Collaborative Critical Thinking

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Overview

- A Collaborative Critical Thinking framework for
  - understanding
  - measuring
  - training and
  - supporting
- Technology
- Experimentation
Collaborative Critical Thinking Framework
Foundations in Science & Theory

- Information age warfare
  - Teams are distributed, ad hoc, multi-disciplinary, mission-critical
  - Teams require coordination & collaboration
    - Manage forces & information
    - Achieve effects
  - Supporting coordination & collaboration requires measurement

- Coordination & collaboration processes can be measured

- Collaboration often involves critical thinking. For individuals, CT
  - Is found in transcripts of planning
  - Can be trained
  - Improves mission performance in Air Defense scenarios

- Alberts, Garstka, Hayes, and Signori (2001)
- Letsky et al. (2003)
- Macmillan, et al., 2001
- Miller, Price, Entin, & Rubineau, 2001
- Moon, et al., 2000
- Cohen, Freeman, and Thompson, 1998
- Cohen and Freeman, 1997
Overview: Collaboration

- Collaboration
  - Consists of functions (or processes) ...
  - That effect C2 ...
  - Which produces mission effects

- What are collaboration functions, particularly Collaborative Critical Thinking?
Collaboration involves*
1. Process knowledge
2. Domain knowledge
3. Team knowledge
4. Negotiating solutions
5. Testing & revising solutions

*(Letsky et al., 2002)
Framework 2: Collaborative Critical Thinking

- Collaborative critical thinking* engages multiple team members in
  - Monitoring for uncertainty
  - Detecting opportunities to handle it
  - Specifying problems
  - Solving problems & gathering info

- CCT can be applied to
  - Assessments
  - Plans
  - The team process & structure

Framework 3: Dispositions Support Critical Thinking

- Critical thinking skills may be driven (in part) by dispositions*
  - systematic inquisition to find truth

- Measures
  - Observational
  - Standardized instruments
  - Self report

* Facione, 1998
Collaborative Critical Thinking

- Define, Measure, Train and Support Collaborative Critical Thinking
- Measure its effects on C2 & Mission outcomes
Concept for a CCT Support Tool

- The setting
  - A geographically distributed team in a long working session
  - The team leader wants to monitor CCT activity
  - Team members need reminders to engage in CCT

- Two components
  - Respondents’ tool –
    - Elicits data concerning team member monitoring, assessments, critiques, actions
    - Cues team members to monitor, assess, critique, act
  - Leader’s tool
    - Helps leader or aid plan, poll for, and analyze collaborative critical thinking activity
Workspaces in a Distributed Team
A Pop-Up Probe
Opportunity to Rate and Comment
Some team members believe the plan is flawed. Time is available to critique the plan. Use it.
Participation Statistics
Leader’s Configuration Interfaces

- Configure (clockwise)
- Work session
- Probes & schedule
- Participants
CCT Probes
Criteria for CCT Probes

- Probes consist of
  - CCT template: “Are you confident in the plan...”
  - Mission-specific content: “to use ground observers to assess battle damage?”

- Probes measure CCT with quick ratings re:
  - Monitoring, Assessing, Critiquing, Action

- Probes elicit CCT
  - Comments

- Team CCT states → diagnosis & action
Monitoring for Uncertainty

- **Team:** “Are you confident in the plan *to use ground observers to assess battle damage?*” (0=No 10=Yes)
  - Low variance = Consensus. Don’t invest time in critiquing this plan unless the situation changes.
  - High variance = Little agreement, high uncertainty. If time is available to critique the plan, focus here.

- **Analysis & Advice**
  - **High confidence, strong consensus**
    - Advice: Do not invest time in critiques on this issue unless the situation changes significantly.
  - **Low confidence, strong consensus**
    - Advice: Critique this issue if time allows.
  - **Weak consensus**
    - Advice: Poll team members with low and high confidence to identify misperceptions or problems
"How much time is available before the team must commit to a decision concerning use of ground observers for BDA?"

- Low estimates, low variance
  - No time to critique plans. Don’t do so.

