COGNITIVE TASK ANALYSIS AND ITS APPLICATION TO TALENT MANAGEMENT[1]

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PURPOSE

The purpose of a cognitive task analysis is to systematically define the decision requirements and psychological processes used by expert individuals (i.e., performers) in accomplishing results.

TALENT MANAGEMENT APPLICATIONS

Task analysis is used to identify, analyze and systematically document the actions taken and the inputs used to accomplish results at this time. Cognitive task analysis is one specific type of task analysis, and it is used to define the mental processes and steps underlying performance in a specific area. In the organizational context, cognitive task analyses are often used to document the cerebral steps that individuals or teams are either using or should be using in order to contribute results. The cognitive task analysis, as opposed to other task analysis processes, focuses on the routinely overlooked thinking processes (rather than observable behaviors) used by performers to make decisions, apply heuristics, adapt logic models, and solve problems.

Within talent management, from recruiting and promoting to mentoring and coaching, the results of a cognitive task analysis can provide you with the necessary insights to align performers with desired performance. Such insights are especially important in today's knowledge-based economies. By identifying and defining the cognitive processes associated with expert of highly proficient performance, the cognitive task analysis findings (especially when combined with the results of other performance analysis processes) can guide your decisions about how to best support the range of talented individuals working for your organization; decisions that would otherwise be have to be made based on assumptions about what it takes to be a high performer within different roles.

ADVANTAGES AND DISADVANTAGES

ADVANTAGES

- A cognitive task analysis generates detailed, precise information on the nature of expert level performance in a specific task of interest.
- When implemented correctly, cognitive task analysis techniques are a highly valid source of information on expert cognitive processes.

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- A cognitive task analysis provides systematic procedures (rather than hit-or-miss steps) for ascertaining the cognitive processes used by experts and high level performers.

DISADVANTAGES

- Analysis of the data gathered during a cognitive task analysis can be time-intensive.
- Cognitive task analysis does not always capture other non-cognitive attributes necessary for accomplishing results (such as physical capabilities, access to resources, and interpersonal relationships).
- The results of a cognitive task analysis can be misleading when expert performers have performance capacities beyond that of others (for example, a cognitive task analysis can be done with high performing professional athletes but implementation of cognitive processes alone will not duplicate performance).

GENERAL PROCEDURES

FAMILIARIZING YOURSELF WITH THE DOMAIN AREA

To kick off the cognitive task analysis process, think about how results are accomplished in the positions or roles for which you are interested in applying the cognitive task analysis method. If you are planning on conducting your cognitive task analysis in a performance area for which you have little background knowledge or experience, now might be a good time to take a moment and learn some of the basics about the domain, the domain-specific terminology, and what constitutes high-level performance in the domain area.

There are a variety of different ways in which you could gather both cursory and detailed information on the domain area. Here are a few suggestions:

- Informally or formally interview professionals in the domain area, and ask them to explain in layman's terms the broad brushstrokes of performance in the domain area (Clark, Feldon, van Merrienboer, Yates, & Early, 2006). As the professionals provide you this insight, be sure to ask them to define unfamiliar terms and to provide examples for key concepts or approaches. These kinds of interviews help you make the connection to the real-world practices and procedures that are associated with the performance area.
- Contact recruiters or high-level decision makers who routinely higher performers in the domain area. Ask them what criteria they would use to determine whether someone is highly proficient in the area. Consider asking them how they might assess in a short amount of time whether someone is an expert or a novice in the domain area.
- Look over job descriptions, training materials, and other written documentation about the performance area (Clark et al, 2006). By reviewing extant documents, you will be better prepared to conduct interviews with experts, and you will also be able to later identify discrepancies between existing training/performance support materials and expert performance.
- Determine whether any systematic inquiry has been conducted by researchers on expertise, expert performance, or novice-expert differences in the domain area of interest. In recent years there has been much interest in the study of expertise, and systematic studies on the psychology of expertise have been conducted in a broad variety of domain areas. If such research has been conducted in your area of interest, the findings would likely be of immense value to your task.

IDENTIFYING TASKS FOR FURTHER EXPLORATION

Once you have started to develop some understanding of the domain area, the next order of business is to use the results from your preliminary review to get a better sense about key cognitive tasks that you should consider studying using the cognitive task analysis approach. Your goal is to gather information on (a) tasks that are important, frequent and highly critical within the performance that you are studying, and (b) tasks or problems within the performance area that allow for discrimination between expert and novice performance (these tasks are sometimes referred to as "representative tasks").

