Towards a **General User Model Ontology** (GUMO)

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PhD Research: Ubiquitous User Modeling

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**Overview**

- **Main Research Hypothesis**  
  - permanent evaluation of user behavior with a variety of systems will improve user models and lead to attractive new services

- **Main Task**  
  - information-exchange and knowledge-sharing between user-adaptive systems on the web and in instrumented environments

- **Presented Methods**  
  - RDF-based exchange language: UserML  
  - OWL-based ontology: GUMO
Outlook of the Talk

1. Applications: motivation for ubiquitous user modeling
   → airport scenario
2. Statements: model of SituationalStatements (UserML)
   → influences the design of the ontology
3. Ontologies: main concepts and classes in GUMO
   → describe vocabulary & OWL representation
4. AdminTools: OntologyBrowser, UserModelEditor
   → short demo
5. Services: situation retrieval, conflict resolution
   → appendix

Motivating Idea in the Airport Scenario:
Exchange of Situational Information

- Variety of Applications
  - Pedestrian Navigation
  - Shopping Guide
  - Restaurant Guide
  - Adaptive Hypertext
- Variety of Environments
  - Office
  - Airport
  - Hotel
- Variety of Locations
  - WWW
  - Info Kiosk
  - Hall
  - Gate
- Variety of Adaptation Functionality
  - Adaptive Web-Sites
  - Adaptive Speech Interaction
  - Product Recommendation
  - Airport Navigation
  - Location-based Information Presentation
What will be exchanged?
Mainpart + Meta Data = Situational Statement

"Peter ist under high time pressure"

Which meta data is interesting for distributed and ubiquitous user modeling?

When and how long is the statement valid?
Where is Peter under time pressure?

Who claims this and which explanation is given?
What is the evidence and the confidence?

Who is the owner of this information?
What are the privacy settings?

How can the statement be uniquely identified?
Can the statement be grouped with others?
From Situational Statements to GUMO

- default expiry of information into the ontology?
  - physiologicalState.heartbeat: can change within seconds
  - mentalState.timePressure: can change within minutes
  - emotionalState.happiness: can change within minutes
  - characteristics.inventive: can change within months
  - personality.introvert: can change within years
  - demographics.birthplace: can't normally change at all

- default privacy settings into the ontology?
  - disabilities.colorblindness: should be accessible for presentation systems
  - disabilities.wheelchair: interesting for pedestrian navigation systems
  - demographics.birthplace: accessible or hidden?
  - emotionalState.happiness: accessible or hidden?
From RDF Triples to Five-tuples

- argument 1: different auxiliaries for each user model dimension
  - Peter is currently teaching
  - Peter likes teaching very much
  - Peter knows a lot about teaching

- argument 2: different ranges for each user model dimension
  - Peter’s time pressure is low (within a scale of low-medium-high)
  - Peter’s time pressure is 0.6 (within a numeric scale between 0 and 2)
  - Peter’s time pressure is 30% (within 0% - 100%)

From RDF triples to five-tuples:

```
<table>
<thead>
<tr>
<th>subject</th>
<th>user model dimension</th>
<th>object</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>auxiliary</td>
<td>range</td>
</tr>
</tbody>
</table>
```

User Model Auxiliaries &
Basic User Dimensions

- User Model Auxiliary
- Basic User Dimensions
- Emotional State

literature study, Prof. Jameson’s tutorial, introspection
Predicate = rdf:Description

```xml
<rdf:Description rdf:ID="Happiness.800616">
  <rdfs:label> Happiness </rdfs:label>
  <u2m:identifier> 800616 </u2m:identifier>
  <u2m:expiry> minutes.520050 </u2m:expiry>
  <u2m:privacy> medium.640032 </u2m:privacy>
  <u2m:image rdf:resource="http://u2m.org/UbisWorld/img/happiness.gif"/>
  <u2m:website rdf:resource="&UserOL;concept=800616"/>
  <rdf:type rdf:resource="#EmotionalState.700014"/>
  <rdf:type rdf:resource="#FiveBasicEmotions.700015"/>
</rdf:Description>
```

Gumo is part of UbisWorld
BUT: Gumo will become part of SUMO

UbisWorld Concept (Ontology + Instances + Relations)

- Physical Ontology
- Spatial Ontology
- Temporal Ontology
- Activity Ontology
- Situation Ontology
- Inference Ontology

Classes & Predicates:
- OWL
- Daml
- OIL
- RDF
- SQL
- XML

Individuals (id, label, category, parents, …)
- User/Group
- Device/Object
- Location
- Time
- Event
- Situation
- Inference

Relations & Statements (binary or n-ary):
- [Diagram of relations and statements]
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Ontology Editor for UbisOntology

User Model Inspection

1. User Model Inspection
2. User Interface: Personalization
3. User Interface: Preferences
4. User Interface: Demographics
5. User Interface: Personality
6. User Interface: Annotative Elements
7. Annotative Elements
8. User Interface: Accessibility
User Model Editor

Demo: Ontology Tools

- OntologyBrowser
- UserModelEditor
- WebVisualization
- ...
Information flow with UserML & UserQL (Add, Query, Report)

1. Add by UserML
2. RDF
3. XML
4. Add by UserQL
5. User/system-adapted UserML Report

Summary: Overall Architecture
Conclusion & Future Work

• Contributions
  – Situational Statements (UserML)
    (introduces n-ary relations into Semantic Web Languages)
  – GUMO = mid-level ontology for user model dimensions
  – WebService approach for distributed user-adaptive applications
  – Overall Architecture for ubiquitous user modeling

• Further Work
  – Integrate GUMO into SUMO/MILO