BPTrends
BUSINESS PROCESS TRENDS

Email Advisor

Volume 7, Number 21 December 15, 2009

Complex and Dynamic Processes

Looking back on 2009, I'd say it was the year during which it became popular to talk about Complex/Dynamic processes. This isn't to say that some people haven't been talking about these processes for some time. Keith Harrison-Broninski, for example, wrote a book titled *Human Interactions* in 2005. In that book he argued that there were, increasingly, processes that involved people working together that were very hard to model using conventional techniques. He went on to argue that these processes required a new process modeling notation.

In the past year, we've seen the OMG, in line with Harrison-Broninski's argument, begin to consider what a new modeling notation might look like. Henk de Man, of Cordys, submitted a proposed approach and notation which launched the OMG's Case Management Process Modeling (CMPM) effort and the subsequent issuance of an RFP. We would opt for avoiding the use of the term "case" and using the term Dynamic and/or Complex processes, since the term "case" is laden with so many other meanings. But, regardless of the term used to describe the new notation, it is safe to say that we can expect a lot more discussion on this topic in the year ahead. (See Henk de Man's article published on BPTrends in January of 2009: *Case Management*)

The OMG effort has triggered a variety of responses from BPMS vendors who are now offering a variety of "solutions" for companies with case or Dynamic/Complex processes. My particular favorite, to date, is a special collaborative process supported by EMC Documentum. In essence, if a BPM team is creating a process diagram in EMC Documentum and designates a particular activity a "collaborative process," they are required to provide the system with an email address and potential collaborative participants. When an activity requiring a decision is actually triggered, at runtime, the BPMS engine automatically creates a mini-website and sends an email to one or more of the collaborative participants who are then asked to set up a team, determine a solution and notify the system of the solution. (See my Advisor of Nov. 20, 2007.)

If more proof of a growing interest in dynamic/complex processes was needed, the March, 2009 *Harvard Business Review* article by Joseph Hall and Eric Johnson, "When Should a Process Be Art, Not Science?" certainly cinched it. We may not agree on the name, but whatever they are called, Dynamic/Creative processes are hot!

I've had a number of interesting discussions on the nature of Dynamic/Creative processes recently and thought I'd share my thoughts. My perspective is influenced by a decade of work in AI and Expert Systems where we modeled human expert behavior with rules. It leads me to use the idea of rules to define complex behaviors. But let's step back and consider Figure 1.

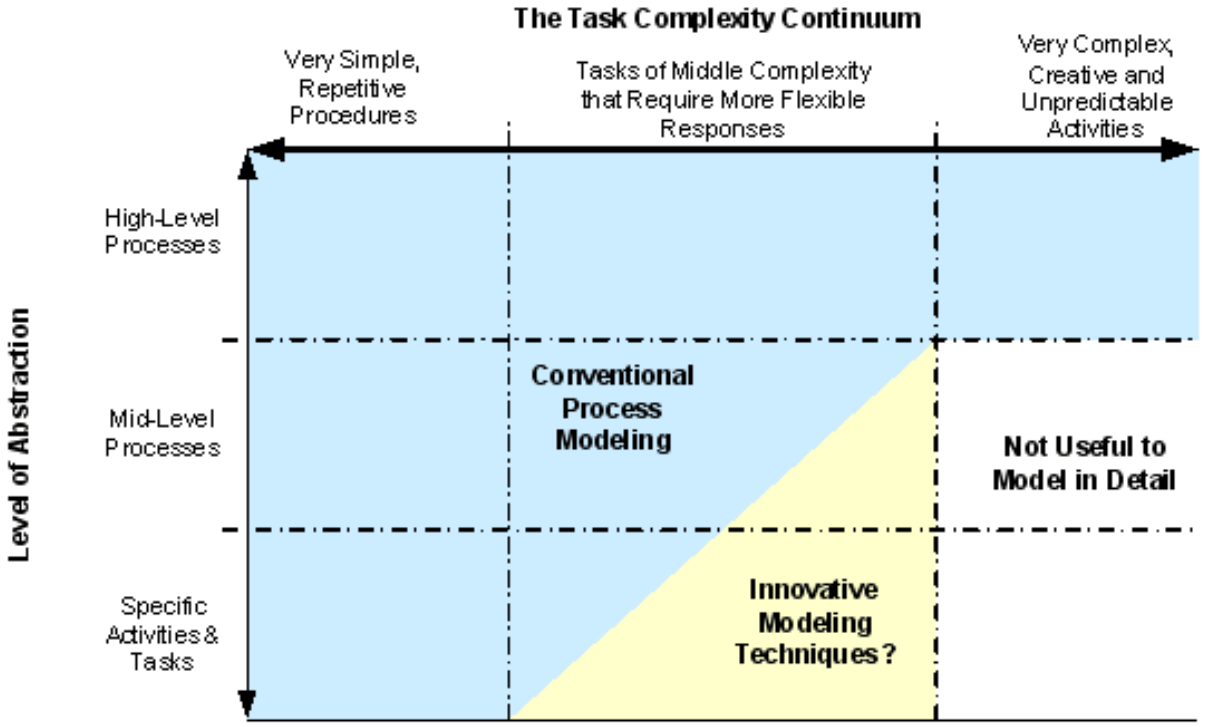

Figure 1. Levels of Abstraction and Task Complexity

I consider both abstraction and complexity to make a point about modeling. At a high-level of abstraction we can model any process. What we do not want to do is to drill down into the details. Figure 2, for example, provides one possible description of a high-level medical diagnosis process. At this level of abstraction we can define the steps the physician should go through.

