Identity Crisis of Ubicomp?
Mapping 15 Years of the Field's Development and Paradigm Change

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Community Imaging Group
Studying communities through their use of technology

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UNIVERSITY of OULU
OULUN YLIOPISTO

Based on a true story...

A newcomer's questions

- Does Ubicomp have any overarching theory?
- Does Ubicomp have any mainstream research methodology?
- Does Ubicomp have accumulated knowledge?

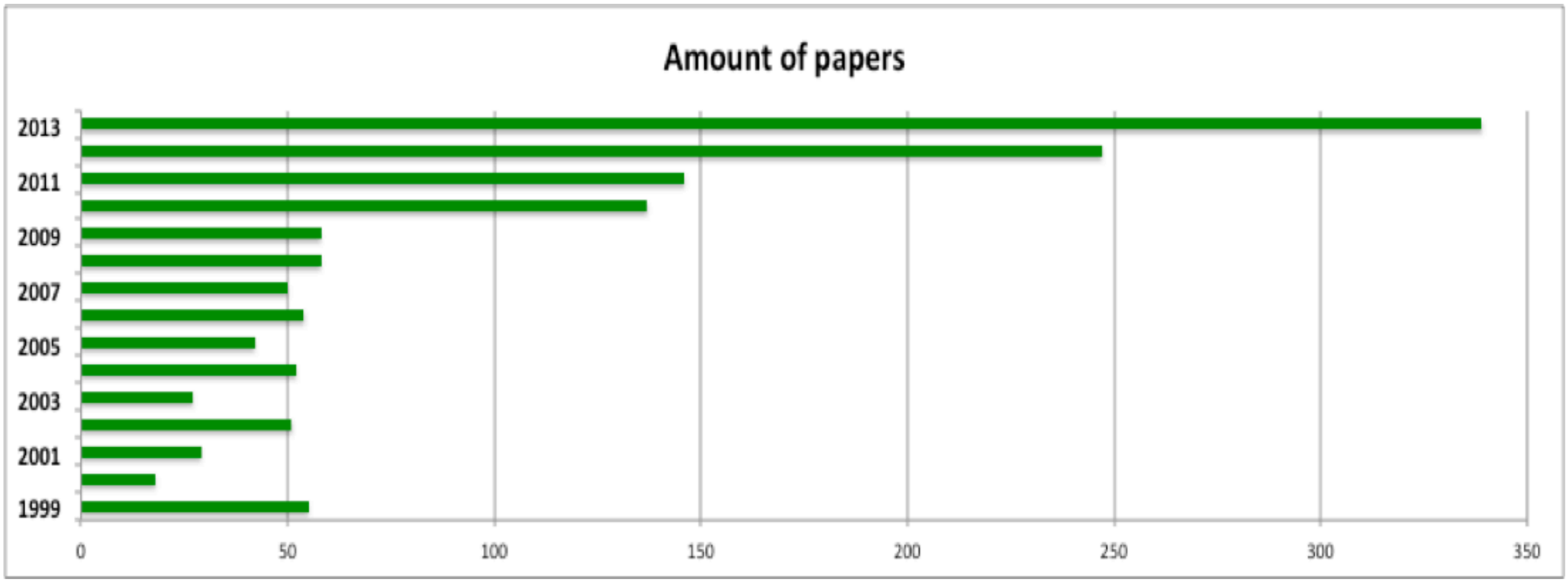
Previous work

- Mostly arguments about **what is** Ubicomp
- Or what it **should be**

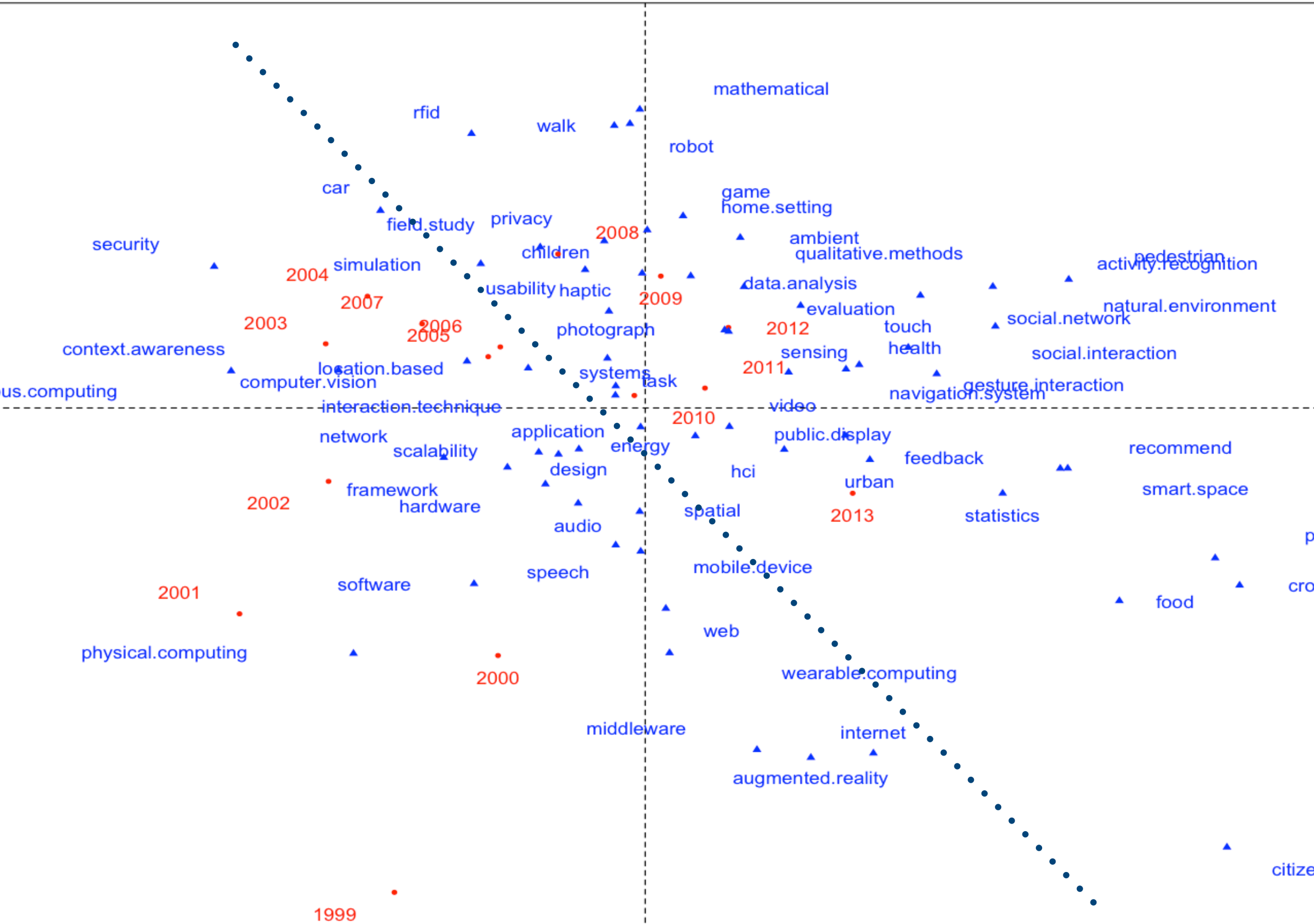
- At Ubicomp 2012 authors were explicitly invited to present their **point of view**
  - "visionary or conceptual ideas that discuss and/or critique the future of Ubicomp"
  - "a forum to present well-argued ideas"

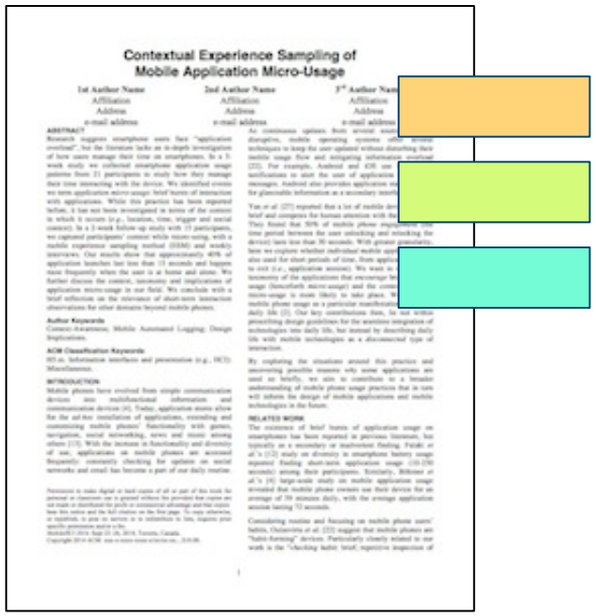
Sample collection

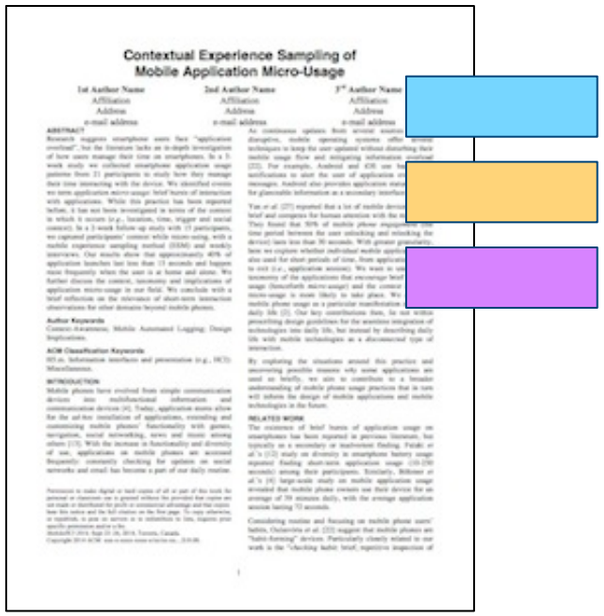
- HUC, UbiComp, Pervasive Proceedings: 1999-2013
- 1363 articles



