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EVALUATING A MODEL OF TEAM COLLABORATION via TEAM COMMUNICATIONS

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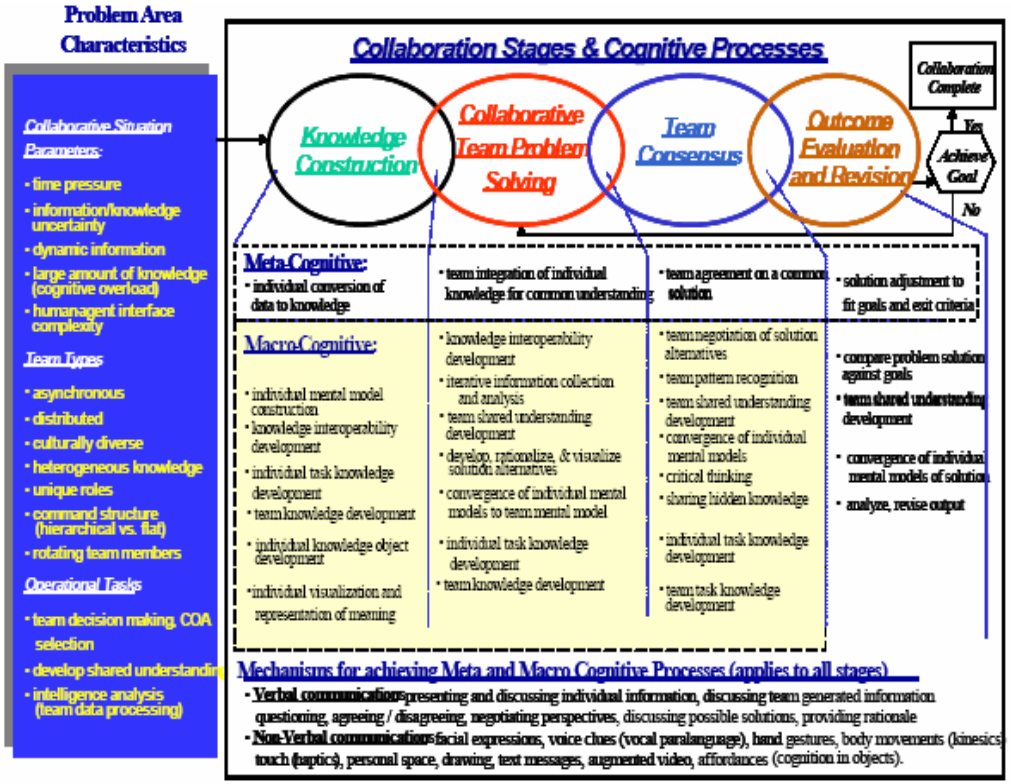
NPS Testbed for Team Collaboration Model Validation

Objective

- Better understand cognitive processes employed when teams collaborate to solve problems

Approach

- Analyze team communications data using cognitive process definitions
- Validate and refine the model of team collaboration



Data Analyzed

- Three Maritime Interdiction Operations (MIO) experiments
- Four Air Warfare scenarios
- Firefighters 9-11

