Towards Reducing the Social-Technical Gap in Location-Aware Computing

Fabien Girardin
Interactive Technologies Group, Universitat Pompeu Fabra
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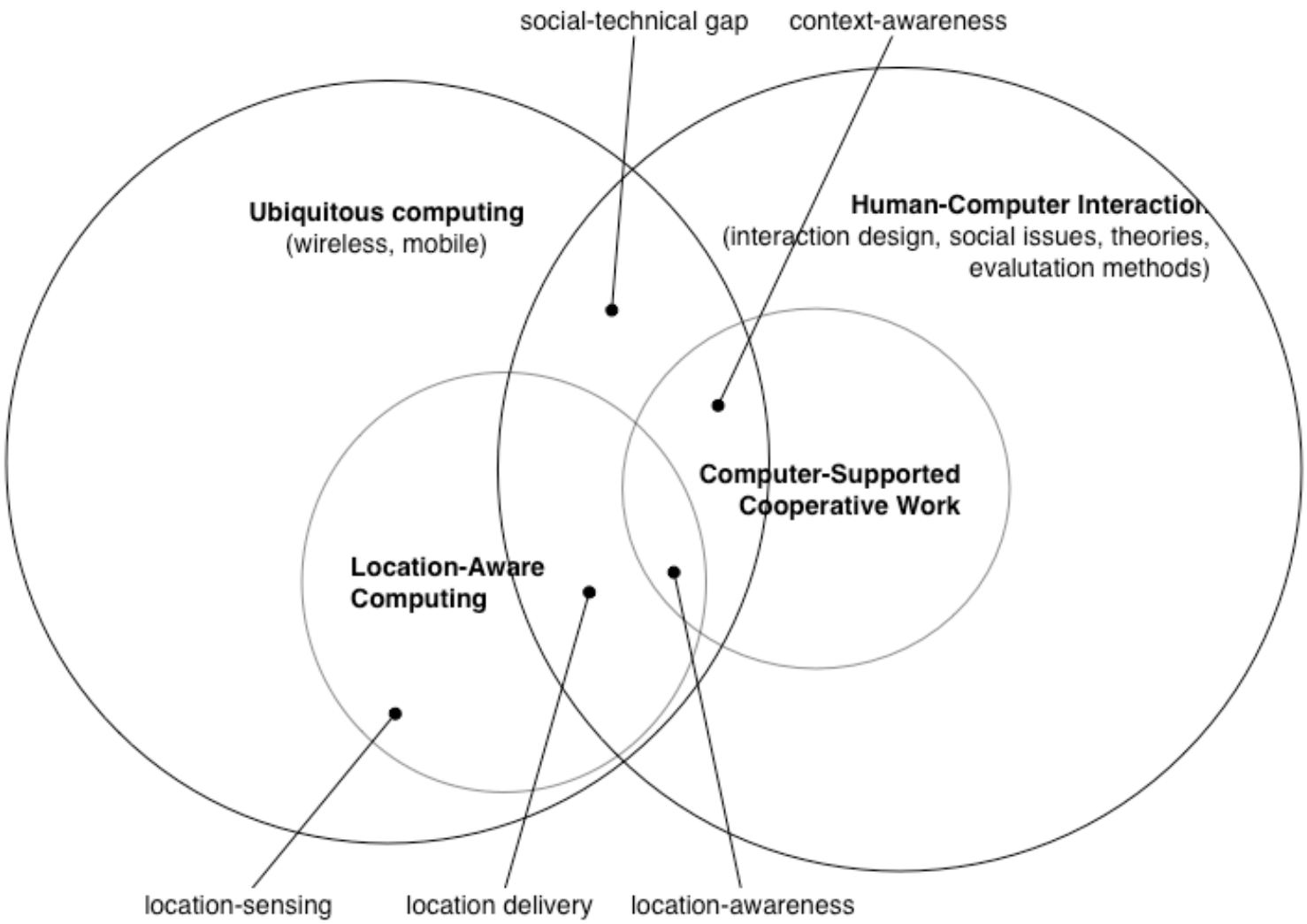
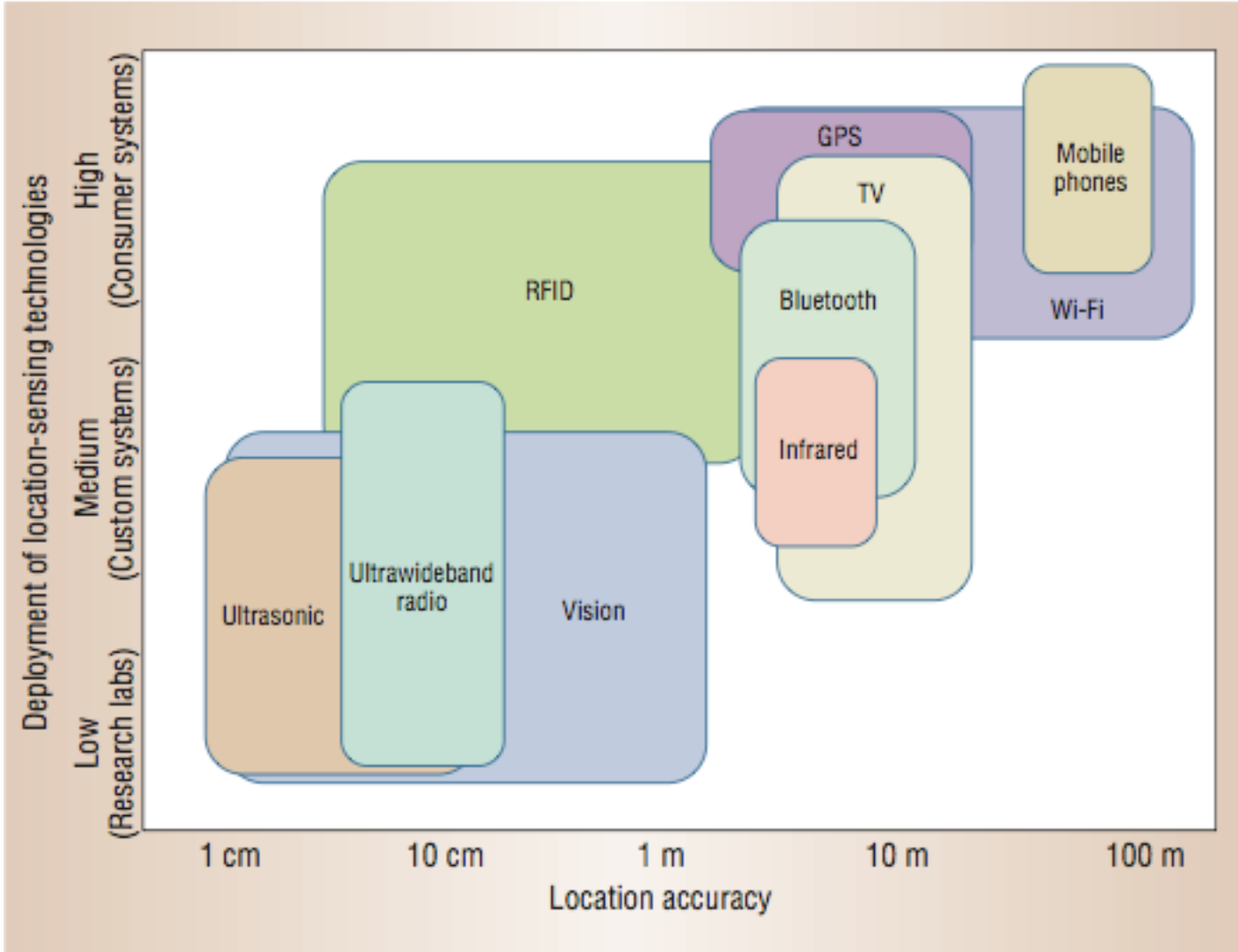
Scope

