The Sounds of Silence Inform Situation Awareness Concepts: Methodological and Terminological Aspects in Aviation Culture and the work of OMEODEK in the Context of Greek and English

6th Session: Activities of organizations and bodies for Terminology – The Hellenic Network for Terminology (EDO)

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και η Ομάδα Εργασίας Ορολογίας Διαχείρισης Εναέριας Κυκλοφορίας (ΟΜΕΟΔΕΚ)
Grounded Theory Approaches in Research Inquiry: Language in Aviation and Communication to Information Science

The book “The Discovery of Grounded Theory: Strategies for Qualitative Research” (Glaser & Strauss, 1967), as a theory generator for sociological interactions
“Grounded” Structure

• GT steps, evaluation/critique
• Examples…(interdisciplinary in many ways: trust, leadership, marketing, HCI and CSSW)
• Keywords to keep
• My Application/implementation
• The dissertation study with HCAA
• Sources/resources
Grounded Theory Paradigm (Glaser & Strauss, 1967)

• Compatible with a qualitative research practice and quite important in the study of processes and in **organizational studies** particularly.

• “Grounded,” means that it is following a strategy of **bottom-up** theory building on discourse issues rather, than a top-down approach dominant in other discourse theoretical perspectives (Strauss, 1998).

• GT choices depend on what works better for the **data** and the **participants** of the study
Grounded Theory Method in HCI and CSCW

- Grounded Theory Methods (GTM) are a set of thought processes and procedures for qualitative data analysis that can help a researcher pursue a highly disciplined exploration of a new area, or of a domain without a dominant theory. The thought-processes and procedures are focused on the data, and always return to the data – i.e., the “grounding” in GTM is grounding in the data.

- In GTM, there is no hypothesis to be tested.

- Rather, research is guided by open-ended questions, and by a set of rigorous strategies that guide data collection, the choice of which data to sample, and the method for developing and testing insights into the data. The result is a rich, deeply interwoven description of the phenomena, and a set of new open-ended questions for further work.

Conventional research process (after coding or initial theory development using the data, a GT approach may lead to the conventional steps of a research question-oriented research on the left). This is a complementarity attribute of a GT approach that makes it applicable for diverse research “problem-oriented” methods.
Bottom-up approach leads to “construction with theoretical sensitivity”
The research Topic: Aviation Safety

GT Approach
- Preparation
- Data Collection
- Coding/Compare
- Memoing
- Sorting

Personal Preconceptions

QUESTIONNAIRE

Scenarios

Coding

Sorting/Comparing

Deep- Interview Scenarios, Transcripts, Accident reports, Participant Observation on site visits etc.

The process of a GT approach applied in this exploratory study
Selective parts from the Glaser’s stream and the Strauss’s stream, as they evolved in:

- **coding** (Charmaz, 2006; 2009; Grover et al, 2014; Jantunen & Gause, 2014),

- **theory construction and comparisons** (Corbin & Strauss, 1990; Glaser, 1992; Christiansen, 2011; Kelle, 2005; Ritchie & Lewis; 2004),

- **evaluation** (Wagner et al, 2010; Suddaby, 2006; Robson, 2002; Guba & Lincoln, 1994) and

- **iterative sorting and analysis** (Muller, 2014; Muller & Kogan, 2010; Reichertz, 2007; Locke, 2001).
A GT Approach as Qualitative Research

• Analyzes words, language, and their implied meanings (Miles & Huberman, 1994). Extended empirical data are treated as texts with multiple meanings.

• Data collection acquires theoretical significance with the selection of additional data (events, testimonies, visual productions, activities, experts, etc.) to exposit all properties of the developing conceptual categories and develop them further (Locke, 1996, p. 240).
A GT Concept and Pattern

Ground Theory is based in the study of a Concept and the identification of a pattern:

• **The concept of the study:** Aviation Safety (as a result and) in terms of human communication (crew and ATC). Speech acts in the context of airline cockpits

• **Secondary concept:** The Constraint Reality of time (as a type of affordances) during Flight Crisis

• **The pattern:** Human Communicative behavior, choices and practices in routine flights and in mission critical cases.
Data gathering, Categorizing and Analyzing

- personal experiences and preconceptions;
- ethnographic field visits to airports, air bases, control towers and aviation authorities;
- case studies of landmark flights;
- interviews with aviation professionals;
- life stories in biographical books and oral narratives;
- artifacts, cultural texts and productions via a special drama series on fighter pilots;
- observational, historical, interactional and visual texts, in documentaries and media interviews.
- protocol analysis lessons to facilitate the acquisition of insights and
- discourse analysis practices with close reading for the theory construction, sorting and comparisons.
Keywords/Expressions in Mind for GT

