Risks People Take and Games People Play

Peter Bernard Ladkin

University of Bielefeld and Causalis Limited

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It's About This Aircraft

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Which Once Looked Like This

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But Now Looks Like This

Photo: Dominique Faget/AFP, from Aviation Herald WWW page

How To Tell If It's Going To Happen

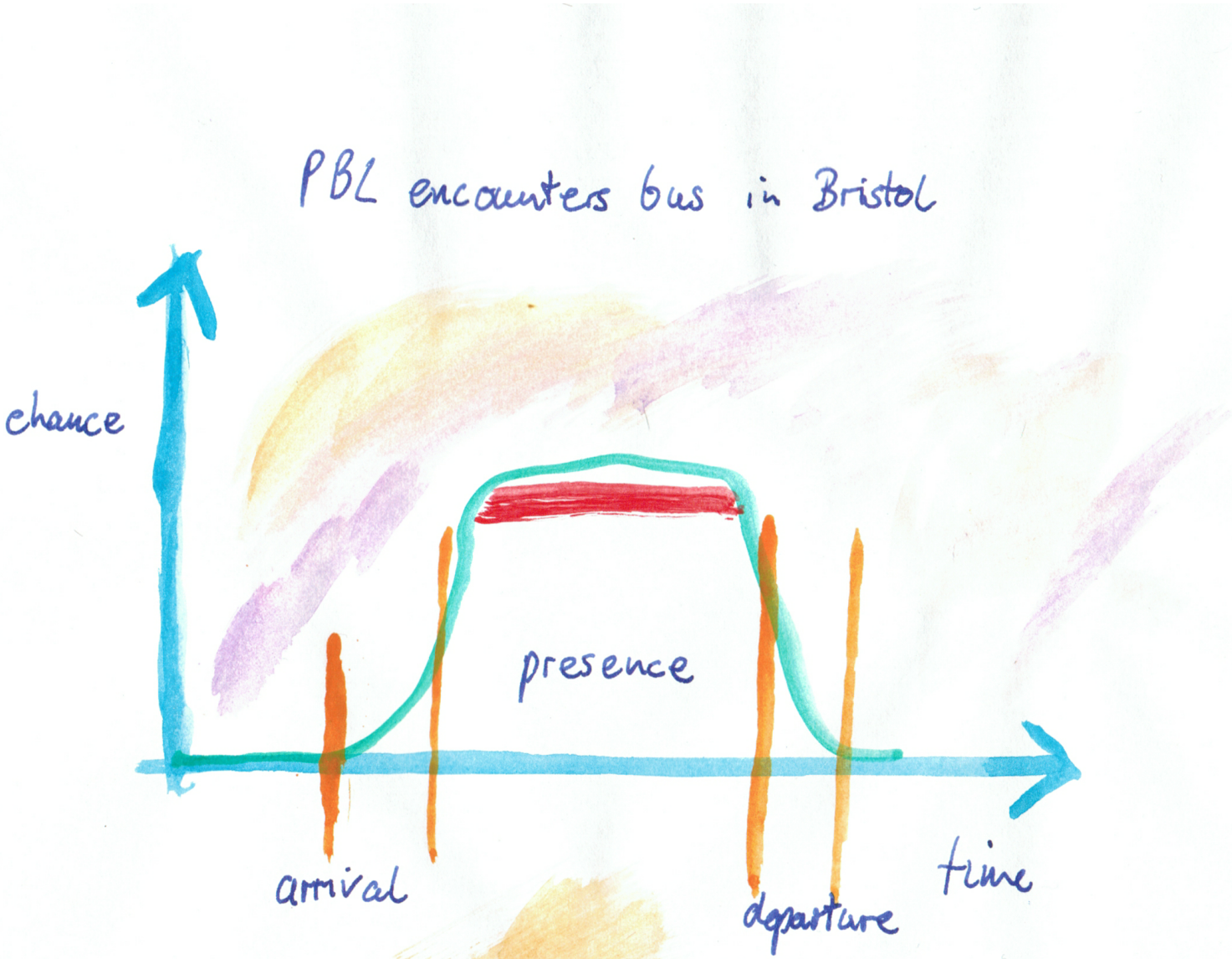
- Think before you fly: what are the risks?
- Are they qualitative?
  - and then put numbers to them and perform a PRA?
- How do you distinguish pertinent risks
  - Somebody collides with me in dense traffic on take-off
- ..... from non-pertinent risks
  - All the molecules in my left wing move 1m sideways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