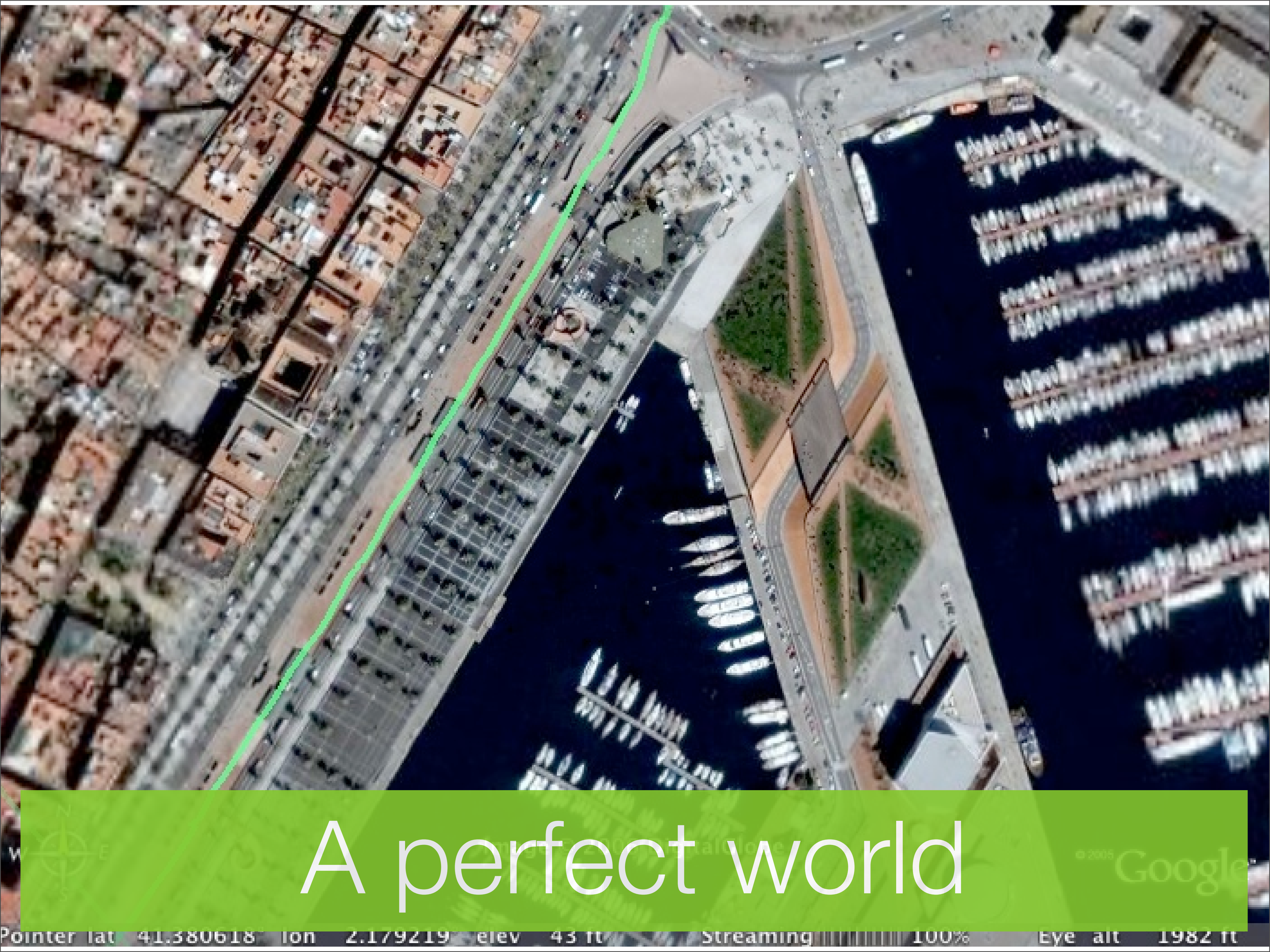

social-technical gap
context-awareness
Ubiquitous computing
(wireless, mobile)
Human-Computer Interaction
(interaction design, social issues, theories,
evalutation methods)
Computer-Supported
Cooperative Work
Location-Aware
Computing
location-sensing
location delivery
location-awareness