CA factor map




Contextual Experience Sampling of Mobile Application Micro-Usage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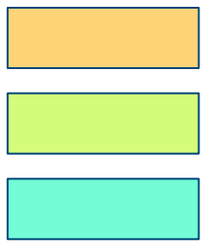
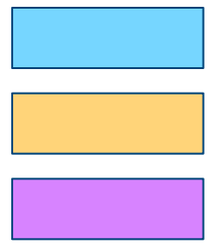
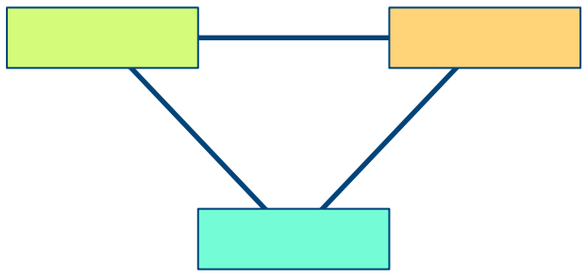
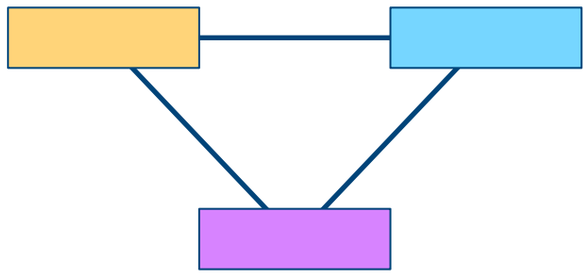
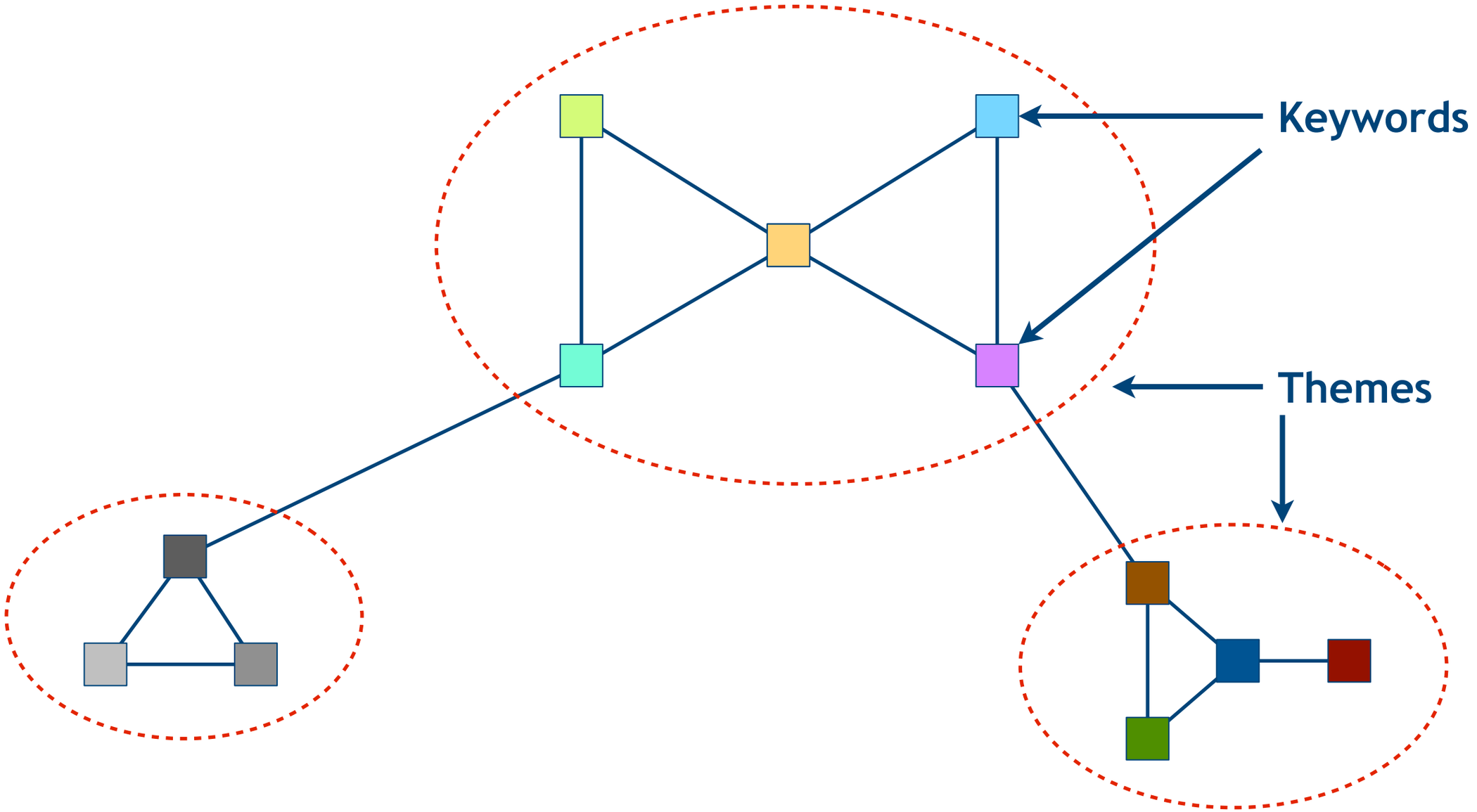
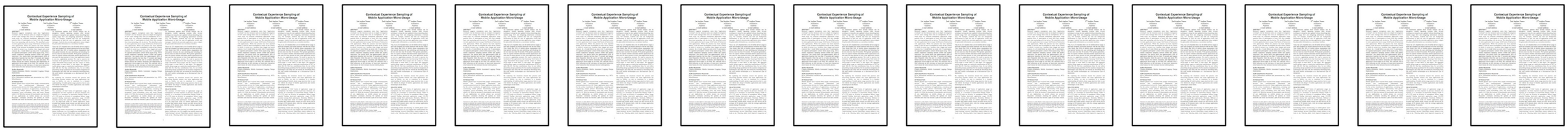




