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# Towards a Taxonomy for Ambient Assisted Living User Interaction

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*Thesis: Sensing in  
Mobile and Ubiquitous  
Information Systems*



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# Research Question and Method

## How can the design of user interaction in Ambient Assisted Living applications be classified?

### Motivation

- Extensive research in the domain of Ambient Assisted Living (AAL)
- Lack of more general classification of user interaction (UI) for this domain

### Approach

- Adopted a systematic taxonomy development method from Nickerson et al. (2012)
- Combined method following 'design as a search process' (Hevner et al., 2004):
  1. Empirical (inductive) analysis
  2. Pseudo-conceptual (deductive) analysis

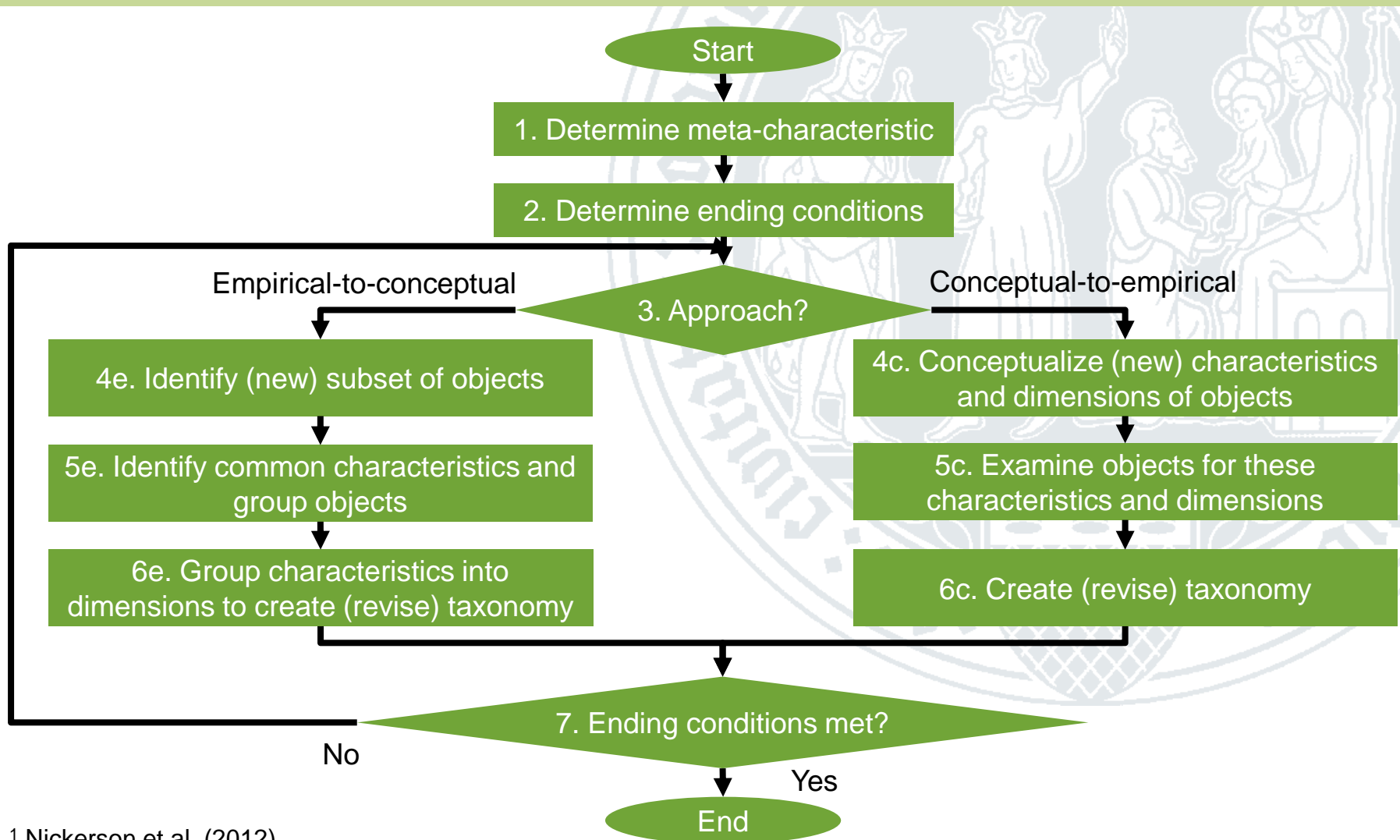


<sup>1</sup> User interaction (UI) covers all aspects of human-computer interaction and user interfaces

Hevner et al. (2004): Design Science in Information Systems Research. In: MIS Quarterly, Vol. 28 (No. 1)

Nickerson et al. (2012): A method for taxonomy development and its application in information systems. In: European Journal of Information Systems (19<sup>th</sup> of June 2012)