- Personal preconceptions
- Selecting sources
- Empirical reality
- Coding- sorting
- Compare-and-question
- Dimensionalization
- Core concepts, core category
- Coding paradigm
- Oral documents; historicity, materiality
- Chief Concern of the people in the domain
- Emergent Theoretical model
Aviate, Navigate, Communicate: Silence, Voice and Situation Awareness in Aviation Safety

Theodoros A. Katerinakis, Doctoral with HCAA, as of December 2014 and on
An Actual Cockpit in a flight from A to B, ... after taxiing
Pilot Controller Communication loop

Shannon & Weaver typical model with Weiner's concepts
The Discursive Space of a cockpit

• Speak-act: "spoken not yet heard; heard not yet understood; understood not yet agreed; agreed not yet applied; and applied not yet always applied."

• Talk and, as emerged, silence too is inseparable from the task, as necessary to develop understanding of the flight situation

• Understanding goes beyond receiving and perceiving to situation awareness
Situation Awareness Breakdown as a Concept

(a) A single individual viewpoint – implicit in the original Endsley’s definition

- persons’s perception of elements in the environment within a volume of time and space
- the comprehension of their meaning
- the projection of their status in the near future

(b) Actors with common interest, the same high-level task, but different data inputs and degrees of 3 types of awareness

**Transitory Awareness**

**Local Awareness**

**Global Awareness**

Increasing time, command span, area of interest, etc
Situation Awareness Model in Human Factors

**Figure 1: Elements of Situational Awareness**

- **Informational Influences**
- **Environmental Influences**
- **Personal Influences**
- **Organisational Influences**

**Crew Actions**

**Figure 2: Gaining and Maintaining Situational Awareness**

- **Thinking ahead**
- **Update the model**
- **Understanding**
- **Comparison with mental models**
- **Scanning**
- **Gathering data**

**Figure 3: Understanding the Situation by Matching Mental Model and Real World**

- **Internal attention**
  - Memory
  - Recall
- **External attention**
  - Real World
  - Searching
- **Our understanding of the situation**
  - Plane
  - Path
  - People
  - What, When, Where, Why (importance)

**Figure 4: Situational Awareness and Decision Making**

- **Perceive**
- **Situation Awareness**
- **Anticipated Result**
- **Planned Action**
- **Think Ahead**

**Goal** → **Action** → **Result**

**Feedback**
Guiding Research Questions

1. How do pilots and air traffic controllers talk, interact, and outeract with orderliness?

2. How are procedural deviations and speech acts recognized?

3. How is specialized language used as an algorithm? Is it a private language?

4. How do air traffic controllers perform an orderly organization of conversation repair when encountering symptoms of miscommunication and phraseology defects?

5. How do interactants negotiate affordances of time and language during an evolving crisis?

6. What differentiates the interaction of a military flight session from a civil aviation one?
### Building on Codes to Construct Theory

<table>
<thead>
<tr>
<th>First-order code of flight facts and crew reactions</th>
<th>Second order code: Two categories emerge (for the crew)</th>
<th>Aggregate Theoretical Dimension for the crew</th>
</tr>
</thead>
<tbody>
<tr>
<td>• pilot confusion due to incomplete destination briefing</td>
<td>• pilot missed to connect with the Macedonia Airport radio-navigational aids</td>
<td>Pilot (and crew) communicative incapacitation and ineffective crew resource management</td>
</tr>
<tr>
<td>• crew did not adequately plan and execute the missed approach</td>
<td>• crew transmitted uncertainty (modifiers like “rather” or pending standby)</td>
<td>loss of operational handling functionality (with radar and crew members)</td>
</tr>
<tr>
<td>• crew showed a “get-there-it-is” expedition</td>
<td>• crew members unable to maintain cockpit discipline and to collaborate with each other</td>
<td></td>
</tr>
<tr>
<td>• crew delayed to declare an emergency when they lost orientation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Silence is not always Golden; Voice maybe the Choice

Periods Of Restricted Communication

- Safety Related Issues Only = communications of a safety nature only
- No Contact = no communication permitted, regardless of circumstances

