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A COMPARISON AND VALIDATION OF 13 CONTEXT META-MODELS

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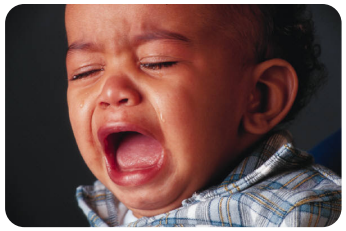
Significant element in pervasive computing is known as 'context'



Motivation

Context is multifarious and complex

- → there is a **need for systematization**!

Context meta-model is

- **generic** description of the context world on an **abstract level**
- not targeted towards a particular system or application

Various context meta-models exist and the community could not yet agree on a single one.

Context meta-models with high level of abstraction

example

Chen and Kotz (2000)

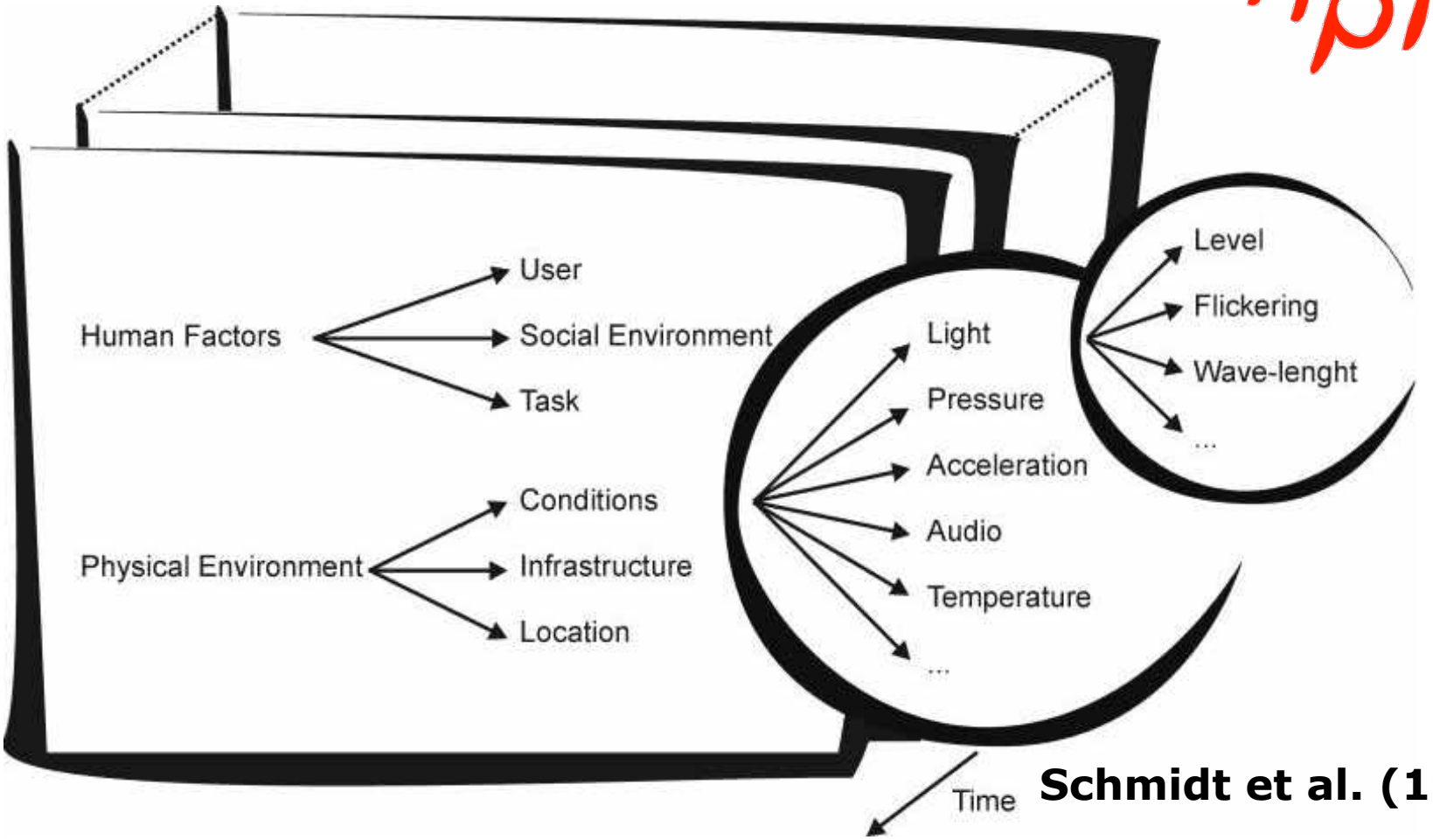
- physical environment
- user environment
- computing environment
- time

Black et al. (2009)

- task
- location
- objects
- contextual world

Context meta-models with low level of abstraction

example



Schmidt et al. (1999)