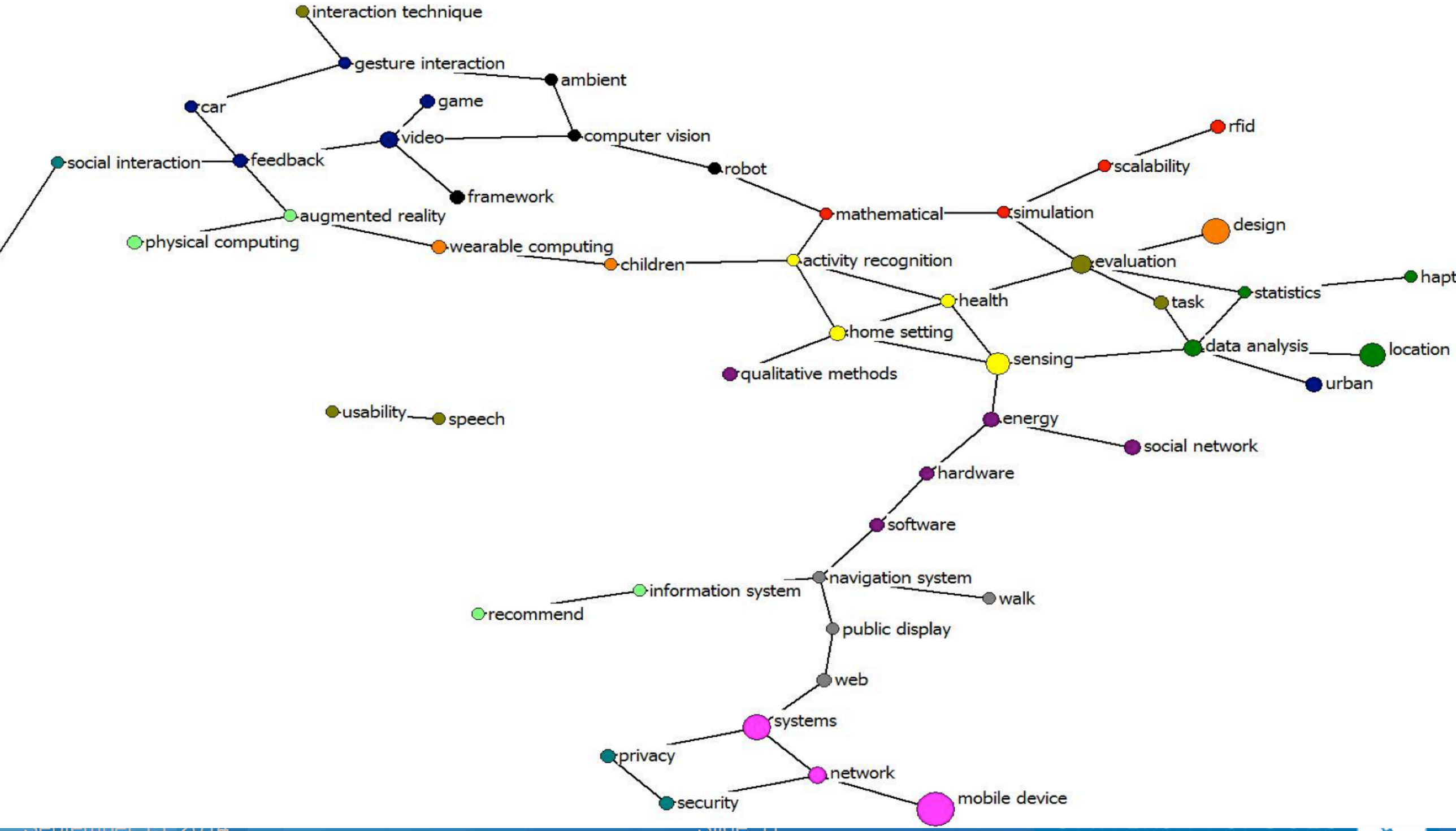




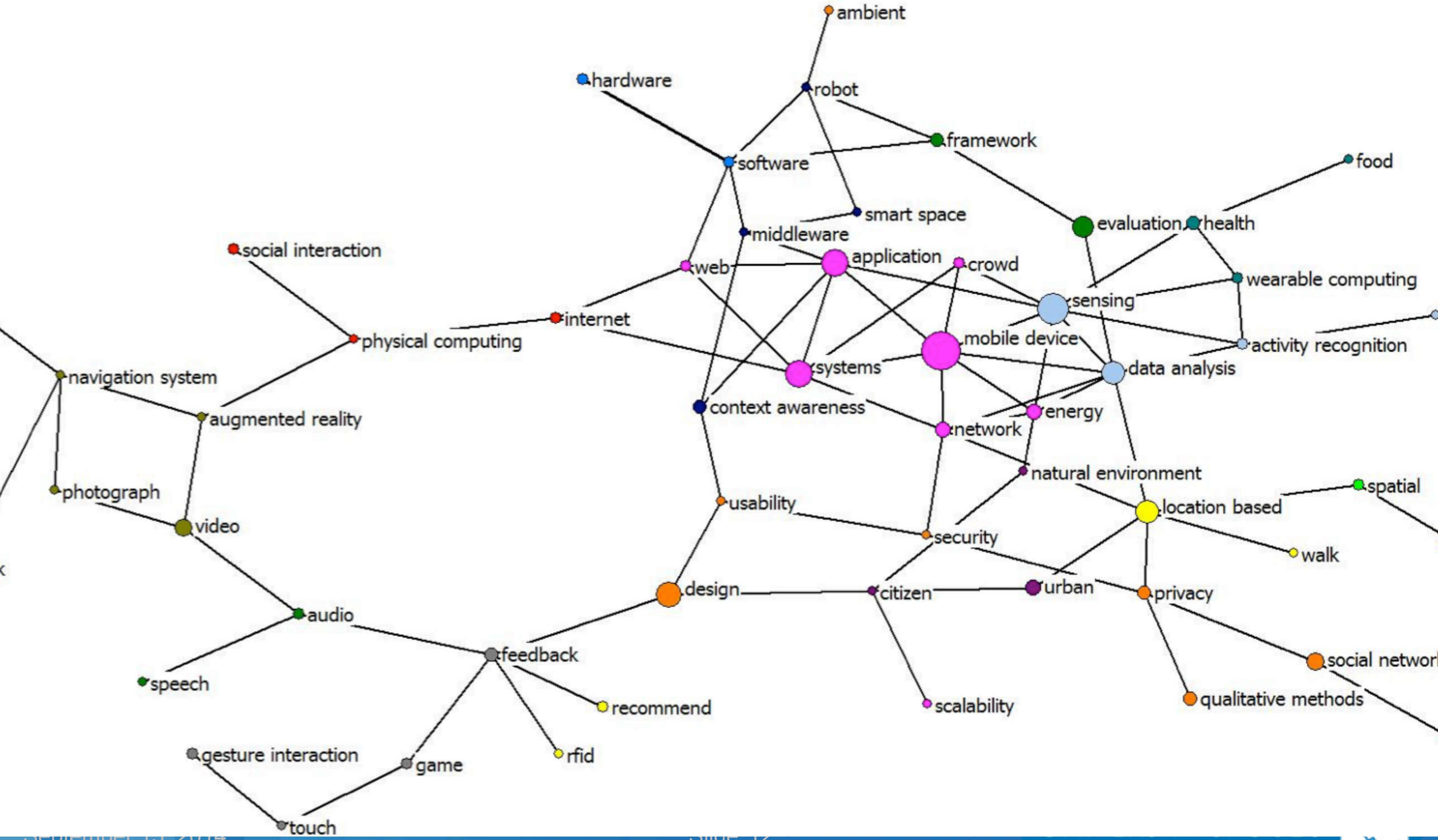

Keywords
Themes



1999-2007

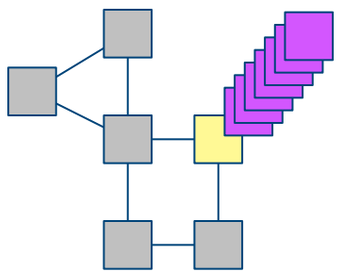

interaction technique
gesture interaction
ambient
car
game
video
computer vision
social interaction
feedback
robot
framework
augmented reality
physical computing
wearable computing
children
mathematical
activity recognition
rfid
scalability
simulation
design
evaluation
statistics
hapt
health
task
home setting
data analysis
location
qualitative methods
sensing
urban
usability
speech
energy
social network
hardware
software
navigation system
information system
walk
recommend
public display
web
systems
privacy
network
security
mobile device

2008-2013

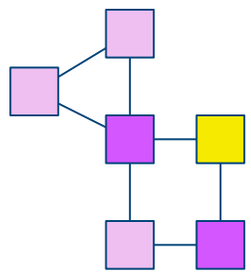

ambient
hardware
robot
framework
software
food
smart space
evaluation
health
middleware
social interaction
application
crowd
web
wearable computing
sensing
internet
physical computing
mobile device
activity recognition
systems
data analysis
navigation system
context awareness
energy
augmented reality
network
natural environment
photograph
usability
location based
spatial
video
security
walk
design
citizen
urban
privacy
audio
feedback
social networ
speech
qualitative methods
recommend
scalability
gesture interaction
game
rfid
touch

Analysis

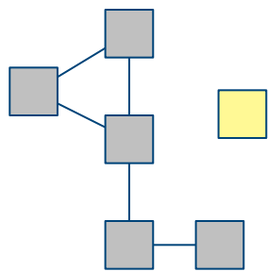
Keywords



Popularity

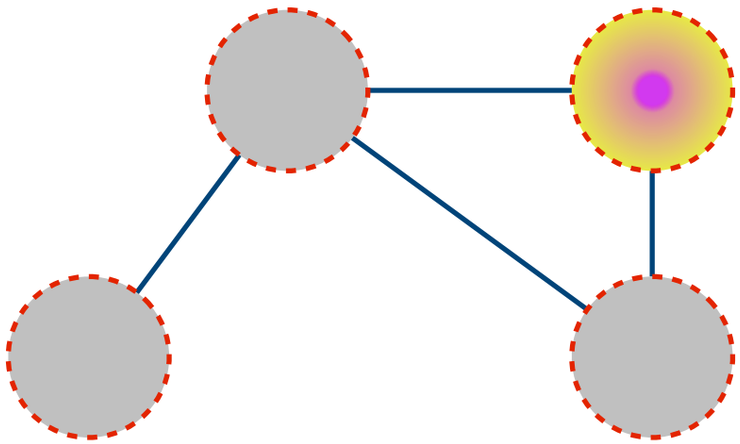


Core

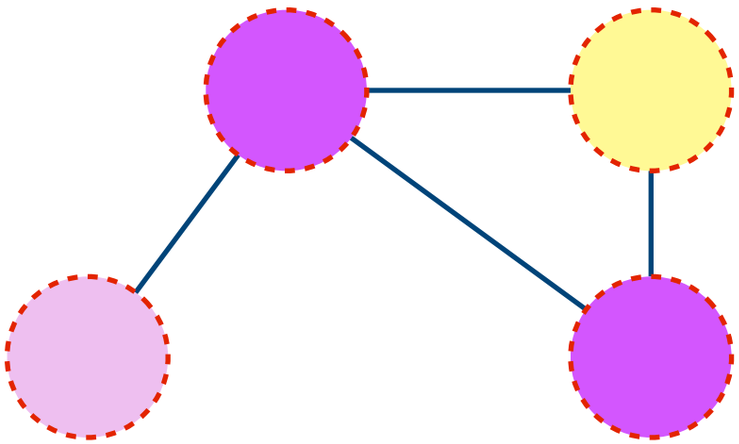


Backbone

Themes



Density



Centrality

Keywords

1999-2007

No.	Topics	Popularity	Topics	Coreness	Topics	Structural holes
1	mobile device	214	mobile device	0.537	mobile device	37.96
2	application	146	application	0.359	application	34.07
3	design	133	location based	0.333	design	33.86
4	location based	128	design	0.303	location based	32.08
5	systems	115	systems	0.300	evaluation	31.71
6	sensing	106	sensing	0.269	sensing	31.53
7	evaluation	74	network	0.208	systems	31.50

Table 5. Topics with high popularity, coreness, and structural holes during 1999-2007.

2008-2013

No.	Topics	Popularity	Topics	Coreness	Topics	Structural holes
1	mobile device	478	mobile device	0.515	mobile device	39.83
2	sensing	347	sensing	0.375	design	38.34
3	application	299	application	0.329	sensing	38.08
4	systems	288	systems	0.305	systems	37.45
5	design	277	data analysis	0.260	evaluation	36.64
6	location based	238	location based	0.241	location based	36.60
7	data analysis	231	design	0.229	application	36.49
8	evaluation	208	evaluation	0.216	framework	35.75

Table 6. Topics with high popularity, coreness, and structural holes during 2008-2013.

Themes

1999-2007

ID	Keywords	Size	F	CW-F	Cohesion	Centr.	Density
A1	**mobile device, systems, network,** internet	4	102.75	463.50	1.040	1.000	29.67
A2	**sensing, home setting, health,** activity recognition	4	43.50	205.20	1.164	0.942	7.67
A3	**application, context awareness, framework**, ambient, robot, computer vision	6	39.33	179.50	0.608	0.980	3.93
A4	**design, wearable computing, audio**, field study, children	5	37.60	167.40	0.883	0.961	3.90
A5	**location based, data analysis, statistics,** haptic	4	45.25	231.75	1.252	0.904	7.83
A6	**evaluation, task, usability**, speech, interaction technique	5	25.60	129.40	1.584	0.961	3.50
A7	**video, urban, feedback**, game, gesture interaction, car	6	22.33	87.50	1.326	0.960	2.20
A8	**social network, energy, qualitative methods**, software, hardware	5	29.40	122.60	1.002	0.961	3.00
A9	**privacy, security, hci,** social interaction	4	14.50	82.25	0.994	0.808	2.67
A10	**web, walk, navigation system,** public display	4	9.75	49.50	1.327	0.673	1.17
A11	**physical computing, spatial, recommend**, augmented reality, information system	5	11.00	48.80	0.795	0.667	1.00
A12	**simulation, rfid, mathematical**, scalability	4	10.25	58.75	1.299	0.615	2.00

Table 1. Research Themes of 1999-2007: size, frequency (F), co-word frequency (CW-F), cohesion, centrality (Centr.), density.

2008-2013

ID	Keywords	Size	F	CW-F	Cohesion	Centr.	Density
B1	**mobile device, application, systems**, network, energy, web, crowd, scalability	8	173.35	857.50	1.519	1	35.86
B2	**sensing, data analysis, activity recognition**, mathematical	4	165.50	802.50	1.075	1	35.67
B3	**design, social network, home setting**, qualitative methods, privacy, usability, ambient, security, field study, public display	10	80.50	361.80	0.880	1	7.56
B4	**location based, recommend, walk**, rfid	4	80.75	381.25	0.893	1	7.00
B5	**evaluation, task, framework, audio,** speech	5	79.20	419.20	1.682	1	8.70
B6	**video, navigation system, augmented reality**, car, photograph	5	46.20	212.00	1.077	0.981	4.10
B7	**context awareness, smart space, robot**, middleware	4	35.50	170.00	1.080	0.945	3.00
B8	**urban, natural environment, citizen**	3	48.67	235.00	1.191	0.982	5.33
B9	**health, wearable computing, food**	3	54.00	239.00	0.706	0.946	7.67
B10	**feedback, gesture interaction, game,** touch	4	41.25	196.25	1.041	0.927	5.67
B11	**software, hardware**	2	41.00	206.50	1.348	0.912	17.00
B12	**internet, social interaction, physical computing**	3	35.67	165.67	0.979	0.911	4.67
B13	**hci, spatial, simulation,** statistics	4	31.50	146.50	0.881	0.982	2.50

Table 2. Research Themes of 2008-2013: size, frequency (F), co-word frequency (CW-F), cohesion, centrality (Centr.), density.