Team Collaboration Model Validation

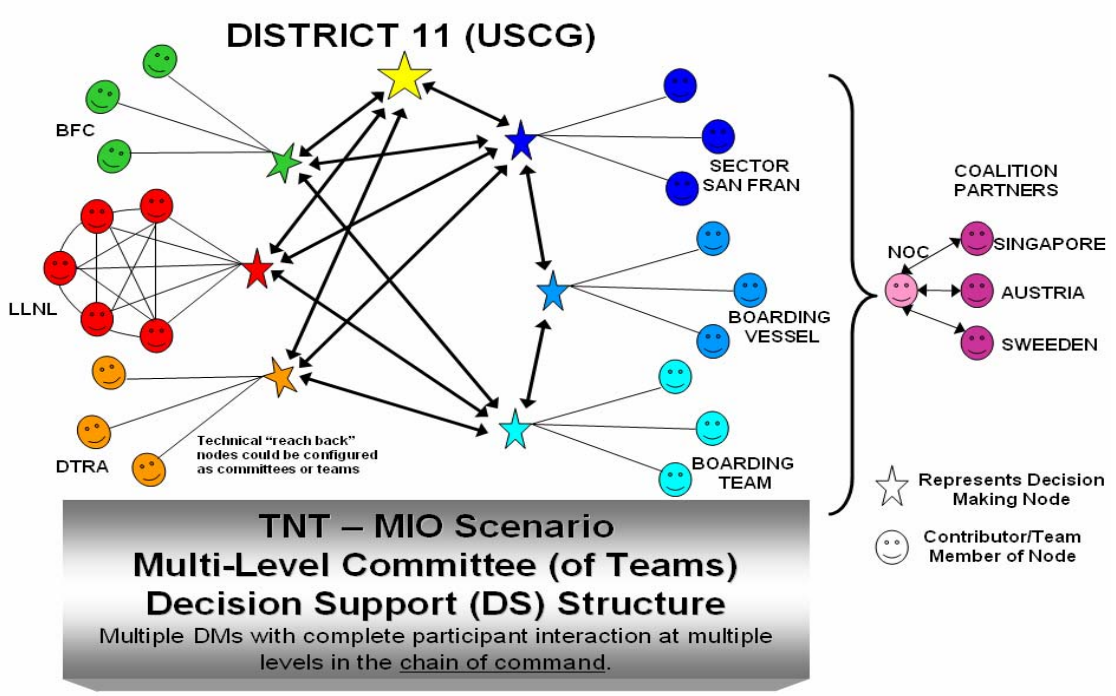
GOAL: Understand and improve effectiveness of team decisionmaking in complex, data-rich situations by validating model of team collaboration

Model of Team Collaboration Defines:

- Meta-cognitive processes that guide team collaboration
- Information processing components the team performs to achieve each collaborative stage
- Communication mechanisms used by the team to build the necessary knowledge
- Emphasizes cognitive aspects of collaboration process — includes major cognitive processes that underlie this type of communication:
  - (1) Individual knowledge building
  - (2) Knowledge interoperability
  - (3) Team shared understanding and
  - (4) Team consensus (Warner, Letsky, & Cowen, 2004)
- Validate that these processes exist and how they contribute to team performance through verbal protocol analysis coding of team communications.

Types of Problem Solving Situations

- Ill-Structured Decisionmaking Tasks
- Time Pressure
- Dynamic Information
- High Information Uncertainty
- High Cognitive Workload
- Human System Interface Complexity



Team Types

m Adm Cebrowski Network centric warfare

- Asynchronous
- Distributed
- Culturally Diverse
- Heterogeneous Knowledge
- Unique Roles
- Command Structure
- Rotating Team Members

Operational Tasks

- Team Data Processing
- Developing Shared Situational Awareness
- Team Decisionmaking and Course of Action Selection

Office of Naval Research
Collaboration and Knowledge Management (CKM) Program
MODEL OF TEAM COLLABORATION
Focus on Macro-Cognition (September, 2005)

Problem Area Characteristics

Collaborative Situation Parameters:

- time pressure
- information/knowledge uncertainty
- dynamic information
- large amount of knowledge (cognitive overload)
- human-agent interface complexity

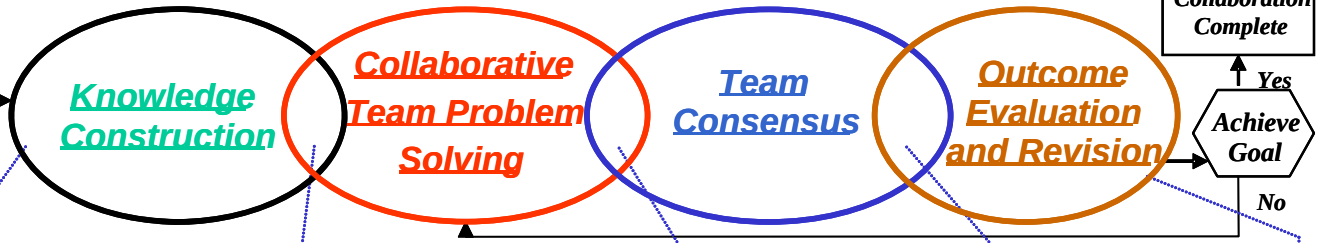
Team Types

- asynchronous
- distributed
- culturally diverse
- heterogeneous knowledge
- unique roles
- command structure (hierarchical vs. flat)
- rotating team members

