

Capturing and Leveraging Expert Decision Making and Problem Solving

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Global Situation and Opportunity

Situation



- Knowledge workers
- Aging boomer experts
- Gen X/Y/millennium novice replacements
- Limited opportunities for classroom training
- Tribal lore versus intellectual capital


Opportunity



- Decrease ramp-up time to competent performance
- Provide timely access to learning, information, and tools

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Objectives



- Describe a CTA approach using inputs, processes, outputs and decisions.
- Apply the approach to specify an expert decision.
- View demonstrations of performance solutions arising from a CTA.
- State lessons learned in applying the CTA approach.

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Apply a CTA Approach

Defined as a broad area consisting of tools and techniques for describing the knowledge and strategies required for task performance (Schraagen, Chipman, & Shalin, 2000, p. xiii). It is the extension of traditional task analysis techniques to yield information about the knowledge, thought processes, and goal structures that underlie observable task performance (p. 3).

Job & Task Analysis Continuum

Job Analysis Task Analysis Cognitive Task Analysis

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How to Know When You Need a CTA

- Huge differences between novice and expert cognition and performance.
- Statements such as “instinct,” “art,” “gut feeling.”
- Lots of cognitive verbs used in task statements (e.g., determine, assess, evaluate, analyze, decide).
- Eyes roll upwards when answering questions.

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CTA Has Measurable Results

In a statistical review of studies (meta-analysis), Lee (2005) noted that interventions based on CTA results improve performance by 35 percent.

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CTA Approaches

<http://mentalmodels.mitre.org/>
www.ctaresource.com

CTA Approach	Researchers
Facilitated Case-Based Reasoning (F-CBR)	Stone & Villachica (1999)
PARI (Precursors • Actions • Results • Interpretation)	Hall, Gott, & Pokorny (1995)

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The Opportunity at POST

- Public expectation of service
- Retirement Incentives
 - ◆ 3 percent at age 50
- Updated take on performance before making curriculum revisions
 - ◆ Feasibility study
 - ◆ Current curriculum didn't focus on decision-making
 - ◆ Tasks, decisions, and stories
- Variance
 - ◆ Geographic issues
 - ◆ Agency size

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DLS CTA Approach

Facilitated Case-Based Reasoning (F-CBR)

1. Set Up CTA Workshops

- Determine number of workshops
- Identify participants
- Ask participants to bring workbasket samples

2. Conduct Workshops

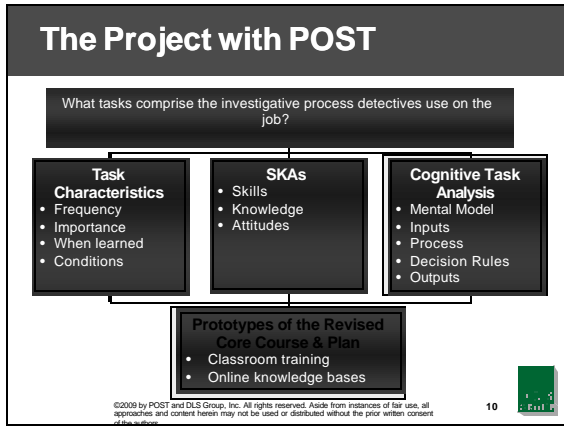
- Decompose job tasks
- Identify cognitive tasks
- Complete complex decision tables
- Identify novice/expert differences

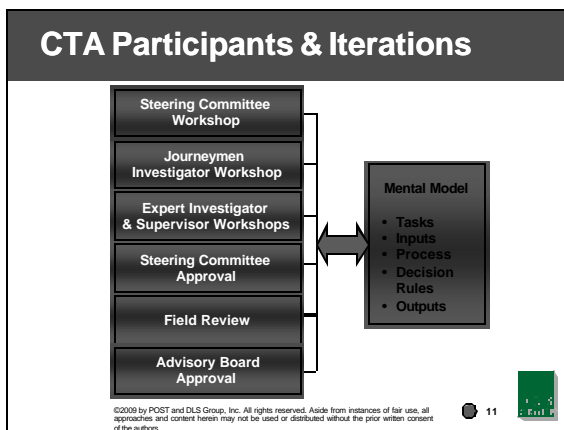
3. Validate and Socialize the Mental Model

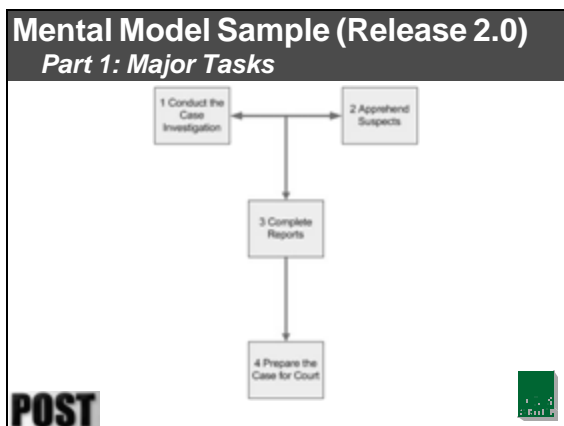
- Internally validate the mental model
- Prototype solutions
- Externally validate the mental model

-Villachica & Stone (in press)

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JOB AID 1: GLOSSARY OF CTA TERMS: FULL LIST ON WWW.DLS.COM

Apperception: “Rapid, knowledge-guided perception” that guides expert problem-solving and decisions (Ross, 2006). Apperception allows expert chess players to know the right move instantaneously and law enforcement personnel to follow correct hunches and instincts.

