Designing Construction Information Workspaces

Presentation for the 1998-1999 CIFE Seed Project Titled:
“4D Annotator and Interactive Workspace”
presented at CIFE Forum
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Overview

- problem
- research opportunities and goals
- research methods
- results to date
- future work
CONSTRUCTION INFORMATION WORKSPACES

realities: information overload

To meet project goals, project teams must successfully manage complex relationships between ever-increasing types and amounts of construction information.

managing relationships involves:

- **descriptive**: using relationships to describe the ‘who, what’, ‘when’, ‘where’ of the project, e.g.,
  - temporal relationships between activities
  - relationships between activities and building components

- **explanative**: using relationships to explain the schedule rationale
  - contract constraints, resource constraints, procurement constraints

- **evaluative**: using relationships to evaluate project goals and verify that project requirements are met
  - relationships between contract, spec info, schedule info, etc.

- **predictive**: using relationships to predict impacts of changes or decisions on project goals (leads to optimization)
**problem:** today’s tools inadequately support information management

today’s tools (including 4D tools) enable teams to:
- manage a limited set of these relationships
- define and communicate primarily descriptive types of relationships

but fail to enable teams to:
- effectively perform descriptive tasks
- easily perform explanatory or evaluative tasks
- quickly predict impacts on a variety of information

**consequently...**
- managing information is primarily a manual process and is ‘people’ and ‘experience’ dependent
- managing information mostly involves time spent describing and explaining rather than evaluating and predicting
example of problem: observations

these problems can be observed in meetings where teams must:

- describe
- explain
- predict
- evaluate

observation context: current practice and 4D practice
observation analysis method

- Question type:
  - descriptive: who?, what?, when?, how?
  - evaluative: meet requirements?
  - explanatory: why?
  - predictive: what if?

- Response form:
  - verbal, physical, visual

- ‘Target’ information
  - source?
  - accessible?
  - relationship type
  - reliability?

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descriptive questions

1. When do we have access to XXX?
2. Can we use the space by this building?
3. Where are you placing the crane for erection of XXX?

<table>
<thead>
<tr>
<th>Question</th>
<th>Form</th>
<th>Source</th>
<th>Accessibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>area</td>
<td>contract</td>
<td>high</td>
<td></td>
</tr>
<tr>
<td>space</td>
<td>GCI schedule</td>
<td>medium</td>
<td></td>
</tr>
<tr>
<td>relationship/source</td>
<td>reliability</td>
<td>low</td>
<td>‘target’ information</td>
</tr>
</tbody>
</table>
evaluative questions

1. Does this meet the contractual milestone?
2. Does the schedule include the specified amount of time for curing?

questions, response, and accessibility

1. REVIEW
   - medium
   - 'target' information
   - relationship/source

explanative questions

1. What is driving the finish times for the rebar?
2. Why are you starting facility at this date?

questions, response, and accessibility

1. space
   - low
   - contract milestones

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**predictive questions**

- Can we get access to the lagoon a week earlier?

- Have you considered impact of this sequence on other work in this area?

**analysis of observations**

- Most of the time is spent ‘describing and explaining’.

- ‘Target’ information is:
  - Often not accessible or even documented.
  - Takes time to find.
  - Easier to view ‘privately’ than publicly.
  - Variety of disparate sources and forms.
  - Difficult to change.

**CONSTRUCTION INFORMATION WORKSPACES**
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Leads to:
- High ‘cost’ of performing information management tasks
- Low reliability of successfully performing those tasks
- Low focus and ability for team to work together

**Research Opportunity**

to design an environment for teams to visually and interactively manage relationships between construction information

collection

construction information workspace
**What is a construction information workspace?**

- Information workspace:
  - ‘is the use of visualization to organize multiple individual visualizations or other information sources and tools to perform some tasks’ (Card, MacKinlay, and Schneiderman 1999)

- construction information workspace:
  - space to view a variety of construction information and their interrelationships
  - space to interact with that information
  - space designed to support descriptive, evaluative, predictive, and explanatory tasks

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**research goal #1:**

Design construction information workspace from ‘user’ perspective:

define the general visualization and interaction functionality that are needed to improve a team’s ability to manage construction information

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**CONSTRUCTION INFORMATION WORKSPACES**

- Observation of Current Workspace Task
- Design Info. Workspaces
- Requirements Analysis
- mock-ups/designs of const. info workspaces
- visualization & interaction functionality requirements
- tasks & info. requirements
- > evaluative and predictive tasks
  > reliability
  < cost
Research Goal #2:

To extend current construction information models and information visualization technologies to support the functionality.

Define a ‘shared’ construction information workspace vocabulary.
research methods

- Observe & Analyze Current Workspace Tasks
- Design/Mock-Up Const. Info. Workspaces

[Flowchart with nodes: Observe & Analyze Current Workspace Tasks, Design/Mock-Up Const. Info. Workspaces, Implement, Validation & Testing, Interactive Catalog, Task and Information Requirements, Visualization & Interaction Requirements, Construction Information Workspace Vocabulary, Prototype & Test Results]

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testing

- test cases:
  - industry test case (1 yr +)
  - hypothetical
- test method
  - ask users to answer several questions using:
    - traditional forms of information
    - construction information workspace
  - document:
    - time spent performing categorized tasks
    - reliability of response

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validation criteria

- decrease descriptive, evaluative questions/task and increase predictive tasks
- increase reliability of descriptive, explanatory, and evaluative tasks and decrease cost of performing those tasks

results to date:

- Some observations
  - extend to other types of observations
- Initial requirements list
- Initial Mock-ups/Designs:
  - Mock-up
  - interactive workspace demo
expected deliverables

- Interactive catalog of construction information workspaces
- Construction Information Workspace Vocabulary in some standard format:
  - XML
  - XSL + ???

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