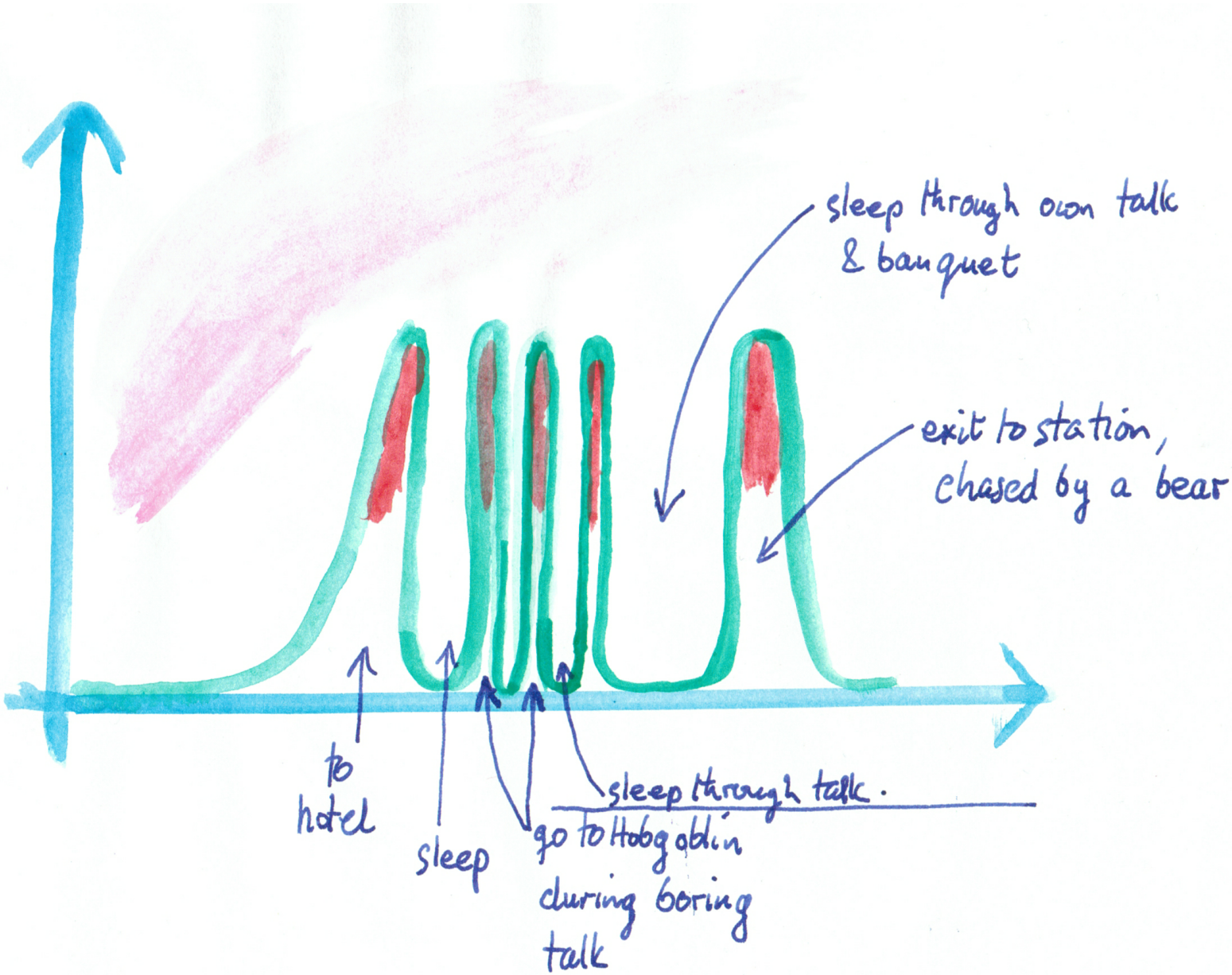
PBL Is Run Over By A Bus in Bristol



PBL, Bus, Etc

- 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

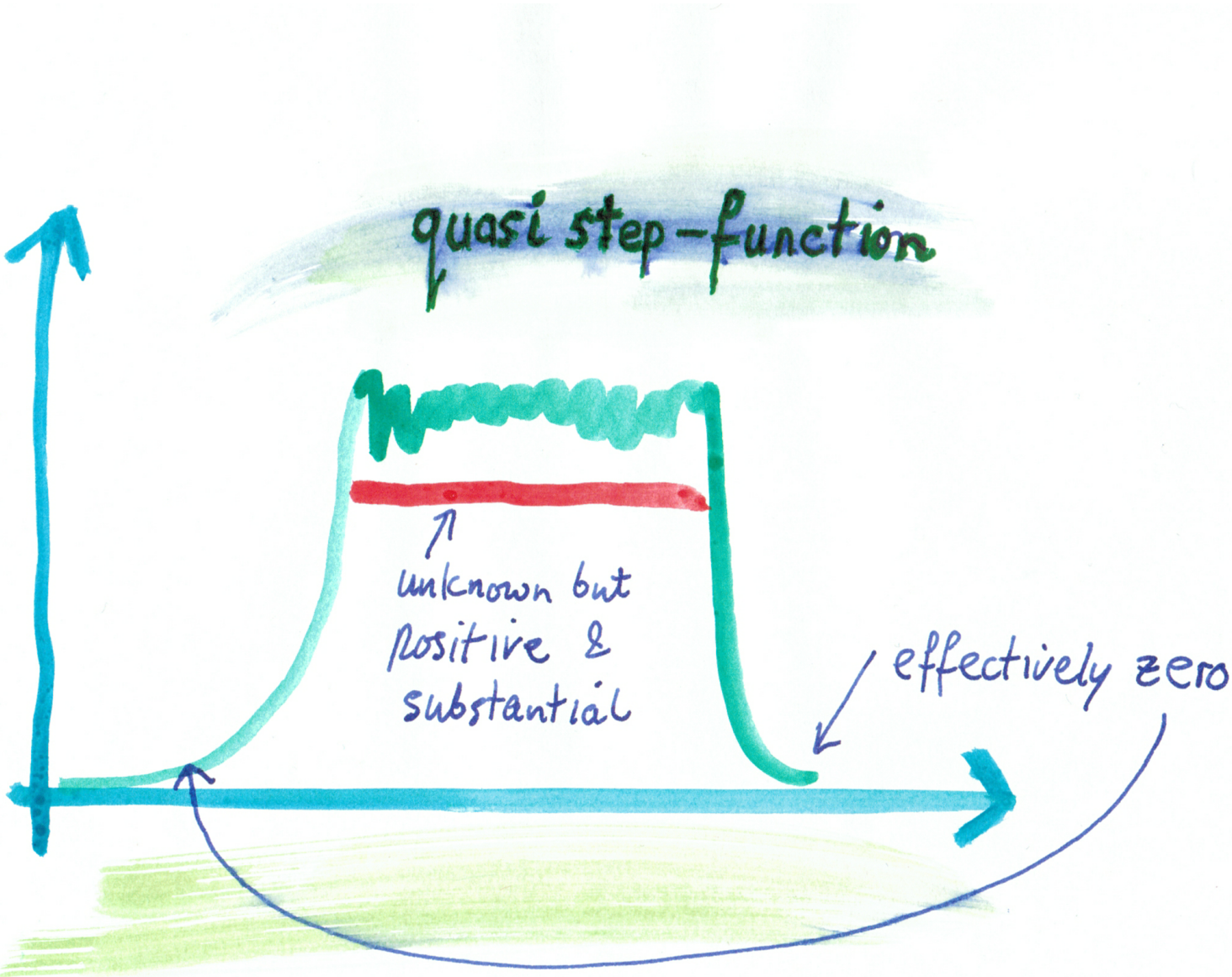
A Finer Representation



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



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 äs 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