Comparison of 13 Context Meta-Models

authors	context dimensions					
	physical world	**individual**	**social groups**	**activity**	**technology**	**change over time**
Schilit et al. (1994)	physical environment	user environment			computing environment	
Schilit and Theimer (1994)	location, objects	identities of people				changes
Rodden et al. (1998)	location, physical				application, system, infrastructure	
Schmidt et al. (1999a)	environment	self		activity		
	physical	*physiological state, cognitive state*	*social*	*behaviour, task*	*device state*	
Schmidt et al. (1999b)	physical environment	human factors				change over time
Chen and Kotz (2000)	physical	user			computing	time
Tarasewich (2003)	environment	participants		activities		present, past, future
Bradley and Dunlop (2005)		user			application	
Sitou and Spanfelner (2007)	operational environment	participants, internal		activities		change over time
Han et al. (2008)	physical		social			past, present, future
Black et al. (2009)	location, objects			tasks		
Zainol and Nakata (2010)	extrinsic	intrinsic			interface	
Sigg et al. (2010)	location, environment	identity, constitution		activity		

Model comparison approach

inductive approach

grouping on top level of abstraction

- identical names
- review of other top level variables for semantic conformity
  → led to reduction of groups

second level of abstraction

- used to ensure semantic conformity

brainstorming and group discussions

- → refinement of grouping structure

final step

- names were given to resulting groupings → '**context dimensions**'

13 Context Meta-Models show similarities, but also point to distinct concepts

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Validation approach

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empirical approach

sample

- all full-length articles of the IEEE Pervasive Computing Magazine, from 2005 through to the articles available in June 2011
- 297 articles

coding

- (1) explicitly stated context variables
- (2) implicitly stated context variables

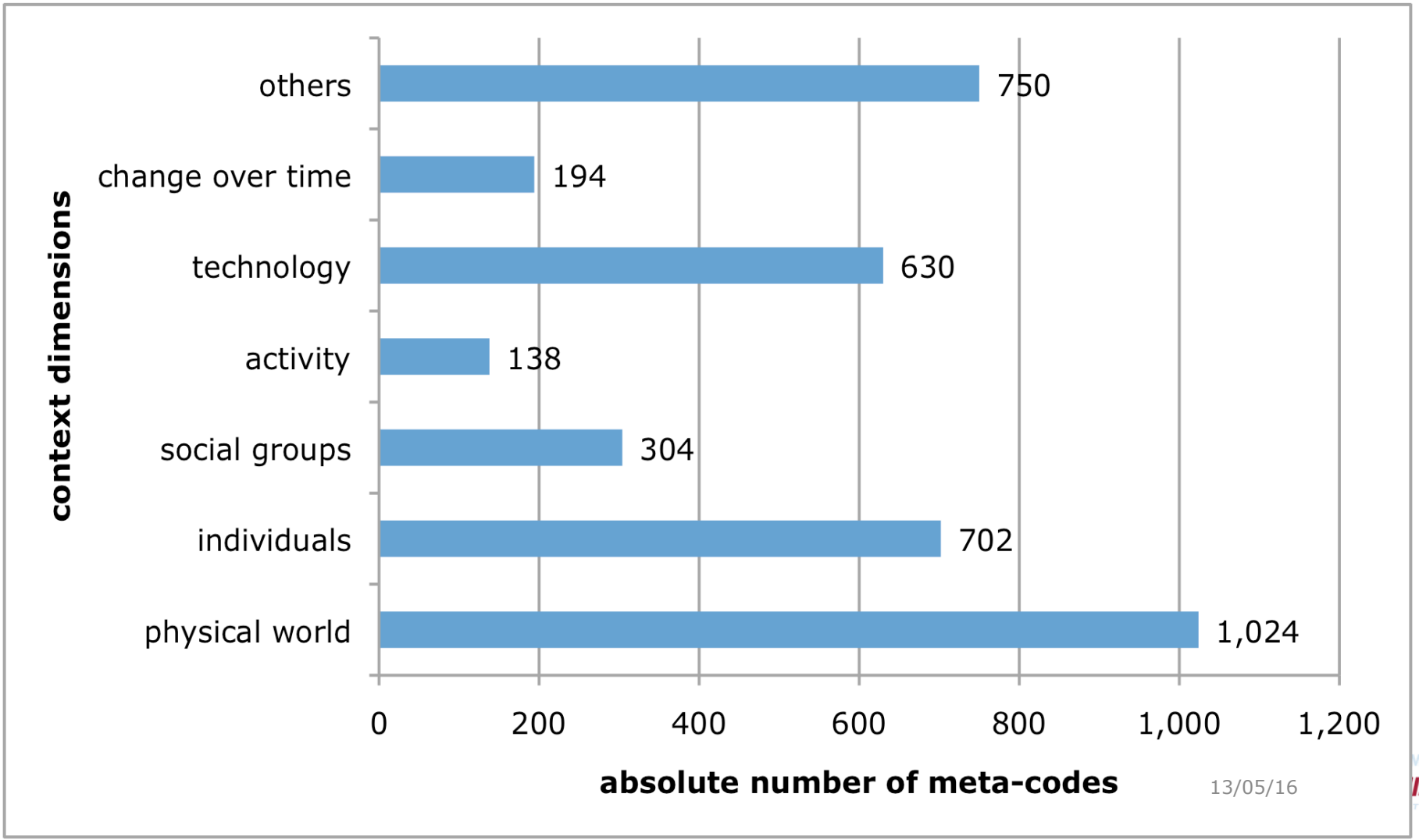
total of 10,498 variables (9,867 explicit, 631 implicit)