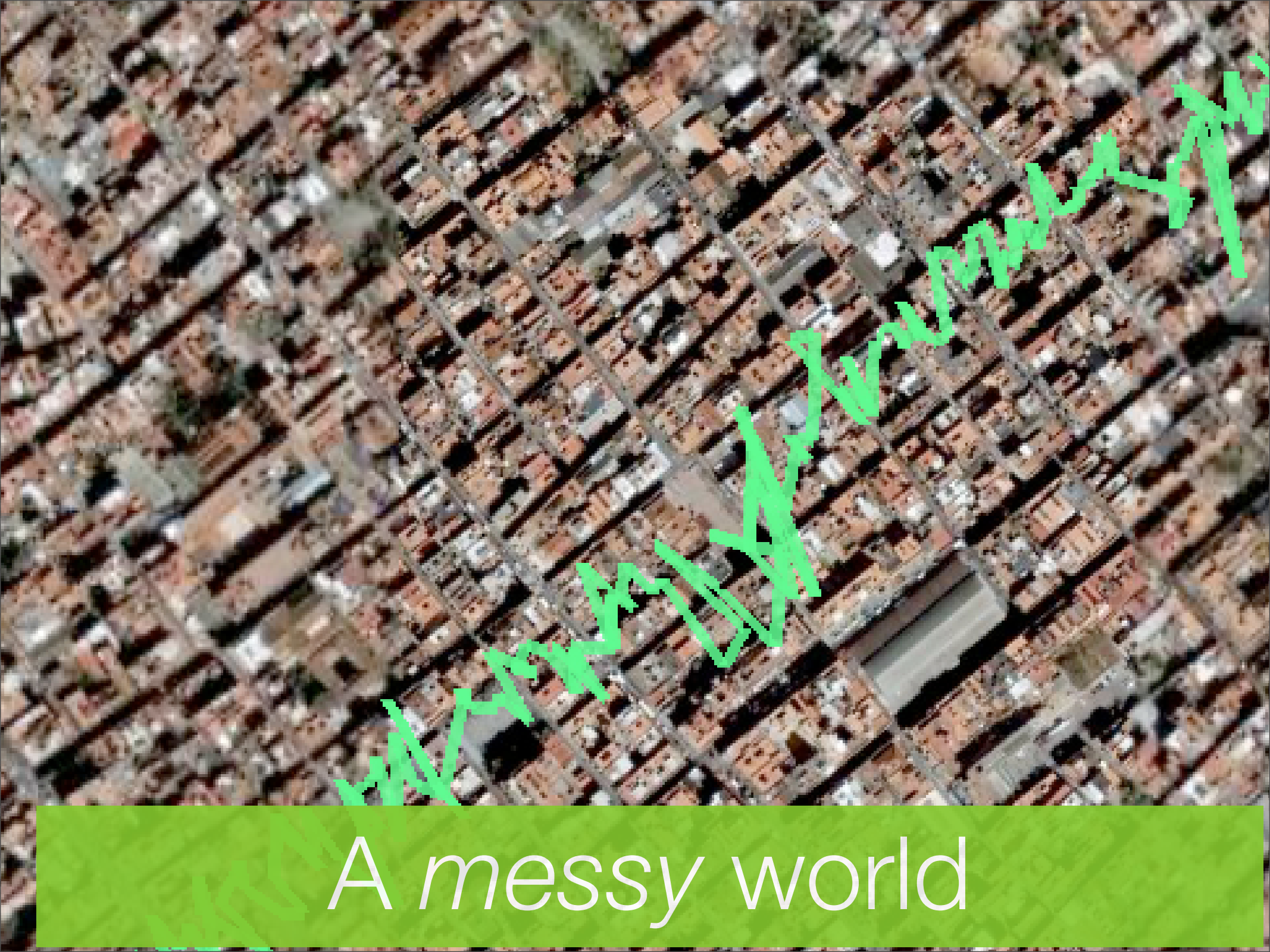
Location-aware computing

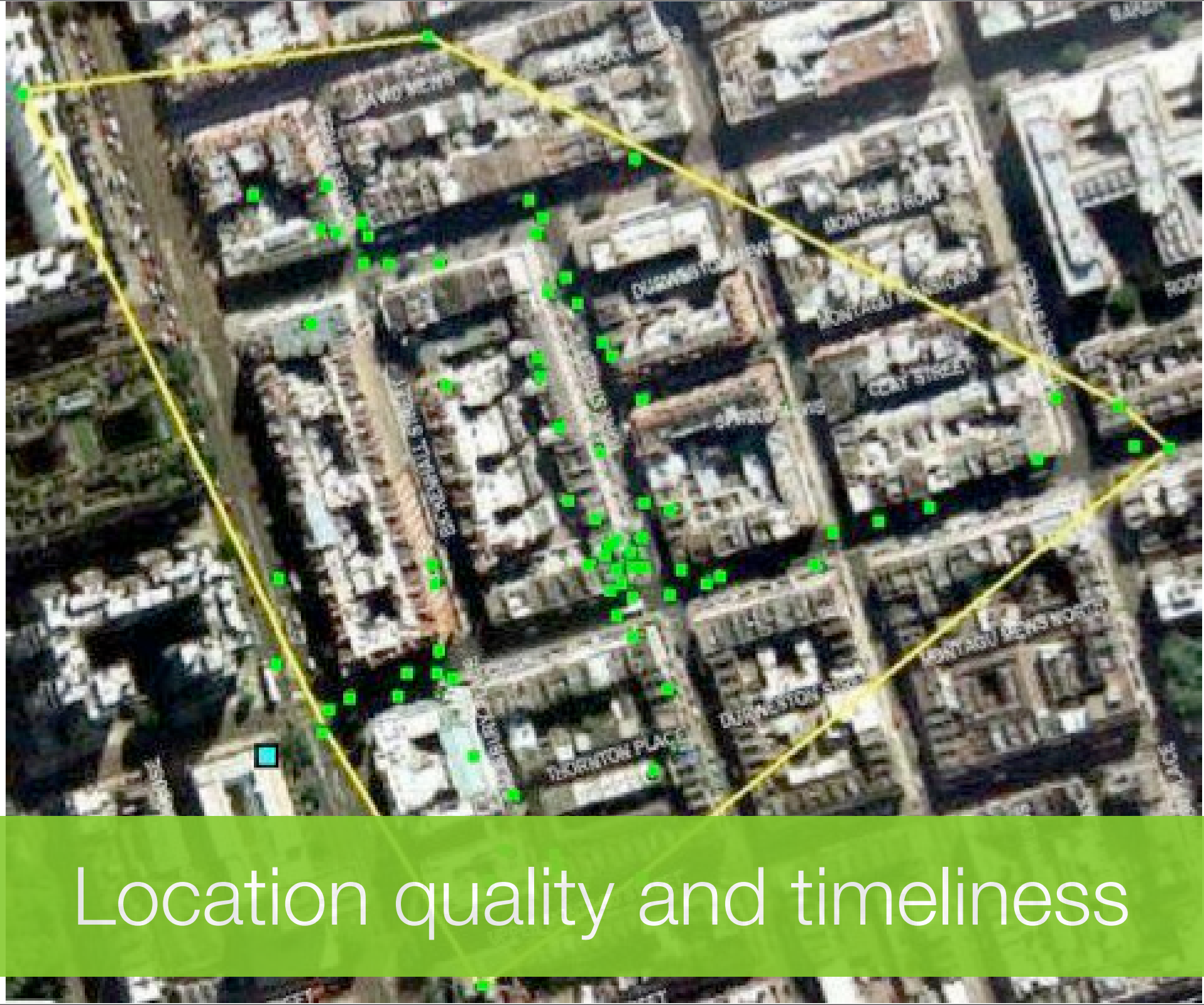
Location sensing



Source: Hazas, M., Scott, J., and Krumm, J. Location-aware computing comes of age. IEEE Computer 37, 2 (2004), 95–97.

