
Requirements Models in Context

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Potts (RE'97 keynote)

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Abstraction & context

- *Design to meet formally stated objectives*
 - » *An SADT model is a complete, concise and consistent description of a system which is developed for a particular reason”*
 - *Marca & McGowan*
- *Design for fit to a use context*
 - » *When system developers ... become interventionists, they take responsibility not only for the design of the computer system but for its actual use in the organization.*
 - *Dahlbom & Mathiassen (1993, p.122)*

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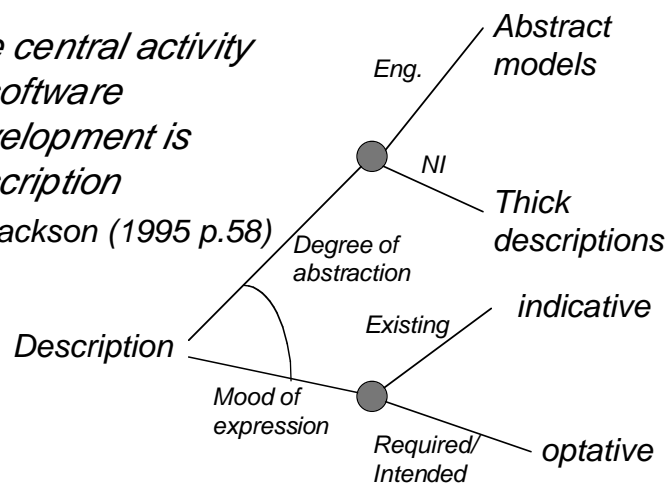
Abstract [sic]

- *Abstractionism & contextualism*
- *Abstractionist system design*
- *Context for system use*
- *Synthesizing both approaches*
- *Naturalistic inquiry & system design*
- *Implications & conclusions*

Description & Abstraction

- *The central activity of software development is description*

» Jackson (1995 p.58)



Abstractionism & Contextualism

	Abstractionism	Contextualism
Role of description	<i>Formal descriptions</i>	<i>"Thick descriptions"</i>
Design criteria	<i>Firmness</i>	<i>Commodity & fitness</i>
Source of requirements	<i>Customer authority or marketing</i>	<i>Observed work contexts</i>
Role of users	<i>Confirmation of requirements</i>	<i>Demonstration of tacit knowledge</i>
Acquisition methods	<i>Interviews & mtgs</i>	<i>Workplace ethnography</i>
Res. tradition(s)	<i>SE/MIS. Some HCI</i>	<i>HCI. Some MIS</i>

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Strengths & limitations

- | | |
|--|--|
| ● Abstractionism | ● Contextualism |
| ✓ <i>Generalization from context to domain</i> | ✓ <i>Accommodation of situation's subtleties</i> |
| ✓ <i>Simplification & manageability</i> | ✓ <i>Concreteness</i> |
| × <i>Oversimplification</i> | × <i>Unbounded richness</i> |
| × <i>Engineering for engineers</i> | × <i>Going from description to intervention</i> |

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Some families of abstractionism

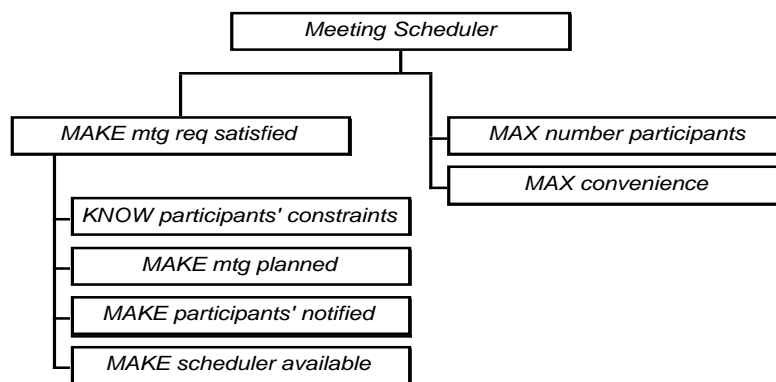
- *Process-based*
 - » *Model the business process or tasks*
 - *Structured Analysis, SADT, process specs...*
- *Object-based*
 - » *Model the UoD or information*
 - *ERA, OOA, model-based FS, algebraic specs.*
- *Teleological*
 - » *Model the system's purpose*
 - *Goal refinement (Van Lamsweerde, Fickas, Mylopoulos, Anton,...)*