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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

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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

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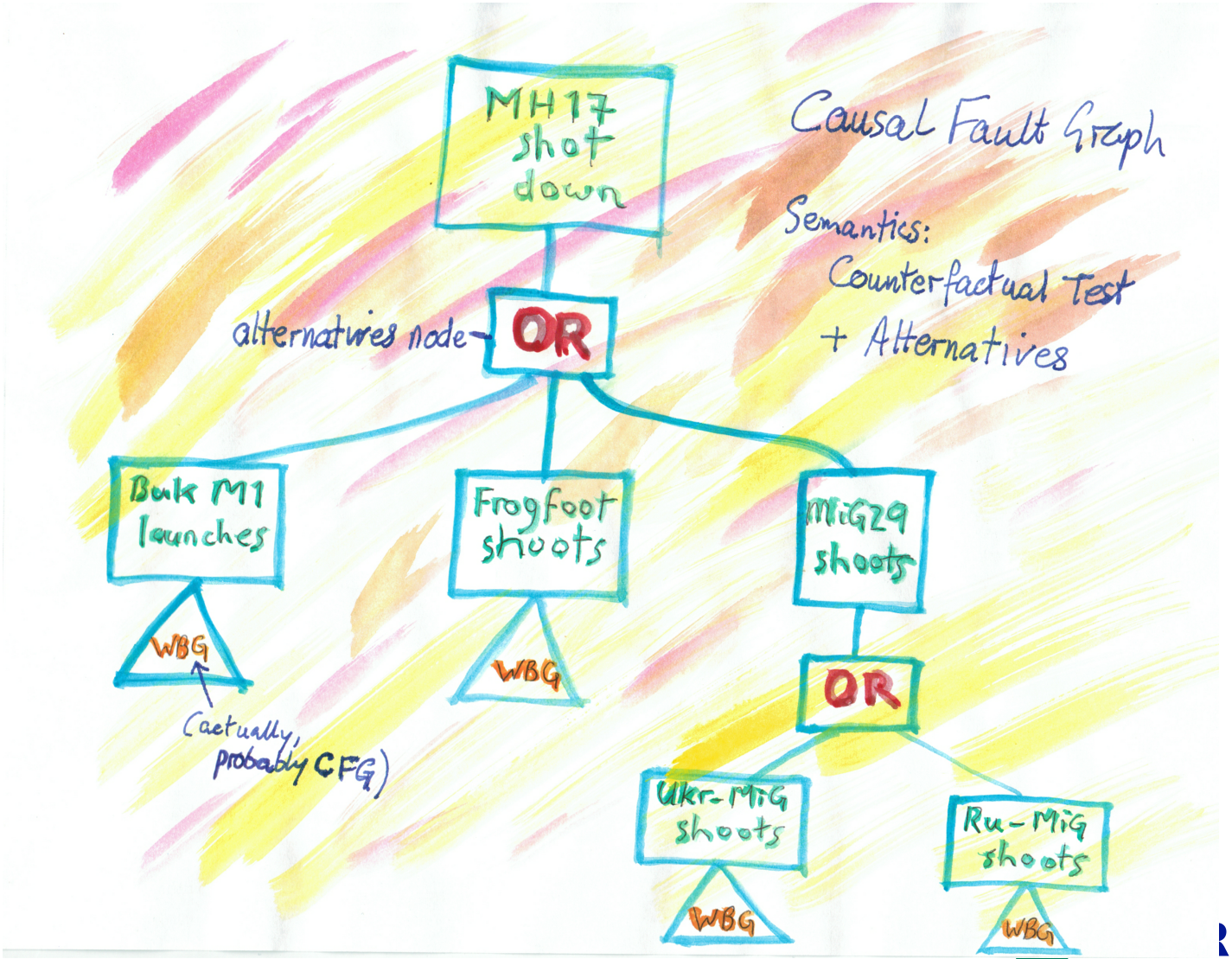
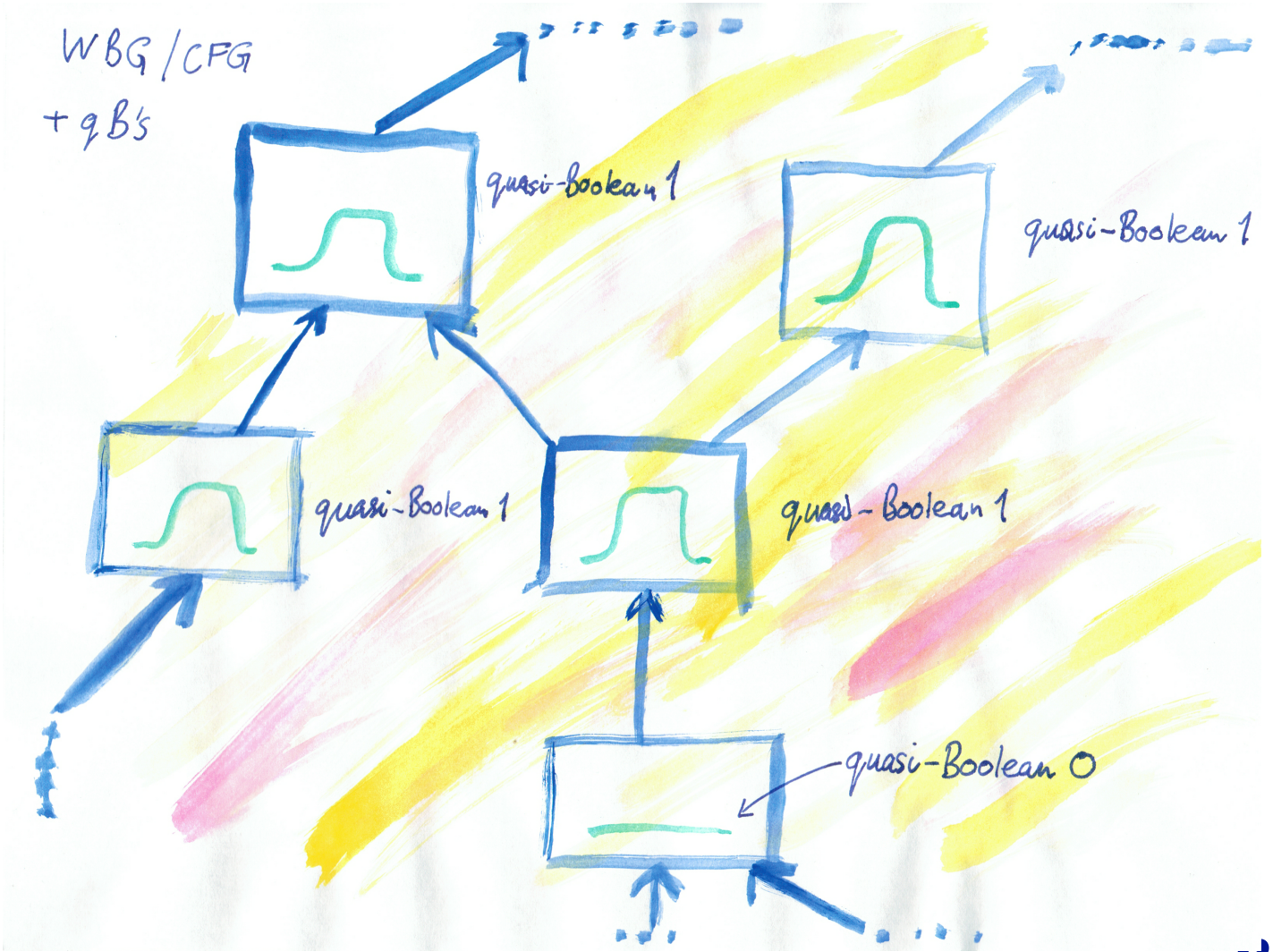
A Causal Fault Graph



