Social Situation Awareness: Empathic Accuracy in the Aircraft Cockpit

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The present study assesses the innovative concept of empathic accuracy within a crew-aircraft-system in a realistic approach scenario. Empathy, one of the key skills of social situation awareness (SSA), was found to be altered in stressful situations. Challenging and surprising events lead to a decrease in empathic accuracy in both pilot flying and pilot monitoring. Stress therefore significantly impacts SSA and modifications in training, procedures and system design could help crews better manage their workload during surprising and challenging situations, leading to increased empathic accuracy and better crew interaction.

Definitions

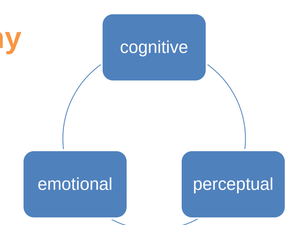
Empathy[5]

- describes isomorphic sharing and, ultimately, understanding of the state of another person
- with full awareness that the source of the shared state is the other person
- results from directly perceiving, imagining or inferring the states of others

Stress[1], [4]

- whenever a demand exceeds the regulatory capacity of an organism,
- particularly in situations that are unpredictable and uncontrollable

Levels of Empathy



Social SA (SSA)

The awareness, i.e., continuous perceiving, comprehending and projecting, of people and their states involved in the operation including passengers

Sociotechnical System & Pilot competencies[3]

- Application of procedures
- Communication
- Flight path management - automation
- Flight path management - manual
- Knowledge
- Leadership and teamwork
- Problem solving and decision making
- Workload management
- Situational awareness (SA)

Research Environment & Methods


Simulator , e.g. AVES DLR ©

- Instructor observations
- Video analysis (aviation experts, researchers)
- Questionnaires (SSA, SART, NASA TLX)
- Individual interview
- Crew debriefing
- Simulator data log
- [fMRI]

SSA questionnaire & Equations

- How much were **you** / was **your colleague** in control of the situation?
- How stressed did **you** / **your colleague** feel in the situation?

$$EA_C = 10 - |PF_R\text{Control-Other} - PM_R\text{Control-Self}|$$

Equation 1: Calculation of empathic accuracy (EA) for control. Example for calculation of EAc for PF.

$$EA_S = 10 - |PF_R\text{Stress-Other} - PM_R\text{Stress-Self}|$$

Equation 2: Calculation of empathic accuracy (EA) for stress. Example for calculation of EAc for PF.

Participants

- 20 crews volunteered; 18 evaluated
- 36 pilots,
  - 19 captains, 17 first officers
- Average age 43 years, (SD = 10.4)
- Average flying experience 2,405.50 hours, (SD = 1,886.61)
- Roles
  - pilot flying (PF),
  - pilot monitoring (PM)

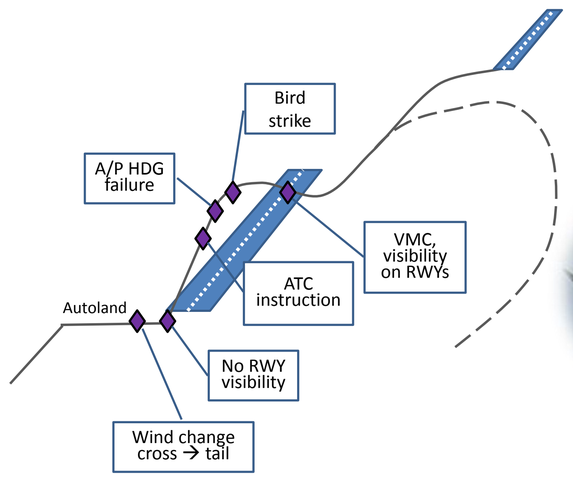


Figure 1: Operational scenario.