Operational Tasks

- team decision making, COA selection
- develop shared understanding
- intelligence analysis (team data processing)

Collaboration Stages & Cognitive Processes



Meta-Cognitive:

Knowledge Construction	Collaborative Team Problem Solving	Team Consensus	Outcome Evaluation and Revision
• individual conversion of data to knowledge	• team integration of individual knowledge for common understanding	• team agreement on a common solution	• solution adjustment to fit goals and exit criteria

Macro-Cognitive:

Knowledge Construction	Collaborative Team Problem Solving	Team Consensus	Outcome Evaluation and Revision
• individual mental model construction • knowledge interoperability development • individual task, team and domain knowledge development • individual knowledge object development • individual visualization and representation of meaning	• knowledge interoperability development • iterative information collection and analysis • team shared understanding development • develop, rationalize, & visualize solution alternatives • convergence of individual mental models to team mental model • individual task, team and domain knowledge development	• team negotiation of solution alternatives • team pattern recognition • team shared understanding development • convergence of individual mental models • critical thinking • sharing hidden knowledge • individual task knowledge development • team task knowledge development	• compare problem solution against goals • team shared understanding development • convergence of individual mental models of solution • analyze, revise output

Mechanisms for achieving Meta and MacroCognitive Processes (applies to all stages)

- **Verbal communications:** representing and discussing individual information, discussing team generated information, questioning, agreeing / disagreeing, negotiating perspectives, discussing possible solutions, providing rationale.
- **Non-Verbal communications:** facial expressions, voice clues (vocal paralanguage), hand gestures, body movements(kinesics) touch (haptics), personal space, drawing, text messages, augmented video, affordances(cognition in objects).

Method

- Verbatim transcripts analyzed from two series of exp'ts and one real-world event where teams collaborated to solve a complex problem
  - Maritime Interdiction Operations (MIO)
  - Air warfare decisionmaking
  - Firefighters from 9-11
- In all three problem-solving tasks, assessment is difficult because available information is often incomplete or ambiguous.
  - Transcripts include communications between all team members and decisionmakers at distributed sites.
- Analyze and code team communications data using the cognitive process definitions developed by Warner, Letsky, & Cowan, 2004.
  - Focus of collaboration model is on knowledge building among team members and developing team consensus for selection of a course of action
  - Builds on previous work to validate model (Warner, et al, 2004)
  - Similar methodology applied to three different DMg tasks

Experiment I: Maritime Interdiction Operations

- Tech'l/oper'l challenges of developing global Maritime Domain Security
  - Wireless network for data sharing during MIO to facilitate reachback for radiation source analysis and biometric data analysis
  - Networking solutions for MIO where subject matter experts at geographically distributed command centers collaborate with boarding party in near real time to facilitate SA / COA selection
- Evaluate networks, adv'd sensors, and collaborative tech'y for rapid MIO
  - Rapidly set up ship-to-ship communications that permit them to search for radiation/ explosive sources while maintaining contact with mother ship, C2 organizations, and collaborating with remotely located sensor experts
- Boarding team boards suspect vessel, establishes collaborative network and begins inspections and data collection process
  - Boarding officer boards vessel with his laptop so he can collaborate with all other members of the team
  - Co-located on the ship, physically spread out (searching for contraband material and obtaining fingerprints of crew members)
  - Virtual members of the boarding team – experts at reachback centers
  - Commercial uses for certain radioactive sources, positive identification of the source in a short time is imperative
  - Pressure to conduct the MIO quickly so as to not detain the ship

MIO Team Members

- Members of the boarding team
  - Boarding Officer, a Coast Guard officer
  - Representative from Lawrence Livermore National Labs (LLNL) with portable radiation detection devices and “reach-back” capability to LLNL
  - Representative from the Defense Threat Reduction Agency (DTRA), who uses biometrics measurements of fingerprints and video imagery to be checked against databases at the remote facility
  - Representative from Special Operations Command (SOCOM), who provides guidance on handling hazardous material.