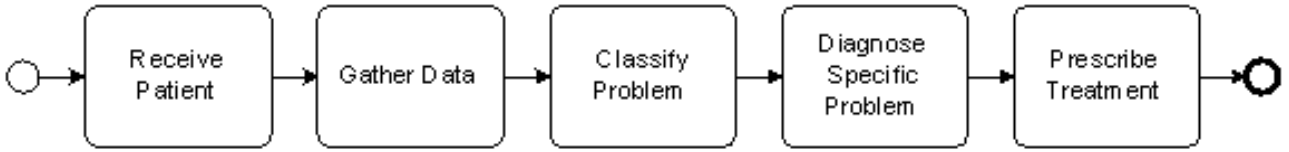

Figure 2. Medical Problem Diagnosis Process

We could easily decompose some of the processes described in Figure 2. We could, for example, spell out some of the steps a physician might go through to gather data or to classify a problem. But we will probably not want to drill down into the details of diagnosis. It's simply too complex and patient specific.

The problem in drilling down into a diagnosis is not that there are potential alternative paths. If it were simply a matter of choosing among alternative paths, it would, in my opinion, be a problem of middle complexity. This is the kind of thing medical technicians frequently do when

they define a problem in a step-by-step manner.

Research into cognitive psychology and expert systems suggests that human experts take years to learn how to solve certain kinds of problems, and, in the course of those years, they learn tens of thousands of rules. The Stanford team that built Mycin – an expert system that could diagnose meningitis symptoms and prescribe treatments – ended up incorporating over 12,000 rules. These rules did not form a neat decision tree. Their use depended on an inference-based rule engine that searched the rules dynamically. (Put in computer terms, the problem space was too large to search with algorithmic techniques.) Given one fact, rules would be called that asked other questions and gained additional information. The development of an expert system required working with physicians and going through hundreds of cases to identify all the rules required. Even then, Mycin would not usually provide a single answer. Instead, it would generate a list of the possible causes and rank them according to consequences.

Based on this experience, my definition of very complex processes is “processes that would require tens of thousands of rules to define and that would result in multiple possible solutions among which humans would ultimately need to choose.”

To make matters worse, we don't use Mycin today. The domain of meningitis diagnosis and treatment is too dynamic. New diagnostic heuristics and new medicines are constantly being introduced. A meningitis expert routinely reads medical journals and attends conferences. In the process, the expert is constantly changing some rules and adding others to his or her knowledge base. It turns out it's too expensive to maintain Mycin. Even if we can build such an expert system – and the Stanford team did and it briefly out-performed the medical team – we can't afford to maintain it. Until we can create software systems that can learn in ways we can't quite specify at the moment, it's easier to rely on human physicians. And the same conclusion applies to business executives, new product designers, the people who create ads or devise marketing campaigns, and the architects who design new software systems.

If we are focused on a routine procedural problem, such as assembling an auto or repairing a copier, we can define each step in the overall process and we can drill down to whatever level of detail we need. Even in the mid-range – processes that have hundreds of rules that can be modeled as a set of alternative paths – we can usually model the process without much difficulty. Moreover, we are getting better at mixing flow diagrams and business rules to allow us to define mid-level complexity in ways that make it relatively easy for a business manager to understand.

As I see it, however, we face serious problems on the border line between processes of mid-level complexity and dynamics and processes that are very complex and dynamic. And, we have two solutions. One is to create new notations for special cases, rather like the EMC Documentum solution, or like the notation that de Man has proposed to the OMG. The other is to explore ways to mix process diagrams and rules more effectively.

Most of the recent work in business rules has derived from a tradition that treats rules as elements derived from business policies (under the control of the business). This has resulted in a lot of good business rule systems, but it's a limited view of rules. It's a lot easier to derive

rules, logically, from business policies, than it is to derive rules from the minds of human experts. As we address the issues posed by Dynamic and Complex processes, we are going to have to rediscover some of the knowledge acquisition techniques developed for expert systems in the Eighties. In effect, we will be identifying human practitioners who have learned how to solve complex and vexing problems, and we will need to formalize their insights into rules. This isn't really information in the control of the organization; it is a collection of insights into how to solve specific problems that have been captured by employees in the course of their work.

At the same time, we need to be aware that there are problems on the right-hand side of Figure 1 that we simply should avoid trying to model. We can, and should, continue to define the processes of management and design and diagnosis at a high-level and tighten up those procedures we can. But, we should also recognize that companies have lots of process problems that they need to understand, and that, today, we have plenty to do to just capture and refine the processes we can understand and model. So, for the time being, we should continue to rely on good business executives, good designers, and good physicians to solve problems that are too complex to diagnose or to maintain with our current process modeling or automation techniques.

In other words, I am suggesting a kind of triage approach. Routine processes should be completely analyzed and, whenever cost-effective, automated. Processes of mid-level complexity and dynamics are the challenge that we ought to focus on, defining those that are most valuable to define, and automating those that are appropriate. Here, new work in modeling notations and rules is valuable and should be pursued by companies seeking to advance their use of processes. Processes of great complexity, or those that are very dynamic processes involving human expertise and tens of thousands of rules, should be modeled at a high level, but otherwise, left to managers and employees who have acquired and continue to maintain the expertise required.

To paraphrase Clint Eastwood, a process team has got to know its limits.

Till next time,

Paul Harmon

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