Ontology Building for Cognitive Task Analysis of Disaster Nursing

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Introduction

- Niigata Pref. Chuuetsu Earthquake
  - 23.10.2004
  - M.6.8, shallow hypocenter, active falut
  - 68 victims, 100,000 evacuees

- Ojiya General Hospital
  - Staff (460 inc. 240 nurses)
  - 287 beds, 766 patients /day
  - 0 Victims
  - Evacuation (223 patients)
  - water leakage , wall and ceiling collapse, ...

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Motivation

- Elicit competency of those nurses who exhibited high performance
  - It is unclear what kind of knowledge and skills separate good and bad responses in disaster situations.
  - There is a strong need for theory and foundation for designing good education and training.
- Accumulate knowledge and lessens learned from actual disasters
  - We don’t have much experience of big disasters.
  - Each disaster situation is very unique, thus it is difficult to generalize the lessens learned form a single experience.

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Cognitive Task Analysis (CTA)

- To understand how cognition make it possible for human to get work done
  - cognitive aspects behind the performance of tasks
  - cognitive skills, knowledge, and attitude needed to respond adeptly to complex situations
  - ACTA(Militello & Hutton, 2000), CDM (Klein & Armstrong, 2004)
- Series of structured- or semi-structured interviews with experts
  - Task analysis, Probe questions, Simulation interviews, etc.
  - But, domain and context dependent

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Objectives

- Propose Ontology based CTA framework for Disaster Nursing:
  1. Interviews
  2. Analysis
  3. Develop Ontology
  4. Redesign interviews

- Develop an ontology of Disaster Nursing
  - to describe contexts for summarizing interview data
  - capturing all the aspects of disaster nursing
  - to design interview questions for Cognitive Task Analysis

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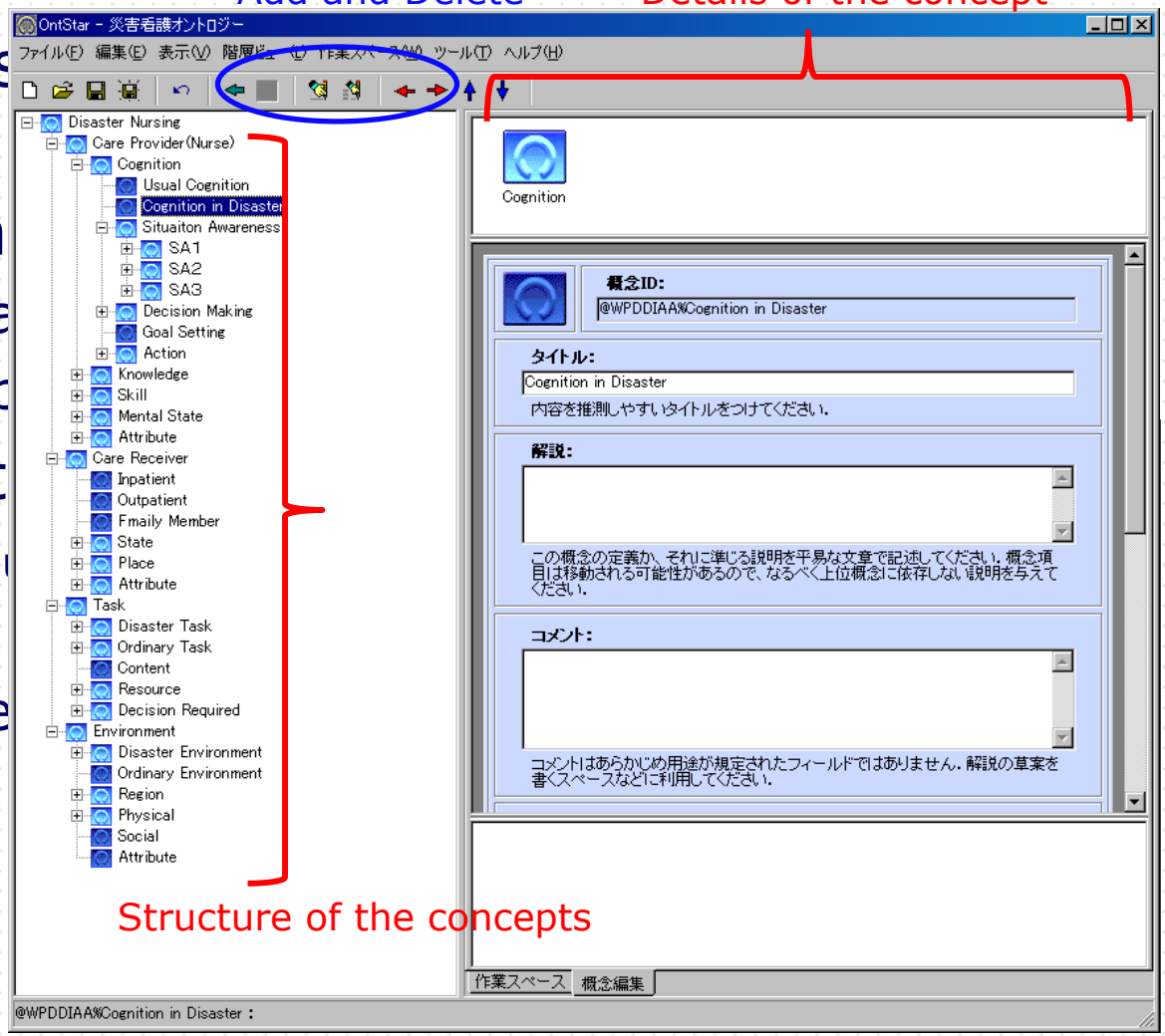
Ontology Building