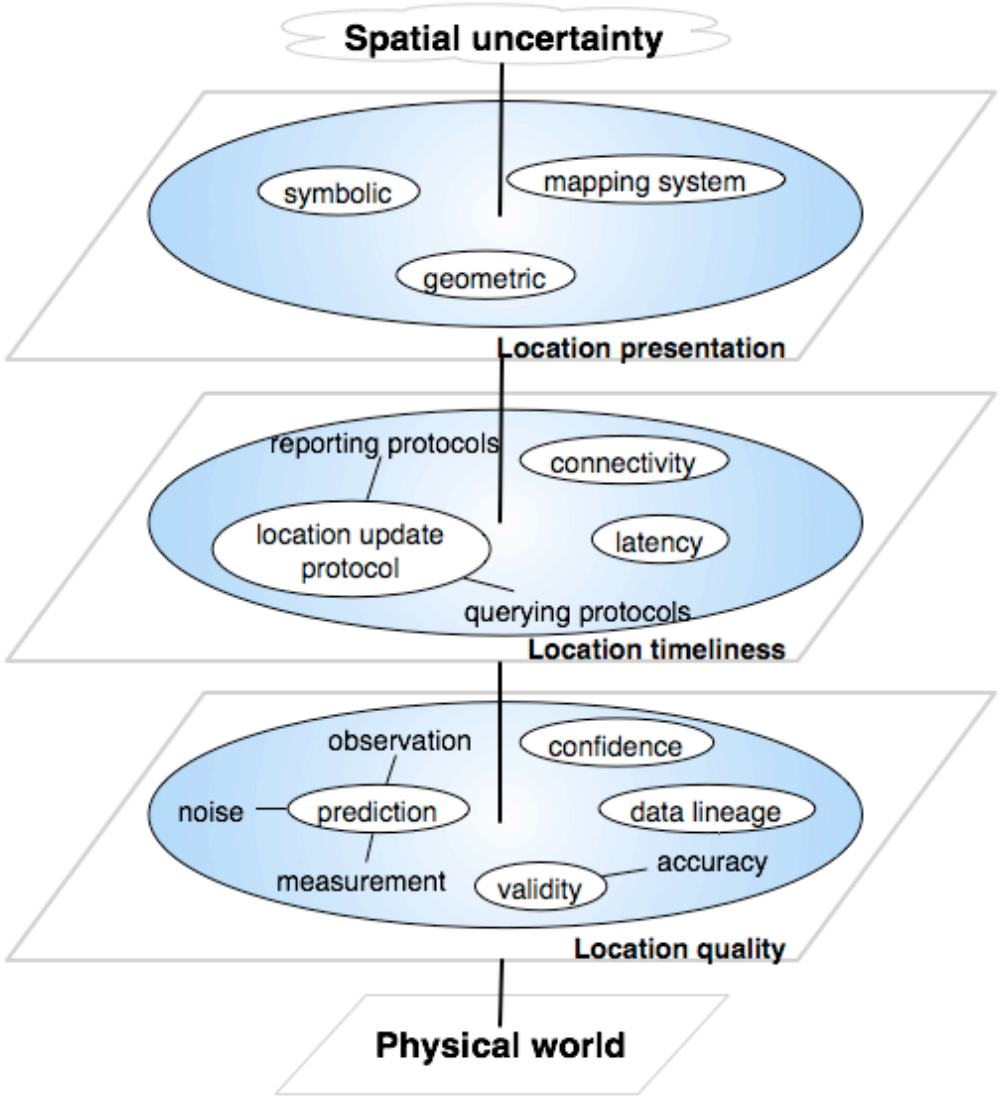

A perfect world
Google
Pointer lat 41.380618 lon 2.179219 elev 43 ft
Streaming 100%
Eye alt 1982 ft


