

707.009
Foundations of Knowledge Management
„Knowledge-based Analysis“

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Overview

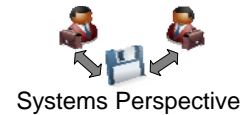
Agenda

- An Agent-Oriented Modeling Method to Analyze Knowledge Transfer Effectiveness
- Next week's: Final Exam
 - Register via TUGonline!
 - „Einsichtnahme“: 29. Feb. 10:00-11:00

Overview

Previous Lectures:

- Knowledge Organization
- Broad Knowledge Bases
- Knowledge Acquisition



- Knowledge Transfer
- Org. Knowledge Repositories
- ...
- **Today:** Knowledge based Analysis



The „Knowledge Aspect“

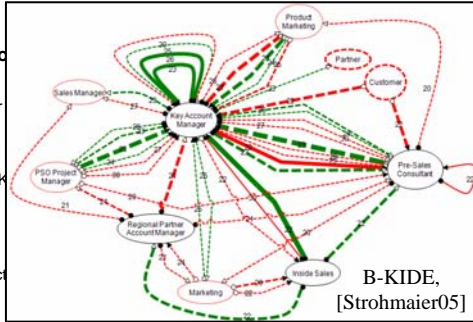
- **Knowledge** refers to
 - *Skills, heuristics and experiences* of actors
- Distinctions
 - Implicit vs. explicit
 - Pragmatic vs. scientific
 - Inter-subjective vs. objective
- **Knowledge Management** is concerned with the development of [*organizational|technological|cognitive|...*] tools for
 - the *identification, acquisition, generation, **transfer**, application and storage* of knowledge

Knowledge Transfer: Effective sharing of ideas, knowledge, or experience between units of a company or from a company to its customers. The knowledge can be either tangible or intangible. (MIT, Definitions for Inventing the Organization)

Knowledge Transfer Background and State of the Art

Research on Knowledge Transfer focuses on

- **Theories** [14, 21]
 - Focus on the Nature of Knowledge Transfer
 - Example: Knowledge Flow Theory
- **Modeling Languages** [10,11]
 - Identification, Visualization and Analysis of Knowledge
 - Examples: B-KIDE, KODA, KMDL
- **Instruments** [3,6,17]
 - Improve and Facilitate Knowledge Transfer
 - Examples: Wikis, mentoring, experience factors



The Problem

Why is Knowledge Transfer Effectiveness difficult to assess?

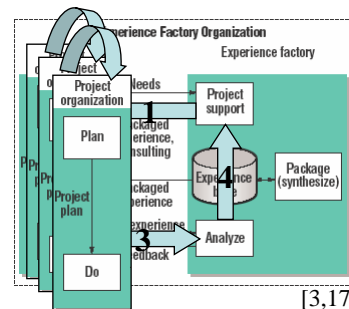
Questions Related to Knowledge Transfer Effectiveness



- Who depends on knowledge of others?
- How is knowledge transfer executed and facilitated?
- What is the purpose and structure of knowledge transfer instruments?
- Under which conditions can a knowledge transfer instrument fail?
- What are the effects of knowledge transfer failure?

Example: A Knowledge Transfer Instrument

- **Experience Factories (EF)** focus on the facilitation of Knowledge Transfer between Software Developers
- Experience Base
 - "Packages Experiences"
- Goals
 - Knowledge Transfer
 - Knowledge Reuse



Knowledge Flow Theory [Nissen 2004]

Classification of different types of knowledge flows along 3 dimensions

- Explicitness
 - Tacit / Explicit
- Reach
 - Individual, Group, Organization, Interorganization
- Life Cycle
 - Evolve, Apply, Distribute, Formalize, Organize, Create, ...