Maritime Interdiction Operations Scenario

- US Coast Guard ordered cutter to stop, board, and search commercial vessel of foreign origin suspected of transporting uranium enriching equipment
- Boarding party brings radiation detection/ biometric gear, drawings of dangerous equipment and people, and video recording capability
- Data collected on suspicious material, equipment, and people and sent to specific experts at distributed reachback centers
- Groove collaborative workspace brought expert services into the boarding party team's tool set
  - Facilitated voice and text communications between all members of the virtual boarding party and physical boarding party
- Requests, transmitted by text message -- taken for action, and radiation source spectrum captures were made of suspect containers that were detected to have a radiation signature presence
- Analysis led BO to recommend vessel be quarantined for further inspection
- Biometric team took digital prints of the crew to be compared to known criminal prints and latent prints from terrorist and crime scenes

Air Warfare Decisionmaking

- Air warfare DMg - conducted in combat information center of Navy ship
- Identification of large number of air tracks under high time pressure
  - Multiple hypotheses regarding threat level posed to the battlegroup due to high level of ambiguity associated with the data
  - Nature of the data, complex judgments required, and socio-technical environment characterized by high workload, and high stakes, create challenging problem for the air warfare team
- Incoming info arrives via various sensor systems (radar, electronic sup't measures system, identification friend or foe, etc.), various reports, e.g., intell, other platforms in area pass messages regarding situation
- Reports passed to rest of team over any of several comm's systems
  - Heard by all team members, reports typically addressed to specific team member/s, sometimes addressed to "all"
  - Communications passed as soon as information is received; updated reports are passed as soon as new information is obtained
- Reports on specific tracks interleaved with reports on other tracks
  - In a series of speech turns, five separate contacts may be discussed at various levels – initial reports, updated reports, sharing information on response/ lack of response, by contact to action taken by the ship, etc.

Air Warfare Team Members

- Six collocated team members consisted of
  - Commanding officer (CO)
  - Tactical action officer (TAO)
  - Air warfare coordinator (AAWC)
  - Electronic warfare supervisor (EWS)
  - Identification supervisor (IDS)
  - Tactical information coordinator (TIC)
- Combat information center team members also communicate with several non-collocated information sources
  - Battle group commander
  - Saudi air tower
  - Assets passing intelligence reports
  - Other ships and friendly aircraft in the vicinity of the battle group
- Gather additional information, keep them apprised of the unfolding scenario as they collaborated to identify air tracks.

Air Warfare Decisionmaking

- Identification/ responding to numerous air contacts: CIC personnel work as a team to identify/ determine if A/C poses a threat
  - High ambiguity often makes threat assessment a very difficult task
  - Many pieces of data fit multiple hypotheses
  - Global response choices (engage, monitor, do nothing) largely determined by ship's orders and the current geopolitical situation
  - Specific actions (e.g., change course, issue verbal warnings, illuminate with radar, challenge with other sensors, etc.) depend on local conditions, relative positions of the inbound contact and ship
    - Determining which actions is likely to be effective depends on maintaining an accurate assessment which requires continually updating based on iterative situation assessments
- Critical contacts ident'd based on ambiguous info. under time pressure
- High mental workload -- constant stream of info. must be continuously evaluated, e.g., when info often pertains to several different contacts
- Teams assess, compare, and resolve conflicting info, make difficult judgments and remember the status of several evolving situations
- Tasks interleaved with other tasks, such a making reports to higher authority and requesting assets
- Situation assessment & action selection

Coding Process

- Cognitive process coding definitions used to code speech turns
- Attempted to develop criteria for coding schema
- Codification of the coding process is part of the overall validation of the model, e.g., goal is to have high inter-rater reliability between coders
- Important to pay attention to which track a team member was talking about when coding the speech turns
- First time discuss a track -- coded as a 2 (*individual mental model* (IMM) construction – where an individual team member, using available info, develops his/ her mental picture of the problem situation)
- After three speech turns discussing the same track (typically involving at least four, of the six or more team members) it was coded as a 4 (*team knowledge development* (TKM) – where all team members participate in clarifying information to build team knowledge
- Once five-six team members had discussed a track, and at least 4 of the 6 team members had been involved in discussing this particular track, it was coded as a 10 – team shared understanding development – which includes discussion among all team members on a particular topic or data item
- Exceptions to the coding criteria include: “All stations, [track # 7010 is a comm-air.]” -- he is telling all team members this evaluation of the track.
  - Because addressed to all TMs & reported a higher level/ more final assess’t of the track, i.e., a comm-air, was coded as a 10. As more TMs discuss contact (i.e., more reports and/or updates have been shared among TMs), cognitive process coding category reflects a higher level of team understanding of the situation