A *messy* world

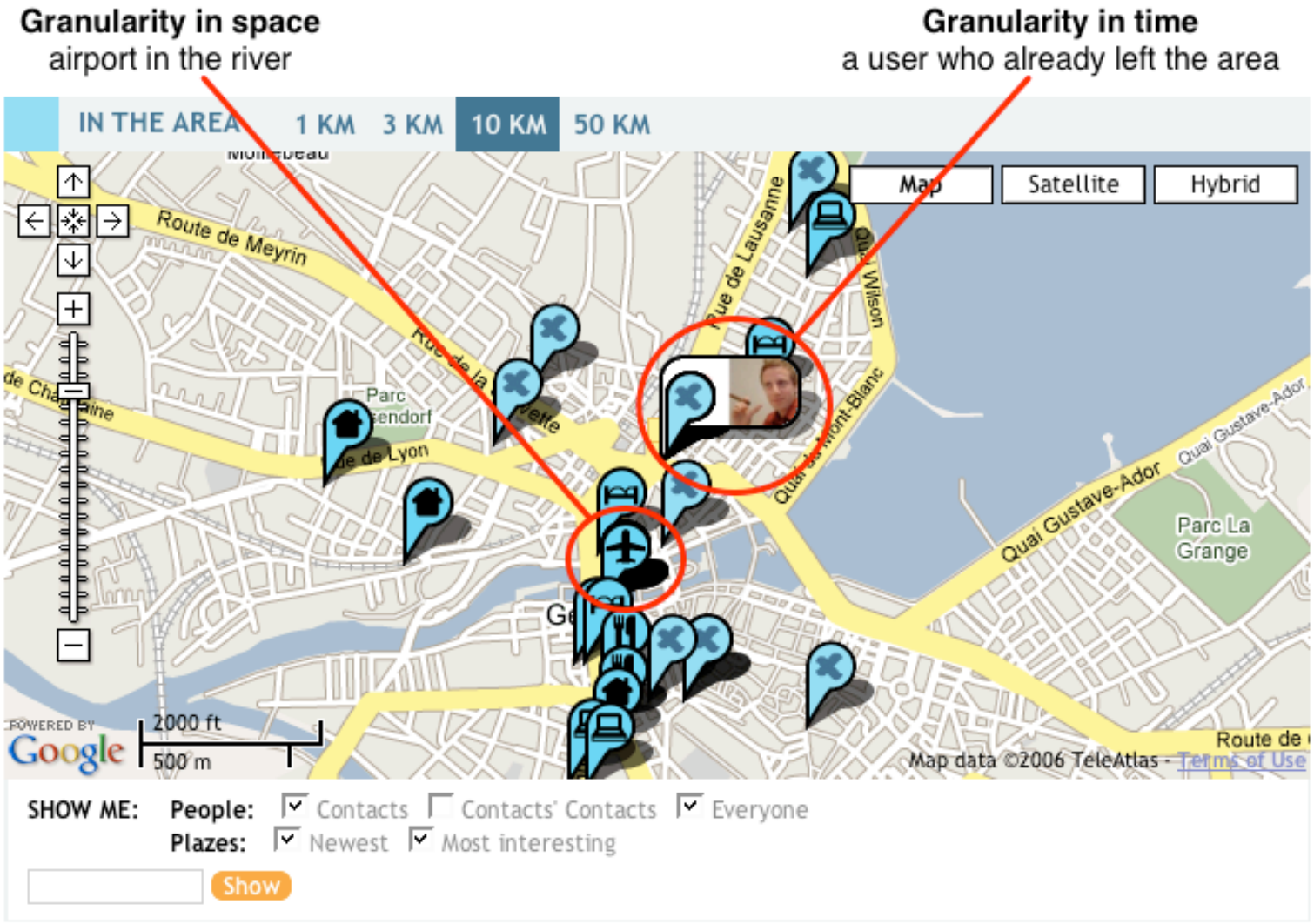


Location quality and timeliness

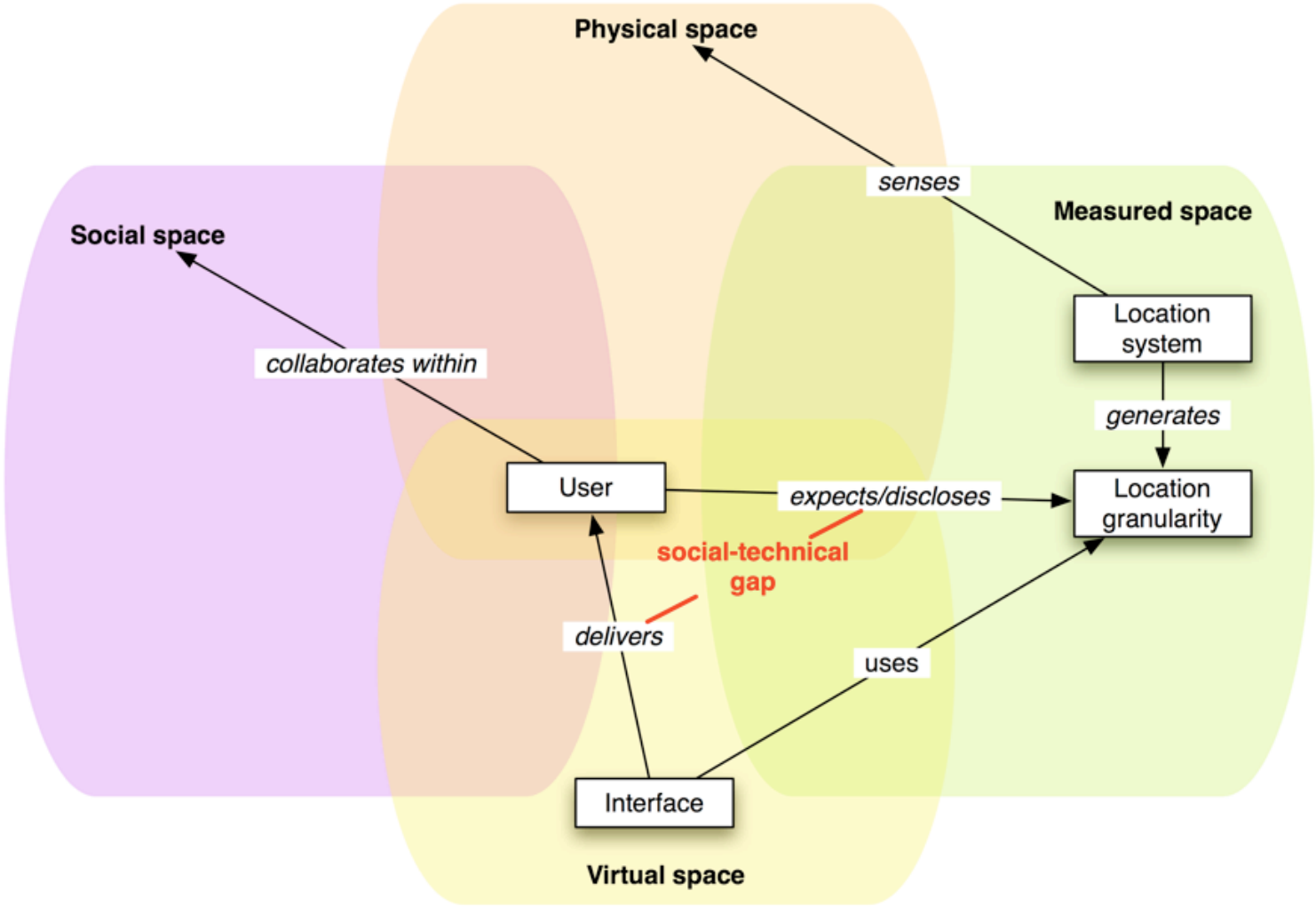
Sources of spatial uncertainty



Location information granularity



Social-technical gap



Ackerman (2000) describes it at the divide between what we know we must support socially and what we can support technically.

Problems

- Infrastructure and systems issues (not only technological)
- Multiple sources of uncertainty
- Difficulty in interpreting the uncertain information conveyed by location-awareness tools
- People have their own perception of the space that often does not match with technologically set ties between information and place.
- Human activity is highly flexible, nuanced and this makes systems technically difficult to construct properly
- How the deliver the appropriate granularity of location information

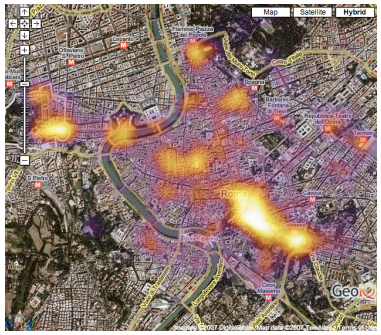
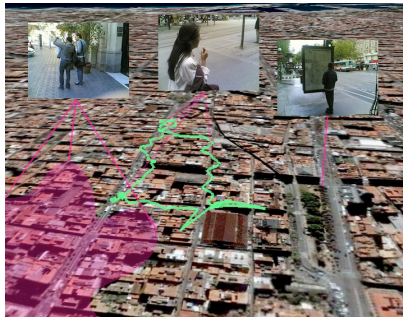
Research questions

How to build a location-aware system that takes into account the spatial uncertainty inherent to ubiquitous technologies?

- what level of location information quality and timeliness must be delivered in order to be useful and relevant?
- what parameters influence successful spatial uncertainty visualization?
- what is the balance between implicit and explicit forms of human interaction with a location-aware system that communicates the inherent uncertainty of its location information?

Approach



social-technical gap in location-aware computing

location information granularity & spatial uncertainty → **informed suggestions**

mixed, exploratory (CatchBob!)
descriptive, exploratory (flickr)
ethnographic, exploratory (taxi drivers)

→ **design strategies**

seamful design
uncertainty visualization
middleware design
spatio-temporal traces

→ **data collection and evalutation**

mixed approach, field study
ethnography supported by spatio-temporal data analysis tool
usability: does it work, where does it work? when and compared to what does it work?