- Ontology :bas
  some task do
- Structure con
  - extract doma
  - relate concep
- Ontology Edit
  - OntoStar (Ogu
  - GUI based
  - Simple and e



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Bidirectional Approach

- Bottom up
  - Interviews
  - Records of Response Activity
  - ⇨ to develop detailed categories and concepts by Content Analysis and compensate the top down approach
- Top down
  - Service model
  - Existing theories and models(SA Model etc.)
  - ⇨ to provide top level categories (concepts) and a frame to develop further items and concepts

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Interviews

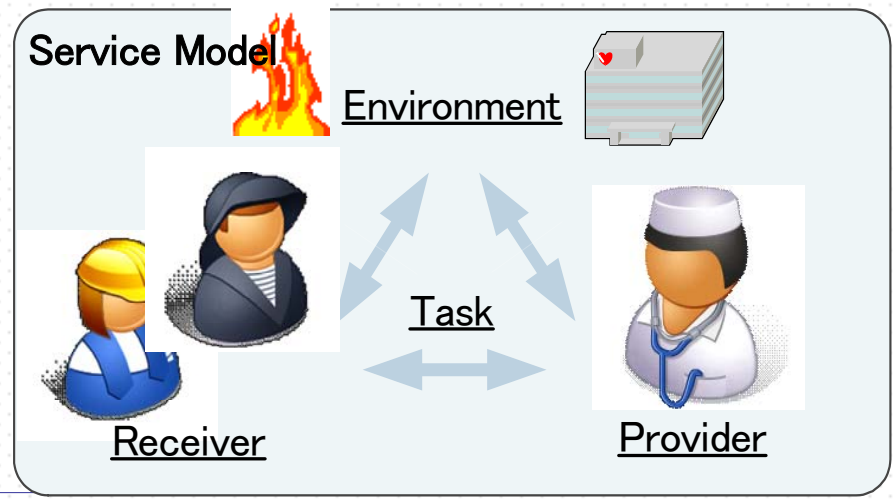
- Interviewee: 5 nurses
- Semi-Structured Interview
  - May-June, 2007
  - Ojiya General Hospital
  - First 24 hours after earthquake (Chuuetsu Earthquake)
- Content Analysis
  1. Transcribe the data
  2. Segmentation and Coding
  3. Categorization and abstraction (11 keywords)
  4. Three Paradigms with hierarchical categories: Information, Decision, and Action
  5. But does not provide well-structured concepts for CTA

Result of the Content Analysis

Category	Subcategory	Code
Degree	Emergency situation	Abnormal change, earthquake, abnormal frequency
	Damage	Damage of patients, damage of nurses, damage of buildings
	Patients' Needs	Physiological needs, refuse evacuation
	Gap from predictions	Delay from predictions, too many visitors
Priority	Triage	Triage in trauma center
	Order for evacuation	Order for evacuation
	Patient first	Patient first
	Priority in cares	Consideration for the need to eliminate, Importance of cares,
Lack	Lack of manpower Lack of resources Inadequate manuals	Lack of manpower
		Lack of resources
		Inadequate manuals
Limitation	Limitation of action Limitation of facilities and apparatuses	Physical limits, restrictions caused by quakes
		Capacity, restrictions caused by the configuration of building
Necessity	·····	·····
Prediction	·····	·····
Progress	·····	·····
Efficiency	·····	·····
propriety	·····	·····

Service Model

- Comprehend all the aspects of disaster nursing activities:
  - Provider (Nurse), Receiver (Victim), Interaction (Task), and Environment
- The starting point to build an ontology
  - Provide top level categories (concepts) and a frame to develop further items and concepts
  - Relate and structure the concepts