Goal refinement method

- *Analyzing goals, actors & objects*
 - » *Identifying & classifying goals & actors*
 - » *Analyzing goal dependencies*
- *Transforming goals into desired behaviors*
 - » *Deciding what goals to realize in system*
 - » *Deciding how to realize goals as behaviors*
- *Identifying & handling obstacles*
 - » *Identification of likely & significant obstacles*
 - » *Handling with defensive or mitigation strategies*

Achievement goals for meeting scheduling

Van Lamsweerde, Darimont & Massonet (RE'95)



Assumptions behind teleological model

- *IT products support rational goals*
 - » *Users & organizations have explicit objectives*
- *Goals in question are the customer's*
 - » *Goals don't conflict fundamentally*
- *Designers can discover these goals*
 - » *by questioning, introspection, ratiocination*

Assumptions behind abstractionism generally

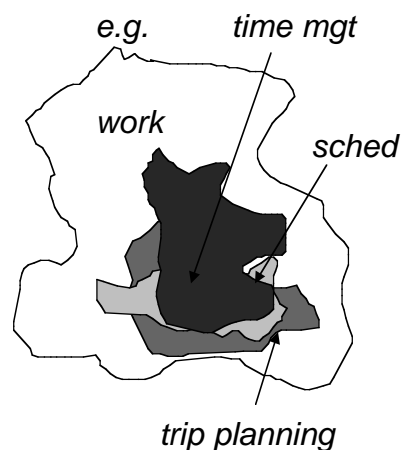
- *A system has essential properties*
 - » *It's core concepts, actions, goals,...*
- *Customer's concepts are the system concepts*
 - » *Customer's goals are "the" goals,...*
- *The abstractions stand for real things*
 - » *Objects in the model correspond to things in the real world*

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NI and meeting scheduling

- *Mtg scheduling is itself an abstraction*
 - » *Embedded in broader work situation*
 - » *“Borders” are unclear*
- *Difficult to model*
 - » *Many special cases*
 - » *Personal “policies”*
 - » *Situated action*



Contextualism in RE

- **Holistic ethnography**

- » *Blomberg et al. (1993) - industrial design*
- » *Pycock & Bowers (1996) - fashion industry*
- » *Sommerville et al (1992); Randall et al (1994) - ATC*
- » *Suchman (1987) - clerical work*

- **Ethnomethodology**

- » *Devlin & Rosenberg (1996); Sachs (1995) - maintenance*
- » *Luff et al (1994) - train dispatching*

- **Design methods using naturalistic techniques**

- » *Holtzblatt & Jones (1993)*
- » *Potts & Hsi (1997)*

Interpretation & thick descriptions (Geertz, 1973)

- *The need for theory to stay rather closer to the ground than in sciences more able to give themselves over to imaginative abstraction*
- *Gain access to the conceptual world in which our subjects live so that we can “converse with them”*
- *Tension between the need to grasp and the need to analyze*
- *Generality grows out of the delicacy of its distinctions, not the sweep of its abstractions*

Naturalistic evidence (Potts & Hsi, 1997)

Maybe he says "I have got to see Dr. C. before such and such a date." Well, we look at the dates and I've got Dr. C's. available dates so of course I take whatever time he's available and I may have to bump two or three people in order for him to do that. So I have to cancel...

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The thing about the monthly, it doesn't give me that luxury. It only says at 8:00 you've got this meeting but it doesn't tell me how long it lasts which is what I need to know. And the nice thing about the monthly, though, is it gives this banner option that says he's going to be gone to this conference for three days...