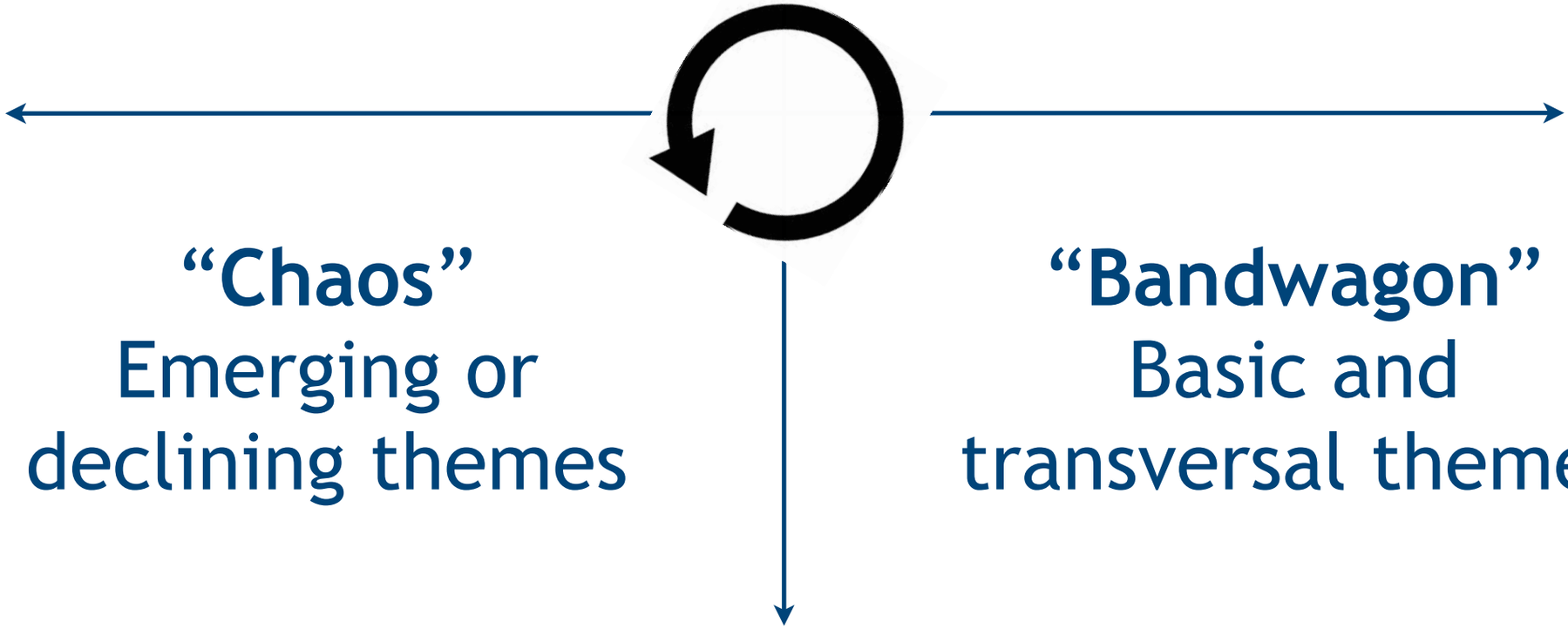
Strategic diagrams

“Ivory tower”
Developed but isolated themes

Centrality

Density

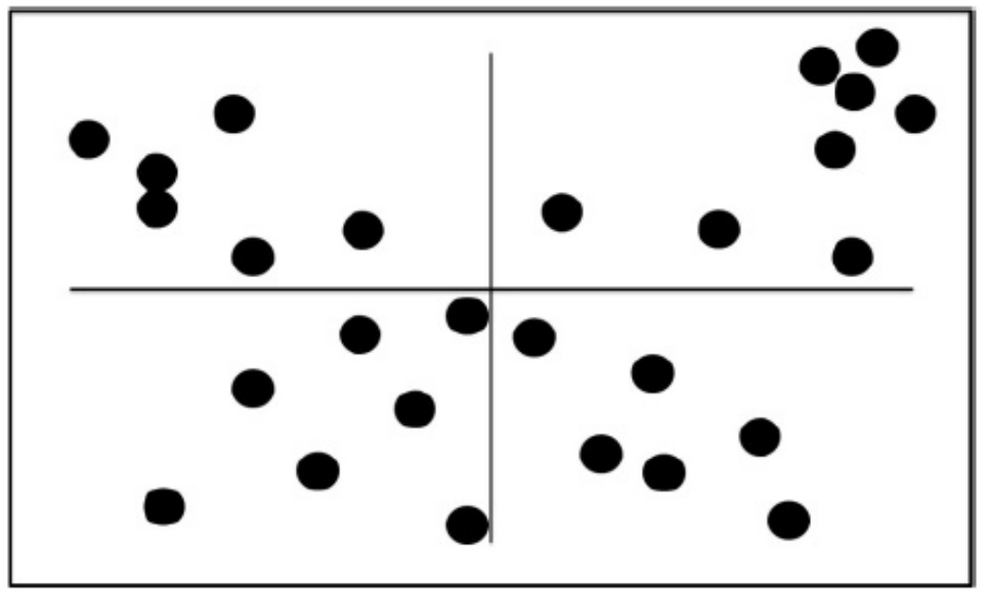
“Mainstream”
Motor Themes



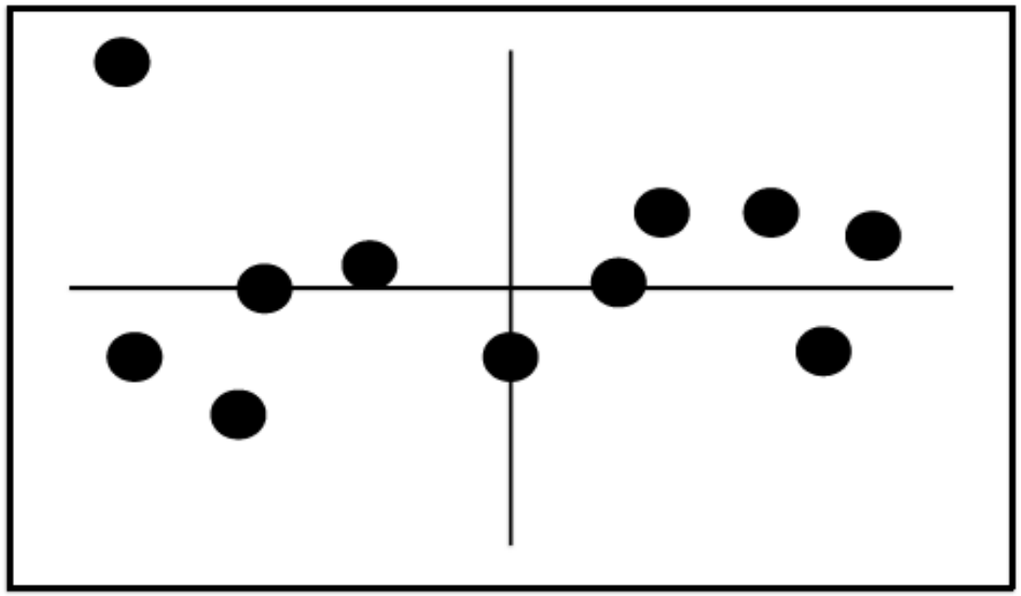
“Chaos”
Emerging or declining themes

“Bandwagon”
Basic and transversal themes

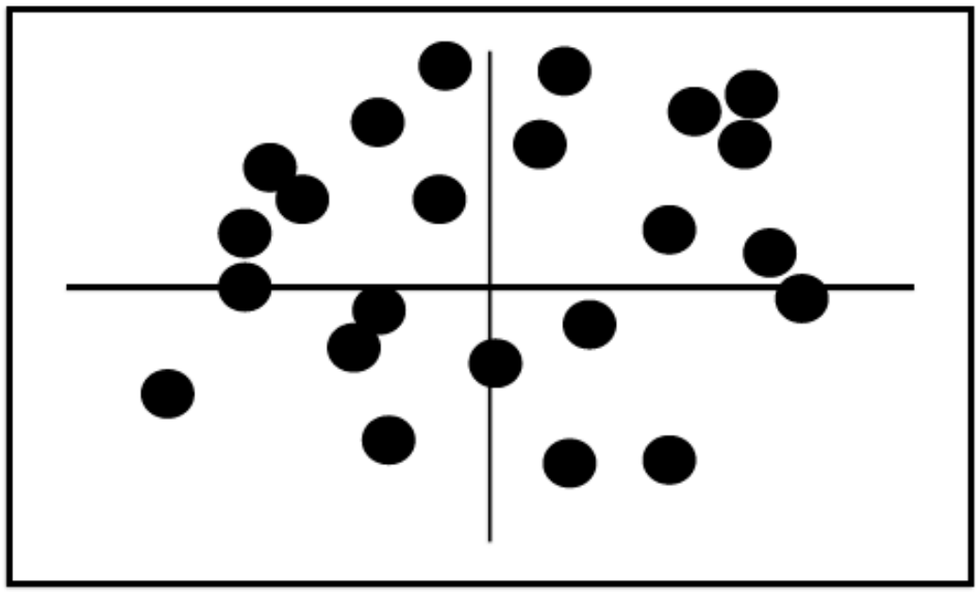
Strategic diagrams of other fields



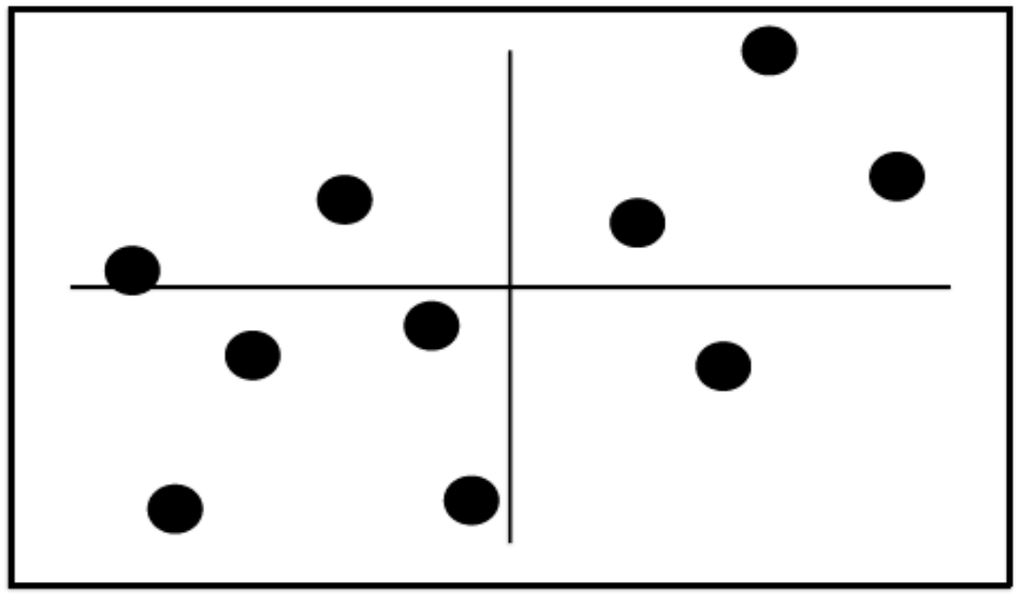
Psychology [21]



Software Engineering [11]



