Risks People Take and Games People Play

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It’s About This Aircraft

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Which Once Looked Like This

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Think before you fly: what are the risks?
Are they qualitative?
  ▶ and then put numbers to them and perform a PRA?
How do you distinguish pertinent risks
  ▶ Somebody collides with me in dense traffic on take-off
..... from non-pertinent risks
  ▶ All the molecules in my left wing move 1m sideways at the same time
even qualitatively it’s difficult!

I have a suggestion..................
Taking a Bet

- Is PBL going to be run over by a bus in Bristol?
- How to reckon the chances?
PBL Is Run Over By A Bus in Bristol

PBL encounters bus in Bristol

chance

arrival

departure

time

presence
The chances of me being run over...bus...Bristol...
- are zero when I am not in Bristol
- become non-zero only when I arrive
- go to zero again when I depart
A Finer Representation

- Sleep through own talk & banquet
- Exit to station, chased by a bear
- Go to Hobgoblin during boring talk
- Sleep
- To hotel

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How Fine Need We Go?

- Depends on your needs
  - bus company insurance: am I ever in Bristol during the fixed insurance period?
  - my travel insurance: ..... in the one-week period?
  - me: when I’m on or near the street in Bristol
The General Picture

quasi step-function

↑
unknown but positive & substantial

effectively zero
Should We Fly Over Afghanistan?

- Assumption: We do not want to get shot down!
- Is there anything that could reach us?
- Sure, International Security Assistance Force assets
- Do we trust ISAF?
  - do we trust the component forces individually?
  - we regularly do so in their home countries
  - we assume the same or similar discipline wrt assets
  - Conclusion: Yes, risk with ISAF is "as usual"
  - we also trust them to tell us when it’s not safe
- What about the opponents of ISAF?
  - They do not have the assets
  - Ergo: quasi-step-function is flat, effectively zero
  - (there is a slim chance somebody might have given them an asset)
- Anyone else? Locally-trained forces. No access to assets
Fly Over Afghanistan? Chances of Shootdown

- ISAF: Same or similar to risk flying over ISAF home countries
  - Acceptable risk
- Opponents: Effectively zero risk
- Locally-trained forces: effectively zero risk
- Anyone else? No.

Calculation: **Acceptable** + Effectively 0 + Effectively 0 = Acceptable
Should We Fly Over Ukraine?

- Same Assumption: We do not want to get shot down!
- Is there anything that could reach us?
- Sure, Ukrainian military assets
- Russian military assets
- Maybe, or maybe not, Rebel military assets
For Example, One of These

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Or One of These

Photo: Mike Freer, Touchdown Aviation, licensed under GFDL 1.2
Or Even One of These

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Which, When Complete, Looks Like This

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Or Maybe, Some Have Suggested, One of These

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Fly Over Ukraine? Chances of Shootdown

- Ukrainian Assets
  - Acceptable/unacceptable risk?
- Russian Assets
  - Acceptable/unacceptable risk?
- Rebel Assets
  - Acceptable/unacceptable risk?
- Anyone else? No.

Calculation: For the Discussion!
A General Approach

- Why-Because Analysis (WBA) allows graphical representation of incident causality
  - Uses the Counterfactual Test to establish causality between possible factors
  - Many examples of Why-Because Graphs (WBG) in the WBA pages on the Uni Bielefeld RVS Group WWW site www.rvs.uni-bielefeld.de

- Causal Control Flow Diagrams (Sieker) allow representation of causality in feedback
  - same causal semantics as WBG
  - allows loops, for there may be and often is feedback
  - Examples from Sieker on the Causalis WWW site www.causalis.com

- Causal Fault Analysis (CFA) and Graph (CFG)
  - same causal semantics as WBG and CCFD
  - allows alternatives - there is a special OR connective node
  - thereby allows expression of limited uncertainty
A Causal Fault Graph
Annotating CFGs

- One can annotate any causal factor in a CFG with a quasi-Boolean (qB)
  - either a quasi-step function as before = quasi-Boolean-1
  - or a flat line = quasi-Boolean-0
A CFG/WBG subgraph with qB assignments
Propagating qB-0’s through the CFG

- qB-0 propagates upwards through NCF edges
- but not through disjunctives
- this follows from the semantics of NCF (≡ necessary causal factor, WBA-speak)
CFG/WBG + qB propagating

propagates because of NCF semantics
CFG/WBG + qB propagating further
Pruning After Propagation

- When the CFG has been annotated and propagated, qB-0 annotated nodes may simply be eliminated.
- The smaller CFG that is left represents the current possible events and behaviours leading to the fault.
Experience with CFGs

- Causalis has performed CFA and derived CFGs for clients
- They are far better and more accurate, especially more complete, than industry-typical FMEA
- Which should not be that surprising, since there is no semantics behind FMEA, whereas WBA, CCFD and CFA are all backed up with rock-solid semantics
- So please ask us to do one for you!
Finish
All done
Fertig
Thanks
so much
Danke
Merci!