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

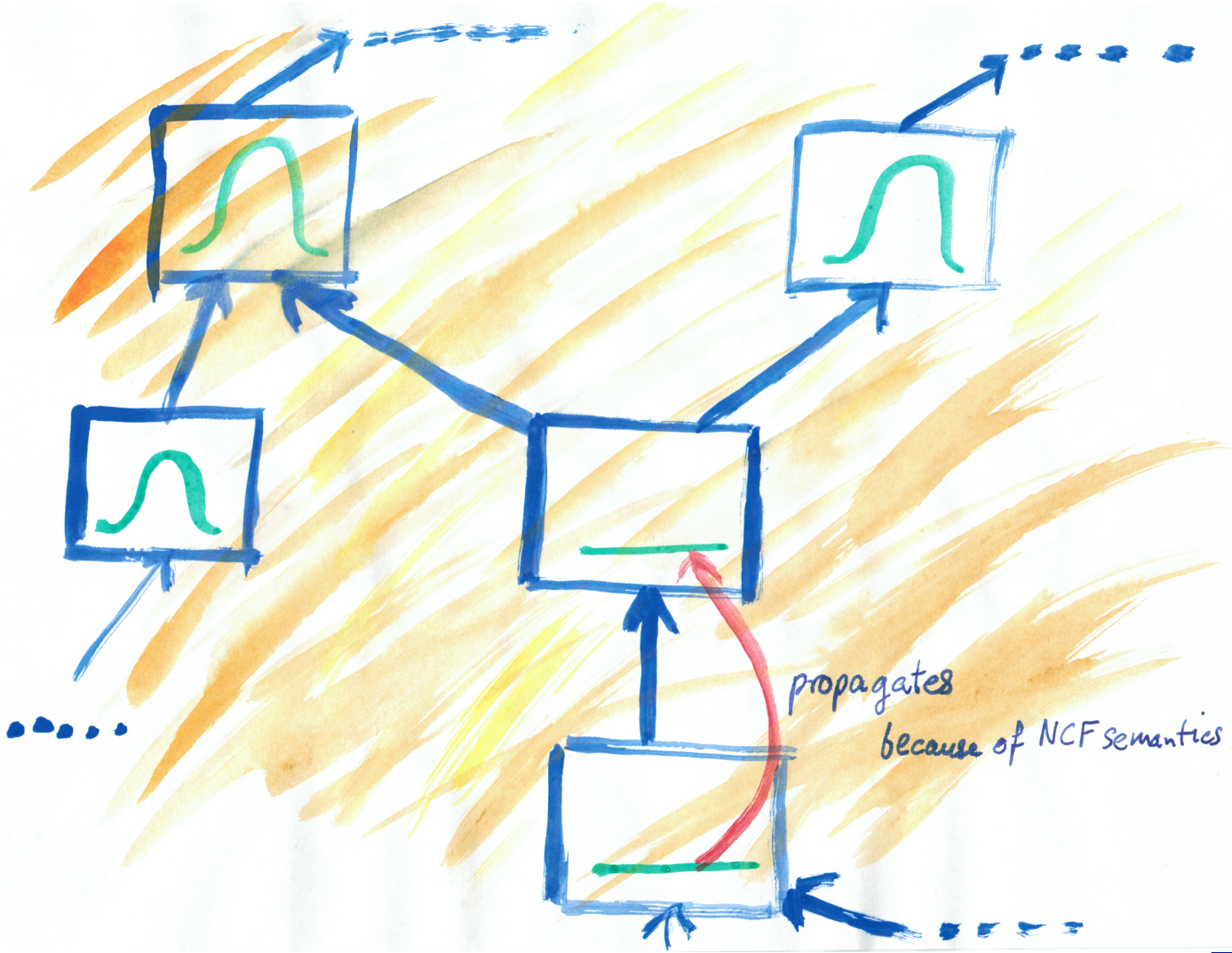
A CFG/WBG subgraph with qB assignments



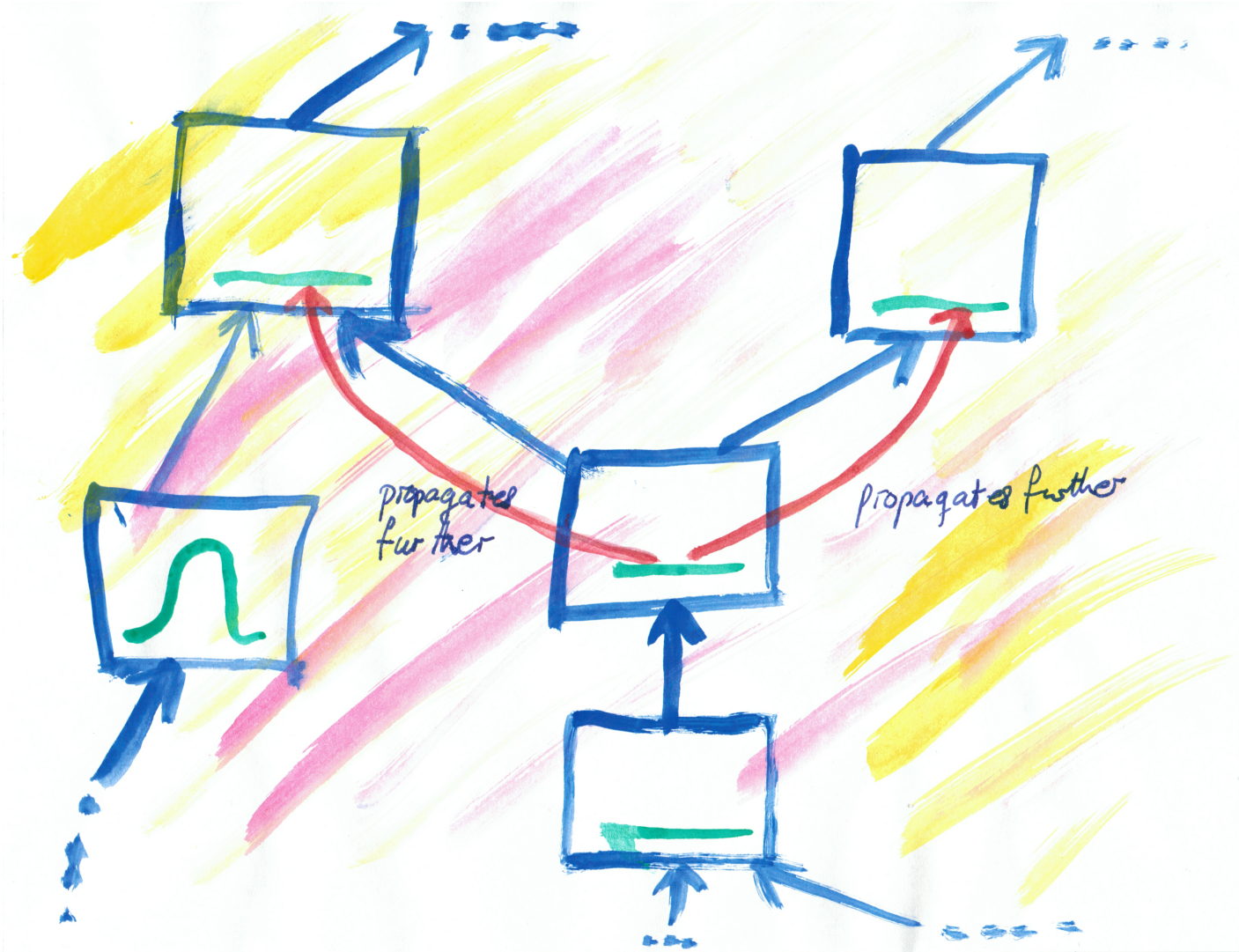
Propagating qB-0's through the CFG

- 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



CFG/WBG + qB propagating further



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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!

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Finish
All done
Fertig
Fini
Thanks
so much
Danke
Merci
!
Tuttut-ats all, folks!