# Taxonomy Development Method<sup>1</sup>



<sup>1</sup> Nickerson et al. (2012)

# Taxonomy Development

- **Domain:** Ambient Assisted Living (AAL)
- **Meta-characteristic:** User Interaction in Ambient Assisted Living Applications
- **Objective ending conditions**
  1. Sufficient AAL applications examined ( $n \geq 15$ )
  2. All selected UI taxonomies analysed
  3. At least one reference application per characteristic
  4. Every dimension is unique and not repeated
  5. Each characteristic is unique
- **Subjective ending conditions (Nickerson et al., 2012)**
  1. Concise – a limited number of dimensions and characteristics
  2. Robust – enough dimensions and characteristics
  3. Comprehensive – should classify all known objects
  4. Extendible – allow addition of new dimensions/characteristics
  5. Explanatory – rather useful explanations than too much details

# Empirical: AAL Applications

- Select AAL applications from most appropriate journals and conferences
  1. Published in a peer-reviewed journal or conference proceedings
  2. Obviously empirical research
  3. An application (prototype) developed
  4. One or more users addressed

Preliminary only ten applications!

## Journals (total # of AAL papers<sup>1</sup>)

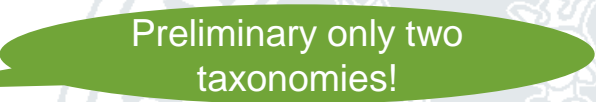
- Journal of Ambient Intelligence and Smart Environments (15)
- Personal and Ubiquitous Computing (14)
- Informatics for Health and Social Care (12)
- Expert Systems with Applications (9)
- Technology and Disability (7)
- Journal of Systems and Software (7)

## Conferences (total # of AAL papers<sup>1</sup>)

- ACM International Conference on Pervasive Technologies Related to Assistive Environments (25)
- IEEE International Conference on Pervasive Computing Technologies for Healthcare (16)
- International Joint Conference on Ambient Intelligence (15)
- International Conference on Universal Access in Human-Computer Interaction (10)
- International Conference on Computers Helping People with Special Needs (9)

<sup>1</sup> Indicating 'Ambient Assisted Living' in their metadata (title, keywords or abstract)

# Pseudo-Conceptual: UI Taxonomies

- Select UI taxonomies 
  1. Published in a peer-reviewed journal or conference proceedings
  2. Explicitly indicated as taxonomy
  3. Describes user interaction
  4. Contains distinct design dimensions and/or characteristics
- Kourouthanassis, Giaglis and Karaiskos (2010): *Delineating 'Pervasiveness' in Pervasive Information Systems: A Taxonomical Framework and Design Implications*. Journal of Information Technology, Vol. 25 (No. 3)
- Tomitsch et al. (2007): *Towards a Taxonomy for Ambient Information Systems*. In: Proceedings of the 1<sup>st</sup> International Workshop on Ambient Information Systems



# Taxonomy for AAL User Interaction

**Preliminary!**  
(only four test iterations)

Dimension	Characteristic	Reference (Application)
Consciousness	Implicit	Braun and Hamisu (2009)
	Explicit	Iglesias et al. (2009)
	Both	Wan et al. (2011)
Modality	Unimodal	Anastasiou (2011)
	Multimodal	Jian et al. (2011)
Participants	Single User	Iglesias et al. (2009)
	Multi-User	TBD
Operation Mode	Directed	Braun and Hamisu (2009)
	Alternating	Abascal et al. (2009)
	Free	Carswell et al. (2011)
Proximity	Tangible	Carswell et al. (2011)
	Immediate	Braun and Hamisu (2009)
	Distant	MacWilliams et al. (2012)
	Mixed	Navarro and Favela (2011)
Visibility	Visible	Koutouthanassis et al. (2010)
	Physical Invisible	
	Cognitive Invisible	
Temporal Extent	Infinite	Tomitsch et al. (2007)
	Finite	
Location	Private	Tomitsch et al. (2007)
	Semi-Public	
	Public	

# Conclusions and Future Work

## Conclusions

- Determined the taxonomy development approach
- Constructed a preliminary taxonomy
  - 4 iterations (2 empirical, 2 pseudo-conceptual)
  - 8 dimensions
  - 22 characteristics
- Should be usable/used for the...
  - analysis of existing research in this field
  - design of user interaction in AAL applications

Final taxonomy to be published in 2013!

## Discussion

- Users point of view vs. application/system (developers) “point of view”
- Cover sub-domains (e.g. telecare) or be more general (e.g. Ambient Intelligence)

## Ongoing/Future Work

- Adjust research method?
- Utilize Delphi method with co-researchers
- Apply taxonomy to AAL applications / evaluate AAL applications
- Map interaction types to devices/sensors



# Thanks for your attention!

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