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Supporting Critical Thinking with Critiquing Systems in Military C2 Environments

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OUTLINE

- Critical thinking: principles
- Critiquing systems
- Dialogue paradigm
- Critiquing process
- Errors and biases
- Critics: knowledge & strategy
  - Generic critics
  - Experiential critics
- Conclusion

Critical Thinking

Critical thinking is the ability to think about one's thinking in such a way as to recognize its strengths and weaknesses and, as a result, to recast the thinking in an improved form.

Needed because of:

- Increasing complexity
- Changing character of military operations
- Information overload
- Increased responsibilities

Critical thinking in the military context

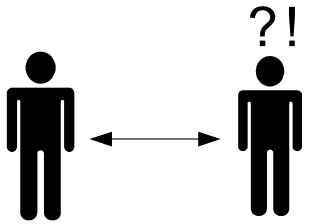
- Asking questions
- Clearly defining the problem
- Seeking & examining evidence
- Closely examining reasoning and assumptions
- Analyzing basic concepts
- Avoiding oversimplification
- Considering alternative viewpoints
- Tracing out implications and consequences

Critiquing systems

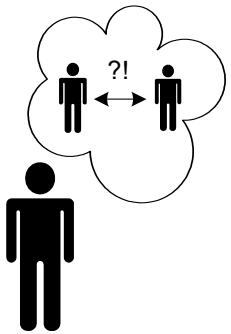
- A class of program that receive as input the statement of the problem and the user-proposed solution and produce as output a critique of the user's judgment and knowledge.
- Feedback to user:
  - Report errors
  - Point out incompleteness
  - Suggest alternatives
  - Offer heuristic advice