Two of the most effective methods that you can use to begin defining tasks of interest for the knowledge elicitation phase of the cognitive task analysis are observations and interviews. For both of these methods you will want to identify some of the domain's high performers to use as a source of information (make sure that the performers who you observe at this stage in the process are not the same performers you intend to use for the actual "knowledge elicitation" process described below). When doing interviews, you may opt to take a "go with the flow" approach, or you can ask the experts to focus on a specific aspect or task related to the domain area. The key thing you want to walk away with is a better understanding of the knowledge structures associated with the task area, as well as some of the main types of decision-making, evaluation and synthesis processes that experts have to work through to perform effectively in the domain (Clark et al, 2006). Ideally you will complete some interviews before you conduct observations, because this will ensure that you can focus your observation on those tasks that are really central to the performance area.

It is best to conduct the observations in the "real-world" setting in which the experts normally perform. During the observations, place yourself in an unobtrusive location and watch the experts as they engage in the tasks of interest. Observe and record the performers' actions, making special note of those moments in the when it seems that they are actively engaged in problem solving, decision making, or other types of cognitive processes. To make the observations as useful as possible, make sure to (a) avoid interrupting the experts during the observations, and (b) avoid communicating either positive or negative judgment regarding their performance (Clark et al, 2006).

Having completed both interviews and observations, you should now be ready to map out the tasks of interest in more detail. Look over your notes and identify the steps, sub-steps, knowledge and skills that comprise the tasks that you wish to study further. Strive to use a concept mapping or flowcharting application (such as Microsoft Visio, Inspiration, or CMAP) to create visual representations of the relationship between the tasks, subtasks and knowledge in the performance area. Ideally, your visual representations will have a hierarchical structure, with the highest level cognitive processes at the top and underlying knowledge and skills underneath. As you refine your visual representations, consider sharing them with professionals in the performance area. Ask the professionals to identify any errors, omissions, or inconsistencies. Once your visual representation is more-or-less stabilized, use it to identify one or two specific performance tasks that you will use during the knowledge elicitation phase.

LAY THE FOUNDATION FOR EXPERT KNOWLEDGE ELICITATION

The demands placed on your organization's experts and highest performers are likely to be considerable. For this reason, it is very important that you ensure that you do advance planning for the knowledge elicitation. Below are some planning tips that will ensure that the data collection and analysis for the cognitive task analysis are as efficient as possible.

1. Determine whether your knowledge elicitation phase will be focused on codifying high-level performance, or on identifying those cognitive processes that distinguish novices from highly competent performers.
2. Select the knowledge elicitation method(s) that you would like to use to identify, cluster, link, and prioritize the critical cognitive decisions that are routine in high level performance in the domain area. All of these knowledge elicitation methods can be used with expert performers. If you intend to also gather information from novices, however, it is recommended that you select either interviews or concurrent verbal protocol analysis as knowledge elicitation methods, since the other techniques assume a high level of domain knowledge.
3. Structured & unstructured interviews: Using a combination of interviews, the expert is asked to list key steps, decision points, procedures, and so on for the performance area of interest.
4. Concurrent verbal protocol analysis: The expert is asked to verbalize all thought sequences while performing a "representative task" in the performance area of interest.
5. Applied cognitive tasks analysis: Several sequential and structured interviews are conducted with each expert, with each interview generating results that are used to define the subsequent interview.
6. Critical Decision Method (also referred to as "Critical Incident Technique"): The expert is invited to recall a critical or uncommon situation in the performance area of interest, and the analyst works with the expert to systematically identify decisions, cues and so on in the context of the critical incident.
7. Create a protocol that you can use to structure the knowledge elicitation process. Your protocol will differ depending on which knowledge elicitation method you select. Below are recommendations for the design of the protocols based on the intended knowledge elicitation techniques:
    - Protocol for structured & unstructured interviews: Develop instructions and questions for interviews, focusing on key decision points, procedures for choosing between different options at decision points, and domain knowledge.
    - Protocol for concurrent verbal protocol analysis: Develop a script that gives participants information on procedures for verbalizing thought sequences, as well as a few simple problem solving tasks that can be used to practice the verbalization process. The protocol should conclude with the presentation of the main problem (based on the representative task).
    - Protocol for critical decision method: Develop instructions and questions, focusing on key decision points, procedures for choosing between different options at decision points, and domain knowledge in use in the critical incident identified by the expert.
8. Carefully select the experts or high performers that you would like to use for the knowledge elicitation.
9. Plan on using several experts as sources of data (Clark et al, 2006). This will ensure that you can look for consistent trends associated with high performance across individuals.

