

Cooperation under guidelines

How guidelines for cooperation affect interaction behavior of airport experts

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Knowledge for Tomorrow



Overview

1. Motivation & Background

Why guidelines for cooperation?

2. Method

How to assess the effect of guidelines on interaction behavior?

3. Results

What is the effect?

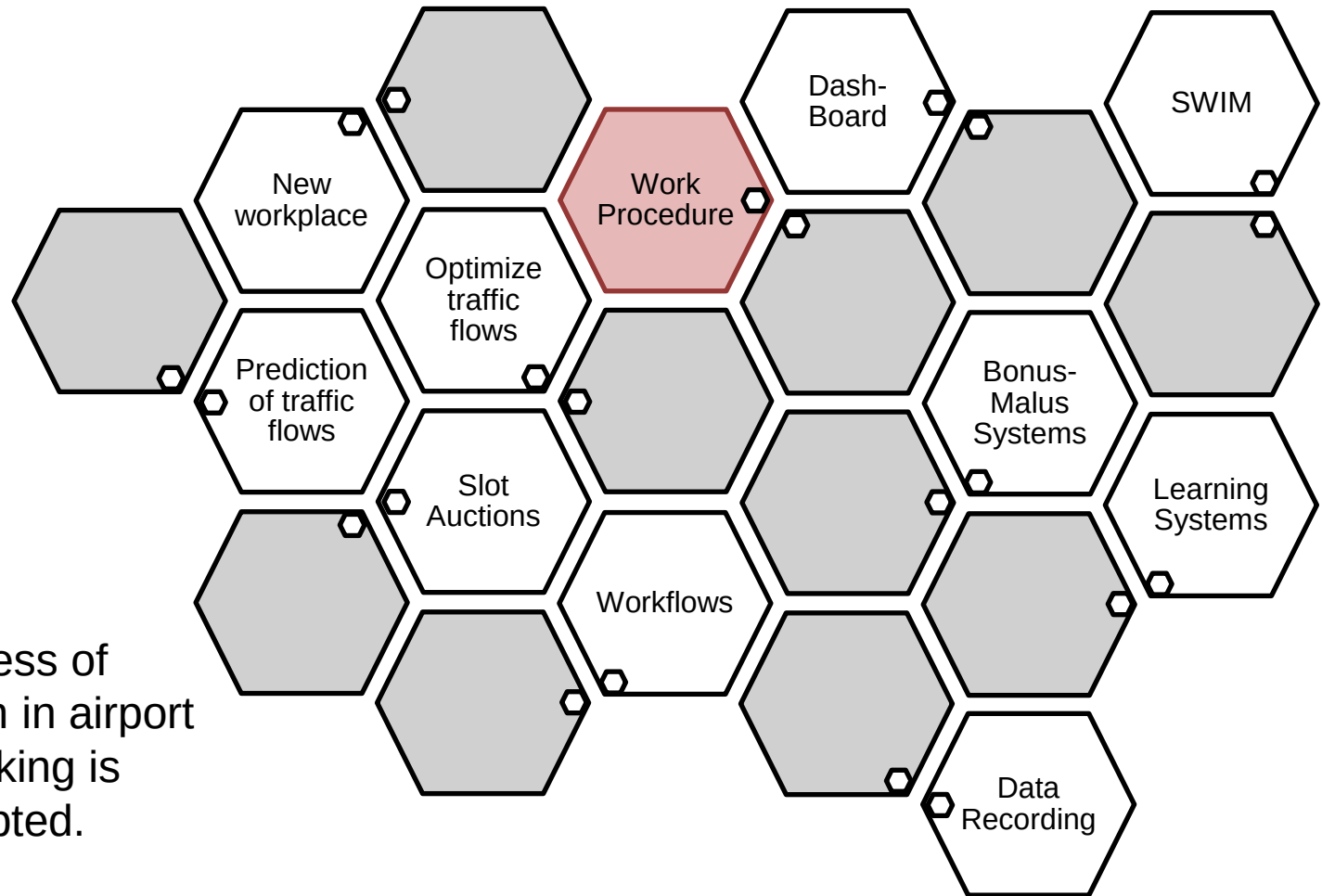
4. Discussion

What did we learn?



Motivation & Background

Gap in Airport Operation Control Center Concepts

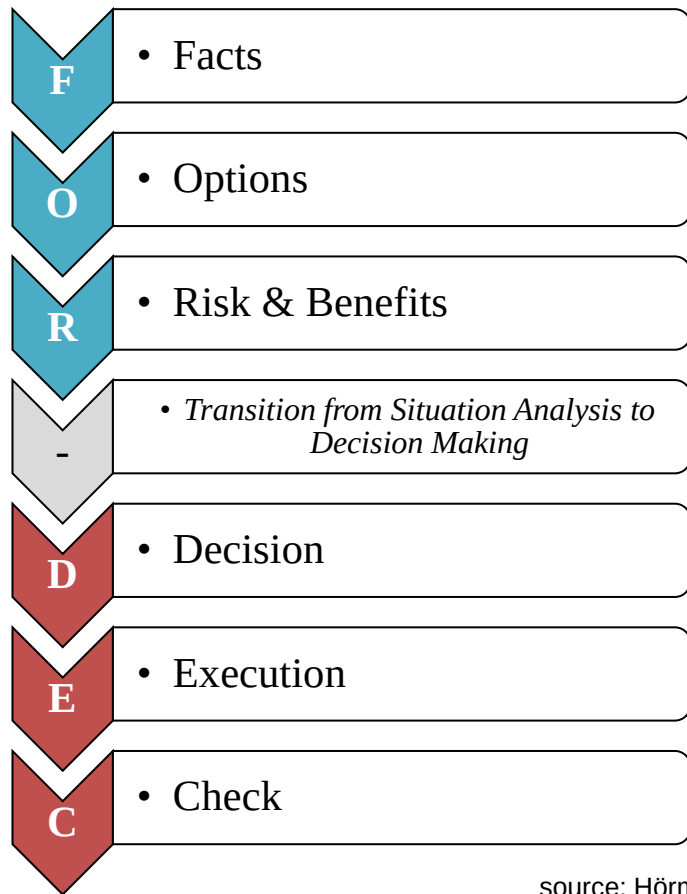


The usefulness of collaboration in airport decision making is widely accepted.