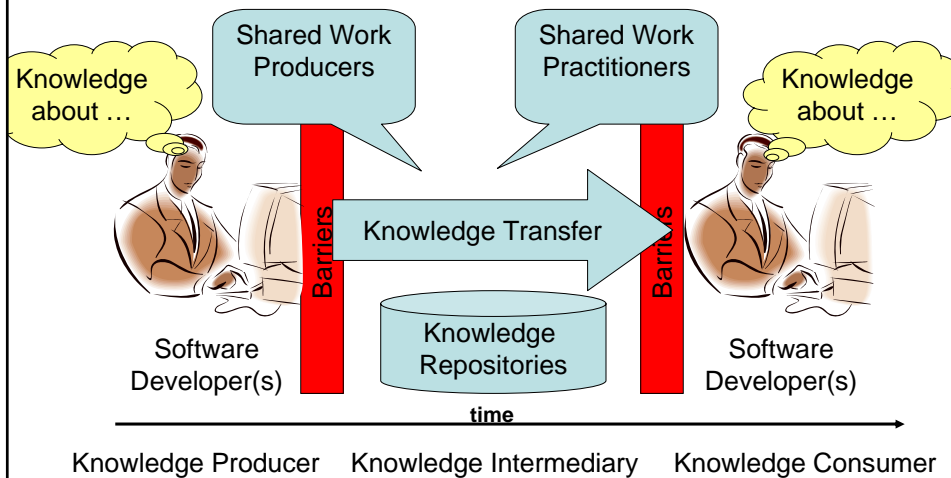
Formalization:

Let $a = [a_1e + a_2r + a_3l]$

within the coordinate system e = explicitness, r = reach and l = lifecycle

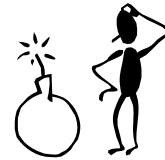
then the goal of e.g. an experience factory can be expressed as the vector AB with $A = (implicit, group, share)$ and $B = (explicit, group, share)$.

Knowledge Transfer in Software Engineering



Barriers to Knowledge Transfer

- **Issues with the Experience Factory [7]:**
 - Lack of awareness, low information quality, low usage, expensive maintenance, context dependent
- **Issues with Knowledge Management in general [8]:**
 - Failure to align KM to org. goals, failure to connect KM to individuals, creation of repositories without defining the goals behind them, etc



Observations

- Knowledge transfer effectiveness is related to the **participants** of knowledge transfer, and their **goals**
- **Knowledge transfer instruments** themselves *serve a purpose*, and thereby pursue goals as well
- Therefore analyzing the goals of knowledge transfer participants is **critical to KM**, but difficult [9]
- However, goal-modeling and analysis has received little attention so far in this context

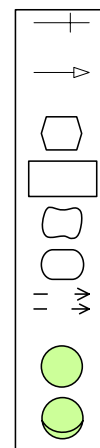


The Knowledge Transfer Agent Method

- Proposes a three tiered approach to modeling Knowledge Transfer (KT) Participants and Instruments as **Agents**
- Based on the **intentional modeling framework i*** [13]
- Which enables
 - **Reasoning and arguing** about KT participants' goals
 - **Evaluating** different degrees of KT effectiveness
 - **Understanding** *how* and *why* KT instruments fail or succeed

The i* Framework [Yu 1995]

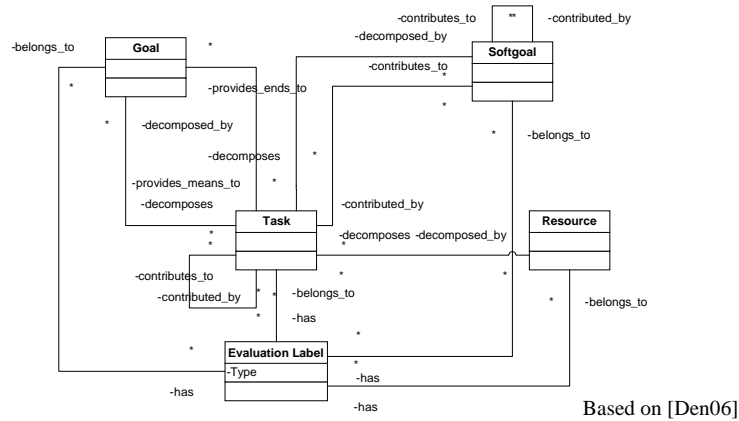
- An *agent oriented* early requirements modeling approach
 - Strategic Dependency Diagrams (Agents' Externals)
 - Strategic Rationale Diagrams (Agents' Internals)
- Beneficial to KM
 - Social actors
 - Implicit knowledge / ability analysis
 - Actor / Role Abstractions
- However, no specific notion of “*knowledge*”
 - *Extensions necessary*



i* Notation (Excerpt)