Results

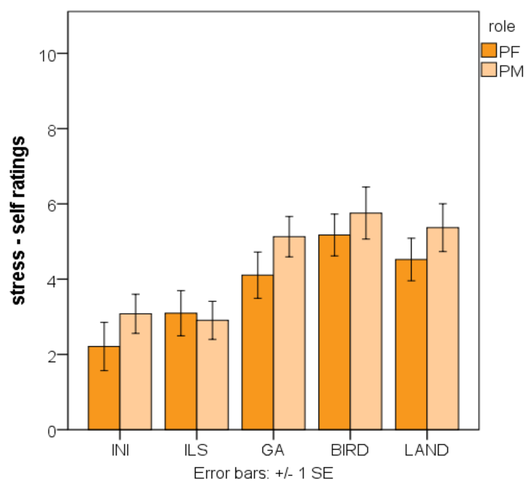


Figure 2: Mean ratings of stress for each flight phase (i.e., "How stressed did you feel in the situation?"), self ratings, N=36.

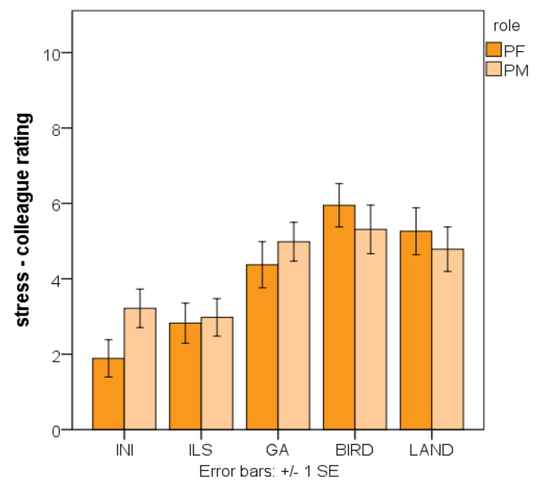


Figure 3: Mean ratings of stress for each flight phase (i.e., "How stressed did your colleague feel in the situation?"), self ratings, N=36.

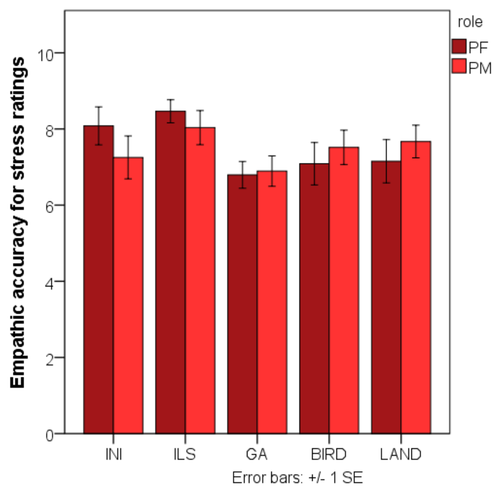


Figure 4: Empathic accuracy for the assessment of stress (i.e., "How stressed was your colleague?"), for each flight phase, N=34.

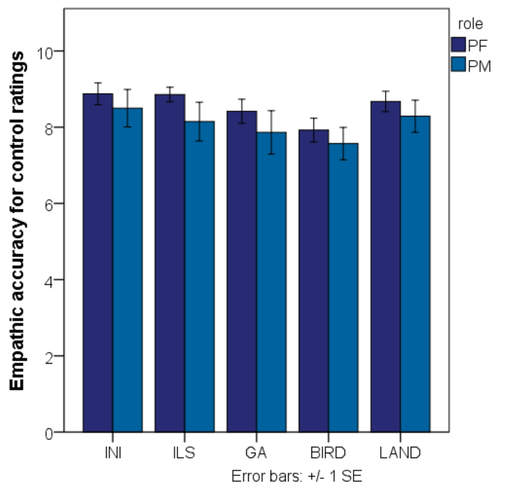


Figure 5: Empathic accuracy for the assessment of control (i.e., "How much was your colleague in control of the situation?"), for each flight phase, N = 34.

Conclusions

- Stress, i.e., challenging and surprising situations during flight, leads to altered social cognition.
- Empathic accuracy of PF and PM was decreased during stressful / high workload situations.
- Pilots consequently may be less able to sufficiently guide their colleagues through challenging situations, carry out effective communication, and make adequate decisions.

References

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