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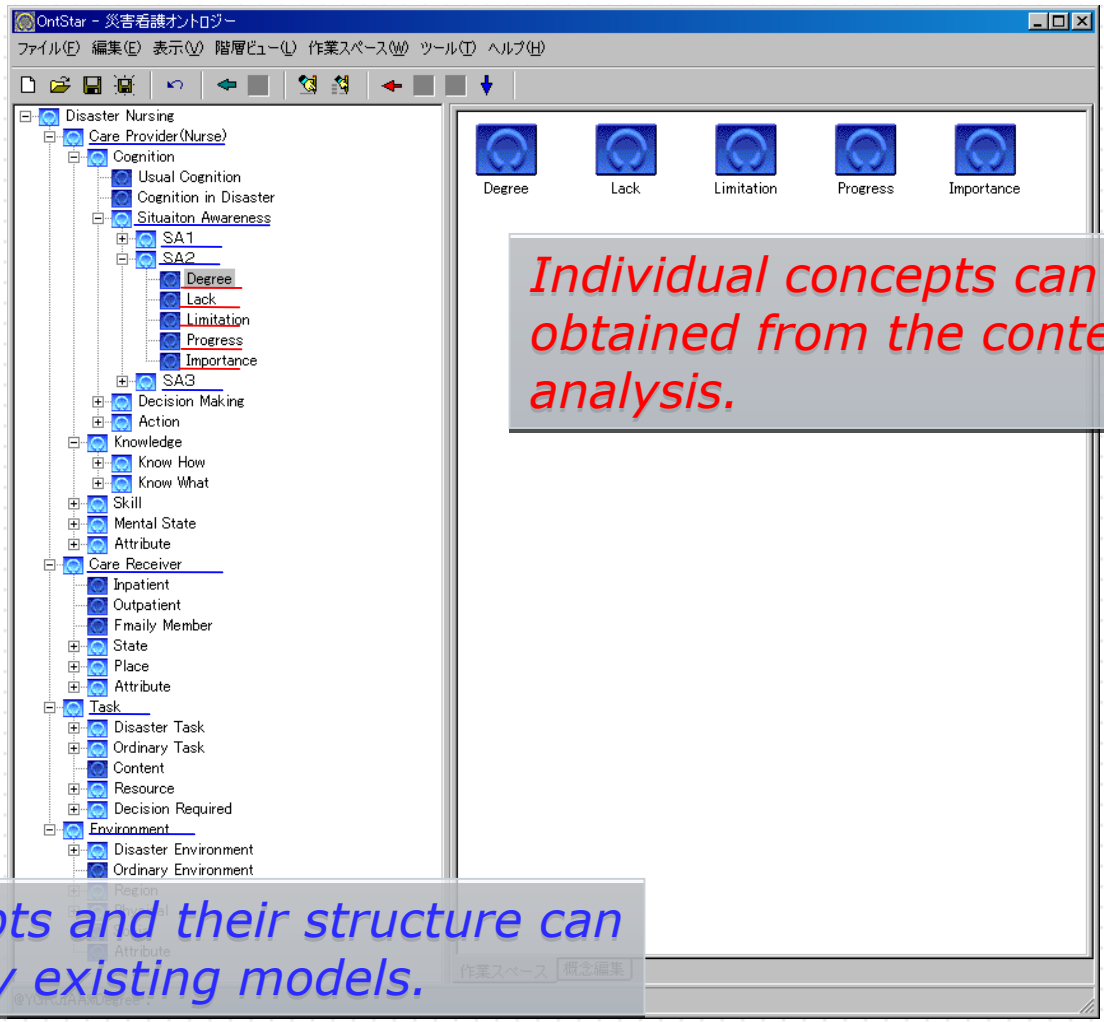
Ontology



Individual concepts can be obtained from the content analysis.

Top concepts and their structure can be given by existing models.