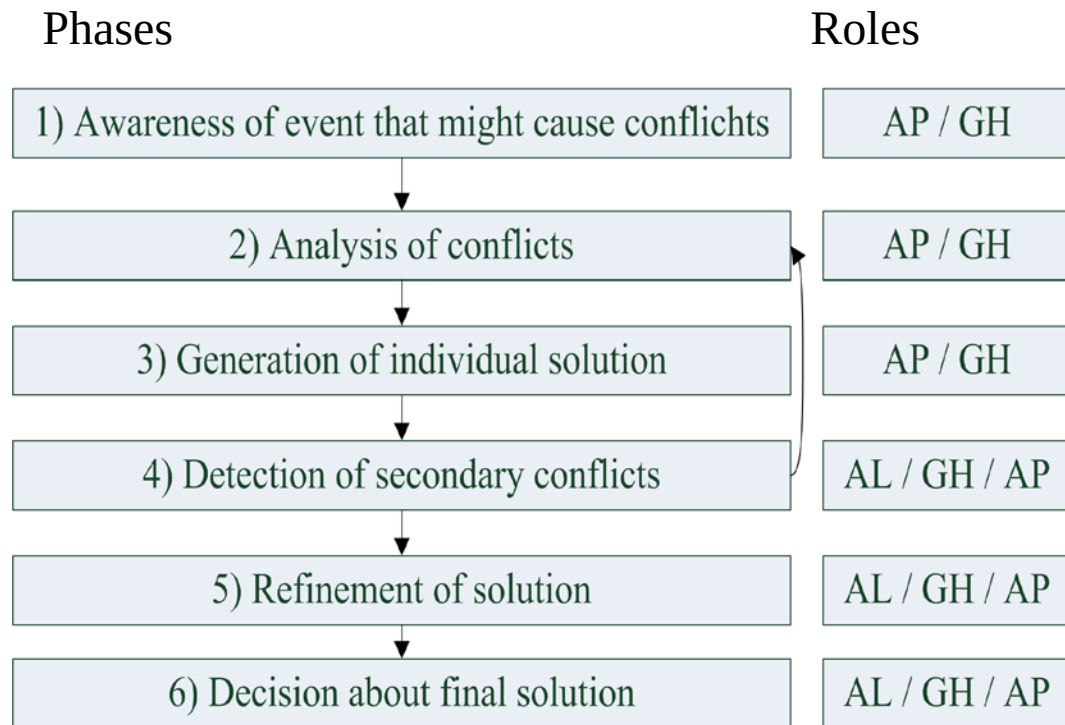


Motivation & Background

Learning from the Cockpit – Prescriptive Models for Decision Making



source: Hörmann, 1995

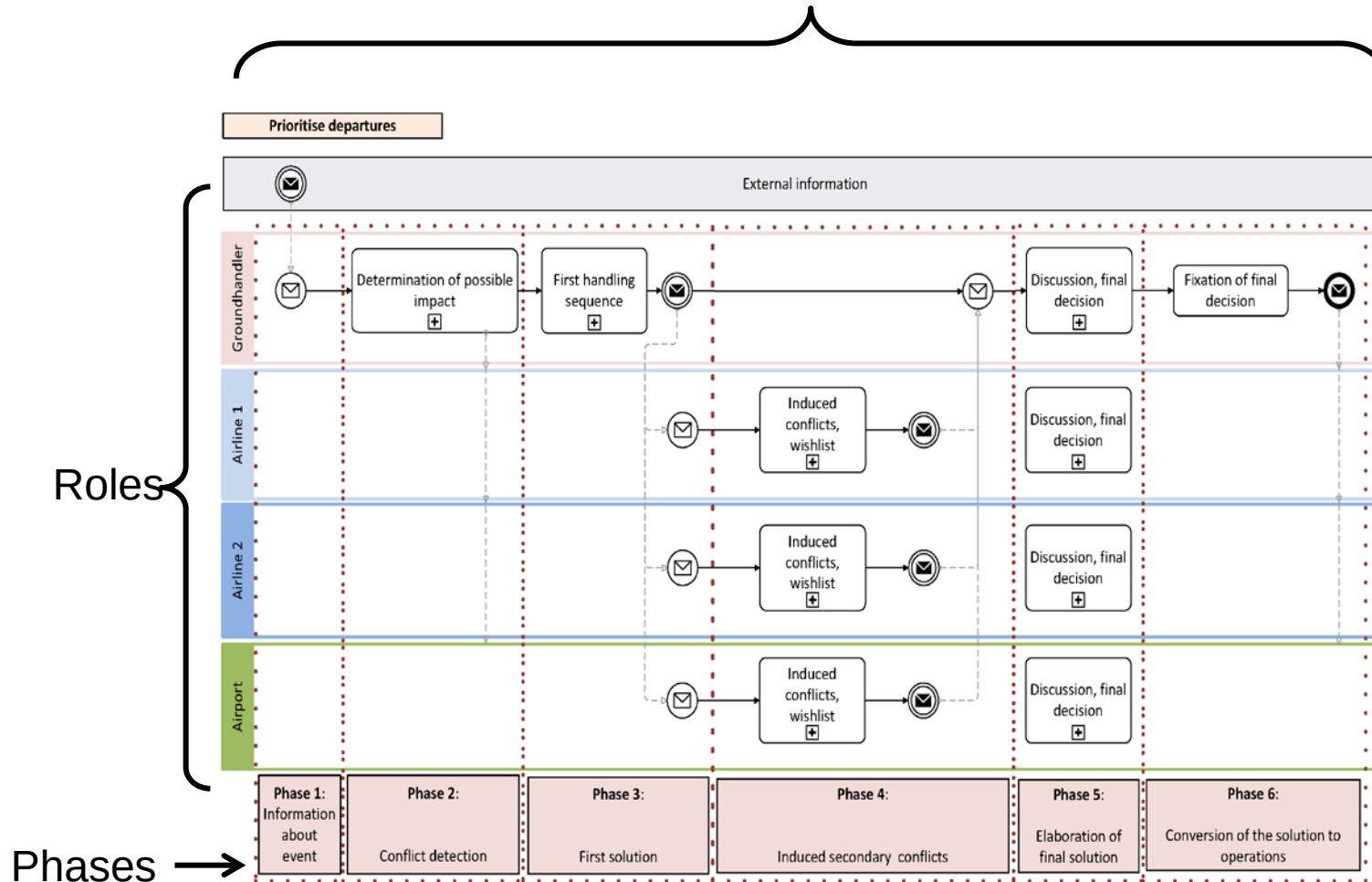


AL = Airline, AP = Airport, GH = Groundhandler

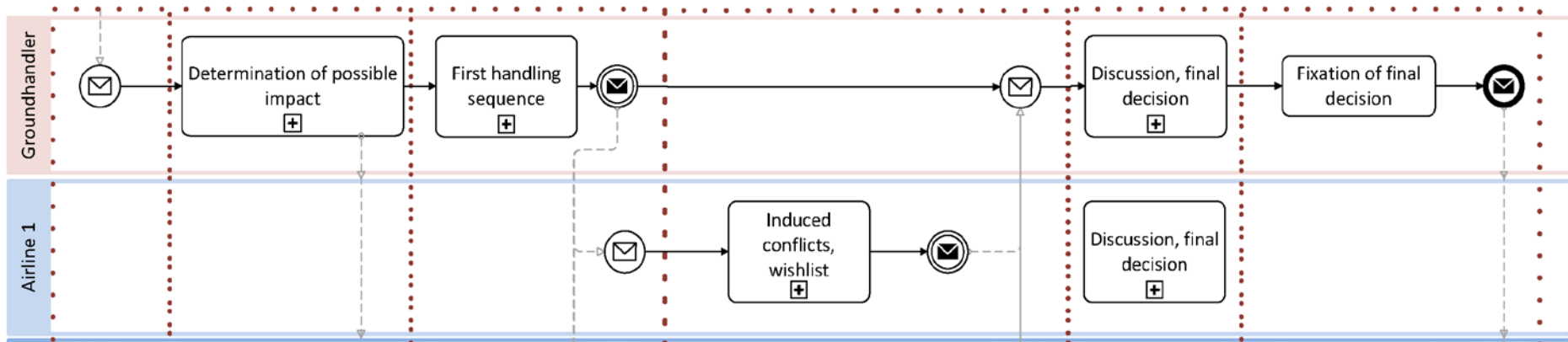


Guidelines for Cooperation

Information, Actions & Decisions



Guidelines for Cooperation

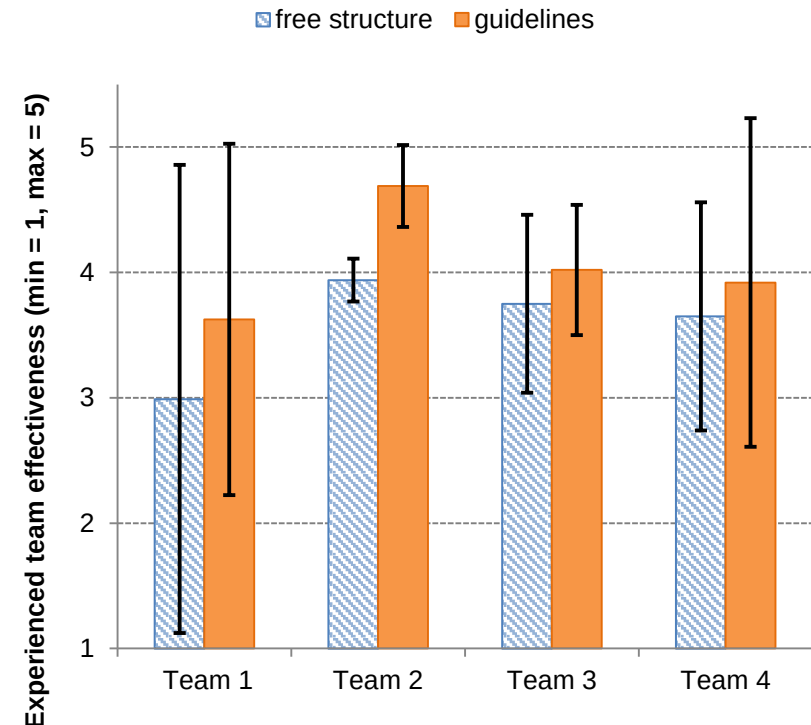


Motivation & Background

Research Question

To what extent do expert teams behaved in **conformance** with the proposed guideless or did they came up with **ad-hoc adaptations** of the prescriptive decision process?

1. Do teams follow the proposed transition of phases and the proposed activity patterns?
2. Are there distinctive features that can be observed when teams apply the guidelines for cooperation compared to an unstructured decision making process?