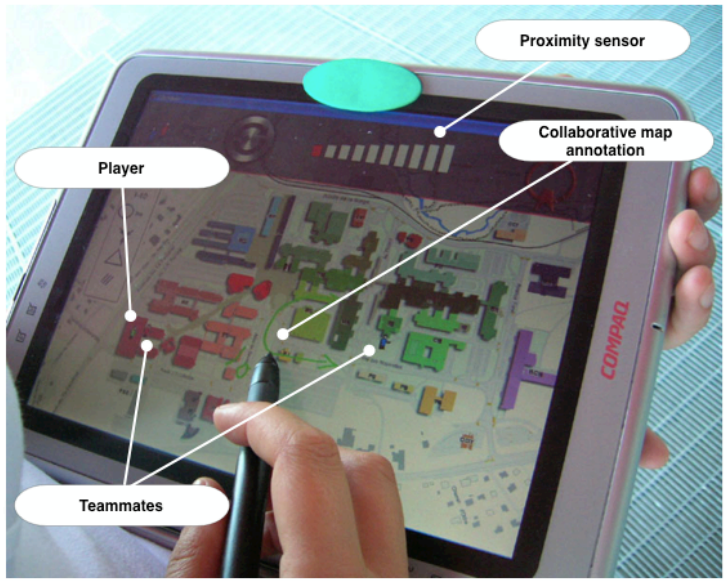
Girardin, F. (2007). Bridging the social-technical gap in location-aware computing, Doctoral Colloquium at Pervasive 2007, Toronto, Canada.

Girardin, F. (2007). Bridging the social-technical gap in location-aware computing. In CHI '07: CHI '07 extended abstracts on Human factors in computing systems, pages 1653–1656, New York, NY, USA. ACM Press.

Phase 1: Exploratory

Field experiment: CatchBob!

- Various players reactions to uncertainty: Believing, not understanding, overcoming
- Various sources of spatial uncertainty
- Automatic location-awareness ≠ Giving a location (act of communication carrying intentions)



Girardin, F. and Nova, N. (2006). Getting real with ubiquitous computing: the impact of discrepancies on collaboration. e-Minds International Journal on Human-Computer Interaction, 1(1):60–64.

Girardin, F., Nova, N., Blat, J. (2006). Towards Design Strategies to Deal with Spatial Uncertainty in Location-Aware Systems, Poster at Ubicomp 2006, Orange County, CA. USA.

Case study: Granularity in geo-referencing

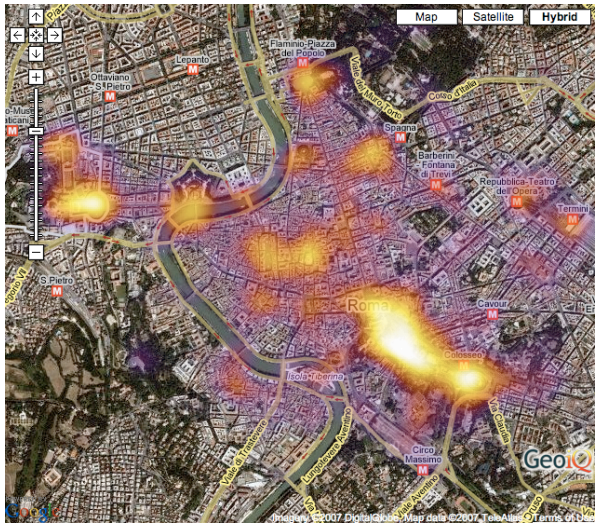
- **Context**: Platform to geo-referencing and share photos

- **Aim 1**: identify the criterias that influence the granularity used to disclose location information (where, what, when, history of use).

- **Aim 2**: analyze how users take advantage of the accuracy feature to georeference and geotag (semantic) their images

- **Early results**: the city and type of urban landscape impact the use of coarse and fine-grained location information

  familiarity with a place does not seem to influence the accuracy of the disclosed location



Girardin, F. and Blat, J. (2007). Place this photo on a map: A study of explicit disclosure of location information. Late Breaking Result at Ubicomp 2007.

Case study: Taxi drivers use of GPS

- **Context**: Barcelona taxi drivers who use GPS navigation systems. Ethnographic study
- **Aim**: Co-evoluation between practice and system. Mastering the system shortcomings and limitations
- **Aim**: Criterias to select among the different modes of a navigation system and the other tools
- **How**: focused ethnography, semi-structured interview

Girardin, F. and Blat, J. (2008). The co-evolution of taxi drivers and their in-car navigation systems. Session on Situating Sat Nav: Questioning the TomTom Effect, 2008 Association of American Geographers Annual Conference. 15-19 April 2008, Boston, USA.

Articulation

Type	Context	Objective	Method
Field experiment 1	collaborative pervasive game	Explore the sources of spatial uncertainty and analyze players' behaviors towards spatial uncertainty	mixed
Case study 1	sharing and geotagging photos	Identify the criterias that influence the use of location information granularity	descriptive
Case study 2	taxi drivers use of GPS	Identify the modes to access location information and its granularity. Co-evolution practices and system	ethnographic
Field experiment 2	collaborative urban-scale environment	Evaluate the integration of location information granularity in the design of the application. to evaluate strategies to decrease the socio-technical gap (i.e. manage spatial uncertainty.	mixed

Phase 2: Field studies

Context: Enhancing urban tourism experience

- **Field experiments:** involve real users in activity in the real world. Control some variables and compare different experimental conditions (mixed method)
- **Context**: Give an awareness to citizens and/or tourists on their behaviors and surroundings in a urban space.
- **Aim 1**: Evaluate design strategies to decrease the social-technical gap based on what has been learned in the first 3 studies
- **How**: Compare approaches (Does it work?)
- **How**: Study the contextual impact of the approach (Where and when?)

