"Critical Decision Method for Eliciting Knowledge",

"by Gary A. Klein, Roberta Calderwood and Donald Macgregor",
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"Critical Decision Method (CDM)" is a retrospective interview strategy that applies a set of cognitive probes to actual non-routine incidents that required expert judgment or decision making

There have been extensive efforts to improve the quality of human performance in decision making tasks.
For example;

a) development and implementation of technologies to aid decision making
b) the design of instructional curricula
c) the design of systems to automate critical task functions.

Why is it that the behavioral science has not already provided knowledge elicitation tools? Because, a) most researchers have emphasized process of cognition, b) methodology has focused on studying cognitive process in context-restricted laboratory environments.
There have been very few methods for eliciting this content knowledge a) multidimensional scaling, b) network analysis, c) repertory grid analysis and d) protocol analysis.
CDM relies on a type of protocol analysis for recalled events. These retrospective protocols are less disruptive, applicable to a wider set of naturalistic tasks.

Although, there have been no attempts to define expert and novice in absolute, the expertise should have

a) factual knowledge: explicit, objective
b) tacit knowledge: appreciation of contextual implications, contextual knowledge, if/then rules, analogical inference, judgment of typicality
c) perceptual learning/perceptual-motor feel: ability to manipulate task automatically

There has been a tendency to emphasize explicit and objective knowledge. Yet, the other aspects of expertise are important and necessary to proficient levels of performance. It may not be possible to analyze tacit knowledge, but knowledge elicitation methods should describe the function served by tacit knowledge in proficient task performance so that it should not appear that explicit knowledge is sufficient for proficient performance

There are some practical knowledge elicitation issues;

a) eliciting time, b) cost-effectiveness of data collection and analysis, c) timeliness of the results, d) level of training needed for the knowledge elicitation data, e) packaging of the knowledge elicitation results.

Consequently, knowledge elicitation methods should be able

a) to address the basis of proficiency for highly skilled personnel
b) to be applicable to field conditions as opposed to well-controlled laboratory environments
c) and the products of the knowledge elicitation should have applied value in terms of training, system design, or development.

CDM have several features sharing with other interview as well as having unique features;

a) CDM focus on non-routine cases.
b) CDM is case-based approach.
c) CDM is not limited to responses that can be objectively anchored and verified. It tries to probe cognitive aspects of experts.
d) CDM using semi-structured probing.

The procedures of implementing the CDM are like bellows;

a) Select incident: that can illustrate non-routine aspects of a domain. Researchers ask decision maker to select an incident that was challenging and that have differed from someone with less experience.
b) Obtain unstructured incident account: Interviewee is asked to describe from the time when the incident was judged to be under control. This procedure accomplished several goals
    i) It created a context for understanding on the part of the interviewer
    ii) The account served to activate the interviewee's memory of the event as a context for questioning
    iii) It helped researchers archive a high level of cooperation from the interviewee by establishing researchers as listener rather than interrogators.
c) Construct incident timeline: The interviewer proceeded to reconstruct the account in the form of a timeline that established the sequence and duration of each event. Events include both objectively verifiable occurrences and thoughts and perceptions reported by interviewee. The timeline served to establish a shared awareness of the "facts of the case" from the interviewee's perspective. Questions about the timeline focused on the interviewee's attention on events from more than a single time perspective.
d) Decision point identification: During the timeline construction, specific decisions were identified for further probing. A decision point was probed if the interviewee would agree that the other reasonable courses of action were possible or that another interviewee might have chosen differently.
e) Decision point probing: cues, knowledge, analogues, goals, options, basis, experience, aiding, time pressure, situation assessment, hypothesis, etc.
f) Additional procedures(Suggestion):
    i) Whenever possible, use a pair of interviewees
    ii) Having interview pairs also serve to allow a less-experienced interviewer to gain experience without having to risk valuable interview time.
    iii) Usually interviews are tape recorded
    iv) Usually interview session are planned to last for about two hours
    v) It is valuable to allow the interviewee to draw a diagram during the recounting of an incident and in response to specific probes.

    How reliably a "decision point" could be identified from the unstructured portion of the interview?
    – As a result of assessing the inter-coder reliability of the method, the range of the agreement was 81%~100%.
    – The interview methods are sensitive to the domain experience of the interviewer.

    How reliably the decision could be classified in terms of the identified strategies?
    – As a result of assessing the inter-coder reliability of the method, the range of the agreement was 66.5%.
    – The coders had difficulty in making the discriminations at this level of detail.

The results of implementing CDM should be analyzed to set up descriptive decision model which is a system that could distinguish the decision strategies between experts and novices. Several research have reported both group (experts and novices) relied on recognitional decisions, but when deliberation was reported the novices were more likely to concurrently deliberate on the option evaluation dimension. One of the products of CDM could be a CCI (Critical Cue Inventory), which is a collection of all of the informational and perceptual cues that are pinpointed in the protocols. The CCI served as the basis for the design of training materials to teach these perceptual discriminations

The result of using CDM for eliciting knowledge has been applied to
a) Knowledge engineering for building expert systems
b) Evaluating expert systems
c) Identifying training requirement

Research Questions

a) What is the general and absolute definition or criteria of the expert and novice?
b) Authors said “Retrospective protocols are less disruptive, applicable to a wider set of naturalistic tasks”, but how can we explain a effects of schema when we perceive represent a incident.
c) Authors said “Serial evaluation (of options) has clear benefits for most applied time sensitive contexts.” Is there any research of the comparison between “concurrent evaluation” and “serial evaluation” in terms of time effectiveness?
d) Authors suggested using a “semi-constructed probing”, which is aim for reducing effects of the interviewer’s interrogation during interviewee’s verbal retrospective protocol. At the same time, a procedure of the “Decision point identification” includes interviewer’s questioning for further probing. How can we make a balance between interrogation and probe.
e) Authors agreed that interviewer (or researcher) had difficulty with making classification of the decision into the identified strategies. What improvements should be studied for solving this problem?