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Language Quality Based Heuristic

effects in the ATC radio communication:

H-LQB

erroneous validation and erroneous falsification effect.

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Italian victims association of Linate 2001

runway incursion accident, a foundation for aviation safety

Searching for H.F causalities in Linate 2001

CVR transcription analysis suggests H-LQB (Trebbi 2004)

But… What is a Heuristic?

Remember Tversky & Kahneman (1992)

It's a cognitive simplification in order to take a decision

And… what is a Language Quality Based Heuristic?

It refers to the property of the language to make cognitive simplifications of the information communicated by the language itself.

This happens by the perception of its quality.

H-LQB Theory
What is a quality of the language?

- It does not refer to the way how an ATC communication is pronounced in English

- It is the level of perception regarding the quality of transmitted factual information (e.g., broadcast flight date, etc.) in a continuum from more “explicit” to more “implicit” shared expectation.

H-LQB Theory

- The quality of a communication is itself communicated between speakers

- The perception of the communicated quality is supposed to affect the process of cognitive elaboration of the information that the language conveys

Hypothesis: ATC communication between speakers is effective when two conditions apply:

A) Sharing of the transmitted factual information (e.g., communicated intention, broadcasted flight date, etc.)

B) Sharing of the expectation of the future events connected to the communicated factual information

Unsafe: predominantly implicit

- When the language quality is predominantly implicit, the sharing of the communicated language quality meaning is not able to give an effective factual information feedback

- The radio exchange gives an implicit sham feedback that could not match the operationaly reality

predominantly implicit: H-LQB

- the sharing of the communicated language quality meaning is not able to give an effective factual information feedback

- Only the implicit level of standardizzation of the organization is shared

- There is no recognized share expectation for future events related to operations

Pilot study

Study material: CVR transcriptions of three misunderstanding broadcast accidents:

- Tenerife 1977
- Linate 2001
- Lexington 2006

Taken together, a list of 16 airborne ATC communications was developed

Pilot study, method

Research Sample: 4 controllers rated the 16 airborne accidents communication

H-LQB questionnaire is developed with 3 questions subdivided into 11 items (7 point Likert scale) to detect the perceived Language Quality for each of the 16 ATC communications

H-LQB questionnaire

Question 1, Items supposed to be positively correlated with the H-LQB occurrences:

a) The communication uses the expectation to receive wait information.

b) The performed communication is standard.

i) The communication employs the implicit knowledge of the communicated meaning

H-LQB questionnaire

Question 1, Items supposed inversely correlated with the H-LQB occurrences:

c) The communication produces a conflict to understand how to resolve the situation.

e) The communication has the aim to clarify an ambiguous information and doubt of the speaker.

h) The communication supports the recognition of the communicated meaning.

H-LQB questionnaire

Question 1, Items free to vary with the H-LQB occurrences:

d) The communication is made to speed up the radio exchange.

f) The communication tends to arouse the impression of a certain emotion of the listener.

g) The communication produces a good communicational contact between pilot and controller.

H-LQB questionnaire

Question 2)The communication is effective for the share of the meaning by the radio.

Question 3)The communication contribute to guarantee the operational safety

Results, correlations per controllers:

correlations between the 11 items for *N*=16 ATC communications separately for each rater (controller)

The standard communication (item b) is negatively correlated with a conflict to understand (item c), positively correlated with the effective communication (item 2) & operational safety (item 3).

The recognition of the meaning (item h) is negatively correlated with the conflict to understand (item c) and positively correlated with the effective communication (item 2)

The conflict to understand (item c) is negatively correlated with the most items, particularly with the effective communication (item 2)

Results, descriptive statistics

Lexington 2006, com 3

- 06:02:01.3 RDO: Comair one ninety one is ready to taxi we have ALPHA.
- 06:02:03.8 GND: Comair one ninety one, taxi to runway two two. altimeter three
  zero zero zero and the winds are two zero zero at eight.
- 06:02:08.9 RDO: three triple zero and taxi two two, Comair one ninety one.

this communication has a high level of expectation to receive wait information (item a), high level to employ implicit meaning (item i) and a low level to produce a conflict to understand (item c)

Results, descriptive statistics

Linate 2001, com 15

- 06 09 19 GROUND: DeltaVictorXray continue your taxi on the main apron, follow the Alfa Line.
- 06 09 28 D-IEVX: Roger continue the taxi in main apron, Alfa Line the.. DeltaVictorXray.
- 06 09 33 GROUND: That is correct and please call me back entering the main taxiway.
- 06 09 38 D-IEVX: I'll call you on the main taxiway.

This has a high level of expectation to receive wait information (item a), high level to speed up the radio exchange (item d) and a high level to employ the implicit meaning (item i). It have also a low level of recognition of the meaning (item h), low effective share meaning (item 2) and a low safety (item 3)

H-LQB occurences

<u>The Linate 2001 and Tenerife 1977</u> H-LQB *erroneous validation effect*

1) a wrong information can be considered correct without stopping the running of the proceeding action

<u>The Lexington 2006</u> H-LQB *erroneous falsification effect*

2) a correct information can be not considered or ignored without stopping the proceeding action

Conclusion

The perceived language quality assessment gives a first indication of <u>the nature of the ATC broadcast communication:</u>

- Its aim is to implement a standard communication, in order to support the recognition of a communicated meaning, but the safety function of the language in producing a cognitive conflict to recover possible procedural ATC mistake seems to be invalidated by a confirmative bias when over trusting implicit language expectations.

Is this a H-LQB relevant situation?

Thank you!