New Coding Categories

- ***Issuing an order regarding a course of action*** **-- person with higher rank**
  - **Tells them to take some specific action against a potential threat track.**
    - **Issuing verbal warnings, illuminating or locking-on with radar, developing a firing solution, covering with missiles, etc.**
    - **Includes responding/ reporting have taken the action/acknowledging**
- ***Request a team member take some action*** **-- tell team member to do something**
  - **Not a direct action against a threat track.**
    - **"Can you try and change 7006 and 7005 to assumed hostile."**
- ***Prodding a team member*** **to jog their awareness**
  - **To make sure they are following the discussion**
  - **Push or suggest to one or more team members to go out and generate knowledge, e.g., "You should go back and see if there is …".**
  - **Might act in a role as teacher gently pushing collaborative effort certain way**
  - **"*Contrarians*" when a person says "Let's re-evaluate/ reconsider**
    - **Person disagrees with the current thinking of the team**
    - **"Outlier" who makes the team consider another viewpoint, or**
    - **"Pulls back the reins"**

Excerpt from MIO Scenario Communications Coding:
Developing Solution Alternatives

	MIO Team Communications		Cognitive Process Coding	
	Speaker		**Code**	
1	DTRA	Cesium 137 can be used to make an RDD. If there are no explosives, then it is not configured as a weapon yet. Recommend material be confiscated.	sa	Develop, rationalize and visualize *solution alternatives*; using data to justify a solution
2	BO	Roger will confiscate.	itk	*Individual task knowledge* development; individual TM clarifying data.
3	BO	Make sure you handle carefully. Cs-137 is an external gamma hazard.	kio	*Knowledge interoperability*: TMs exchanging *knowledge* among each other.
4	BO	Roger. Will take precautions.	kio	*Knowledge interoperability*: TMs exchanging *knowledge* among each other.
5	SOCOM	Does CG ship have proper storage area for material confiscated?	itk	*Individual task knowledge* development: individual TM clarifying data, asking for clarification.
6	SOCOM	Search team will report size of material and its current containment condition; then make recommendations.	Ccu	Team integration of individual TM knowledge for *common understanding*; one or more TMs combine individual pieces of knowledge to achieve common understanding.

MIO Scenario Communications Coding: Knowledge Interoperability Development and Agreement on a Final Plan

MIO Team Communications		Cognitive Process Coding	
Speaker		**Code**	
BO	Negative for explosives Station 2.	MCkio	*Knowledge interoperability*: TMs exchanging *knowledge* among each other.
LLNL	Finally received RAD data from station 2.	MCkio	*Knowledge interoperability*: TMs exchanging *knowledge* among each other.
SOCOM	Will need to resolve RAD containment hazard if it exists.	MetCcu	Team integration of individual TM knowledge for *common understanding*; one or more TMs combine individual pieces of knowledge to achieve common understanding.
DTRA	If you have plutonium, you need to confiscate. It's an alpha hazard, but still must be handled carefully	MCica	*Iterative information collection and analysis; collecting and analyzing information to come up with a solution but no specific solution exists.*
BO	Roger.	Misc	Acknowledge report.

MIO Scenario Communications Coding:

Knowledge Interoperability Development and Agreement on a Final Plan (cont'd)

DTRA	**By the way, if plutonium is in solid metal form, your team can handle safely with rubber gloves and a dental face mask, depending on how much is there.**	**ica**	***Team shared understanding development – discussion among all team members on a particular topic or data item..***
BO	**Talking to search team to see if this is within their capabilities or if we will need outside assets.**	**kio**	***Iterative information collection and analysis; collecting and analyzing information to come up with a solution but no specific solution exists.***
LLNL	**Hazard is probably minimal, can isolate and confiscate.**	**cs**	***Team agreement on a common solution – all tem members agree on the final plan.***