Team effectiveness rated significantly higher with guidelines
 $F(1,12) = 9.35, p = .01, \eta^2 = 0.44$
source: Papenfuss et al. 2017



Method

Set-Up and Roles

- 3 different scenarios with impact on departures
 - thunderstorm
 - construction work at apron
 - radar center software failure
- 45 minutes time to adapt TOBT for departures
- pre-tactical time frame, i.e. two hours in advance



Method

Joint Planning of Airport Operations disturbed by Events



conflict free & feasible plan,
fulfil overall performance goal (PBAM in place)

Airline

- Two punctual priority flights
- Minimize delay
- Set TOBTs



Airport

- Maximum a/c handled at gate
- Allocate stand & gates



Ground handler

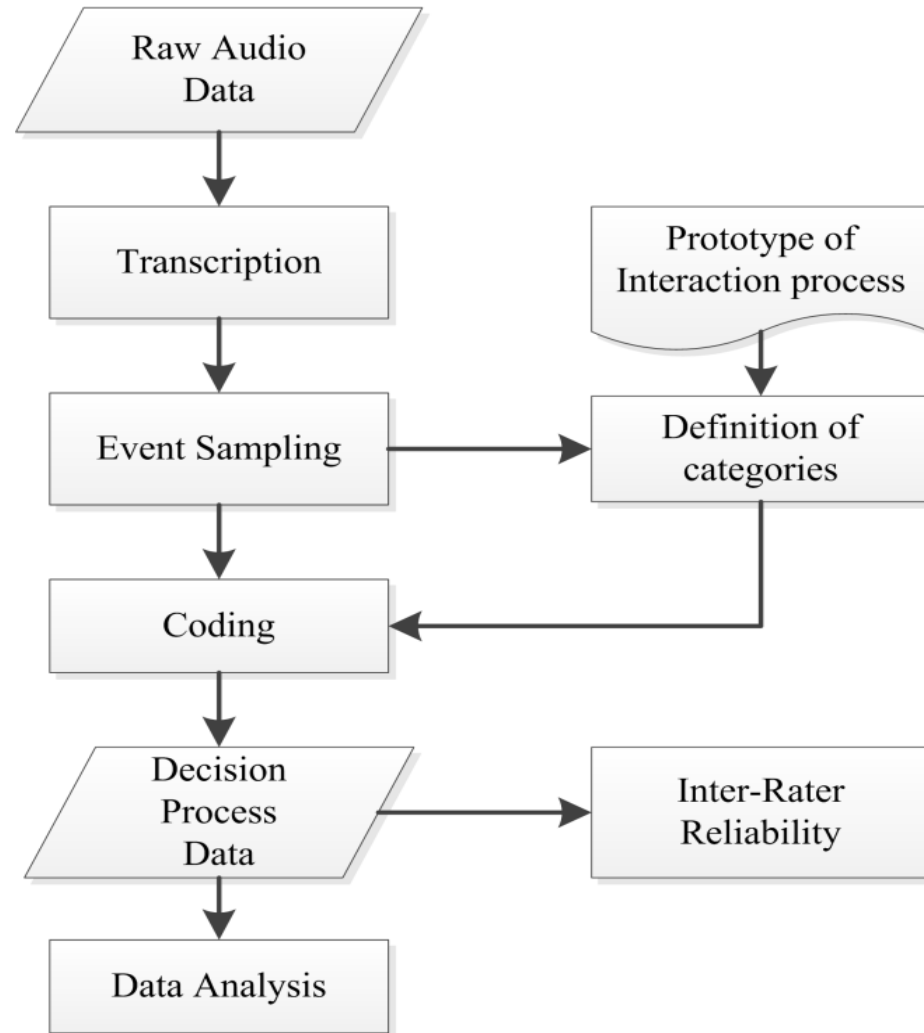
- Fulfil contract with airlines
(2 quick)
- Minimize staff cost
- Allocate ground handling teams