10. Seek to involve experts who have recently been involved in performing the tasks that are the focus of your cognitive task analysis (Clark et al, 2006).
    - Determine whether you have access to experts who have also had experience training people in the domain area (Clark et al, 2006). If you do, those are excellent participants for the cognitive task analysis.
    - Avoid using experts whose advice and insight you solicited during the first two phases ("Familiarizing Yourself with the Domain Area" and "Identifying Tasks for Further Exploration").
11. If the cognitive task analysis will be conducted by someone other than you, identify someone to serve as the cognitive task analyst. Note that it is highly desirable to choose this individual carefully. Ideally, it is someone who can interact comfortably with the subject matter expert and who can learn domain/task-specific terminology efficiently.
12. Secure an appropriate location for conducting the knowledge elicitation. Generally, a quiet, spacious location is most desirable. Ensure that the location comes equipped with the tools or resources that the expert may need to use during the knowledge elicitation process.
13. Determine how you will capture the data from the knowledge elicitation process. You may want to use a combination of note-taking, audio recording, and/or video recording. If you decide to use audio or video recording techniques, be sure to get participants' permission in advance. Test out the equipment to make sure that it functions properly before you begin the focused knowledge elicitation.

GATHER DATA THROUGH KNOWLEDGE ELICITATION TECHNIQUE

You are now ready to implement the procedures you have outlined for eliciting knowledge from the experts. During the "knowledge elicitation" phase you apply the technique(s) that you selected in the previous phase (e.g., interviews, verbal protocol analysis), with the goal of gathering the amount and type of data that is needed in order for you to develop a clear sense of the nature of the cognitive processes that underlie performance in the domain area of interest.

Since people generally do not feel immediately at ease with being recorded, and since the process to be used may not be familiar to the expert, it is highly recommended that you run the expert through a short sample session of the knowledge elicitation shortly before conducting the actual knowledge elicitation session. This is particularly relevant if you choose to implement a concurrent verbal protocol analysis, an applied cognitive task analysis or the critical decision method.

TRANSCRIBE AND ANALYZE DATA

If you have recorded the knowledge elicitation session(s), transcribe the recorded information into a text-based format.

Prepare the transcripts for further categorization and synthesis by coding the transcripts (Clark et al, 2006). Pay special attention to diagnosing and characterizing key decisions points based on the techniques used, cues signaling the decision points, and the inferences made.

Provide a copy of the formatted results from the knowledge elicitation to each of the experts from whom you gathered data (Clark et al, 2006). Allow the expert to make any suggestions

for changes or clarifications. Next, integrate edits and adjustments recommended by the expert.

Once coding has been completed, organize the data from each of the transcripts into a format that summarizes and categorizes the data. Finally, compile the summarized data from all of the transcripts.

FORMAT RESULTS FOR INTENDED APPLICATION

1. Using the formatted results from the expert knowledge elicitation sessions, create a single model task analysis, representing all the skills, knowledge and strategies used by the experts when functioning in the task area (Clark et al, 2006).
2. Write a summary report of the findings from cognitive task analysis.
3. The task analysis is an essential ingredient to talent management and should be used as a point of comparison with other assessment data (e.g., surveys, interviews, focus groups) in order to inform decisions about how to best support the talent within your organization.

*** Insert Table 1 About Here***

TIPS FOR SUCCESS

Strive to be very systematic in your analysis. Take care notes about what you learn from the cognitive task analysis and systematically compare those findings with information gathered from other processes.

Expert performers have often internalized or made habitual many of the key decisions that go into performing the related steps within the task. This makes completing a cognitive analysis challenging. Aid expert performers in communicating their cognitive processes by using techniques such card sorting, process tracing, or concept mapping.

Use the findings from your cognitive task analysis to inform decisions at multiple stages of the talent management process (for instance, recruiting, hiring, training, coaching, or succession planning).

REFERENCES AND RESOURCES

REFERENCES

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WEB SITES

- Cognitive Task Analysis (by Clark, Feldon, van Merriënboer, Yates and Early): http://www.cogtech.usc.edu/publications/clark_etal_cognitive_task_analysis_chapter.pdf
- Cognitive Task Analysis (from NATO): http://ftp.rta.nato.int/public//PubFulltext/RTO/TR/RTO-TR-024/TR-024-$$ALL.pdf
- Protocols for Cognitive Task Analysis (from the Institute for Human and Machine Cognition): http://ihmc.us:16080/research/projects/CTAProtocols/ProtocolsForCognitiveTaskAnalysis.pdf

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TABLE ONE: COGNITIVE TASK ANALYSIS PLANNING GUIDE

Cognitive Task Analysis Activity	Date To Be Completed By	Person Responsible for Completion
Develop background on the task and context.		
Identify experts to participate in the task analysis.		
Identify associated knowledge structures.		
Create knowledge representations.		
Determine who will conduct the task analysis.		
Select one or more knowledge elicitation methods.		
Develop appropriate protocols for completing the task analysis processes.		
Complete a formative evaluation of the task analysis protocols through practice sessions.		
Collect information from expert performers through the selected procedures.		
Code and synthesize findings from the task analysis.		
Compare and contrast results from the cognitive task analysis with findings from other performance analysis processes.		
Prepare a report on the findings of the task analysis.		