Sterile Flight Deck

<table>
<thead>
<tr>
<th>Safety Related issues only</th>
<th>NO CONTACT</th>
<th>Safety Related Issues Only</th>
<th>All Communication</th>
<th>Safety Related Issues Only</th>
<th>NO CONTACT</th>
<th>Safety Related Issues Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door Closure</td>
<td>Start of Takeoff Roll</td>
<td>Landing Gear up</td>
<td>Seat belt sign off</td>
<td>20,000 FT. PA</td>
<td>Landing Gear down</td>
<td>Aircraft stops or turns off active runway</td>
</tr>
</tbody>
</table>

QANTAS Flight Operations Training
Two Landmark Flights

The Ghost Plane Helios 522

The Shaking VIP Falcon 900 Plane

Romanian soldiers guard the Greek aircraft at Bucharest airport
The Effect of Erroneous Communication in Aviation Safety

Errors in Communication

- Insufficient Information
- Unreliable Information
- Contradictory Information
- Plethora but too much information
- Non-interpretive information

Controllers

Operators and pilots

Erroneous Situation Awareness

Accident

Non-desirable situation

Incident

ICAO/FAA Phraseology, AirSpeak English, Plain Language, Paralanguage, Hesitation, Non-verbal signals, Mother tongue filter
Tenerife Accident on 1977
US (Airways) 1549/United Airlines Flight 1919  Flight in ...the river
Passengers stand on the wings of the Airbus A320-214 in the Hudson
ah yes he ah he was a bird strike can i get him in for runway one

runway one that’s good

cactus fifteen twenty nine turn right two eight zero you can land runway one at teterboro

we can’t do it

okay which runway would you like at teterboro

we’re gonna be in the hudson

i’m sorry say again cactus

jetlink twenty seven sixty contact new york one two six point eight

twenty six eight jetlink twenty seven sixty
Air France Flight AF 447
Rio de Janeiro bound for Paris, 2009

A crash which killed 228 people

A renowned cockpit designer at Boeing—himself a transport pilot—one said, “We don’t believe there are any bad pilots. We believe there are average pilots who have bad days.” This a principle that underlies Boeing’s cockpit designs.
Why Hellenic Aviation and Hellenic Air Force is important?
Grouping of Topics from in-depth interviews

Communication phenomena

1. Silence: When aircrew members don’t speak-up and why?
2. Hesitation Exists or needed?
3. Directness in Language
4. Professional Relationship Factor
5. Standardization language Factor and mother tongue
10. Redundancy and mutual verification
11. Listening mode (Pilot- ATC)
12. Forward Interpretation or “GetThereItis’, (Pilot- ATC, a,b)

Expertise, Knowledge and Decision making

13. Superiority and authoritative Mindset (Pilot Specific)
14. Witnessability as “Building up the Picture” (controller’s Specific)
15. The Two challenge rule (an analogy from the medical profession/nuclear reactor operation)
16. Affordances and Skills
17. Oral Information
18. Heuristics and Experience
20. Air Force/Military Aviation Doctrine (Fighter Pilot specific)

The Culture of professionalism

6. Trust and professionalism
7. Instructor with Trainee in flight Mode (a,b)
8. Communication Equipment Use and Priorities (a,b)
9. Dual Instruction
17. Oral Information
19. Relationship and Familiarity

Personal factors (or beyond Human factors)

21. What do you remember most..
22. Feeling safe means
23. Safety and Just Culture
24. Briefing- debriefing
25. A Why question and the concept of triage
The Core Concept: Aviation Safety

Category: Silence
- Silence as no-talk and no report
- Non-verbal intra-plane and plane-to-plane signaling
- Paralanguage and Hesitation

Category: Voice
- Language with standard phraseology, checklists and mother tongue
- Interaction with truncated messages, interrupted conversation monitoring

Situation awareness as a communication parameter
Issues Explored

1. One set of problems involves issues of reference, repetition, ambiguity, sequence breaking, and such.

2. A second set of problems concerns the implementation of SOPs/RoE, with the language factor.

3. Although, there are highly detailed SOPs, what counts as following them in a crisis situation is not always clear, and sometimes not to be followed at all.