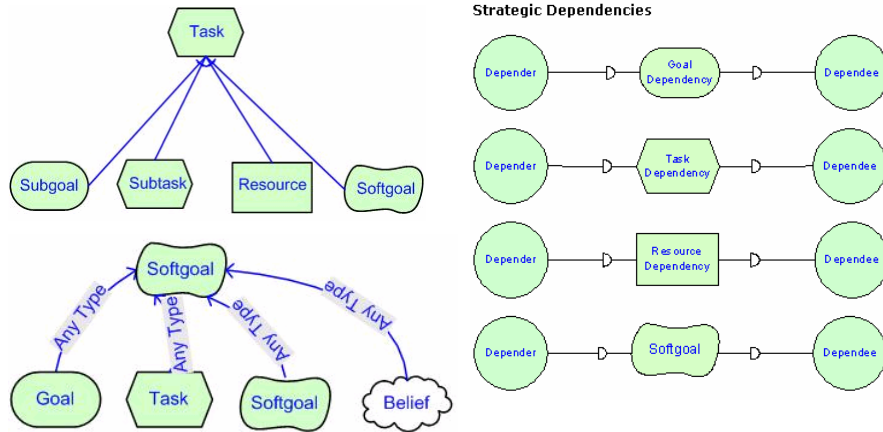
The i* Framework

– Excerpt of the i* framework meta model



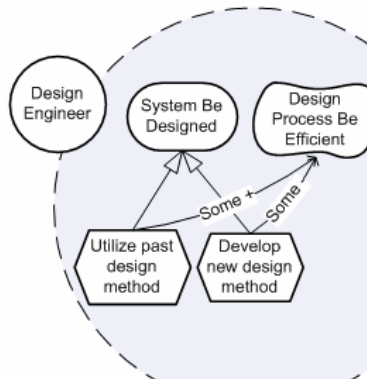
i* Modeling Examples

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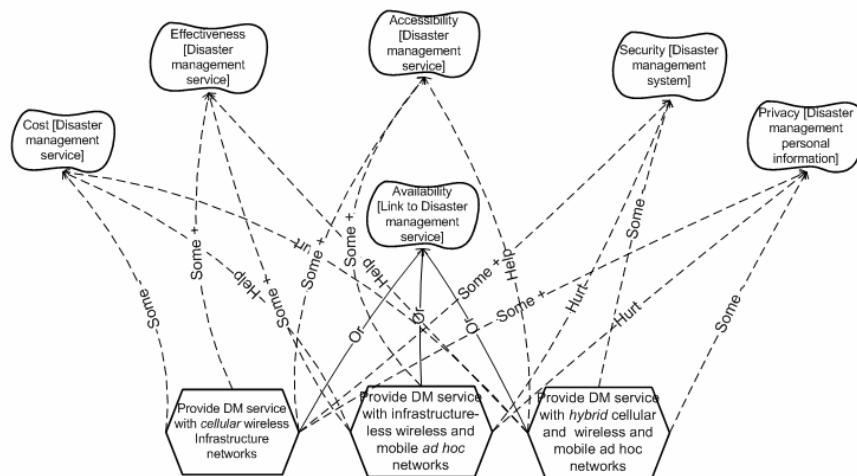
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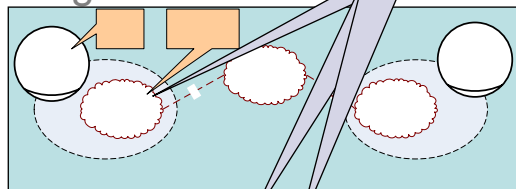


Proposal

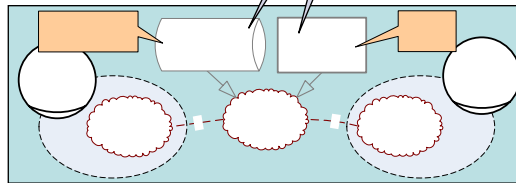
How can we analyze effectiveness of knowledge transfer instruments?