- High variance
  - Advice: Some team members have time constraints not understood by their team members. Have team members discuss their time constraints.
  - Advice: Some team individuals misperceive the time course of the mission. Talk with the team members with the tightest time constraints to understand if their constraints are realistic. Correct this.
Experiment
Objective:
- Determine the relative importance of cognitive and dispositional factors in CCT.
- Determine the impact on C2 and mission outcomes of
  - Training cognitive factors and
  - Sensitizing dispositional factors

Method:
- Each of 3 team members receive
  - Training in several cognitive aspects,
  - Sensitization to several dispositional aspects
  - Both, or
  - Neither
- Teams execute 2 TDGs
Tactical Decision Games*

- You are the commanding officer of Company G, Battalion Landing Team 2/2, the small boat company of the 26th Marine Expeditionary Unit (Special Operations Capable).
- Your company is currently embarked aboard the USS Austin, and it is part of a combined U.S.-Baklavarian amphibious task force responding to an escalation of arms smuggling in the Adriatic Sea.
- Arms smugglers continue to use the small, uninhabited islands along the central Baklavarian coast as transshipment points for weapons to insurgent groups operating in the southern Astorian Sea.
- Etc...

*Marine Corps Gazette
Analyses

- Measures
  - Counts of skills observed in dialogues
  - Self-reported use of skills
  - Correctness of solutions

- Analyses
  - Evaluate impact of training & sensitization on outcomes
  - Estimate unique contributions of cognitive and dispositional factors using hierarchical regression
Collaborative Critical Thinking

- Objective
  - Define
  - Measure
  - Train and
  - Support

- Collaborative Critical Thinking for teams
  - Multi-expert
  - Distributed
  - Ad hoc
  - High stakes
Mike: JFACC Rear (CONUS Junior Analyst) calls Gavan to discuss the current situation. They are using NetMeeting to share information.

Gavan: JFACC Forward Analyst in charge of mission planning
Theory Development:
Example of Collaborative Critical Thinking

The Situation: A long-range mission is in progress to attack pre-targeted areas in Ichtar and West Ichtar and is scheduled to commence at 0800. One of the specific targets which impacts the entire mission is a fortified SAM site. Electronic Intelligence has reported that the site has remained stationary for over a year. In addition, Imagery out of Langley reports the absence of any support vehicles necessary to facilitate relocation. Four hours before the attack begins, Communications Intelligence out of NSA reports that the fortified SAM site is indeed on the move.

A group of JFACC analysts is required to make sense of all this information. The location of the SAM site influences both allocation of friendly resources and the protection of friendly forces. One of them is concerned that the location of the SAM has become uncertain.

Mike monitors for uncertainty concerning the situation and plan.
Theory Development:
Example of Collaborative Critical Thinking

- Mike: Gavan we need to redirect our friendlies to account for SAM A34’s relocation.
- Gavan: If there’s a new threat, yes we do. Which SAMs, briefly?

*Mike & Gavan assess the importance of resolving this uncertainty*
Example of Collaborative Critical Thinking

Mike: Blue arrow, due north of the river Ichtar.
Theory Development: Example of Collaborative Critical Thinking

- Gavan: Ok. I thought this SAM was fortified, stationary?
Mike: Negative. COMINT has just reported that the SAM is moving. Here is a copy of that report.
UUUUFM: NSA/CSSTO: JFACCSUBJ: POSSIBLE SAM MOVEMENT(U)
THE SA-6 LOCATED AT 32U345098 IS POSSIBLY PREPARING TO
MOVE LOCATIONS. VOICE COMMUNICATIONS BETWEEN
OPERATORS INDICATE THAT PREPARATIONS NECESSARY FOR
THE MOVEMENT MAY HAVE BEGUN AS EARLY AT 0030Z.
Theory Development: Example of Collaborative Critical Thinking

- Gavan: I see it. Didn’t ELINT and IMINT report no movement and no support.
Theory Development: Example of Collaborative Critical Thinking

- Mike: Roger.

- Gavan: That doesn’t make sense. Doesn’t COMINT get their information from the other two?

  *Gavan identifies a source of uncertainty.*
Theory Development: Example of Collaborative Critical Thinking

- Mike: That’s my understanding, but I will confirm that.
- Gavan: So, we should check back to make certain these reports are correct. Why don’t you check back with IMINT and I’ll check back with ELINT to verify this information. We still have a bit of time. Ask them how conclusive their information is. How did they decide this SAM would not move?

Gavan produces a plan to refine their confidence in the information.
Example of Collaborative Critical Thinking

- Mike: Shouldn’t we decide on a time to abort the mission or at least to make a final call?

- Gavan: Yes. Probably the safest thing to do would be to cancel the mission if we aren’t certain. That way, no friendlies will be compromised due to a lost SAM. Let’s huddle no later than 0500 and make a final call no later than 0600.

Gavan & Mike will produce a contingency plan
Mike: But wouldn’t we miss the opportunity to hit these other sites? Do we know why we are hitting these sites today?

Mike monitors for sources of uncertainty and risk, and prompts Gavan to help identify them.