Girardin, F., Blat, J., and Nova, N. (2007). Tracing the visitor's eye: Using explicitly disclosed location information for urban analysis. IEEE Pervasive Computing, 6(3):55.

Girardin, F., Fiore, F. D., Blat, J., and Ratti, C. (2007). Understanding of tourist dynamics from explicitly disclosed location information. In 4th International Symposium on LBS and Telecartography, Hong-Kong, China.

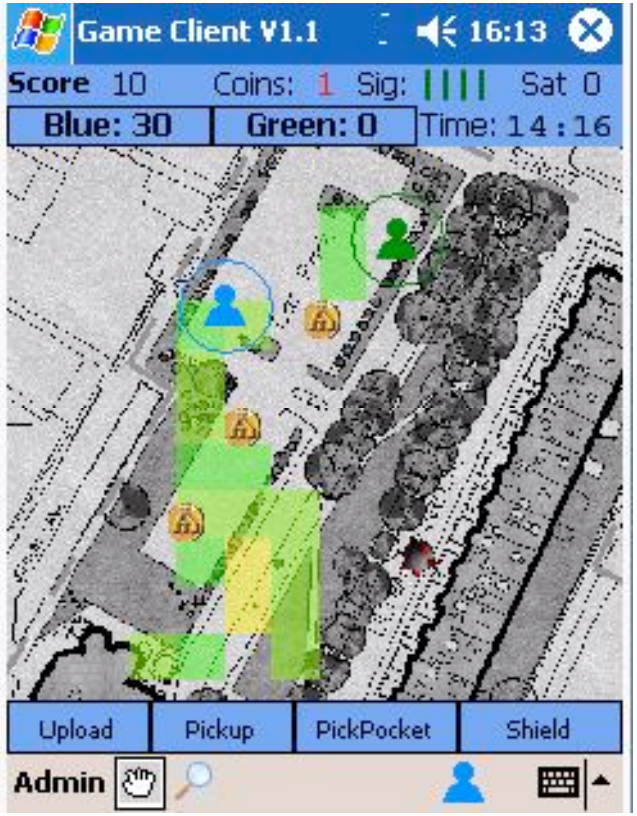
Seamful design

- Delivering a clear mirror of the reality from sensed and explicitly disclosed data might be **hard to reach** (location information quality and timeliness).

- Instead of hiding the imperfection of the data and mislead the user, a proper design would be to **reveal the limits of the technology**.
  (i.e. seamful design: Chalmers and Galani, 2004)

- **Reveal to improve the appropriation**

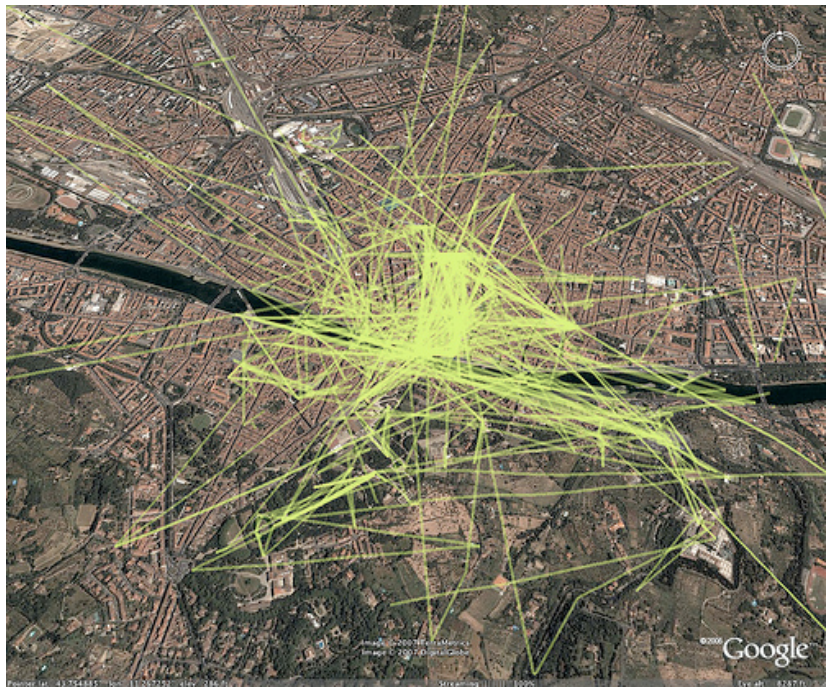
- Exploit the activity of other people as indicator of the **nuances of the granularity employed to communicate or retrieve location information** (e.g. definition of a neighborhood)



Leveraging spatio-temporal traces

- Use **position history to tailor results** from requests for information further

- **People's past interactions** with the location-aware application **become recommendations** and impact the perception of the space and quality of the system (Mountain and Raper, 2001)



Feedback loop

Take aways

- **Socio-technological gap** form by the discrepancies between what people expect (flexible, nuanced, and contextualized social world) and what positioning system can deliver.

- People have their own perception of the space that often **does not match** with technologically set ties between information a place.

- Location information is treated at different **levels of granularity**.

- Studying how people manage this granularity “should” help reduce the socio-technological gap and **inform the design of location-aware systems**.

- **Seamful design** can be an approach to reveal location information granularity and uncertainty to improve the appropriation.

Conclusion

“Let’s do smart things with stupid technology today, rather than wait and do stupid things with smart technology tomorrow?”

William Buxton