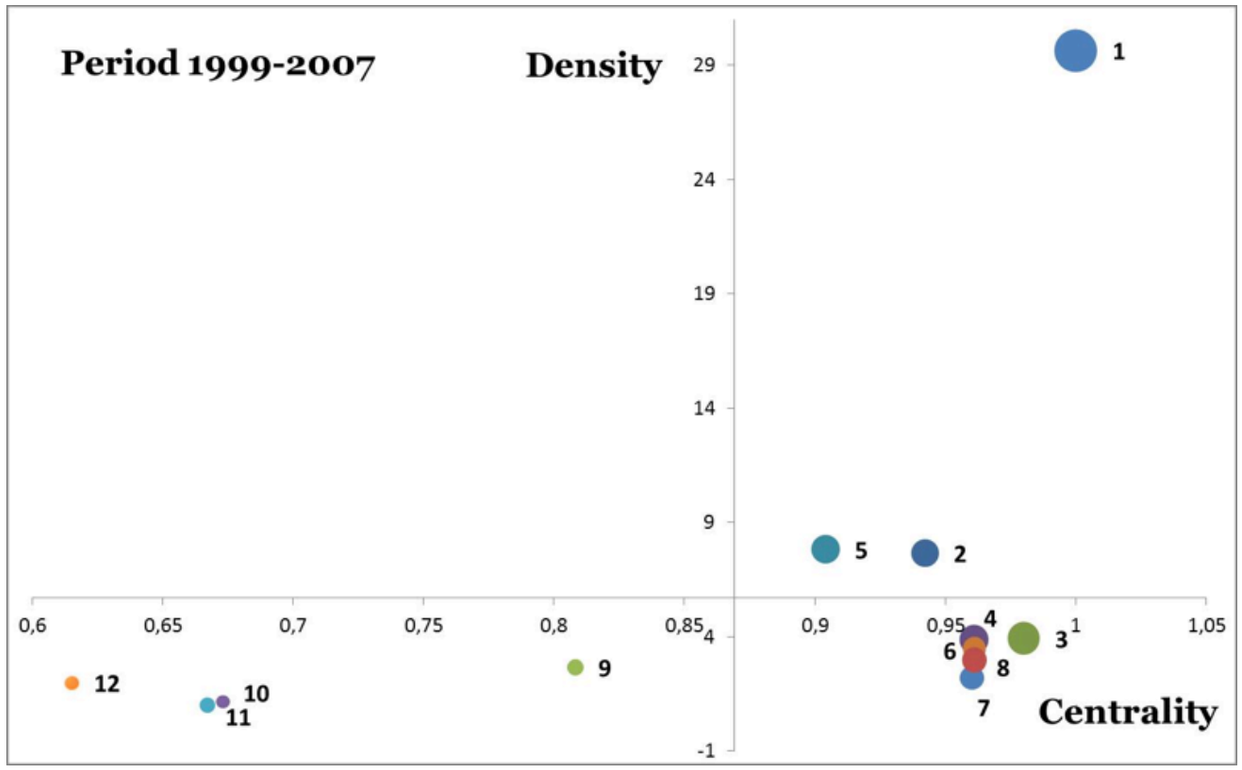
Consumer Behavior [22]



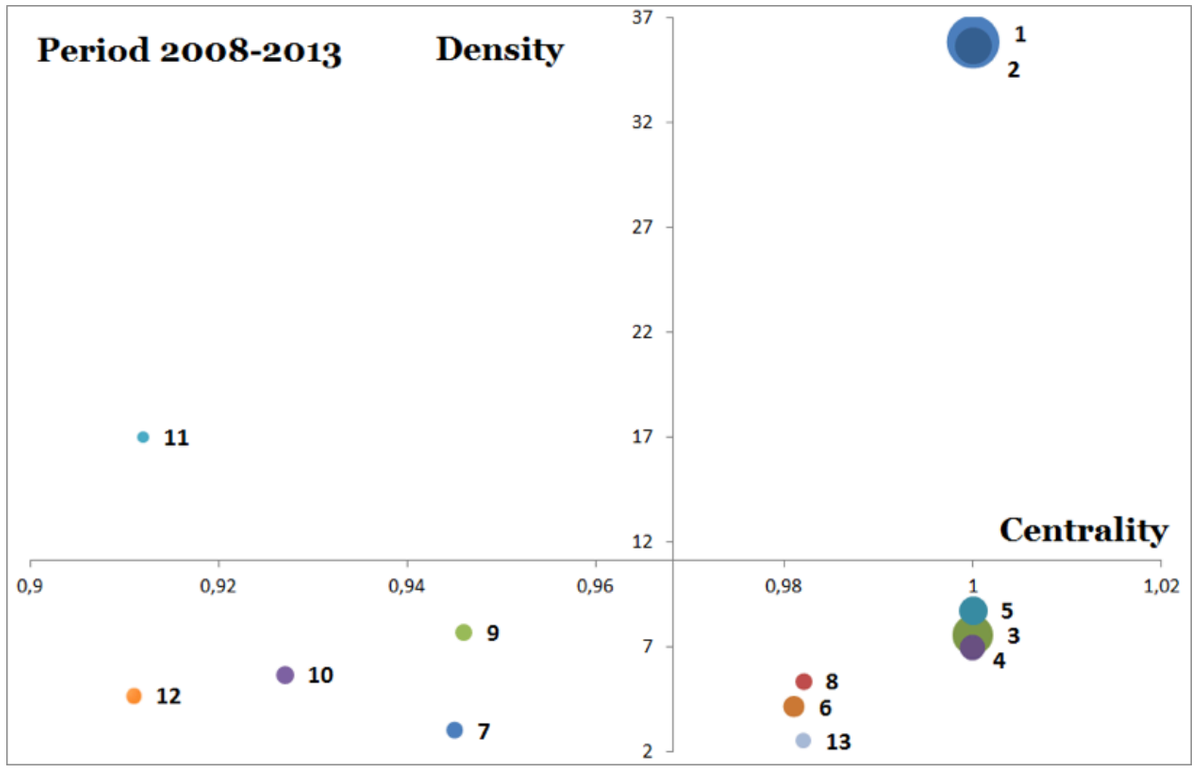
Stem Cell Research [1]

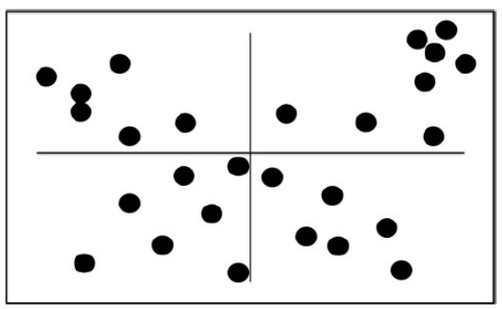
Ubicomp

1999-2007

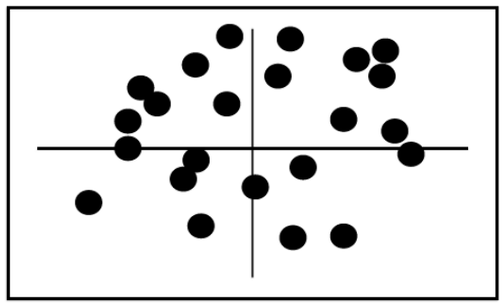


2008-2013





Psychology [21]



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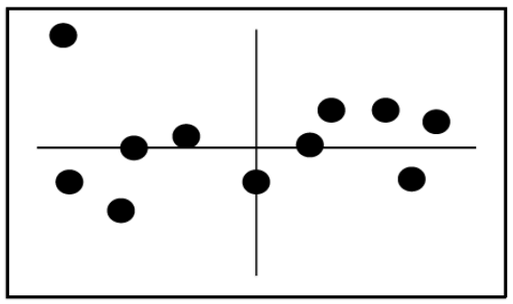
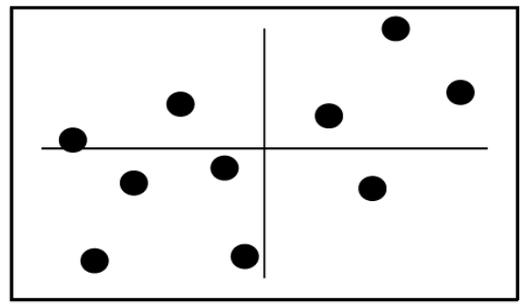


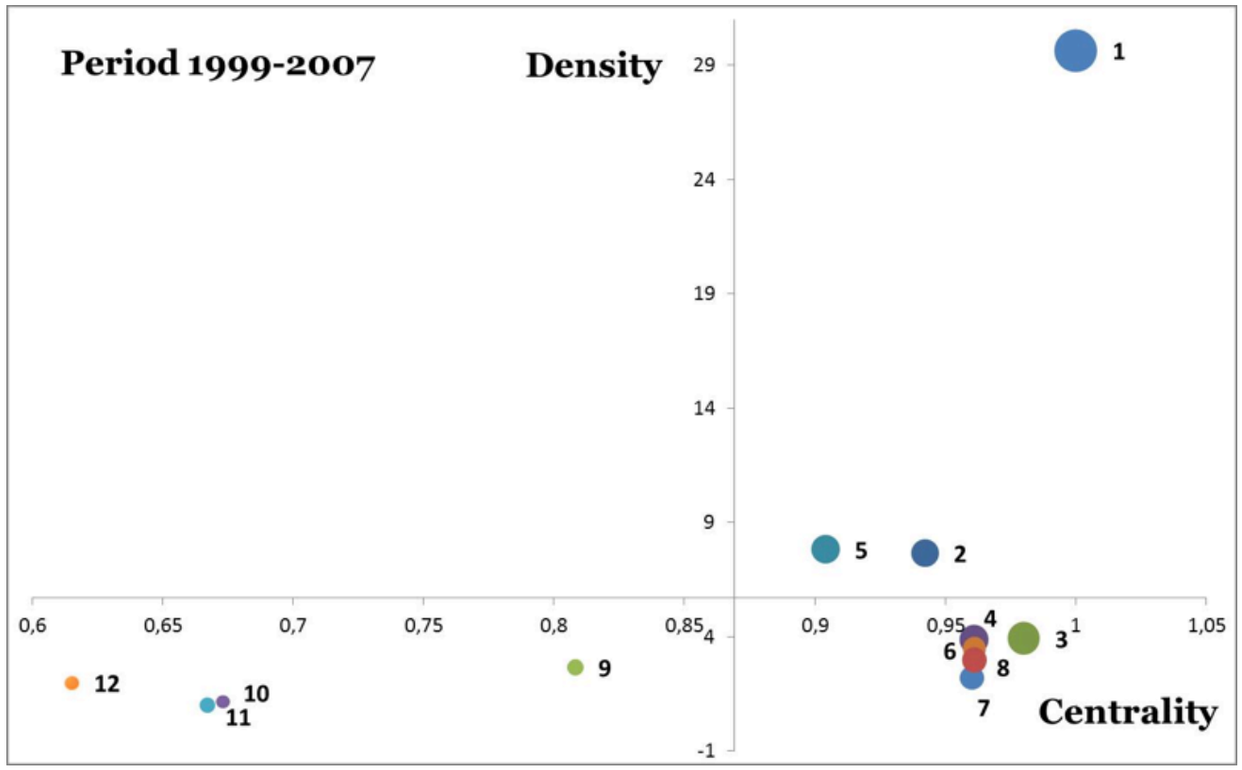
Software Engineering [11]