Method

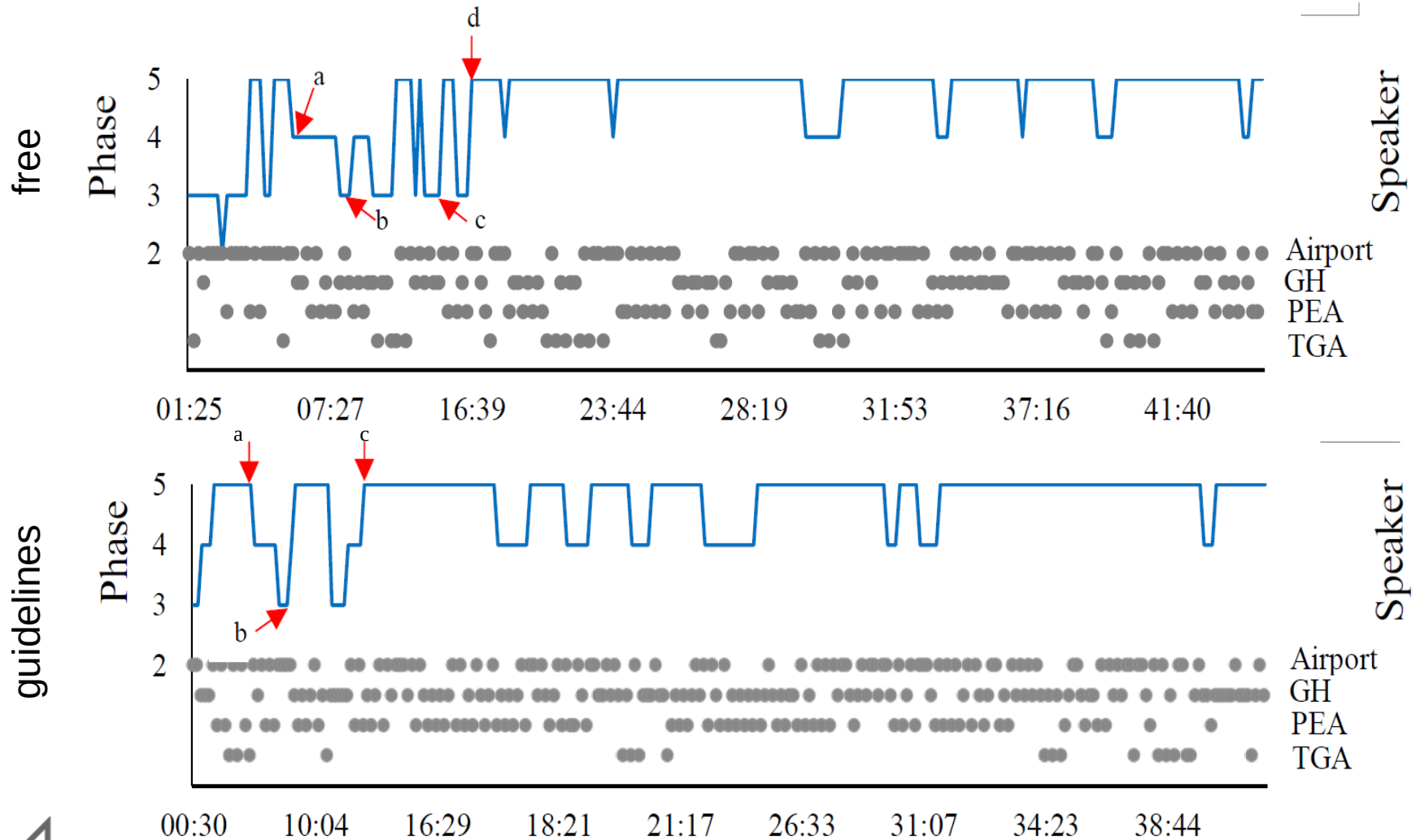
Data Preparation

- Each interaction event defined by:
 - Start time
 - Speaker
 - Receiver
 - Content
 - Code (Phase of Guideline, Priority Flight, System, Other)
- Reliability of Coding – Krippendorffs' alpha
 - Stability (intra-rater) $\alpha = .91$ (almost perfect)
 - Objectivity (inter-rater) $\alpha = .57$ (moderate)



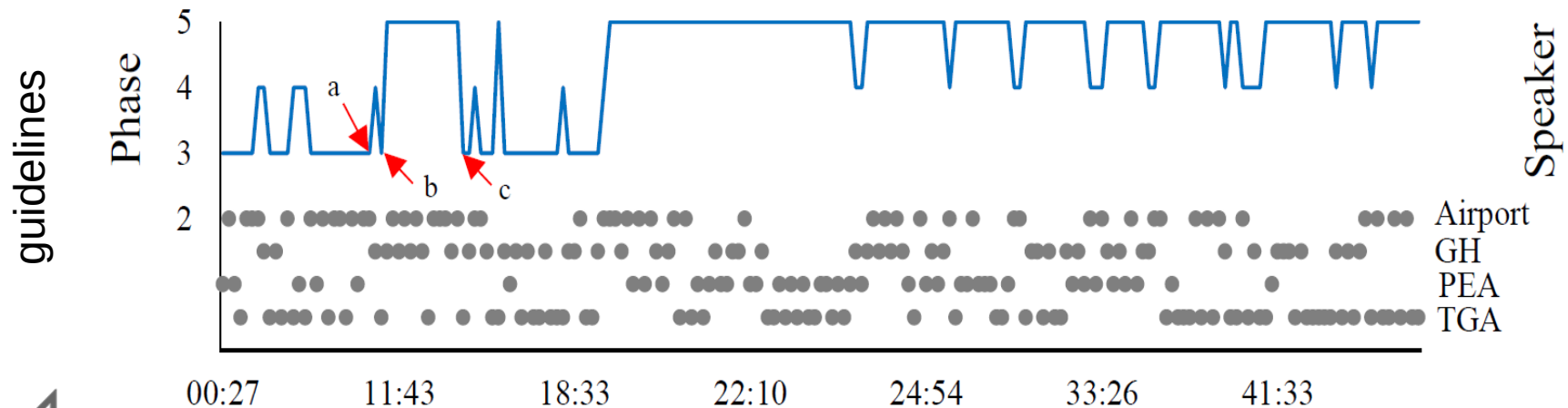
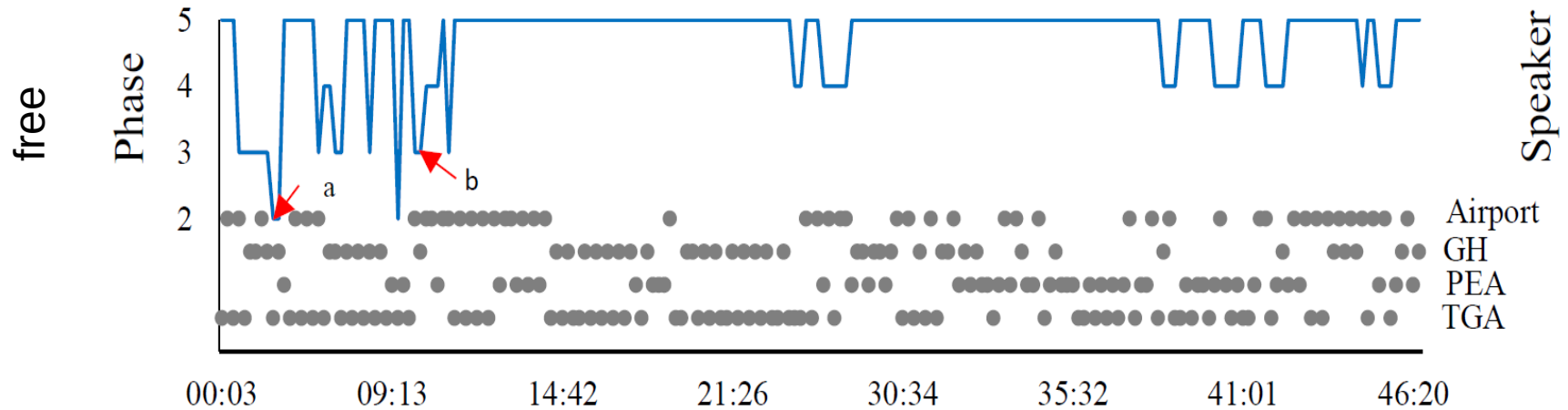
Results