4. All of these problems need to be negotiated in time-critical situations, with conversation interaction.

5. Also, in the process, it will be examined how inner and outer identities and culture are sustained in crisis conversation where trust is a requirement and safety non-negotiable.
Literature Review (…after GT introduction)

**Systems Theory** (in the Cockpit, Actor-Network theory, rules, team culture, a holon)
Checkland, 1981; Ostrom, 1997; Bertalanffy, 1956; Leydesdorff, 2014; Suchman, 2006

**Communication, Knowledge Culture:**
Shannon & Weaver, 1948
Dance, 1967; Devito, 2011; Hofstede, 2004; Salem, 2009; Cushing, 2004; Jones, 2003; Turner, 2010; Doak & Assimakopoulos, 2010; Merin, 1996; Helmreich, 1992

**Human Factors**
(Human actors, liveware, safety culture, just culture, crew resource management, situation awareness, multitasking inside the cockpit, the view on human error and correction), accident investigation)
Edesley, 2001; Loukopoulos et al., 2001; Dekker, 2012; 2005; Levenson, 2005

**Discourse Analysis**

**Structured in-depth Interviews** of key informants borrowing from protocol analysis as think aloud in algorithmic steps (Ericsson & Simon, 1993) (Standard Operating Procedures, Rules of Engagement, as well as language barriers, and safety and just culture) Briggs, 1986 for socio-linguistic interviews

T. Katerinakis, Drexel University
Methods

- Discourse Analysis to read raw data (*close* reading to unpack meanings)
- In-depth interviews discussions with pilots (civil- military), controllers, accident investigators using selected *scenarios* to comment and re-enact events
- Protocol Analysis concepts to prepare the informants on talk-aloud conversation
- Participant observation (extensive) in real work and military operations environments
- Grounded theory for core categories, concepts, selection of data collection
Sample and with Key Informants
Several accidents have shown that crew members’ failure to speak up can have devastating consequences. Despite decades of crew resource management (CRM) training, this problem persists and still poses a risk to flight safety. To resolve this issue, we need to better understand why crew members choose silence over speaking up.

Exploring past speaking up behavior and the reasons for silence in 1,751 crew members from a European airline, who reported to have remained silent in half of all speaking up episodes they had experienced. Silence was highest for first officers and pursers, followed by flight attendants, and lowest for captains.
This can be proven very **dangerous behavior** as there is always a possibility an indication to turn into a disaster. I believe that there is rather a **fear among crew members to speak up** in such cases without having in mind the consequences of this decision (freely speak up about the “problem”).

Last, I would like to mention that **during emergencies** crew members have to focus on how to navigate the aircraft, so they need **time and peace**. **SILENCE** is the **magic word** imposed to the Controllers who also need it periodically.
Voice of Choice: Hesitation (Scenario -1/2)

Captain Reports:
- On takeoff roll approaching 80 knots, the Tower Controller called us and said in a very slow, unsure voice, “[AE 1549 ...(pause).]” He sounded as if he had something to tell us, but did not know what to say. We both noted a tone of concern and hesitation in his voice as if he was still unsure of something at that moment. We were light weight and had 13,000 feet of runway ahead of us. We had to make an immediate decision.

Captain Acts
- I elected to initiate rejected takeoff procedures. During deceleration the Tower Controller said, “Disregard.” I would take the same action again.

The First Officer’s report on the same incident
- In the few seconds before Tower finished his thought, we were left to guess what the call was about. We were still relatively slow speed on the roll, so the Captain did what was prudent and safe by rejecting.

T. Katerinakis, Drexel University
• We are trained to keep a calm, strict and precise tone of voice to transmit a sense of safety to the aircraft.
• We are supposed to be “the ears and eyes of the pilot on the ground” and our job is to provide them with such information and clearances that are absolutely safe for their cruise. I am of the opinion, and that is something rather common, that even a wrong clearance or instruction should be transferred to the pilot with preciseness, calmness and certainty.
• Afterwards, the ATC may correct his/her previous clearance without putting any additional pressure to the pilot due to his unsure tone of voice.
Voice of Choice: Hesitation

• The take-off is a very critical phase for the flight safety. I experienced such cases some times in my career but not harmful ones. The hesitation in this example is rather due to lack of situational awareness of the controller. The pilot did the right thing in order to safeguard the aircraft.

