

Thoughts on Ubiquitous Computing Grand Challenge Manifesto

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Who Am I?

- D.Phil Oxon
 - Formal Methods in HCI
- Postdoc, University of York (ESPRIT)
 - FM in HCI
- Postdoc, Carnegie Mellon University
 - FM in Software Architecture
- Faculty, Georgia Tech
 - Applications-driven ubicomp (HCI, SE)

Why I don't do FM

- I spent years building models and abstractions to explain problems people already understood.
- I wanted to influence the future instead of understand the past.
- I dream of going back to the maths.

Outline

- The good
- The bad
- Some suggestions

The Good

Three Perspectives

- Theoretical
- Engineering
- Human Experience

Seek to integrate, rather than divide.

Appreciation is much more important than deep understanding across these perspectives.

Properties

- Fluid
- Purposive
- Autonomous
- Reflective
- Trustworthy
- Sustainable
- Efficient
- Scalable

Foothills Projects

- Somewhere to start and something to aim for.
 - Analysing movement in a sentient environment
 - Automating the highway
 - Model-checking for ubiquity
 - Rigorous protocol design
 - Ubiquitous computing and the urban environment
 - Ubiquitous healthcare
- How do they push on merging of theory/engineering/experience?
- How do you keep track of progress across a community?

The Bad

Where are Answers to Criteria?

- **Is it driven by curiosity about the foundations, applications or limits of basic Science?**
- **Does it promise a revolutionary shift in the accepted paradigm of thinking or practice?**
- **Will its promotion as a Grand Challenge contribute to the progress of Science?**
- **Does it have the enthusiastic support of established scientific communities?**
- **Does it appeal to the imagination of the general public?**
- **Does it avoid duplicating evolutionary development of commercial products?**
- **When was it first proposed as a challenge?**
- **Why has it been so difficult so far?**
- **Why is it now expected to be feasible in a ten to fifteen year timescale?**
- **What are the most likely reasons for failure?**
- **Is there a clear criterion for the success or failure of the project after fifteen years?**

Relationship to other GCs

- *In Vivo – In Silico*
- *Memories for Life*
- The Architecture of Brain and Mind
- Dependable Systems Evolution
- Journeys in Nonclassical Computation
- Learning for Life
- Bringing the Past to Life for the Citizen

Suggestions

- What makes a GC?
- What appeals to me?

What makes a GC?

- Refutable
- Desirable
- Grand?

Furthermore, it relies on ubiquitous computing

But what is ubiquitous computing? Is it just the way all computing is going?

The Essence of Ubicomp

- Bridging Physical and Digital worlds
 - Meaning you can no longer separate them
- Scale
 - Over space, over time, across more people, between more and different devices

Sample problems

- Build:
 - an invisibility cloak
 - a sentient building, then a sentient community
 - a recyclable computer
 - a programmable environment
- Reduce average commute time in London by 50% while also reducing pollution by 50%.
- Reduce healthcare costs in the UK by 50% while maintaining current quality of care delivery.
- Provide a reliable indicator of developmental delay within the first year of birth.

Other Sample Problems

- Recycling computing cycles
 - We throw away perfectly usable cycles every day.
STOP IT!!!
 - Both software and hardware issue
 - What is sustainable software?
 - Guaranteed forward compatibility
 - Metric: reduce unused cycles
 - SETI approach, power off, reuse/recycle
- Worry:
 - Not going to be popular
 - We created and depend on this problem

Caution

- Who drives the research?
 - As computer scientists, we want to.
 - As citizens, we should want the problem domain to drive.
- How to keep up momentum?
 - Somebody else has to care
 - We have to keep track of progress
- But relax, there are lots of GCs out there.