		Air Warfare Scenarios				MIO Scenarios			Firefighting
	Macro-Cognitive Process Coding Categories	**Scen D-Run A**	**Scen D-Run B**	**CG - 59**	**DDG-54**	**Nov 06**	**June 06**	**Sept 06**	**Firefighters 9-11**
	Knowledge Construction								
1.	**Data to information (dti)**	**1**	**4**	**-**	**37**	**2**	**5**	**-**	**2**
2.	**Individual mental model (imm)**	**8**	**11**	**18**	**25**	**1**	**7**	**8**	**14**
3.	**Individual task knowledge development (itk)**	**25**	**30**	**31**	**29**	**35**	**7**	**47**	**325**
4.	**Team knowledge development (tk)**	**11**	**5**	**18**	**1**	**3**	**5**	**8**	**210**
5.	**Knowledge object development (ko)**	**-**	**-**	**-**	**-**	**-**	**2**	**8**	**0**
6.	**Visualization and representation (vrm)**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0**
	Collaborative Team Problem Solving								
7.	**Common understanding (cu)**	**-**	**6**	**-**		**2**	**6**	**7**	**16**
8.	**Knowledge interoperability (kio)**	**-**	**5**	**-**	**1**	**2**	**-**	**10**	**8**
9.	**Iterative collection and analysis (ica)**	**1**	**11**	**-**	**-**	**6**	**4**	**14**	**0**
10.	**Team shared understanding (tsu)**	**1**	**17**	**28**	**34**	**3**	**2**	**3**	**6**
11.	**Solution alternatives (sa)**	**-**	**3**	**-**	**-**	**6**	**-**	**-**	**13**
12.	**Convergence of mental models (cmm)**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**22**
13.	**Agreement on Common solution (cs)**	**-**	**2**	**-**	**-**		**-**	**-**	**1**

	Team Consensus	Air Warfare Scenarios				MIO Scenarios			Firefighting
14	Team negotiation (tn)	-	-	-	-	4	-	-	1
15	Team pattern recognition (tpr)	-	-	-	-	-	-	-	3
16	Critical thinking (ct)	-	-	-	-	-	-	-	3
17	Sharing hidden knowledge (shk)	-	2	-	-	-	-	-	5
18	Solution adjustment against goal (sag)	-	-	-	-		-	-	0
	Outcome Evaluation and Revision								
19	Compare solution options against goals (csg)	-	1	-	-	-	-	-	2
20	Analyze, revise solutions (aro)	-	-	-	-	-	-	-	1
21	Miscellaneous (misc)	38	27	57	61	6	-	-	0
22	Issue order regarding course of action (coa)	7	5	17	37	-	-	2	92
23	Request take action (rta)	3	2	18	8	1	2	11	53
	Totals	96	131	187	233	73	40	118	777

MIO Scenario Coding Example
Team Shared Understanding Development

MIO Team Communications

DTRA: Cesium 137 can be used to make an RDD. If there are no explosives, then it is not configured as a weapon yet. Recommend material be confiscated.
BO Rgr will confiscate.
BO Mark material for confiscation.
BO Make sure you handle carefully. Cs-137 is an external gamma hazard.
BO Rgr. Will take precautions.
SOCOM Does CG ship have proper storage area for mat'l confiscated?
SOCOM Search team will report size of material and its current containment condition; then make recommendations.

Cognitive Process Coding

sa: develop, rationalize and visualize solution alternatives = using data to justify a solution
itk: individual task knowledge dev't.= individual TM clarifying data
kio: knowledge interoperability =TMs exchanging *knowledge* among each other.
itk: individual task knowledge dev't = individual TM clarifying data, asking for clarification.
cu: team integration of individual knowledge for common under-standing = one or more TMs combine individual pieces of knowledge to achieve common understanding

Model of Team Collaboration: Validation

- **Codes used by Firefighters**
  - **19 out of the 23 cognitive processes in the model (all codes except:)**
    - ***knowledge object development*** **(ko)- requires pictures and icons**
    - ***individual visualization and representation*** **of meaning (vrm)- requires visual aids**
    - ***iterative information collection and analysis*** **(ica)- collect and analyze information without mentioning a solution**
    - ***solution adjustment against goal*** **and exit criteria (sag)- compares solution option against goal and exit criteria**
  - **Did not pertain to FDNY radio communication but still pertain to other team collaboration environments and should not be eliminated from the collaboration model**