The 3 Levels of Analysis Extending the i* Framework

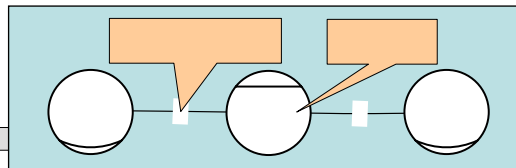
Level 1:
Identification of Knowledge Dependencies



Level 2:
Identification of Supportive Means per Knowledge Dependency

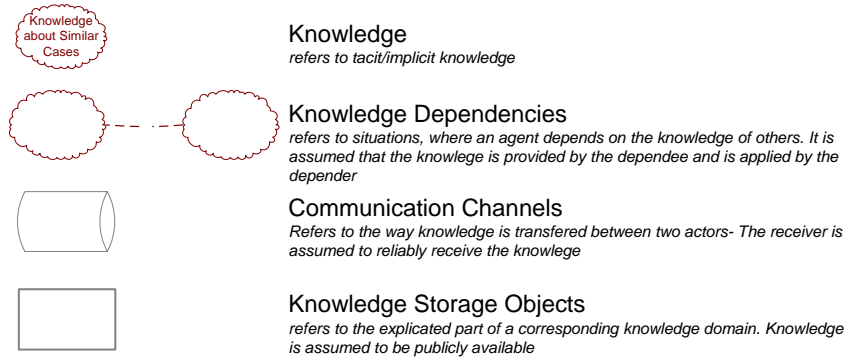


Level 3:
Reconceptualizing Supportive Means as Agents



KM Extensions to i* Modeling Notation

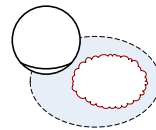
(based on [Str04])



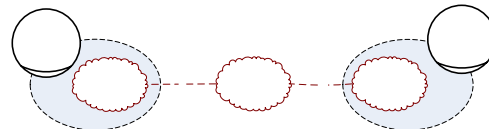
KM Extensions to i* Modeling Notation

(based on [Str04])

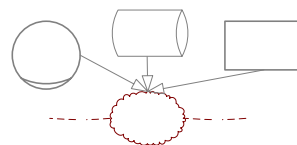
Knowledge resides within Actors



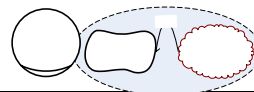
Knowledge dependencies are modeled between actors



Knowledge dependencies are refined through means-ends links



Knowledge domains can be related to softgoals



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Knowledge Transfer Agents

- A reconceptualization of Knowledge Transfer Instruments as Agents:

- **Definition:** A knowledge transfer agent is an intentional human, organizational or technological actor that focuses on the facilitation of knowledge transfer between two or more other actors.

The Experience Factory Case

- Experience Factories (EF) focus on the facilitation of Knowledge Transfer between Software Developers



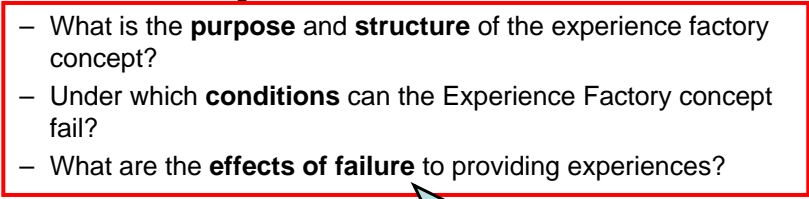
- EF constitute a **Knowledge Transfer Agent**

KTA Concept	Experience Factory Concept
<i>Intentional Actor</i>	↔ „Separate Organizational Entity“
<i>Goal</i>	↔ „Facilitate Knowledge Transfer“
<i>Participants</i>	↔ „Two or more software developers“

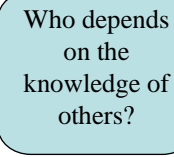


The Experience Factory Case Questions

- Who **depends** on knowledge of others?
- How is knowledge transfer **executed** and **facilitated**?
- What is the **purpose** and **structure** of the experience factory concept?
- Under which **conditions** can the Experience Factory concept fail?
- What are the **effects of failure** to providing experiences?