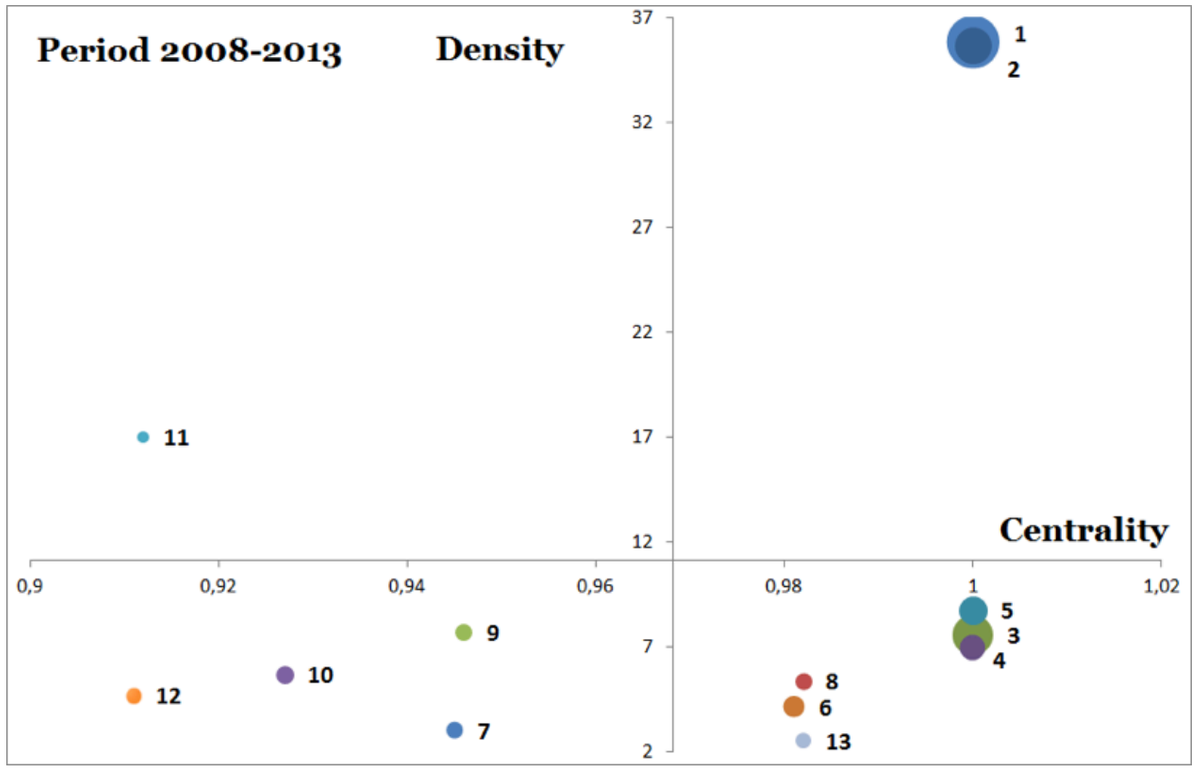
Stem Cell Research [1]

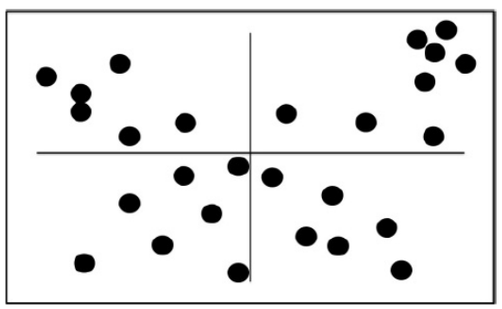
Ubicomp

1999-2007

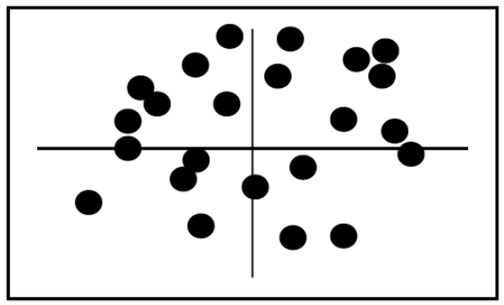


2008-2013





Psychology [21]



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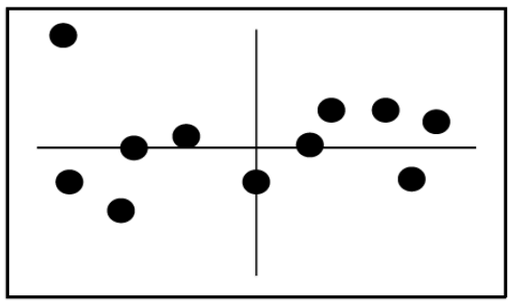

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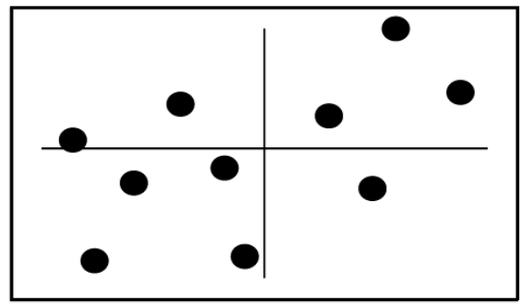
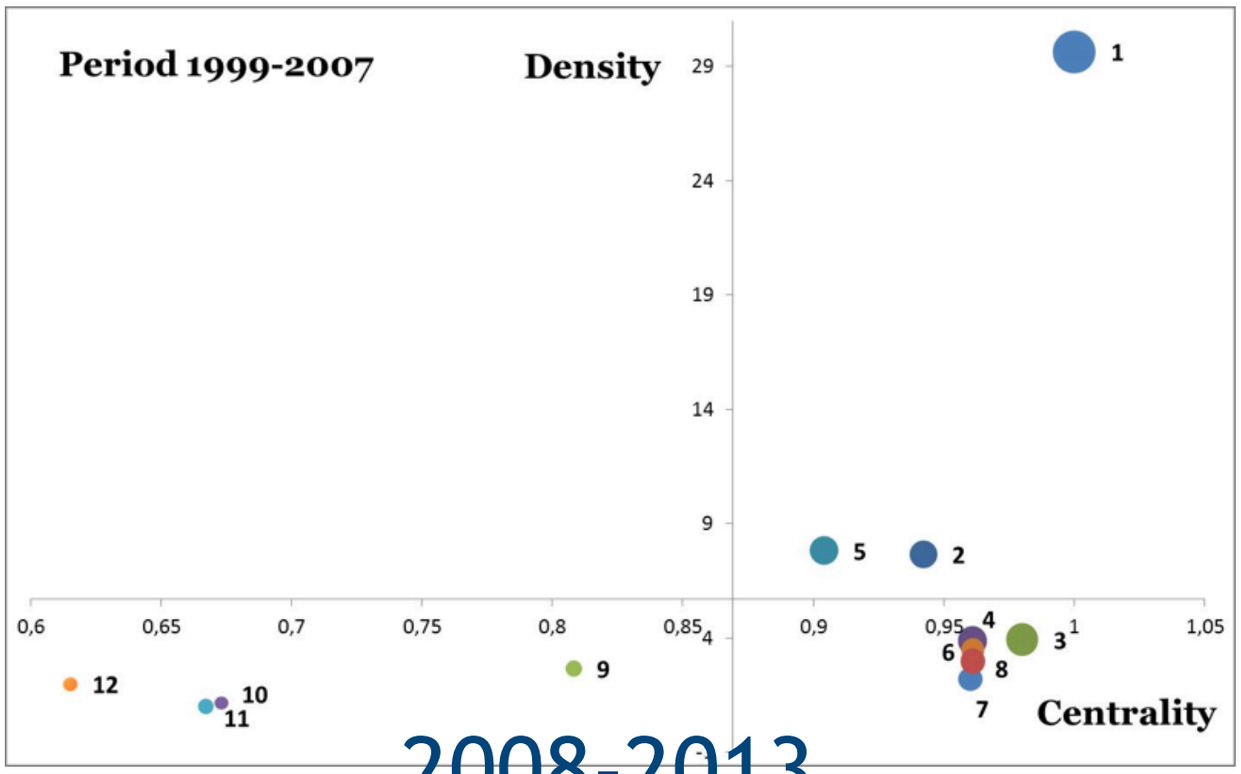
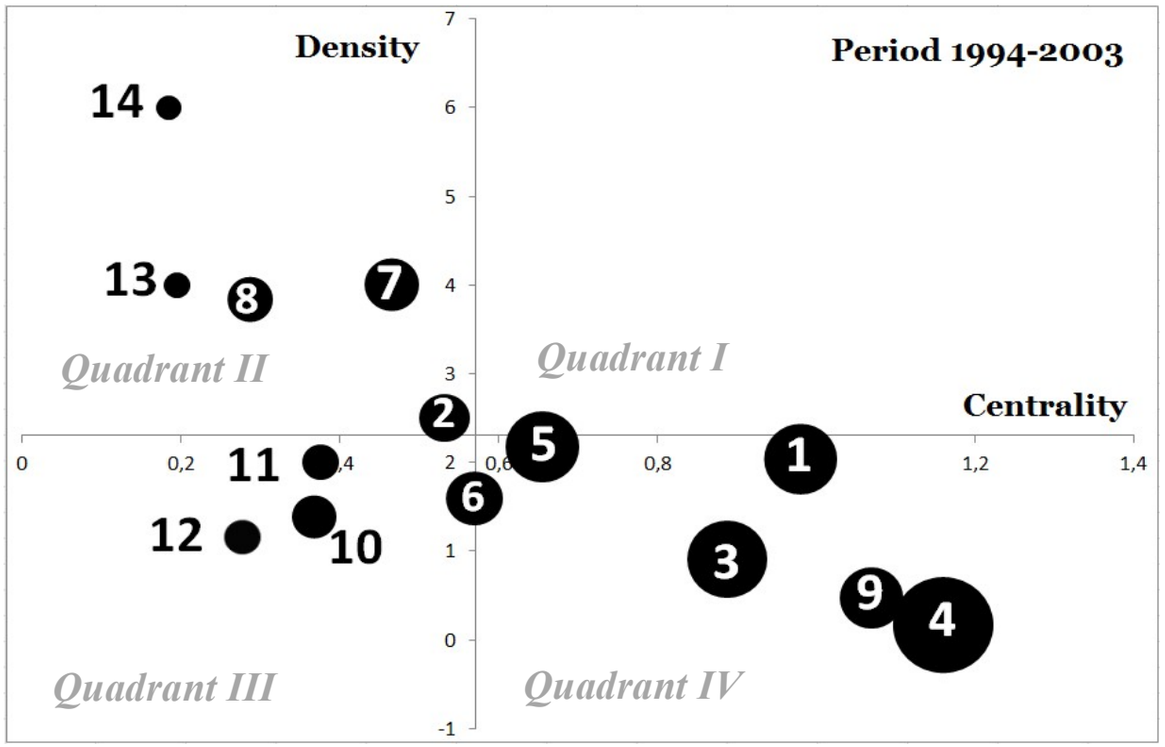


Stem Cell Research [1]