Automaticity: “When cognitive processes [are practiced to the point they] become automatic, they demand very little space in working memory, they occur rapidly, and they often occur without conscious effort. Automaticity is sometimes called fluency” (Willingham, 2004).

Cognitive task analysis: A broad area consisting of tools and techniques for describing the knowledge and strategies required for task performance (Schraagen, Chipman, & Shalin, p. xiii). It is the extension of traditional task analysis techniques to yield information about the knowledge, thought processes, and goal structures that underlie observable task performance (p. 3).

Context-specific knowledge: Knowledge about a given domain, including concepts, facts, procedures, rules of thumb (heuristics), and learning strategies (Collins, Brown, and Holum, 1991).

Decision-making ability: The ability to choose among options and reach conclusions within a given situation (MSN Encarta, accessed 2007). Problem solvers must make multiple decisions.

Implicit learning: “...a person typically learns about the structure of a fairly complex stimulus environment, without necessarily intending to do so, and in such a way that the resulting knowledge is difficult to express” (Berry and Dienes, 1993, p. 2). Implicit learning is unintentional and usually constructed while “mucking around.”

Mental model: Networks of facts, concepts and principles, along with their supporting facts and concepts, stored in a meaningful structure based on the context for which it was created and the past experiences of the learner (Foshay, Silber, and Stelnicki, 2003).

Problem-solving ability: Problems arise when individuals have goals they do not know how to achieve. Some problems are well-structured, and problem solvers can identify the problems, develop straightforward processes for solving them, and know what the solved problems will look like. Other problems are ill-structured. Problem solvers cannot necessarily identify the problem at the start, they don’t know exactly how to solve it, and they don’t know what it will look like when they are done (Villachica, 2000).

Reactions to the unexpected: When problem solvers encounter a problem, they will apply their context-specific knowledge to solve it. When novices encounter a novel problem, their existing context-specific knowledge does not apply, and they resort to what they know how to do—regardless of whether it solves a problem.

Self-monitoring ability: Problem solvers must monitor their own progress as they solve a problem. This self-monitoring ability requires them to employ control (or metacognitive) strategies. Self monitoring involves selecting possible problem-solving strategies, monitoring how well they are working, deciding when to change strategies, and knowing when the problem is solved. Decisions about proceeding in a problem-solving task generally depend on an assessment of one's current state relative to one's goals, on an analysis of current difficulties, and on the strategies available for dealing with difficulties (Collins, Brown, and Holum, 1991).

Tribal lore: Context-specific knowledge, problem-solving ability, decision-making ability, self-monitoring ability that knowledge workers communicate and learn informally. Tribal lore is often shared around the water cooler.

Working memory capacity: Working memory is a short-term store for about 3-9 bits of information used when learning, reasoning, or comprehending. It is involved in attending, encoding, storing, and retrieving of information (medicinenet.com, accessed 2007).

JOB AID 2: MENTAL MODEL WORKED EXAMPLE

1.0 Conduct case investigations

...

1.6 Collect and evaluate physical evidence

...

1.6.1. Determine physical evidence to collect and evaluate

Input (What Prompts You)	Process (Activities)	Decision Rule (Questions that Help You Make a Decision)	Output (Results)
<ul style="list-style-type: none"> ➤ Experience level of CSI ➤ Experience level of investigator ➤ Experience level of first responders (patrol, fire, child protective services, etc.) ➤ New technology that allows new evidence collection ➤ Investigation to this point 	<ul style="list-style-type: none"> ➤ Direct CSI or self to collect physical evidence ➤ Conduct physical and photo line-ups ➤ Place pretext calls ➤ Identify victim's property 	<ul style="list-style-type: none"> ➤ What are the 4th amendment issues, including search warrants?¹ ➤ What is the evidence? ➤ Why is it there? (reconstruction) ➤ What is its source? ➤ How is the evidence relevant or prove effect? <ul style="list-style-type: none"> ▪ What additional forensic testing can enhance the value of the evidence? ➤ What evidence do I need in order to disprove possible defenses (e.g., self defense and relationship to suspect)? ➤ What is the experience level of CSI and investigator ➤ What can I do to ensure the collection of not-so-obvious evidence? <ul style="list-style-type: none"> ▪ Trace evidence? ▪ DNA evidence? ▪ Latent prints? ▪ Etc.? 	<ul style="list-style-type: none"> ➤ Evidence in support/non-support of your case ➤ Case disposition ➤ Links to other crimes

¹ Items in **bold** are high-priority questions that trump all others for this decision.

INTERACTIVE EXERCISE: COMPLETE A CTA TABLE

Instructions

1. Break into groups.
2. Select a task and write it in the space below. For example:
 - ◆ Selecting a gift for someone.
 - ◆ Finding a sponsor for a project.
 - ◆ Selecting a performance intervention.
 - ◆ Other
3. Select a member of your group to act as an expert in the task you chose.
4. Write the *inputs* that prompt the expert to perform the task in the right-hand column.
5. Write the *processes* that the expert uses to perform the task in the second column.
6. Write the *decision rules* that the expert applies when making task-related decisions in the third column.
7. Write the *outputs* that result from the completed task in the left-hand column.
8. Place an asterisk (*) next to any question/decision that takes a precedence over others (a.k.a. "trumps" it).
9. After 20 minutes, we'll debrief.

Task: 2: _____

Input (What Prompts You) ④	Process (Activities) ⑤	Decision Rule (Questions that Help You Make a Decision) ⑥	Output (Results) ⑦

PARTIAL CITATION LIST (FULL LIST AT WWW.DLS.COM)

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