7PMG: Guidelines for process modeling

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Focus: process model comprehension

Got it! create

Got it! read

Got it! modify

Got it! understands

Got it! represents

[Image of a process model diagram with labels for create, read, modify, understands, and represents]
Seven process modeling guidelines (7PMG)

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\section*{Abstract}

Business process modeling is heavily applied in practice, but important quality aspects are still only addressed thoroughly by research. A notorious problem is the low level of model quality that many casual modelers in process documentation projects have. Existing approaches to improving model quality might be of benefit, but they suffer from at least one of the following problems: they are too complex and not intuitive enough, or too abstract to be understood by and non-experts in practice. On the other hand, there are collections of pragmatic guidelines, e.g., the Guidelines of Modeling Practice. In this paper, we analyze existing research on relationship graphs, and we develop a new, more complete set of guidelines that are closer to practice and easier to use.

\section*{Keywords:}

Business process modeling, process documentation, model quality, relationship graphs, guidelines.
Tutorial 1: Process Model Comprehension
A Human View on Formal Structures

This tutorial covers the emerging field of empirical research into the quality of business process models. Various papers at the recent BPM conferences have shown that quantitative methods can provide valuable insights for the business process management field, also in the formal and technical area. With our tutorial we are embracing this trend and summarize the major pillars and backgrounds of process model comprehension. This is an important subject, as in various contexts the effective use of process models is influenced by the extent to which human readers can quickly and correctly understand these.

The tutorial will be subdivided into four parts, each of 20min. In the first part, we revisit theoretical foundations comprehension and comprehension performance. Then, we discuss various factors that influence process model comprehension. Thirdly, different measures of process model comprehension are investigated. Finally, we draw conclusions from comprehension research on how process models should be constructed and presented to model readers. We illustrate corresponding guidelines, using an example of a process model from practice.

The tutorial is intended for practitioners with an interest in improving their process modeling styles on the one hand and for (young) researchers that are interested in pursuing research in this field on the other.

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For the second half of the morning, I elected to attend a tutorial on a human view of process model comprehension by Jan Mending of Humboldt-Universität zu Berlin and Hajo Reijers of Eindhoven University of Technology. Obviously a lot of other people are interested too, since we had to move to a much larger room before beginning.

This started with a definition of process model quality based on the SeQual Framework: syntactic, semantic, pragmatic and other measures of quality. Then, some basics on how human memory works:

- **External stimuli pass through immediate sensory memory to short-term working memory to long-term memory that represents the knowledge that we maintain.**
- **Dual coding theory** states that we process visual information differently depending on whether it is textual or graphical: with text, we tend to hear the words in our head and process them through auditory channels rather than visual channels.
- **Cognitive load theory** states that we can only hold a maximum of seven things in working memory at one time.
- **Cognitive fit theory**, which looks at how different types of stakeholders interact with the same information differently.

Having covered some of the theory around how we process information, we looked at some of the practical examples of how novices and experts view process models; in this case, “expert” may refer to either a subject matter expert or a process modeling expert. The selection of the visual representation – the “language” – does not have much of a difference on comprehension, assuming that all of these languages are flow-oriented, such as EPC, Petri Nets or BPMN. There are, however, a number of factors that do impact comprehension:

- Model complexity (this seems a pretty obvious conclusion to me, but I guess it needed to be proven 😄), including complex operators and some clever but obscure model optimization.
- Layout/topology and coloring: these are considered secondary notation characteristics in that they don’t change the model, just its visual appearance.
- Text labels, that is, the understandability of text labels within process step.
- Purpose, that is, whether the process model is for execution, training or to meet specific certification requirements.

There are different methods of measuring process model comprehension while viewing a model: how accurately can people respond to questions about the model; how long does it take them to answer those questions; how much mental effort is expended to reach those answers; which is done by asking the subjects how hard it was for them. There are also different measures of how well that process model is remembered when it is removed from the subject: recall of process characteristics such as how many start events exist in the model; retention of the business meaning of tasks in the model; transfer of the entire model, measured by questions such as how the model could be simplified.

There are several implications of this process model comprehension research:

- Modeling tools should enforce structured models, analyze correctness (which is well understood in the research community and available in open source tools, but poorly represented in commercial products), and provide different views of the model for different stakeholders.
- With respect to training, abstract modeling knowledge is useful, but familiarity with a specific technique/language is less important.
- Adopt **WfMC** modeling guidelines: use as few elements as possible in the model, minimize the routing paths for each element (which can be counter to the first recommendation, since it may result in a complex gateway being split into two simpler gateways), use one start and one end node; keep the model as structured as possible, avoid OR routing elements in favor of AND and XOR elements, use verb-object text labeling style, and decompose a model with more than 50 elements to subprocesses (my sense, as well as Raul’s, is that this should be a lower number, such as 20-30, although their research shows a definite advantage at 50).
Process Modeling Euro-Style

A reader asked me to comment on an interesting paper by the European BPM academics Mending, Reijers, and van der Aalst entitled Seven Process Modeling Guidelines (7PMGs). Like my book BPMN Method and Style, 7PM is asking the right question: what are the principles of style that improve a model’s chance “(1) to become comprehensible to various stakeholders and (2) to contain few syntactical errors.” I don’t completely agree with their recommendations. See what you think.