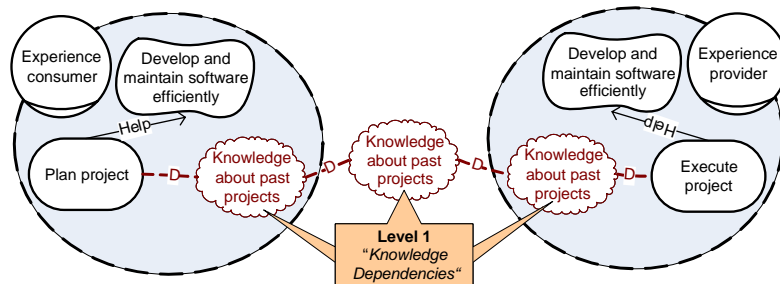


Questions that can not be answered with traditional approaches



The Experience Factory Case Level 1 Analysis

- Identification of Knowledge Dependencies



Who depends on the knowledge of others?

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Level 2 Analysis

How is knowledge transfer executed and facilitated?

- Identification of Supportive Means per Knowledge Dependency

The diagram illustrates the Level 2 analysis of knowledge dependencies. It shows two main components: an 'Experience consumer' side and an 'Experience provider' side. The consumer side includes 'Plan project' and 'Develop and maintain software efficiently'. The provider side includes 'Execute project' and 'Develop and maintain software efficiently'. Both sides are supported by 'Knowledge about past projects'. An 'Experience base' is shown as a central support. The diagram is divided into 'Level 1: Knowledge Dependencies' and 'Level 2: Supportive Means'. A speech bubble asks 'How is knowledge transfer executed and facilitated?'.

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The Experience Factory

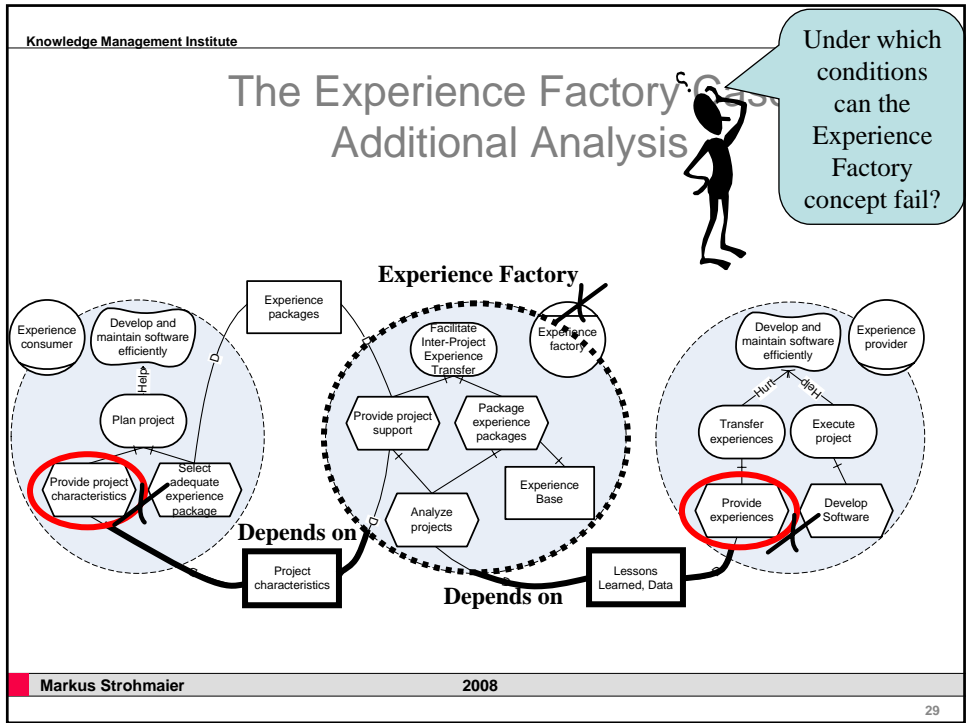
Level 2 Analysis

What are the effects of failure to providing experiences?