Dialogue paradigm

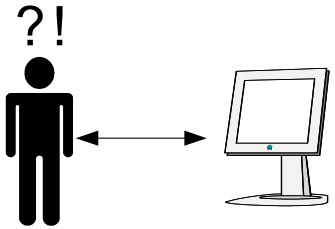
Critical discussion



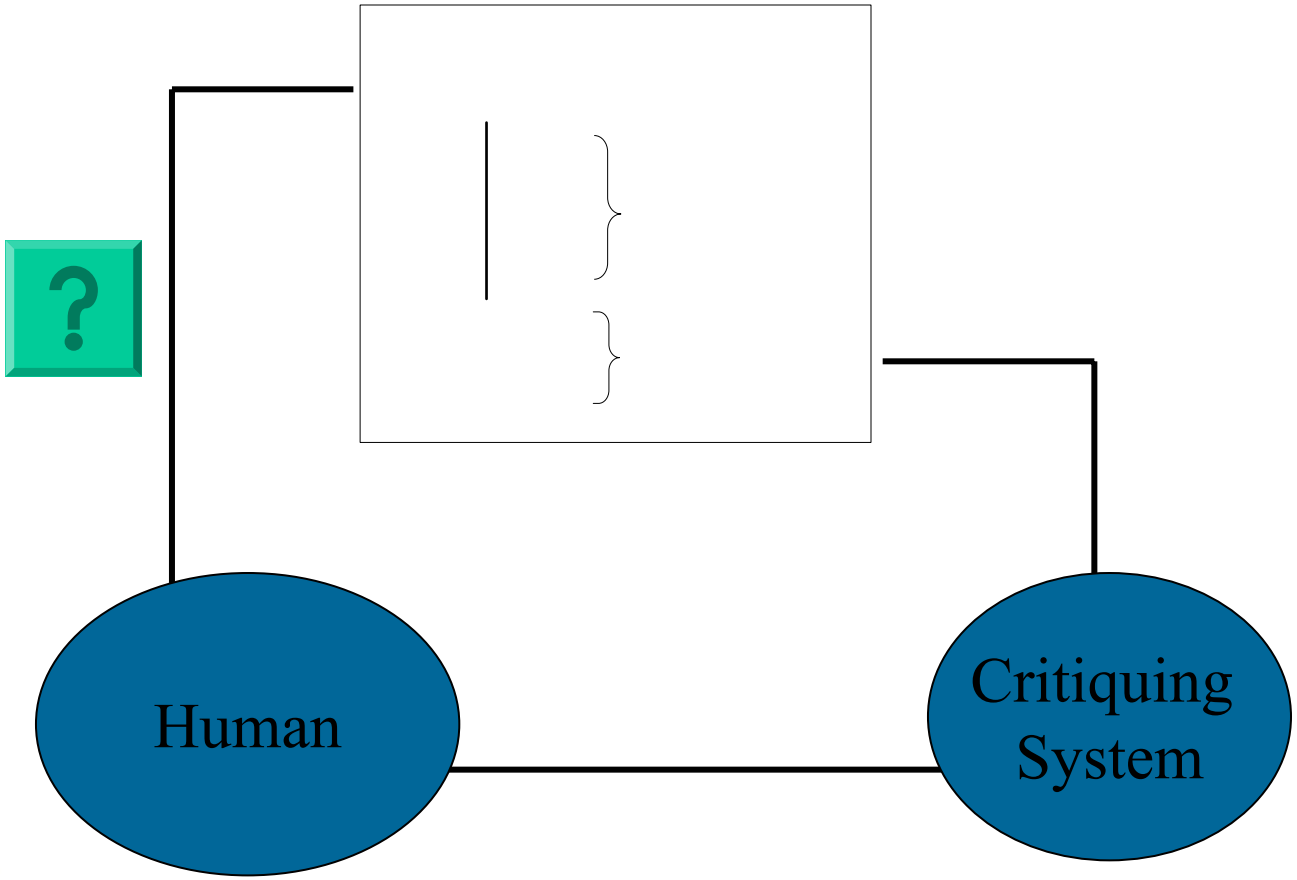
Critical thinking



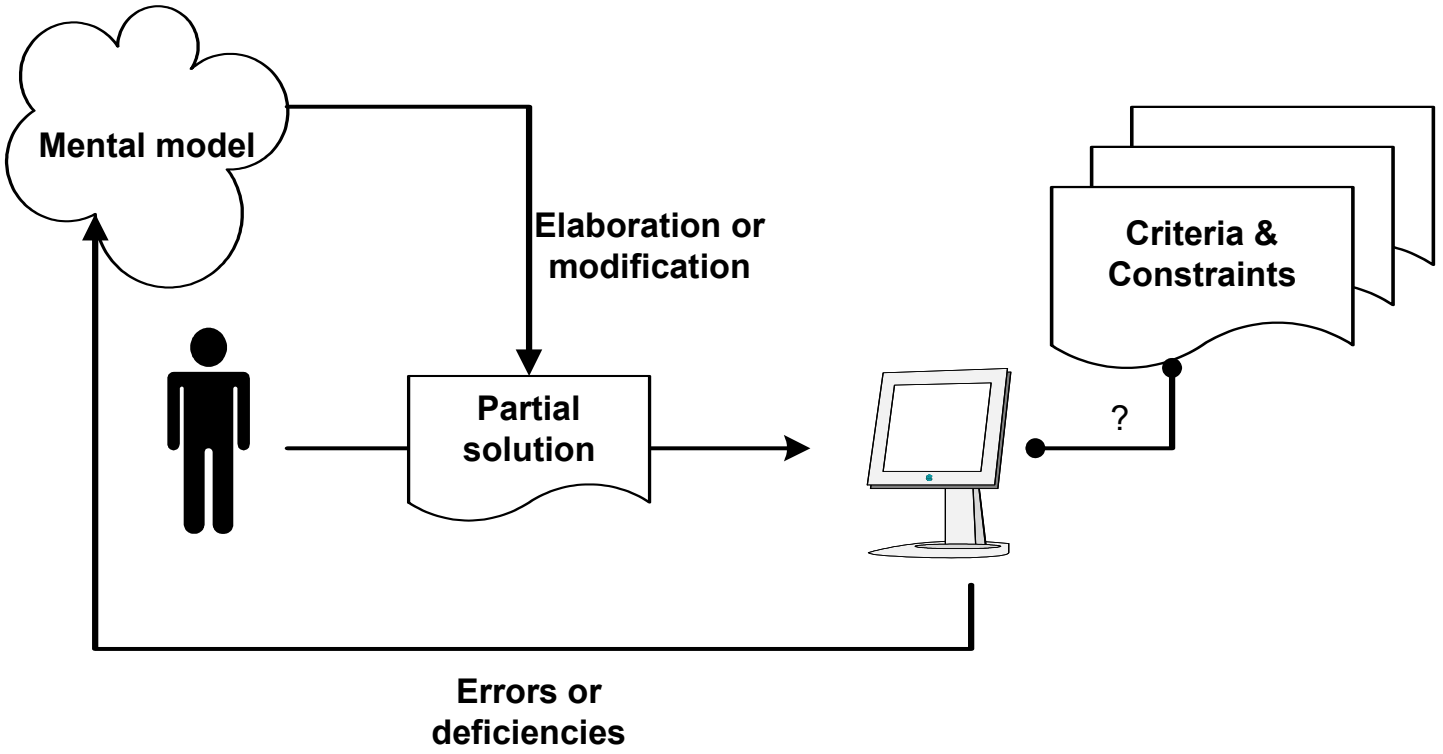
Critiquing systems



Critique versus Evaluation



Critiquing process



Errors & Biases

- Knowledge errors due to missing concept or missing knowledge
- Errors in reasoning processes due to cognitive bias or systematic selection of poor judgment heuristics
  - Force of habit
  - Selective perception
  - Availability bias
  - Confirmation bias: seeking information consistent with current beliefs and avoiding falsifying evidence.