They begin with the refreshingly honest statement (with which I concur 100%):

A notorious problem is the low level of modeling competence that many casual modelers in process documentation projects have.

On the other hand, the authors’ assumed tool for these folks is ARIS or CaseWise, which are really tools for architects not casual modelers. The diagrams in the paper are all EPC. I wonder why they did not write the paper in context of BPMN. But let’s look at the recommendations. After applying some academic hocus-pocus, they arrive at the following prioritized list:

1. Make the model as structured as possible. That’s one of my top ones also, but they mean something completely different than I do. To Mending et al., “structured” means “block-structured.” That would make Michael Rowley happy, but not mainstream BPMN modelers. No, I think these guys are living in a BPEL yesteryear. Enforcing block structure probably does reduce syntactical errors, but at a heavy price: Only developers are willing to go along with it. In BPMN Method and Style, I emphasize structured models as well, but I mean hierarchical structure, in which a single end-to-end semantic model can be viewed at different levels of detail.

2. Decompose a model with more than 50 elements. I’m not sure what constitutes an element, since EPC diagrams include everything but the kitchen sink. In BPMN, my recommended style limits you to 5-10 activities in a process level (subprocess).

3. Use as few elements in the model as possible. In other words, if an element is redundant, leave it out. I agree with that. But how did it make the top 3? Kind of a moodydark statement.

4. Keep modelers out of design. That’s good advice but they seem to miss the boat. They want to “limit the number of types of elements.” But are you really going to limit the number of models envisioned by your stakeholders? I doubt it.

5. Avoid complex constructs. I agree we should avoid complex constructs. But if they don’t offer examples of complex constructs, I must assume they mean multilevel modeling. But then multilevel modeling makes me wonder how it can be “geared toward non-BPM experts.”

6. Avoid complex sentences. I agree that complex sentences can obscure models. But what’s wrong with “Use a verbless description?” Simple, they mean “keep sentences short and simple.” The irony is, this is exactly what I mean in BPMN.

7. Keep models to one page. This is a bit of a head-scratcher. They offer no examples of how to do this. I do keep the number of activities in a process level small. But what’s the basis for claiming that “the brain can process one visual page at a time”?

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Method

- Inspected various quality frameworks (SEQUAL, Guidelines of Modeling)
- Looked into cognitive literature
- Collected insights from empirical studies (experiments, process model collection analysis)
  - Understanding
  - Errors
- Distilled guidelines
- Validated with experienced modelers in the Netherlands and Germany
- Followed up on prioritizing
G1: Use as few elements in the model as possible.
G2: Minimize the routing paths per element.
G3: Use one start and one end event.

- Incoming phone call
- Customer at desk
- Complaint letter
- Complaint has arrived
- XOR
  - Incoming phone call
  - Complaint letter
- Customer at desk
G4: Model as structured as possible.
G5: Avoid OR routing elements.
G6: Use verb-object activity labels.

- Complaint to be written down
- Complaint analysis
- Write down complaint
- Analyze complaint
G7: Decompose the model if more than 50 elements.
## Priorities?

Table 2  
Prioritizing guideline 7PMG.

<table>
<thead>
<tr>
<th>Position</th>
<th>No.</th>
<th>Explanation</th>
<th>Accumulated rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G4</td>
<td>Model as structured as possible</td>
<td>58.5</td>
</tr>
<tr>
<td>2</td>
<td>G7</td>
<td>Decompose a model with more than 50 elements</td>
<td>73.5</td>
</tr>
<tr>
<td>3</td>
<td>G1</td>
<td>Use as few elements in the model as possible</td>
<td>80.5</td>
</tr>
<tr>
<td>4</td>
<td>G6</td>
<td>Use verb-object activity labels</td>
<td>84</td>
</tr>
<tr>
<td>5</td>
<td>G2</td>
<td>Minimize the routing paths per element</td>
<td>86.5</td>
</tr>
<tr>
<td>6</td>
<td>G3</td>
<td>Use one start and one end event</td>
<td>101</td>
</tr>
<tr>
<td>7</td>
<td>G5</td>
<td>Avoid OR routing elements</td>
<td>104</td>
</tr>
</tbody>
</table>
Further insights

- Abstract process modeling knowledge is pivotal
- Tool support may be of major importance:
  - Structured modeling
  - Correctness analysis
  - Support for different views

- Domain knowledge is tricky..

- The particular (flow-oriented) technique is not so important
Open issues

• Relative importance of factors:

• Interaction effects?

• Where to invest?

• Translation to tool support:

• Modularity?

• Size?

• Secondary notation issues:

• Layout?

• Process modeling guidelines: where to next?
• **SEQUAL:**

• **Cognitive dimensions framework:**

• **Learning:**
Literature: process model comprehension

- **General modeling guidelines:**

- **Framework:**
• **Metrics:**


Comparison of techniques:


Role of labeling and icons:


Role of modularity:

• **Role of domain knowledge:**

• **On measurement:**

• **Cognitive Load and Visualization:**
  - Weidong Huang, Peter Eades and Seok-Hee Hong: Measuring effectiveness of graph visualizations: A cognitive load perspective. Information Visualization. Volume 8, Issue 3, 2009