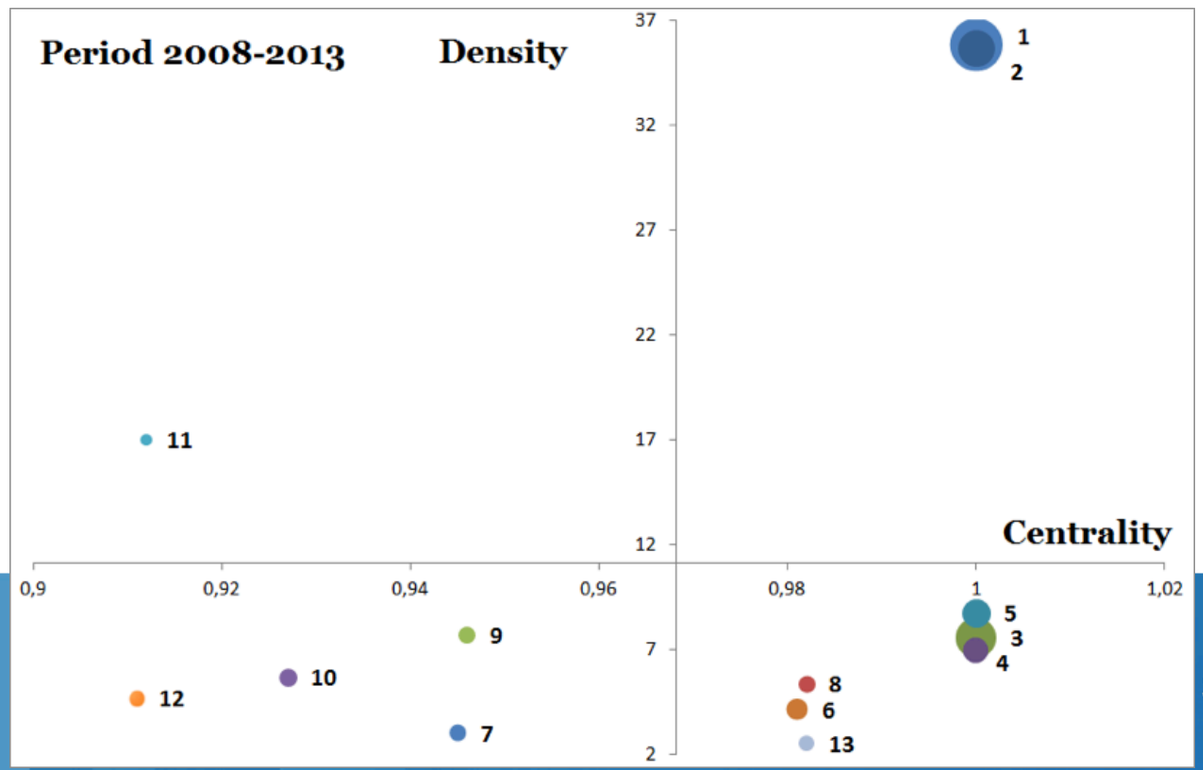
Ubicomp
1999-2007



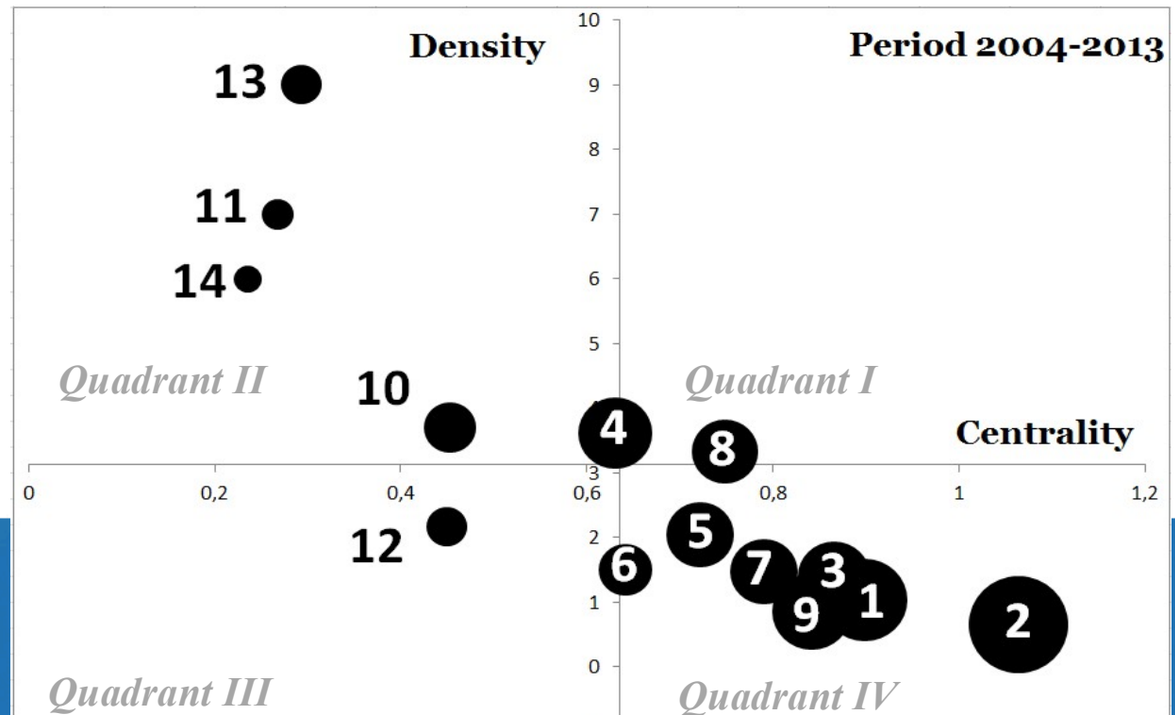
CHI
1994-2003



2008-2013



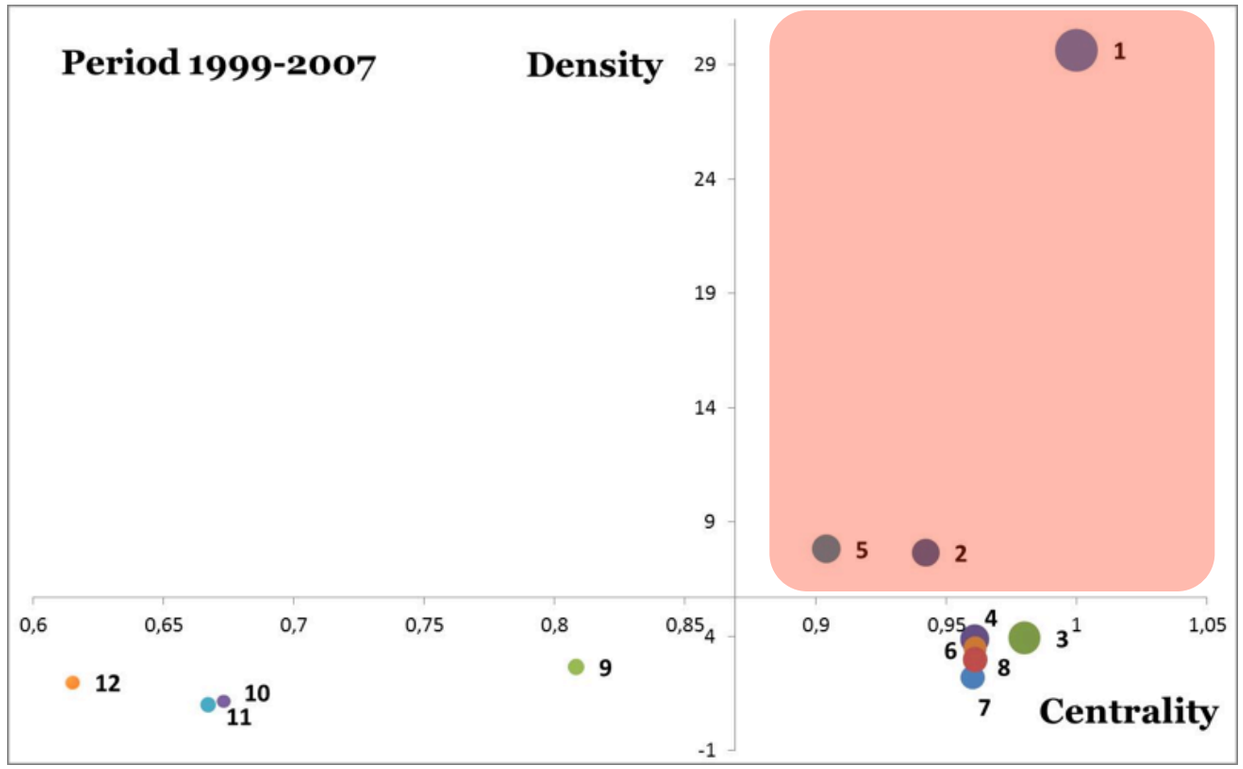
2004-2013



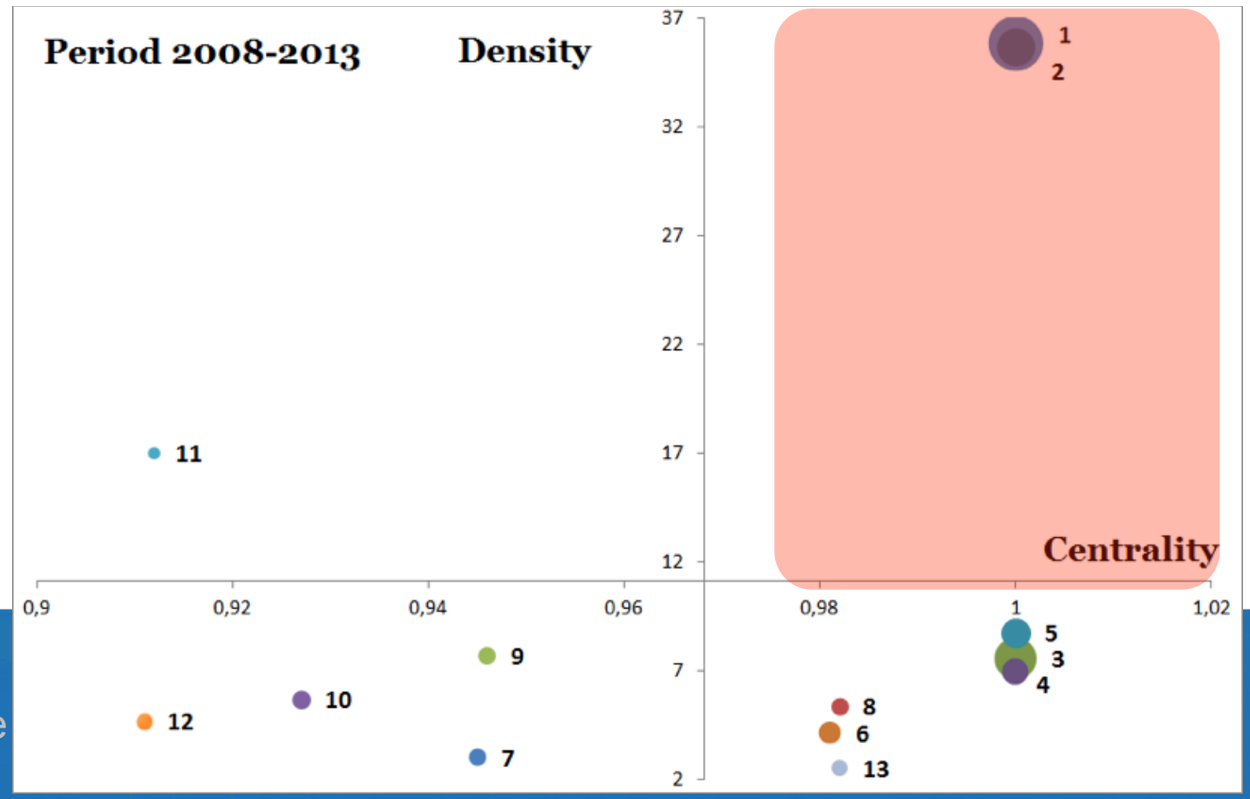
Findings

- The mainstream themes of Ubicomp have been:
  - 1st period:
    - Mobile devices (systems, networking)
    - smarthomes
    - location-based
  - 2nd period:
    - Mobile devices (applications, energy)
    - sensing (data analysis, activity recognition)