Model of Team Collaboration: Validation

Divide 2 hours, 31 minutes of recordings → problems faced

- **Larger problem of Search and Evacuation – never got to final stages because the buildings collapsed**
- **Broken up into phases to represent the mental model within which the FDNY was working**
- **Divide into smaller problems**
  1. **What happened? Create a mental model**

     Time period: 0846-0902
  1. **Evacuate South Tower after the North had been hit?**

     Time period: 0902-0958
  1. **How to divide units between the two towers?**

     Time period: 0958-1028
  1. **Evacuate the North Tower after the South collapsed?**

     Time period: 1028-1107

Model of Team Collaboration: Validation

- **Trends in the codes, 1620 total speech turns**
  - **849 (52.41%) miscellaneous, removed for the following percentages, leaving 771 total codes**
  - **325 (42.15%) itk – *iterative team knowledge development***
    - **asking lots of questions, how to alleviate questions and therefore message traffic?**
  - **210 (27.24%) tk – *Developing team knowledge***
    - **Sharing knowledge with fellow firefighters and passing knowledg back to the dispatcher**
  - **92 (11.93%) coa – *Course of action***
    - **Telling the dispatcher and/or other responding units what to do**
  - **53 (6.87%) rta – *Request take action***
    - **Requesting something of the dispatcher or responding units**
  - **22 (2.85%) cmm — *Constructing team mental model***
  - **16 2.08%) cu – Developing *common understanding***
  - **14 (1.82%) imm – *individual mental model***
    - **Individuals contributing to the team's mental model**

Model of Team Collaboration: Validation

- Inter-rater Reliability Analysis
  - Two coders, test subjectivity of model's codes
  - 34 out of 1626 codes (4.37%) were disagreements
    - Discussed differing opinions to reach an agreement with the other coder
  - 49 out of 1626 codes (6.31%) were decided upon after a discussion between the coders
    - One or both of the coders was unsure of how to code the communication turn and left it to discuss further with the other coder.
- In total, did not completely agree on 10.68% of codes
- Reliable 89.32% of the codes

Adherence to SOP

- Minor Deviations, SOP Deviation #1
  - ID speaker and addressee
  - Requesting ambulances and units
  - Casual communication
  - 10 codes
- Major Deviations, SOP Deviation #2
  - Unit to Unit transmissions
  - Use first names
- Major Deviations, SOP Deviation #3
  - Urgent Radio Messages (24 messages identified as urgent)
  - Mayday Radio Messages (3 messages identified as mayday)
- Department-wide Recall
  - Never used before
  - Unclear as to where to go, what to do

Discussion

- Differences between three scenarios - how the team's behavior maps to the model
  - Course of action selection is done less collaboratively in tactical domains, due to inherent time pressure to make decisions and take actions
    - Decisions made unilaterally by tactical action officer or commanding officer -- do not typically involve discussion with the rest of the team.
    - Decisions regarding course of action selection entailed very little collaboration for air warfare tasks due to the speed of the potential threat aircraft.
  - When actions need to be taken very quickly in an attempt to determine the intent of an inbound track, time is not available to discuss alternative courses of action
- Air warfare consists of situation assessment ("what's going on") and action selection ("what to do about it")
  - Decisionmakers use a recognition-primed decisionmaking strategy (Klein, 1989)
    - Situation itself either determines or constrains the response options
    - Recognition primed model of decisionmaking fuses two processes — situation assessment and mental simulation (Klein, 1993)
      - Simplest case the situation is recognized as familiar or prototypical, using feature matching, and the obvious response is implemented
      - More complex case -- decisionmaker performs conscious evaluation of response, using mental simulation to uncover problems prior to implementing
      - In most complex case -- evaluation reveals flaws requiring modification, or option is judged inadequate/rejected in favor of next typical reaction
- Experienced DMs make 90% of all decisions w/o considering alternatives
    - If situation appears similar to one previously experienced, pattern will be recognized and COA is usually immediately obvious

Adherence to SOP- Mayday

Type of Mayday Message	FDNY Communications	
	Speaker	
Imminent collapse feared	N/A	
Structural collapse has occurred	FIELD	Engine 3-9 acting, report on the 22nd floor, reporting a floor collapse at that location, K.
A firefighter is unconscious or suffers a life threatening injury	FIELD	We have a medical emergency, possible heart attack, firemen, we're on the bulkhead, west, requesting oxygen for the firemen, K.
A firefighter becomes aware that another firefighter is missing	N/A	
A firefighter becomes trapped or lost	-	A civilian came on the radio asking for help because they were trapped in the rubble after the South Tower collapsed. While the civilian did not know about the correct use of “mayday” the dispatcher relayed the message saying, “transmitting a mayday.”