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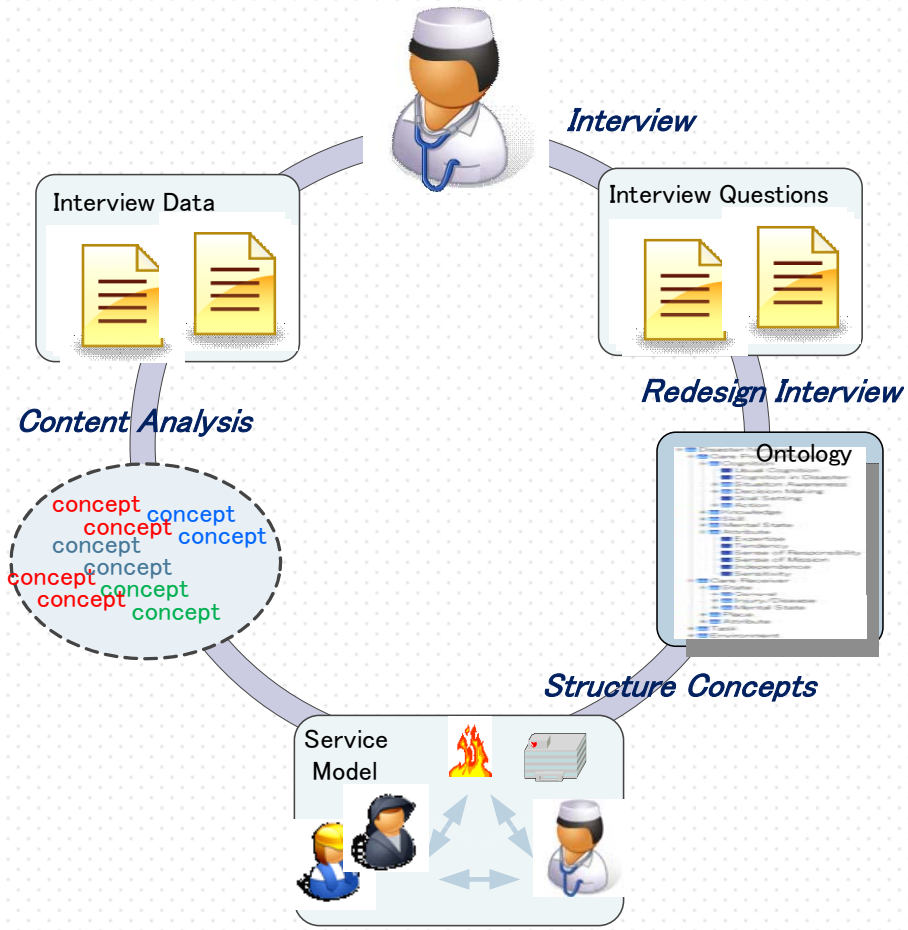
Cycle of CTA (Knowledge Accumulation)

1. Interviews
2. Analysis
3. Develop Ontology
4. Redesign interviews
   - help determine next focus points
   - avoid redundant questions
   - easy-to-follow interview guide



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Next Interview Items

- What were you doing, when, where, under what circumstances, and for what?

Categories of the ontology

		Nurse	Receiver	Task		Environment	
		Myself Other Staffs	Patient Family	Resources Manpower	Hospital function Nursing function	Life Line Apparatus	Information
Cognition	**Factors**						Focus Points
SA1	Symptom Availability Timing						
SA2 SA3	Importance Necessity Focus Degree Similarity						
Decision Making	Goal Planning Action Option Priority Difficulty						
Action							

- What did you notice?
- When did you notice it?
- What kind of information is available?

About yourself
About other staffs
About information from other staffs

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Conclusion

- Proposed CTA framework based on ontology
  - Interview, analysis, ontology, and redesign interview
  - Bidirectional Approach: top down (model based) and bottom up (content analysis) analysis
  - Easy to follow and design CTA
- Conducted the 1st cycle of the proposed framework
  - The service model provided a good viewpoint to comprehend disaster nursing: Provider, Receiver, Task , and Environment
  - 83 concepts in total
  - Easily designed the next interview items = (Cognition)*(Focused Ontology Categories)

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Next Step

- Next interview
  - 36 nurses (12 hospitals) in 2-3 phases
  - with those nurses who experienced Chuetsu Earthquake
  - with those who do not have experiences of actual disasters but of intensive exercises
  - We will evaluate its efficiency and effectiveness of the developed interview questions. (Validity of the proposed cycle)

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Questions and Comments

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SA1

- What did you notice? (symptom)
- What information was available? (Availability)
- When did you notice it? (Timing)

SA2, SA3

- What was most important information for decision making? (importance)
- What information triggered your decision?
- What was the missing information ? (necessity)
- What kind of information did you need and looked for?
- What did you think you should do first?
- What was your predication about the future situations? (prediction)
- How did you assess the situation? (degree)
- Did you have similar experiences like this? (similarity)

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Decision Making and Actions

- What was your decision? (decision)
- What was your objective? (goal)
- Did you have any options and what was that? (planning, option)
- Why did you choose the option? (priority)
- Did you have enough information for making decision? (uncertainty)
- What did you do and why? (action)
- What made your decision making difficult? (difficulty)
- What did you improvise ?(improvisation)
- What knowledge is necessary for your decision (knowledge)
- What kind of experience was useful? (experience)

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