

# Characterizing Factuality in Normal Form Sequential Decision Making

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# About Us

- Nathan Huntley



- from Redcar, Teesside
- master's thesis on Bayesian decision making in contaminated land
- PhD student since 2007
- main research interest is Bayesian imprecise decision theory under very weak assumptions

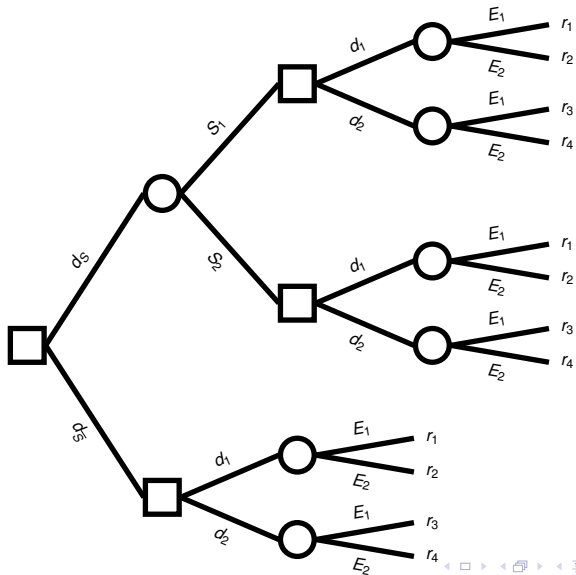
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- Matthias Troffaes

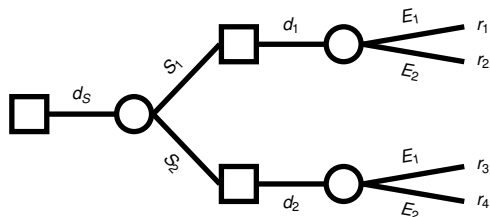


- Brugge → Gent → Pittsburgh → Durham Brewery
- in Durham since 2006, lecturer in Statistics
- main research interests in foundations of imprecise probability theory and sequential decision making

# A Decision Tree



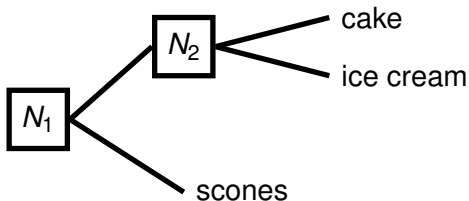
## Example: Normal Form Decision



$$S_1(E_1 r_1 + E_2 r_2) + S_2(E_1 r_3 + E_2 r_4)$$

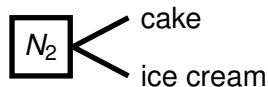
- A **normal form solution** of a decision tree is a set of these normal form decisions.
- Simplification: represent normal form decisions by **gambles** and use a choice function  $\text{opt}(\mathcal{X}|A)$  on gambles to find solution.

# Example



- There are three paths through this tree.
- Suppose that the path leading to cake is the only optimal path.

## Example Continued



- Suppose here that the path to ice cream is the only optimal path.
- The choice between cake and ice cream **depends on the tree in which the decision is embedded.**
- For technical definition of factuality, see poster.

# What Choice Functions Induce Factuality?

- Most choice functions are counterfactual.
- A notable exception is expected utility.
- In particular, typical imprecise probability choice functions are counterfactual.

## “No Imprecision” Theorem

*opt must be induced by a total preorder to induce factuality.*

# What Can Be Done?

- Some types of counterfactuality may not be so bad, e.g. those where backward induction still works (maximality, E-admissibility).
- Other normal form solutions may be factual. **These often have other unpleasant properties.**
- Extensive form solutions can be factual without such major disadvantages.
- **Come to our poster!**