Qualitative Analysis of Interaction Behavior – Team 1



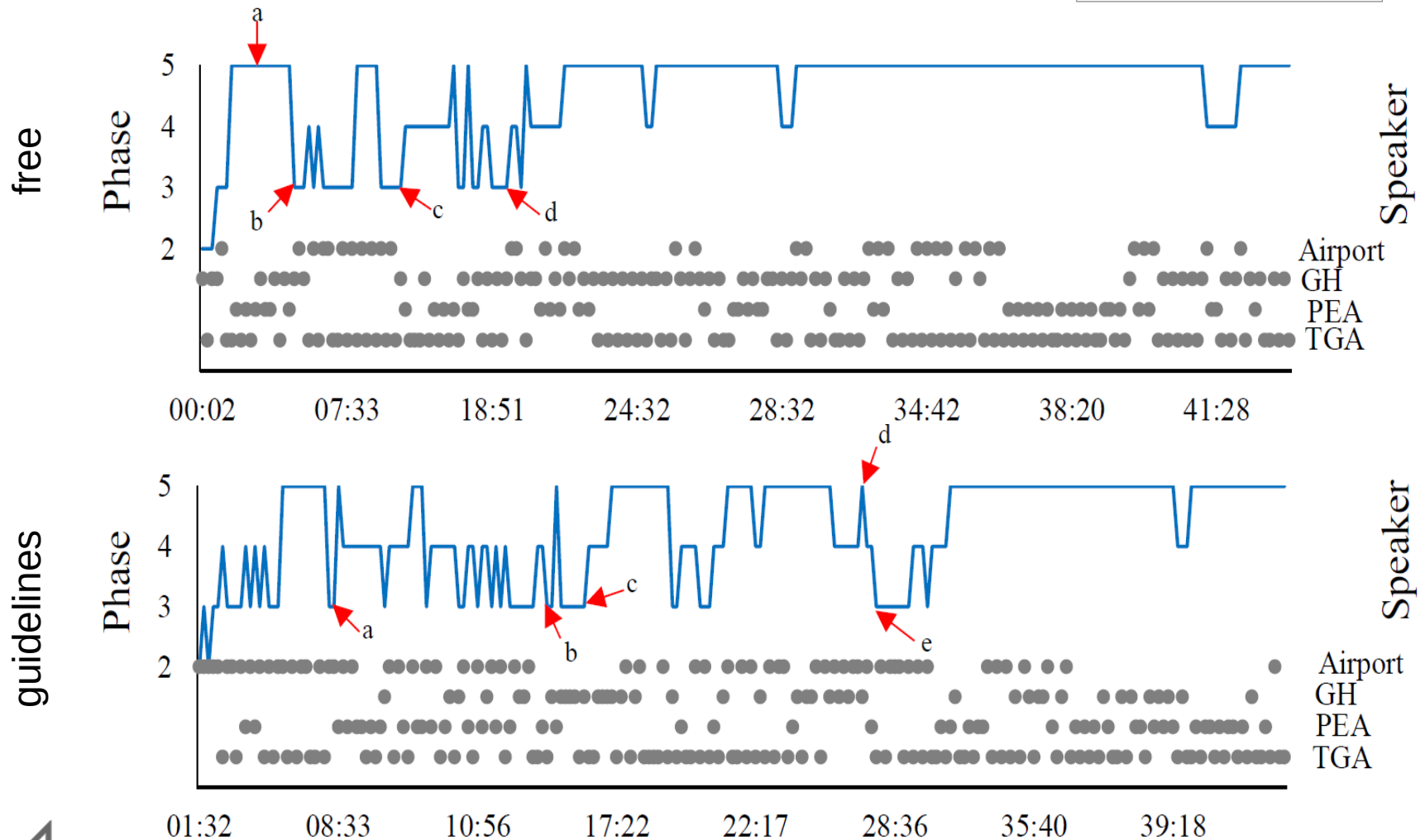
Results

Qualitative Analysis of Interaction Behavior – Team 3



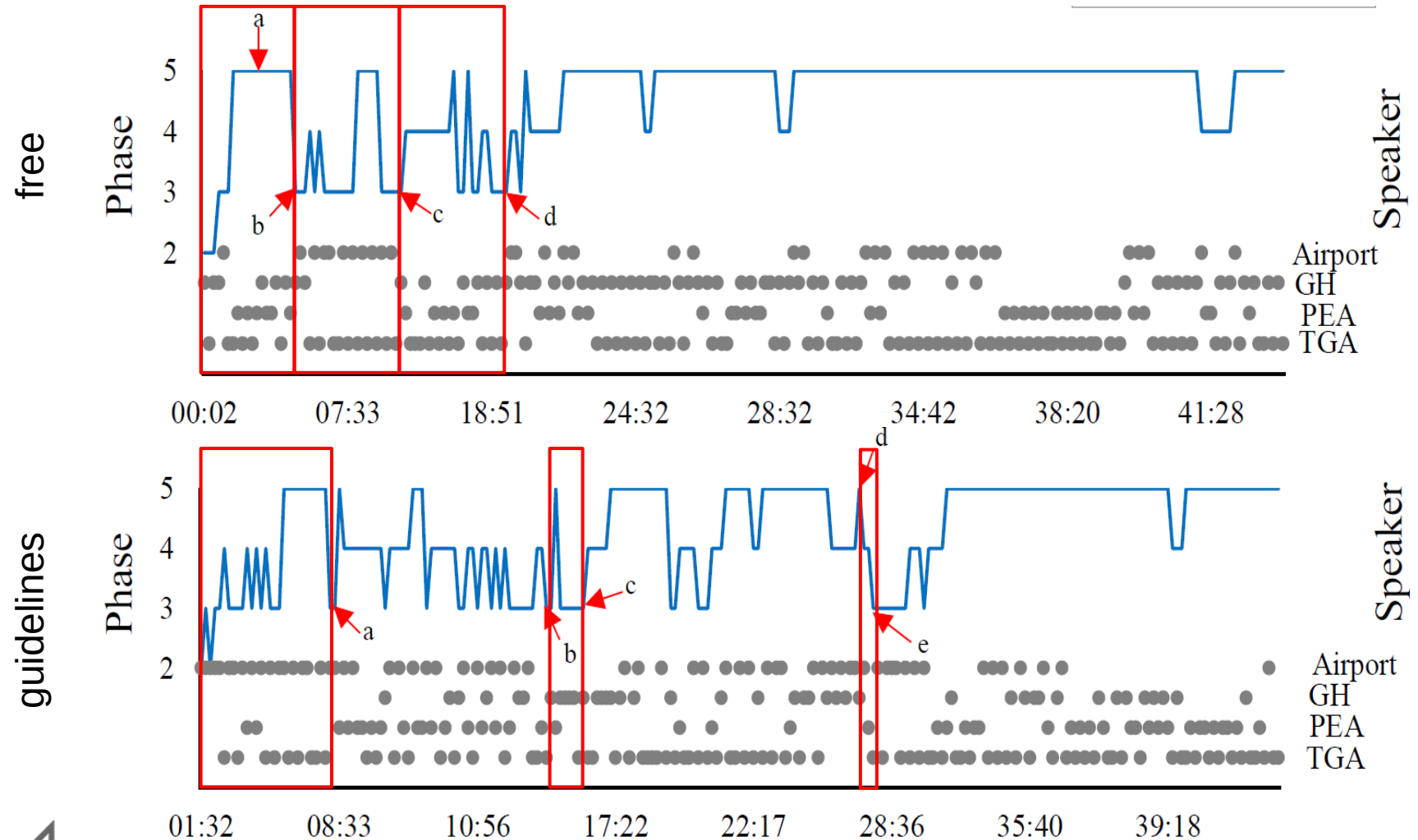
Results

Qualitative Analysis of Interaction Behavior – Team 2



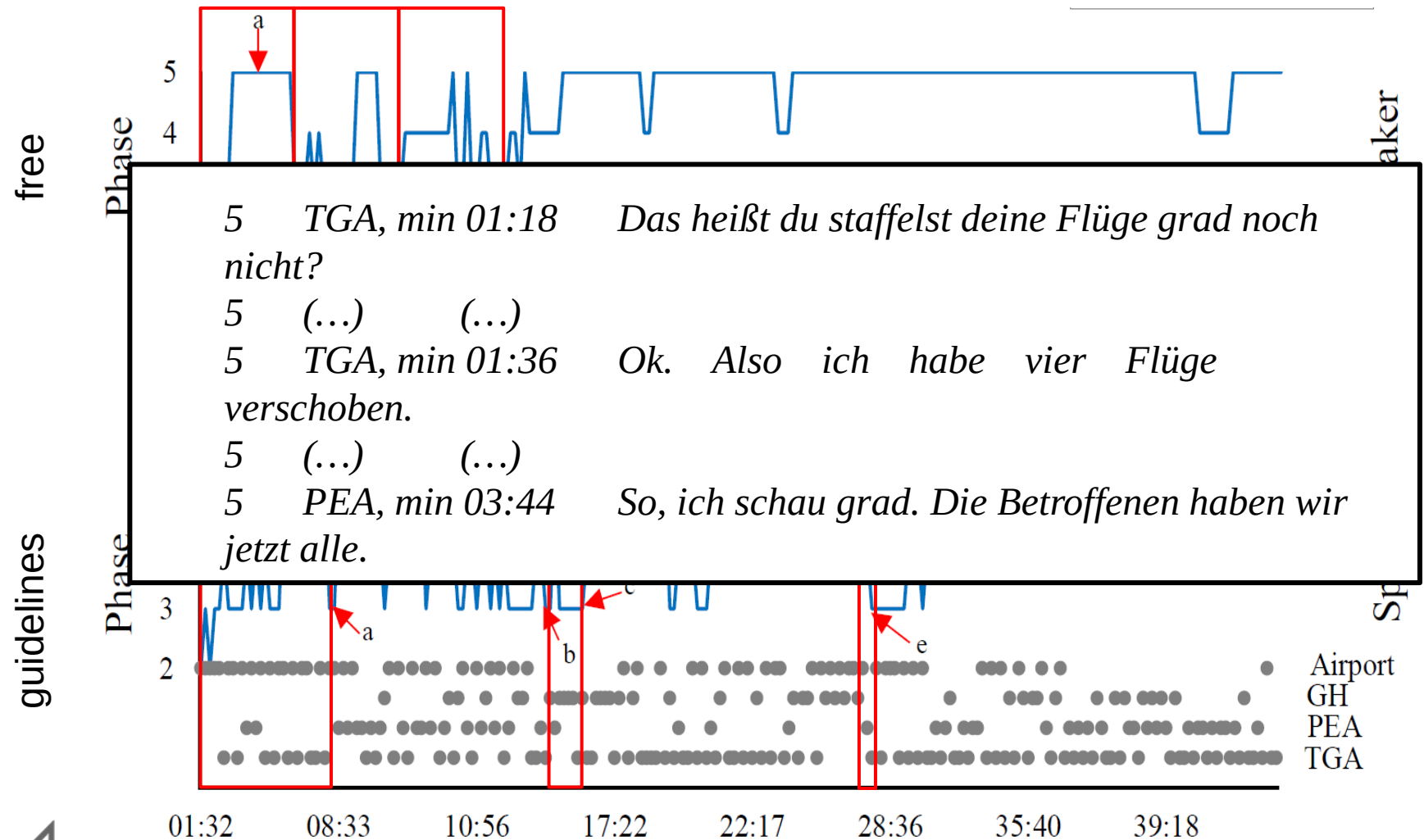
Results

Qualitative Analysis of Interaction Behavior – Team 2



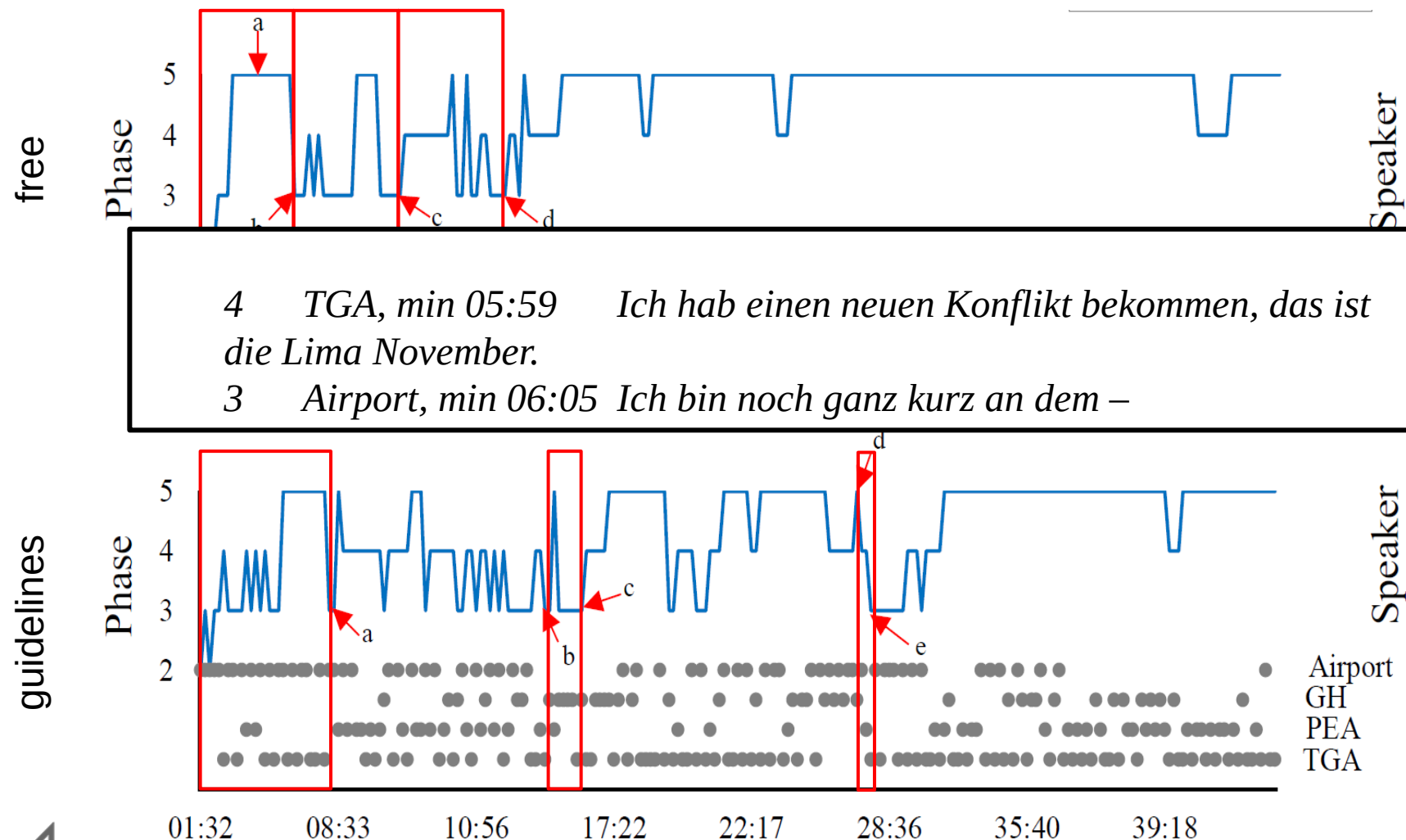
Results

Qualitative Analysis of Interaction Behavior – Team 2



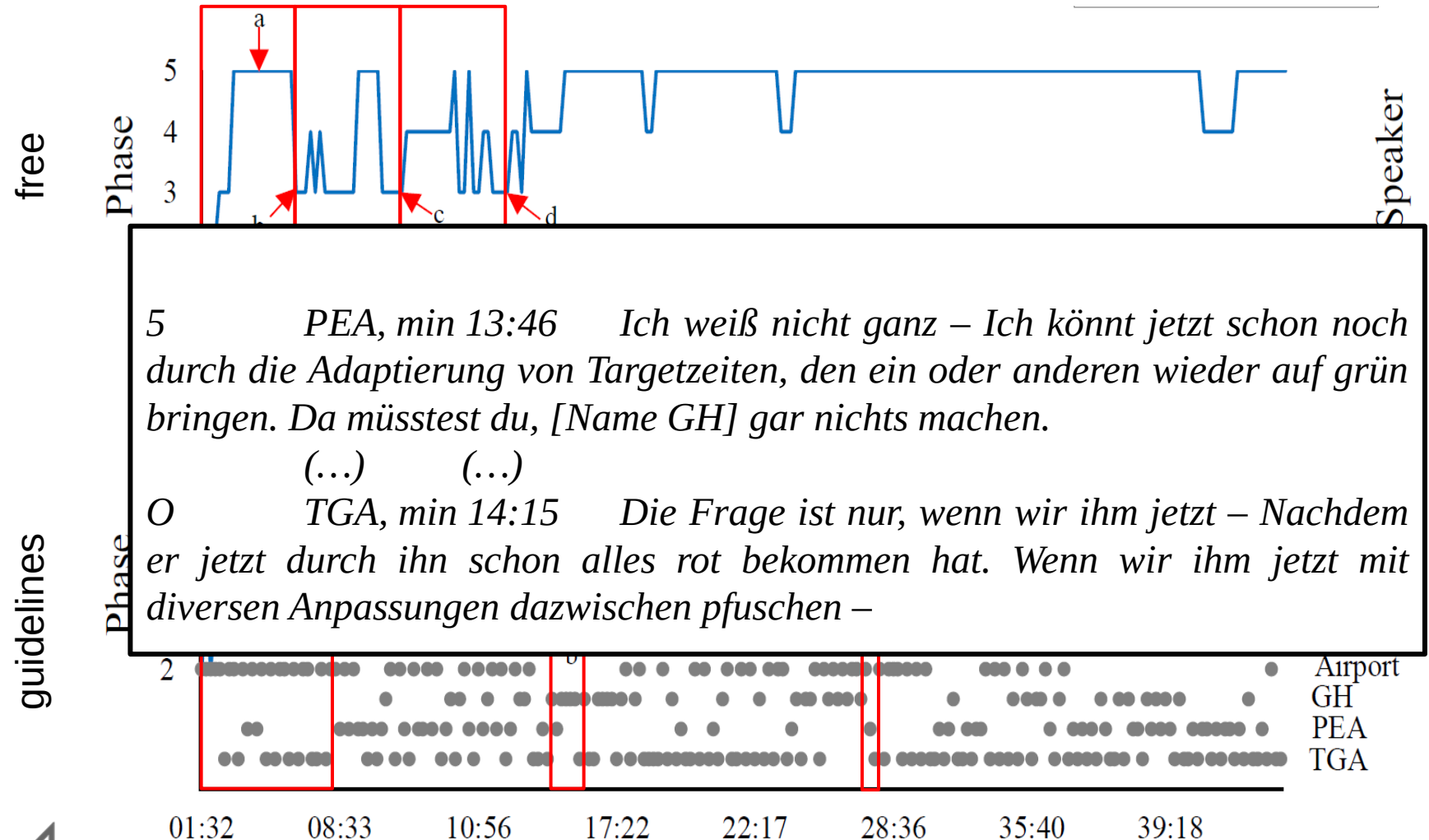
Results

Qualitative Analysis of Interaction Behavior – Team 2



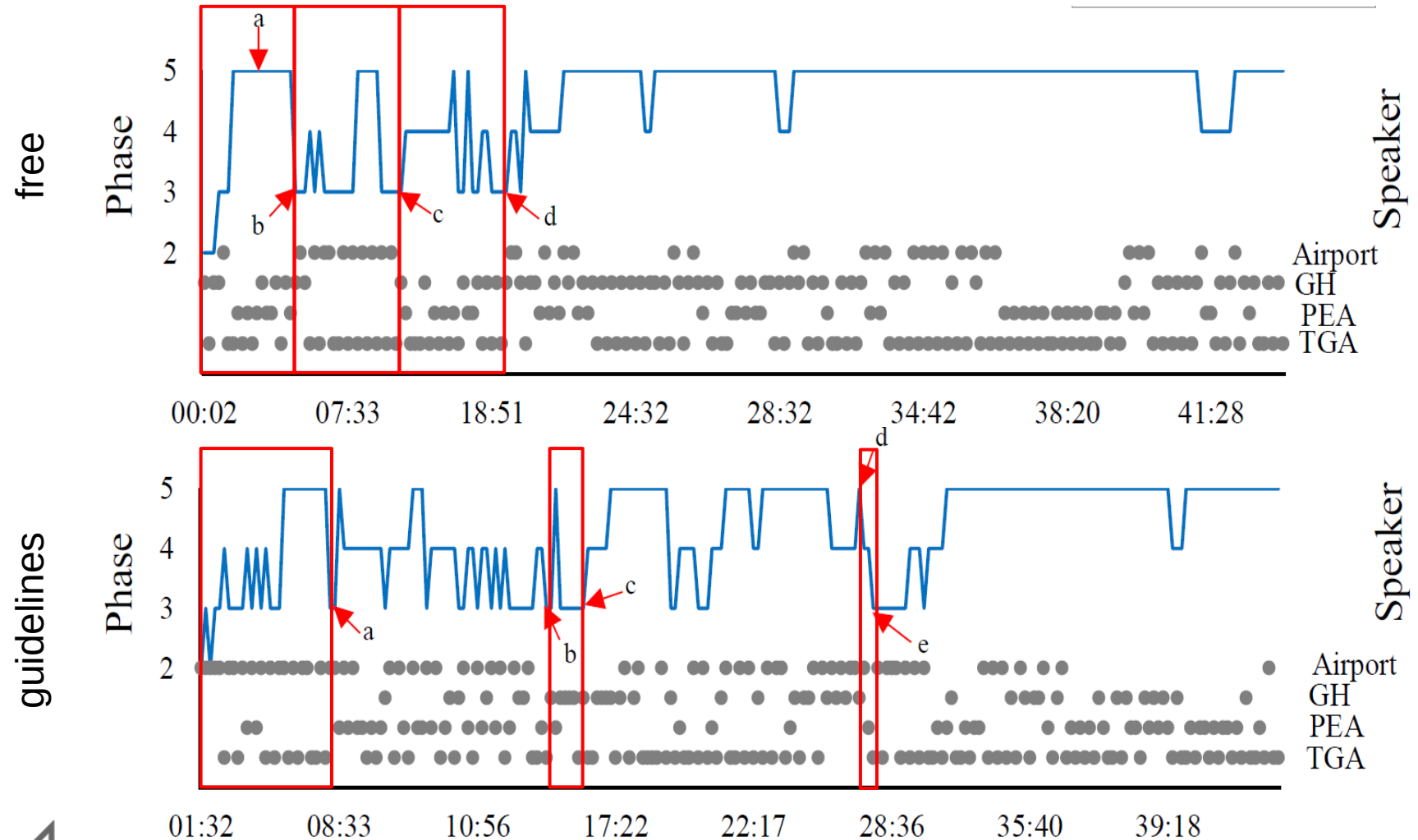
Results

Qualitative Analysis of Interaction Behavior – Team 2



Results