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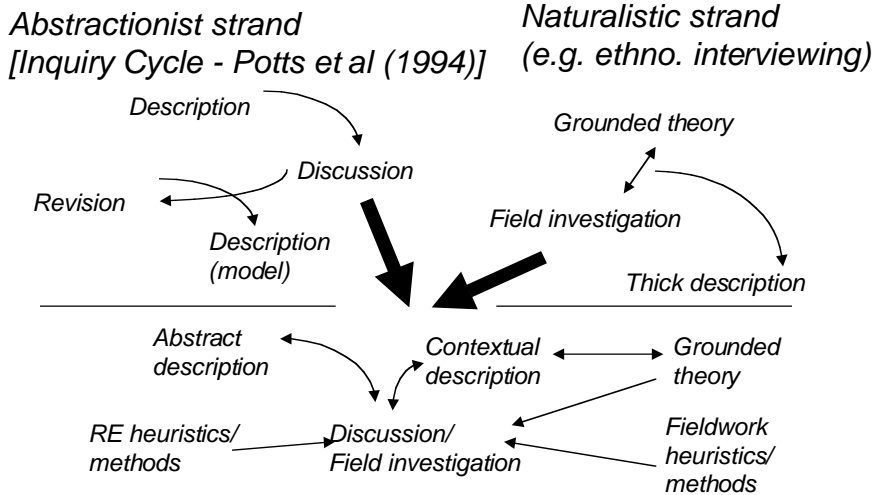
Synthesizing abstractions with context

- **Option #1**
 - » *Concentrate on context first to get “background picture”, then specify system formally*
 - *Too narrow communication channel*
- **Option #2**
 - » *Elicit requirements and specify, then check against context for fittingness*
 - *Summative evaluation comes too late*

Synthesizing abstractions with context

- **Option #3**
 - » *Develop abstractions incrementally, shaped by contextual analysis*
 - *Formative evaluation helps steer process in right direction*
 - » *Develop contextual inquiry incrementally, shaped by abstractions sought*
 - *Increases likelihood that implications of contextual findings can be assimilated*

Synthesizing the Approaches



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Example: Ethnographic fieldwork & goal refinement

- **Goal identification**
 - » Delay commitment to scope & span of system
 - » Concentrate on obviously constitutive activities
- **Object identification**
 - » Concentrate on workplace artifacts

(Narratives
Artifacts
Goals)
- **Responsibility for action**
 - » Concentrate on information ownership
 - » Concentrate on generic scenarios & critical incidents
 - » Examine communication patterns in context
- **Obstacles & defenses**
 - » Concentrate on them by asking about scenarios & artifacts

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Lincoln & Guba's Axioms

	Naive positivism	Naturalistic Inquiry
Reality is...	<i>single and tangible</i>	<i>socially constructed</i>
Knower and known...	<i>are independent</i>	<i>interact</i>
Goal of inquiry is...	<i>theory (nomothetic statements)</i>	<i>working hypotheses (idiographic statements)</i>
Causes...	<i>precede effects</i>	<i>and effects are mutually shaping</i>
Inquiry is...	<i>value-free</i>	<i>value-bound</i>

Trustworthiness criteria

	Positivism	NI
Truth	<i>Internal validity</i> - Real-world correspondence	<i>Credibility</i> - Prolonged engagement - Persistent observation - Triangulation - Peer debriefing - Negative case analysis - Referential adequacy - Member checks
Applicability	<i>Generalizability</i> - Abstraction	<i>Transferability</i> - Thick description
Consistency	<i>External validity</i> - Stability of phenomena	<i>Dependability</i> - Triangulation - Stepwise replication - Inquiry audit
Neutrality	<i>Objectivity</i> - Investigator independence	<i>Confirmability</i> - Inquiry audit

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Implications

- *Negotiated outcomes*
- *Case study reporting mode & idiographic interpretation*
- *Tentative application*
- *Focused-determined boundaries*
- *Grounded theory & emergent design*
- *Natural setting & human instrument*
- *Utilization of tacit knowledge*
- *Qualitative methods, purposive sampling & inductive data analysis*
- *Special criteria for trustworthiness*

Tensions

- *Synchronous vs. serial adoption*
 - » *Contextualism as (mere) way of gaining background knowledge*
- *Interpretation vs. intervention*
 - » *Indicative, optative & subjunctive description*
- *Balance of context to abstraction*
 - » *Reflects (tacit) ideology of design*

Finally

- *Programming, specification, testing, architectural evaluation are instrumental activities*
- *System design is (human) ends-driven*