• Controller’s stabilized voice can be proven helpful but this is not easy all the time, due to the human nature and the stress occurring in such dangerous situations. As all communications between pilots and controllers are recorded there is an additional fear for not being compliant with the standards phraseologies or the rules, thus imposing more stress (voice uncertainty, low voice, fear, sweating, hand trembling, heart bit etc).
Summary of Findings

• Silence is an interactional element with substantial contribution both to completed flights and aviation accidents

• Hesitation is an early symptom and action when situation awareness lacks

• Tacit knowledge of pilots, controllers, and accident investigators is a necessary addition to SOPs and RoE

• The aviation sub-cultures contains several distinct micro-cultures which affect professional responsibility, uncertainty avoidance response, and decision-making in micro-environments

• Local rationality is a condition to evaluate communicative behaviors

• Human Errors should be acknowledged, talked and repaired with transparent communication
What is important in Communication/Information Science

• Situation awareness seems to be an enriching addition in communication models
• Redundancy can be a message amplifier in several communication contexts
• Non-verbal communication in institutional settings and mediated environments is instrumental (produces operational speech acts)
• Human error repair (not excuse) evolves as a systemic feedback in communication for mission critical environments
• Safety culture and just culture demand continuous intra-institutional communication (not only outreach)
• Deontological inquiries and moral judgments should always be part of message evaluation in communication models
Infrastructure in Greece and Partnerships already formed

46 airports in an
Area size of: 131,957 km²
Coastline: 15,000 Km
Population: 10,815,197 people

My NSA Souda office in Crete
The Grounded Theory Review is an interdisciplinary, online academic journal for the advancement of classic grounded theory and scholarship. The Grounded Theory Review adheres to the highest standards of peer review and engages established and emerging scholars from anywhere in the world. While centered in social sciences and the health care fields, The Grounded Theory Review is open and welcoming to contributions from any academic field.
Barney G. Glaser is the founder of the Grounded Theory Institute in Mill Valley, California, and has also been a research sociologist at the University of California Medical Center, San Francisco. He is the author or coauthor of several books, including The Grounded Theory Perspective II and Experts versus Laymen: A Study of the Patsy and the Subcontractor, published by Aldine Transaction. Anselm L. Strauss (1916-1996) was emeritus professor of sociology at the University of California, San Francisco. He was the author of numerous books, including Professions, Work and Careers, Mirrors and Masks: The Search for Identity, and Creating Sociological Awareness: Collective Images and Symbolic Representations, all published in new editions by Transaction.

Christakis Fowler to connect from ex-patients with expected “date of death”, but surviving through their social network.
What is Grounded Theory?

All research is "grounded" in data, but few studies produce a "grounded theory." Grounded Theory is an inductive methodology. Although many call Grounded Theory a qualitative method, it is not. It is a general method. It is the systematic generation of theory from systematic research. It is a set of rigorous research procedures leading to the emergence of conceptual categories. These concepts/categories are related to each other as a theoretical explanation of the action(s) that continually resolves the main concern of the participants in a substantive area.

Grounded Theory can be used with either qualitative or quantitative data.

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Here is an excerpt from one of our GTI Fellows, Olavur Christensen, explaining the main differences between "classic" or "glaserian" GT, and other methods which call themselves GT.

I have tried to explain this difference by referring to the three "hallmarks" of Glaserian GT. These "hallmarks" are unique for "glaserian GT" and sums up how Glaserian GT is different from the other versions of GT:
(1) Many equally justifiable interpretations of the same data?
   Answer: find the core variable (the main concern and its recurrent solution)
   as the first stage of the study, and delimit to the core variable
(2) To "get through to exactly what is going on in the participant's recurrent solution of their
   main concern", the researcher suspends his/her preconceptions, remains open, and trusts in "emergence of concepts from the data"
(3) Avoiding descriptive interpretations in favor of abstract conceptualizations by the method
   of constant comparison, which facilitates the discovery of stable patterns in the data (i.e., "emergence of concepts")

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T. Katerinakis, Drexel University
A Final Word

• “A great advantage of the grounded theory approach is the fact that grounded theories are solution-oriented rather than problem-focused. I believe this solution-seeking speaks convincingly to a main concern of contemporary society, in which new forms of digital communication constantly change the ways that individuals and large groups of people relate to each other.

• Even if most of us are increasingly computerized in thinking and doing, our apparently rational clear cut goals are still coupled with values, affections, and traditions, as once pointed out by the influential sociologist Max Weber. Grounded theories are outstandingly good at conceptualizing main concerns of the few on behalf of the many, therein lies their explanatory strength and firm support

From the editorial of GT Review at http://groundedtheoryreview.com/2014/12/19/the-strength-of-a-solution-seeking-approach-editorial/of productive change".

T. Katerinakis, Drexel University
GT Epistemology

- “[In GT] It is no linguistic accident that "building", "construction", "work", designate both a process and its finished product. Without the meaning of the verb that of the noun remains blank“.

- To this we may add "design“.

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Thank you
Questions and comments are welcomed…