Qualitative Analysis of Interaction Behavior – Team 2



Results

Quantitative Analysis of Interaction Behavior

	team 1		team 2		team 3	
	free	guide	free	guide	free	guide
n events	229	265	226	235	212	205
n events phase 2-4	65	74	70	115	48	69
n events in phase optimization (5)	164	191	156	120	164	136
% of compliant transitions	90.8	96.1	93.3	88.5	91.0	91.2
perc. events in phase optimization	71.6	72.1	73.0	51.1	77.4	66.3

Chi-Square Test for distribution of events

Ratio of compliant transitions increased?	*	(*)	
Situation Analysis more in focus than Optimization?		*	*



Discussion & Outlook

Data Level

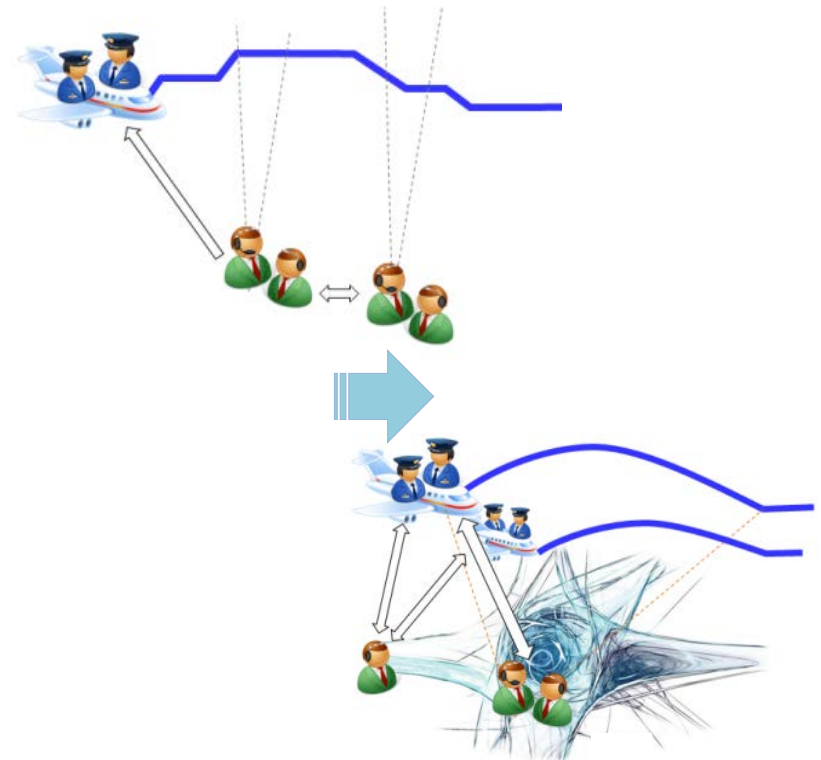