1999-2007



2008-2013



Discussion

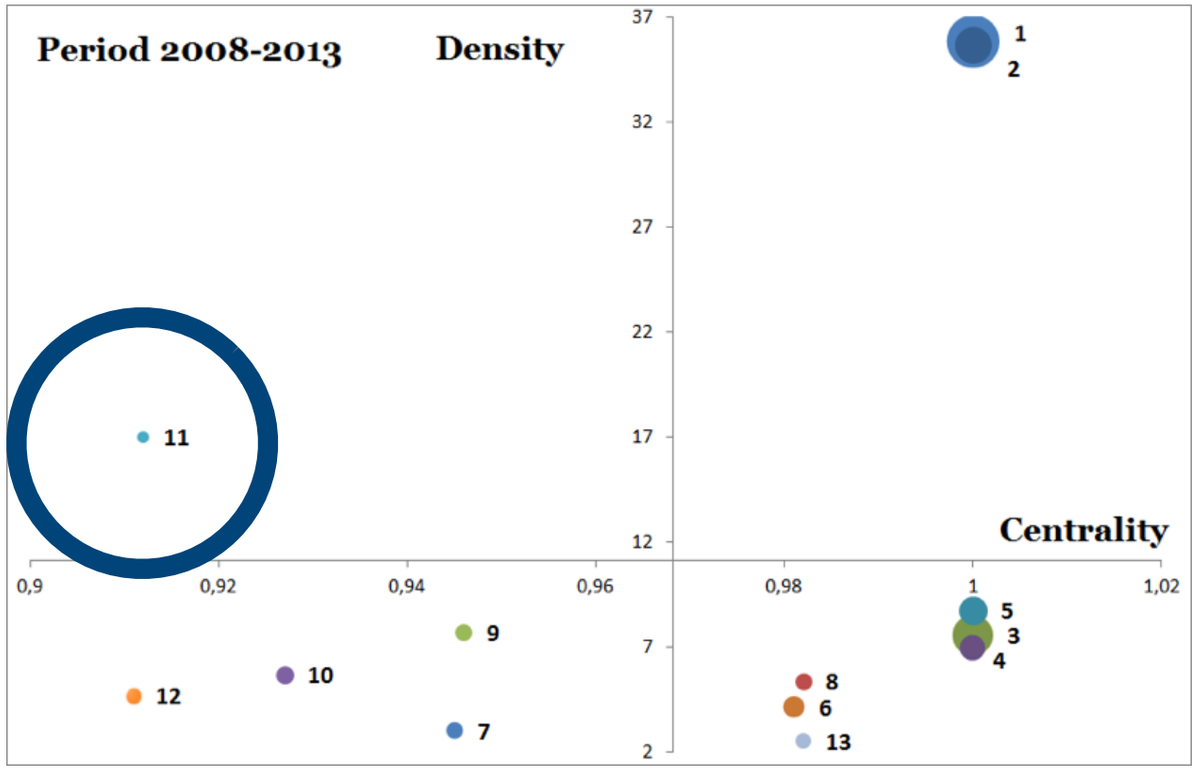
- The driving force of the field:
  - –Mobile devices

Discussion

- Fading away:

  –Software and hardware

2008-2013



Saturday, November 07, 2009

I give up on CHI/UIST

The CHI reviews just came out and I have to say I'm pretty unhappy... not with the **numbers** per se... (one paper I co-authored has a 4.5 average out of 5 and I'm sure I'll get a fair number of papers accepted), but instead with the attitude in the reviews. The reviewers simply do not value the difficulty of building real systems and how hard

About Me

James Landay

Follow

Professor of Computer Science at Stanford, specializing in human-computer interaction. I am also a Cornell

To answer the initial questions

- Does Ubicomp have any overarching theory?
  - –Not really, just overarching applications

- Does Ubicomp have any mainstream research methodology?
  - –Anything related to mobile devices

- Does Ubicomp have accumulated knowledge?
  - –Application driven

The big question

- Given the billions provided by the NSF and EU for Ubicomp research:

–How does previous research help ME, TODAY?

- We need to share!
  –tools
  –data

Community Imaging Group

Studying communities through their use of technology

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On this page we provide links to tools, software, and platforms that we have contributed to.

Social networks and graph theory

- Co-word analysis algorithms implemented in R. The bundle includes the source code, input data, and output figures/statistics. The analysis pipeline was initially designed in citation 1, and implemented for citation 2:
  - Liu, Y., Goncalves, J., Ferreira, D., Xiao, B., Hosio, S., & Kostakos, V. (2014). *CHI 1994-2013: Mapping two decades of intellectual progress through co-word analysis*. Proc. **CHI**, Toronto, Canada, 3553-3562. [Acceptance rate: 23%, SIGCHI Best of CHI Honorable Mention Award & Best Talk Award]
  - Liu, Y., Goncalves, J., Ferreira, D., Hosio, S., & Kostakos, V. (2014). *Identity Crisis of Ubicomp? Mapping 15 Years of the Field's Development and Paradigm Change*. Proc. **Ubicomp**. [Acceptance rate: 21%]

- Temporal graphs algorithms implementated in R. The bundle includes variants of the algorithms optimised for RAM, CPU, or hard disk space (depending on the size of the network you want to analyse). Citation:
  - Kostakos, V. (2009). *Temporal graphs*. **Physica A: Statistical Mechanics and its Applications**, 388(6), 1007-1023. [Impact factor: 1.676]

- A social network analysis primer. If you are interested to find out why social network analysis can be useful for HCI researchers, read:
  - Liu, Y., Venkatanathan, J., Goncalves, J., Karapanos, E., & Kostakos, V. (2014). *Modelling what friendship patterns on Facebook reveal about personality and social capital*. **ACM Transactions on Computer-Human Interaction**, 21(3), 17:1-17:20. [Impact factor: 1.179]

Platforms

- AWARE: a middleware for context aware computing on smartphones. Citations:
  - Ferreira, D., Ferreira, E., Goncalves, J., Kostakos, V., & Dey, A. K. (2013). *Revisiting Human-Battery Interaction with an Interactive Battery Interface*. Proc. **Ubicomp**, 563-572. [Acceptance rate: 23%]
  - Ferreira, D., Koehler, C., Karapanos, E., & Kostakos, V. (2013). *Ubiquitous mobile instrumentation*. Proc. **Ubicomp adj.**, New York, NY, USA, 1409-1412.
  - Ferreira, D., Goncalves, J., Kostakos, V., Barkhuus, L., & Dey, A. (2014). *Contextual Experience Sampling of Mobile Application Micro-Usage*. Proc. **MobileHCI**. [Acceptance rate: 21%]

- SAWA: a middleware for context aware computing on desktops. Citation:
  - Faria, S., & Kostakos, V. (2012). A scalable sensor middleware for social end-user programming. In Lovett, T., & O'Neill, E. (Eds.), *Mobile Context Awareness* (pp. 115-131). Springer.

- CrisisTracker: an online platform that tracks crises reports on Twitter in realtime [source]. Citation:

- We need to share!
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Markets. Proc. **AAAI Conference on Weblogs and Social Media**, Barcelona, Spain, 321-328. [Acceptance rate: 20%]

- Database of facial expression images. For this material email one of the co-authors. These images were used in citation:
  - Hosio, S., Goncalves, J., Lehdonvirta, V., Ferreira, D., & Kostakos, V. (2014). *Situated Crowdsourcing Using a Market Model*. Proc. **UIST**. [Acceptance rate: 22%]

Bluetooth scanning

- Do-it-yourself Bluetooth scanning and instructions.
- Bluestation: A distributed Bluetooth capture-dissemination infrastructure written in Perl for Unix-like systems. Citation:
  - Kostakos, V., Camacho, T., & Mantero, C. (2010). *Wireless detection of end-to-end passenger trips on public transport buses*. Proc. **IEEE Conference on Intelligent Transportation Systems**, 1795-1800.
  - Kostakos, V., Camacho, T., & Mantero, C. (2013). *Towards proximity-based passenger sensing on public transport buses*. **Personal and Ubiquitous Computing**, 17(8), 1807-1816. [Impact factor: 1.133]
- FastBlueScanner: A C Bluetooth scanner optimised for multi-dongle scanning and name-requesting. Citation:
  - Kostakos, V., O'Neill, E., Penn, A., Roussos, G., & Papadongonas, D. (2010). *Brief encounters: Sensing, modeling and visualizing urban mobility and copresence networks*. **ACM Transactions on Computer-Human Interaction**, 17(1), 2:1-2:38. [Impact factor: 1.179]
  - O'Neill, E., Kostakos, V., Kindberg, T., Schiek, A., Penn, A., Fraser, D., & Jones, T. (2006). *Instrumenting the city: Developing methods for observing and understanding the digital cityscape*. Proc. **Ubicomp**, 315-332. [Acceptance rate: 13%]
- CitywareScanner: A Java Bluetooth scanner for multi-platform support. Uses a single dongle, optimised for running on multiple platforms. Citation:
  - Kostakos, V., & Venkatanathan, J. (2010). *Making Friends in Life and Online: Equivalence, Micro-Correlation and Value in Spatial and Transpatial Social Networks*. Proc. **SocialCom**, Washington, DC, USA, 587-594. [Acceptance rate: 13%]
- ScanningDemo: A Java Bluetooth scanning demo with a realtime social network visualisation. Citation:
  - Kostakos, V., & O'Neill, E. (2008). *Urban encounters: the game of real life*. Proc. **CHI extended abstracts**, New York, NY, USA, 3555-3560.

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Thank you!

Identity Crisis of Ubicomp?
Mapping 15 Years of the Field's Development and Paradigm Change

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