'word stemming' procedure

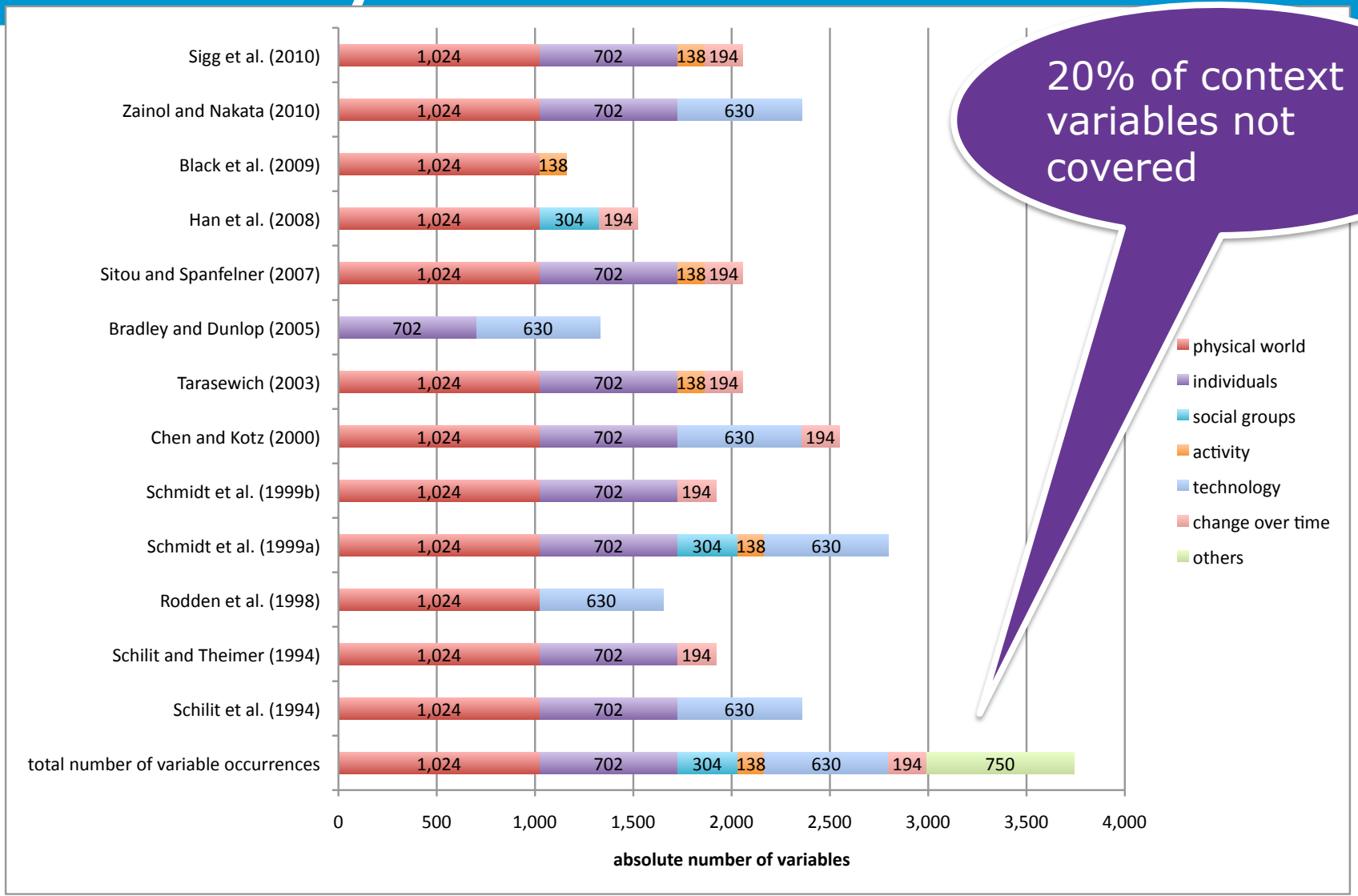
- in 3,742 distinct context variables (meta-codes)

allocation of each meta-codes to corresponding context dimension

Context dimension richness: Number of meta-codes describing the context dimensions



Number of variables per context dimension covered by context meta-models



Interesting items that are not covered by existing meta-models

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refer to abstract, non-tangible concepts such as:

- e.g., confidentiality, ownership, risk, threat, control, cost, easiness, simplicity, distraction, or usefulness

refer to characteristics and quality aspects such as:

- e.g., feasibility, plausibility, efficiency, accuracy, precision, obtrusiveness, correctness, or constrainedness

items related to information and content

- e.g., news, recommendations, content types

Take away message

20% of context variables could not be clearly attributed to any context meta-model.

- Current systematization of the complex concept of context not sufficient.

Research practice in pervasive computing is far ahead of research dedicated to model development.

Clear indicator that the research community does not 'stick' to existing context meta-models when elaborating their research.

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