Adherence to SOP- Urgent

Type of Urgent Message	**FDNY Communications**	
	Speaker	
A firefighter suffers an injury that is not life threatening, but requires medical attention and hospital care	DISPATCH	Manhattan to Field Comm., urgent.
	FIELD	Receive, Manhattan, Field Comm.
	DISPATCH	Tower No. 2, 19th floor, firefighter down. Tower No. 2, 19th floor, firefighter down.
	FIELD	Field Comm. Received.
Discovery of a structural problem indicating the danger of collapse	FIELD	Engine 3-9 acting, report on the 22nd floor, reporting a floor collapse at that location, K.
	FIELD	Marine 1 to Manhattan with an urgent message, K.
	DISPATCH	Unit with an urgent message, K.
Fire is entering an exposure to a degree that any delay may considerably enlarge the fire problem	FIELD	This is Marine 1, we're in the river. You've got fire out of the north side and now coming out of the west side of the World Trade Center, the west side.
Report of apparatus breakdown while unit is responding to an alarm	FIELD	Engine 317 to Manhattan, urgent.
	DISPATCH	Engine 3-1-7, go.
	FIELD	I've got… from the Port Authority telling me that the elevators are on the 44th floor. Don't use them, they're about to come down.
Loss of water which would endanger firefighters	DISPATCH	Engine 33 urgent, go.
	FIELD	Engine 22 is being manned by an off-duty member form Rescue 1. Be advised it appears that we have lost water pressure down in lower Manhattan. Can you have Marine 1 or any other available fire boat respond to Vescey Street on the West Side? We're going to need water supply into the area, K.

Loss of SA

- Minor Losses
  - Vague, inaccurate information
    - Reporting floor numbers
    - Referring to the two towers
- Major Losses
  - After the South Tower collapsed
    - Who survived? Field Comm?
  - After the North Tower collapsed
    - Where were the responding units? Who was in which tower?

→ Made rescuing those trapped very difficult

Loss of SA

SITUATIONAL AWARENESS LOST			FIX	EFFECTS
TIME	**SPEAKER**	**MESSAGE**		
0904	Marine 6	Marine 6, that plane was a large bomber-style green aircraft into the second tower, be advised.	None.	None.
0913	Car 9	Car 9 to Manhattan.	Car 9 came back on the radio to correct Dispatch, saying they wanted the mobile command vehicle, not field com	None, corrected before it had an impact.
	DISPATCH	Car 9 go ahead.		
	Car 9	Would you advise the mobile command vehicle to come in on West and Liberty Street, West and Liberty Street.		
	DISPATCH	I already advised them.		
	Car 9	What's their ETA?		
	DIS-PATCH	Manhattan calling Field Comm.		
0930	Engine 317	I've got ... from the Port Authority telling me that the elevators are on the 44th floor. Don't use them, they're about to come down.	None.	**The firefighters working in whichever building the elevators were not coming down in would have had continued access to elevators, but instead were told not to use them because of vague information.**
	DIS-PATCH	**Is that going to be for No. 2 or No. 1 World Trade?**		
		Wasn't sure. I'd say go with both.		
	DIS-PATCH	Attention all companies operating at the fifth alarm for both World Trade Centers, the elevators, the Port Authority reports the elevators on the No. 4-4 floor are about to come down. All companies operating at No. 1 and No. 2 World Trade Center at the fifth alarm, do not use the elevators. They are about to come down as per the Port Authority on the No. 4-4 floor. Field Comm., receive that urgent? Manhattan to Ladder 2-1, K.		


242
580
24
680
1
13
980
880
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380
92
101
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Pointer 37°46'51.30" N 122°14'36.15" W
Streaming 100%
Eye alt 29.25 mi