- Recognizing Supportive Means as Agents

The diagram illustrates the Level 2 analysis of knowledge dependencies, focusing on the effects of failure to provide experiences. It shows two main components: an 'Experience consumer' side and an 'Experience provider' side. The consumer side includes 'Plan project' and 'Develop and maintain software efficiently'. The provider side includes 'Execute project' and 'Develop and maintain software efficiently'. Both sides are supported by 'Knowledge about past projects'. An 'Experience base' is shown as a central support. The diagram is divided into 'Level 1: Knowledge Dependencies' and 'Level 2: Supportive Means'. A speech bubble asks 'What are the effects of failure to providing experiences?'. A central 'Knowledge Transfer Agent' is shown with a scale for 'Label values' from 'Goal achievable' to 'Goal not achievable'. The scale includes categories: Satisfied, Weakly satisfied, Conflict, Undecided, Weakly denied, Denied. A '1st Label Propagation' is shown at the bottom, and an 'Initial Assessment Label' is shown on the right. A '2nd Label Propagation' is shown on the right side. A '3rd Label Propagation' is shown at the top left. A '4th Label Propagation' is shown at the top right. A '5th Label Propagation' is shown at the top center. A '6th Label Propagation' is shown at the top right. A '7th Label Propagation' is shown at the top right. A '8th Label Propagation' is shown at the top right. A '9th Label Propagation' is shown at the top right. A '10th Label Propagation' is shown at the top right. A '11th Label Propagation' is shown at the top right. A '12th Label Propagation' is shown at the top right. A '13th Label Propagation' is shown at the top right. A '14th Label Propagation' is shown at the top right. A '15th Label Propagation' is shown at the top right. A '16th Label Propagation' is shown at the top right. A '17th Label Propagation' is shown at the top right. 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The KTA Method Contributions

Enables Knowledge Analysts to

- Analyze knowledge transfer **effectiveness** in the light of (potentially conflicting) stakeholder goals
- Analyze **how** knowledge transfer instruments work, and why they can succeed or fail
- **Transform** KM problems into requirements engineering problems

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Limitations

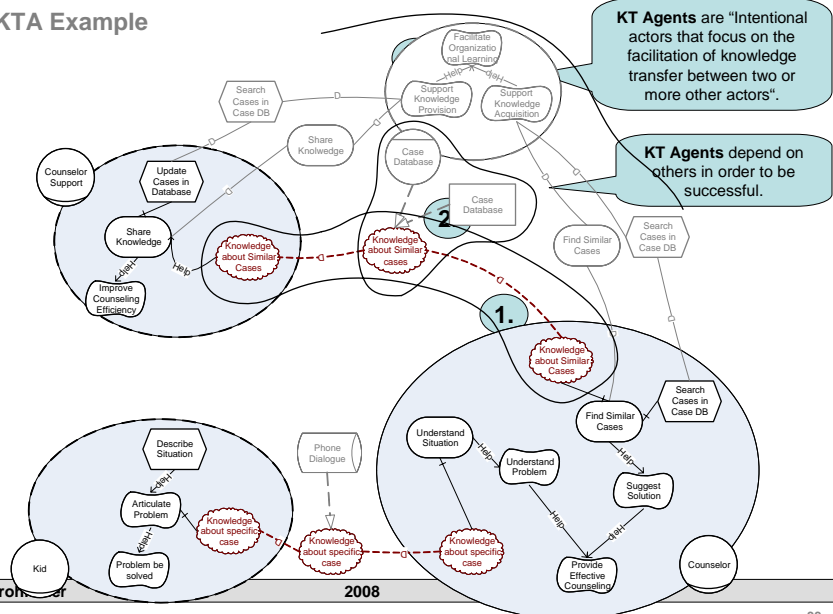
- Application so far only on a conceptual level
- Conclusions already known about the experience factory concept
- Validity of models
- Scalability

The KTA Method Applications

An Empirical Case Study

- In cooperation with Bell Canada / Kids Help Phone
- Applying the KTA Method to the Kids Help Phone Counseling Centre Toronto (~100 employees)
- Deduction of implications for the design of the Kids Help Phone's knowledge infrastructure,
 - incl. organizational and technological aspects

KTA Example



Any questions?

- See you at the exam!

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