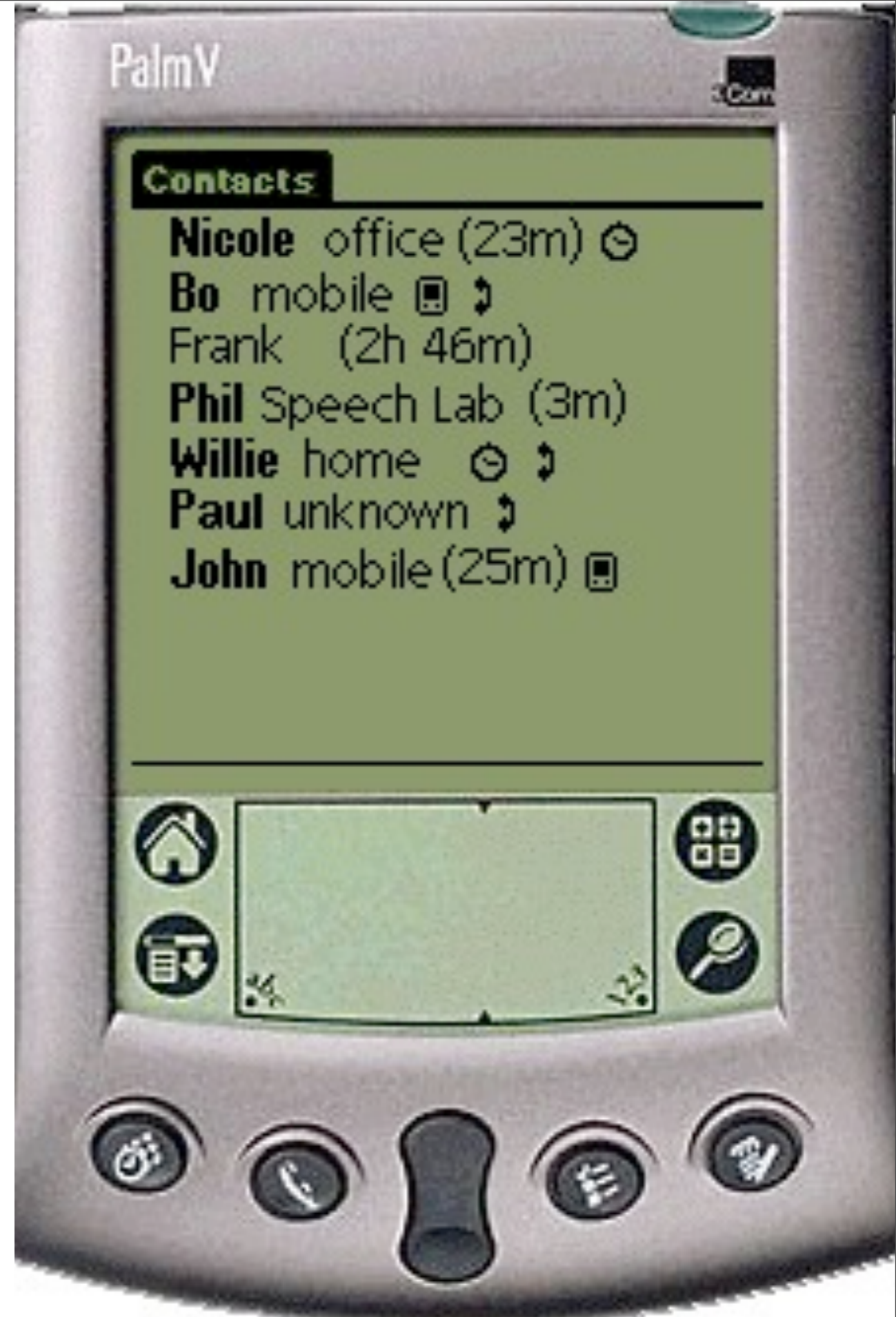
awareness

what's my target up to?