Overlooked and/or missing knowledge

Critic can provide (in training sessions):

- Doctrine-related knowledge that the practitioner ‘normally masters but has neglected to apply’.

- Experiential knowledge that is based on other individuals’ experiences and observations and which are either unknown or not accessible to the user.

Generic critics

- Provide general knowledge about standard practices
- Remind certain rules, criteria, constraints
- Check whether procedures have been followed & requirements have been met

Constraint-satisfaction problem-solving

- Manage multiple factors (procedures, risks, benefits, side-effects, cost)
- Check for inconsistencies and problematic conditions
- Check whether alternative solutions have been considered

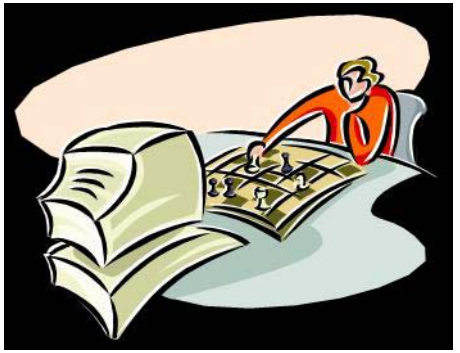
Generic critics: strategies

Leading Question Asking, Explaining, Arguing

- Problem has been correctly identified
- Right objectives
- Objectives have been clearly articulated
- All options have been considered
- Relevant criteria
- Undesired consequences
- Valid assumptions
- Correct inferences

Human-system criticism dialogues in a training context

- Different problem solving approaches
- Tolerance to system-generated critiques
- Tolerance to intrusiveness
- Openness to different perspectives
- Evaluation of data independently from personal goals and beliefs



Experiential critics

- Relate past experiences and observations to the current problem-solving situation.
- Make the user regress to distributional data (knowledge about distribution of outcomes in similar situations)

Case-based reasoning &
Lessons learned management

- Capture and organization of knowledge for future use
- An approach to incremental, sustained learning

Case-Based Reasoning

- Supports analogical reasoning.
- Use of specific knowledge of previously experienced, concrete problem situations as opposed to making associations along generalized relationships.
- Detailed information that can support inexperienced individuals.
- Constitutes corporate memory.

Lessons Learned

- Lesson: ‘A validated experiential knowledge from a work experience.’
- Tacit knowledge that can be reused to improve a process by suggesting a relevant contribution to a work practice.
- Allows evaluation of both successes and failures.
- Not solutions to problems but relevant elements that may support or impede a reasoning process.

Experiential critics: strategies

- Critic uses knowledge assets (CBR, LL) to make recommendations proactively.
- Acquaint the practitioner with knowledge he is unaware of.

Provide knowledge at different levels of description.

  - Critic hints at information based on detected similarities (area of operation, type of threat, etc.).
  - User proceeds to further examination of cases, thus contextualizing advice, observation, positive or negative critiques.
  - User determines to what extent retrieved experience can apply.

Experiential critics

- Provide specific knowledge that can only be acquired through the experience of co-workers (e,g. information about remote countries with different social, religious and cultural backgrounds).

Experiential critics

- Avoid use of heuristics (schema-driven reasoning) in unfamiliar situations.

1. Familiar situation: Not to overlook data that are not integrated into his schema of decision situation.
2. Unfamiliar situation: Take advantage of his co-workers' knowledge and experience.

(Personal experience improves decision-making only for well-practiced or anticipated tasks with established procedures)

Experiential critics

- Operate both on errors of knowledge and errors of reasoning.
  - Target confirmation bias and availability biases (similar situations but different outcomes)
  - Fill the gaps of knowledge (missing from usual training)
- Reduce cost of learning
- Learn to think critically

Conclusion

- Provide ‘unsuspected’ knowledge;
- Make the user consider relevant criteria & issues;
- Make the user question position and assumptions;
- Draw the user’s attention on alternatives he had not foreseen;
- Promote reflection & create learning opportunities;
- Enroll the practitioner into the habit of gathering data and considering different perspectives before committing to a decision.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