- Content analysis revealed that teams were aware of the guidelines but analysis of phase progression revealed they did not follow them consequently
- Quantitative measures do not show an overall impact
 - Phases could also be identified in runs with free structure, esp. phase 3 - 5
 - Deviations from proposed structure, esp. early input from airlines
 - Strong inter-team differences, more factors influence interaction behavior, e.g. extraversion
- Metrics proposed to quantify impact of guidelines on interaction behavior
 - compliant transitions (n, %)
 - Odds ratio
 - Can be used for statistical analysis, e.g. Chi-square tests
- Small sample size of this study prevents statistical analysis of this data
- Time span of decision making process was fixed (45 min)



Outlook

Advancing the Guidelines & Planned Work

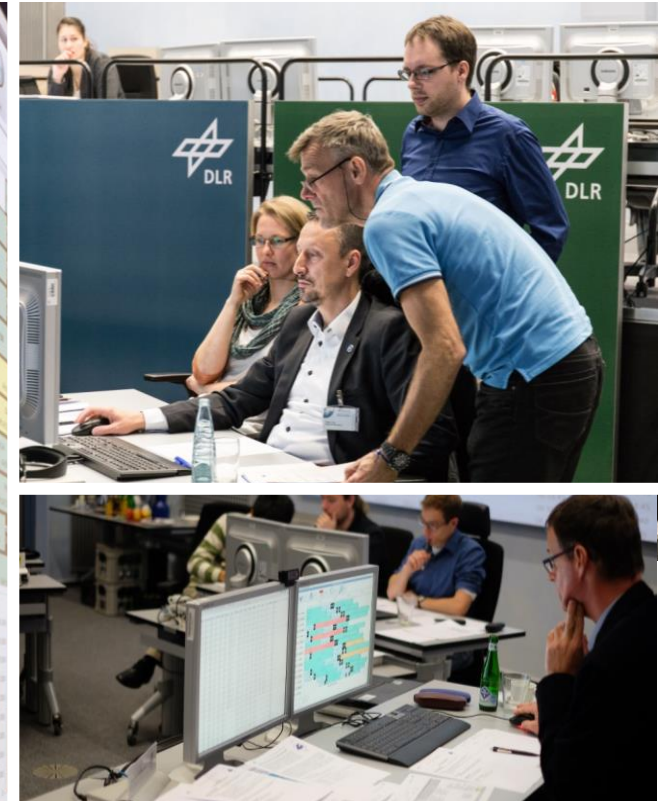
- communicate „affordances“ of the situation early → adapt/add phase where airlines can communicate priorities
- develop „easy-to-remember“ structure
- highlight necessity of situation assessment
 - In collaborative environment no single stakeholder has access to all information relevant for situation assessment
- Collaborative decision making
 - in situations with higher risk and time pressure
 - where several teams contribute to decisions (teams-of-teams)
 - Inter-Team-Collaboration (ITC) as DLR-projekt, planned start 04/2018



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COCO

Collaborative Operations in Control Rooms