Watchdog: plays audio clips
when sensor fires

AwareNex: contact list that
displays current activity

Roomotes: controls room lights
and audio/video equipment and
notifies people nearby



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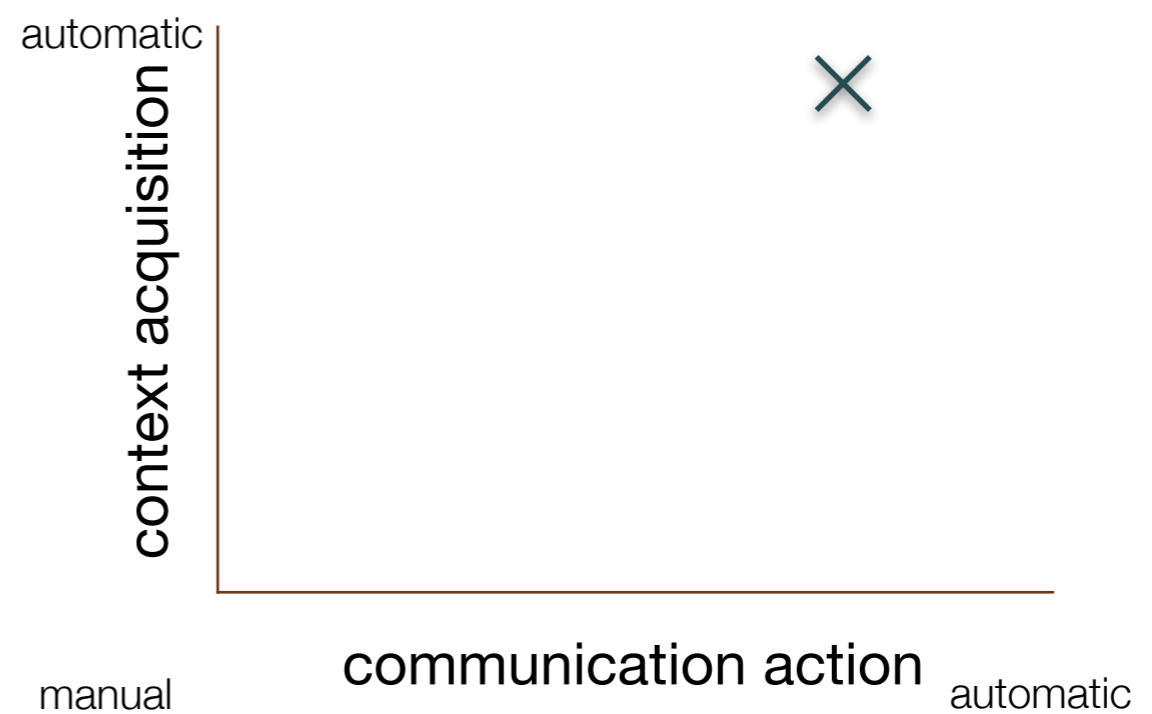
again, one automates communication, another automates context

how's everyone doing?

take a break, stretch, juggle, eat a banana, etc

criticisms of context awareness

automatic context acquisition and action?



context is difficult for computers to grasp

humans are really good at knowing context

computers aren't. very different from humans:

- small set of cues, limited by sensors
- all data is quantitative

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context aware -- detecting, identifying and location people's behavior to provide relevant information

ambient intelligence -- pre-empting people's needs

tracking -- assisted living. ex: monitoring movement

context awareness can be reduced to AI

if we don't use AI, then must use heuristics.

lots of heuristics are bad:

- that's not how humans operate
- too many heuristics means the system becomes incomprehensible

suggestion: semi-automatic

Tom Erickson suggests: give humans context, let them decide

ex. automatic receptionist tells context, caller decides

- joe has been motionless in a dimly lit room for the last 2 hours

my opinion

the machine is already making inferences!

motion sensor readings below threshold => joe is motionless

light sensor readings below threshold => room is dark

aren't these also problematic?

so it's just a matter of degree.

conclusion

context awareness is an important feature in ubicomp applications

can be applied to make many types of applications more compelling (ex. context-aware communication)

but there are many huge technical challenges in the field

some hybrid approaches are useful

thanks for listening

^_^

discussion

implementation details: how does the system represent context internally?
store on network?

what overhead is incurred in context aware systems? how to minimize?

what minimal set of services in environment to make context awareness
feasible? what is the fallback?

what location sensing technology is best? when should one or the other be
used? is location a special kind of context?

(from Satyanarayanan)