ARE RISK ANALYSTS TOO REWARD-AVERSE?

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Is risk assessment a science?



Robert B. Cumming, first issue, March 1981:

'Risk assessment cannot demand the certainty or completeness of science. It must produce answers because decisions will be made, with or without its input.'

'The quality of societal decisions will be influenced by the quality of the risk information that goes into them.'

Scientific discovery: Exploring the anti-matter world





Anti-Risk Studies



- Hunting the Black Swan
- Exploring Dangerous Terrains
- Exploiting Volatility
- Evading the Precautionary Principle

What are the reward-seeking deficits induced by dopamine depletion?

Handbook of Reward and Decision Making (2009)

Law and rare injury risk: Bolton v Stone 1951



The cricket club was carrying out a lawful and socially useful activity.

The club is not liable for injury to an outside bystander because, although the possibility of this happening was foreseeable, such a colossal hit had so rarely been recorded.

The risk was thereby too low to qualify as unreasonable.

David Ball and Laurence Ball-King Public Safety and Risk Assessment

The reward of canoeing at sea



The risk of canoeing at sea

On 22nd March 1993, a party of teenagers, together with a teacher and two instructors went canoeing in Lyme Bay. Some of the canoes drifted out to choppy water at sea and capsized. The coastguard were called late and arrived late. Four children died.

Peter Kite, the London-based boss of the Dorset activity centre was jailed for **two years** after being found guilty of manslaughter. However, the centre manager in Lyme Bay was acquitted.

> *'This was not an accident.'* Carolyn Langley (bereaved mother)



Tolerability of risk

Unacceptable region

ALARP region: risk is only tolerable if risk reduction is impractical, or its cost is grossly disproportionate to the improvement gained.

Broadly acceptable region



Negligible risk

Farber's α-precautionary principle

Worst case scenario loss



α-precaution is aimed at avoiding the worst case scenario, such as dominates application of the precautionary principle.

It is more nuanced, and also involves precautions against losing the possible benefits of the best case scenario.

The user decides on the value for the optimism-pessimism weight parameter α , balancing the worst and best cases.

Risk at sea: Magellan's circumnavigation



On 20 September, 1520, Magellan led a flotilla of five ships with a crew of 250 out of the Spanish port of Sancar de Barrameda. Their goal was to find a water passage around the Americas and continue on to the riches of the spice islands of the East Indies.

Three years later, only the *Victoria* with nineteen crew aboard returned home to Spain.

Dynamic risk matrix



Dynamic reward matrix



Risk aversion

THE CONQUEST OF



Wernher von Braun's: 1948 Das Marsprojekt

 The mission parameters called for 70 men to travel to Mars in 10 spacecraft. The men would travel in groups of 10 divided between seven passenger ships equipped with 20meter-in-diameter habitation spheres.

 In 1948, the intensity of cosmic and solar rays and the likelihood of being struck by a meteoroid were both unknown.

Mars 2023: inhabitants wanted



Physics Nobel laureate Gerard 't Hooft is a Dutch ambassador for the project. Nasa's guidelines say that astronauts should not be exposed to more than 1,000 millisieverts (mSv) of radiation in a lifetime, which is associated with a 5% increase in risk of developing a fatal cancer.

Based on data from the Mars Science Laboratory spacecraft, astronauts on the shortest 360-day round trip to Mars would get a dose of 2/3 of this on their journey.

Science, 31 May, 2013

Challenger disaster: January 1986



'Since the shuttle is a manned vehicle, the probability of mission success is necessarily very close to 1.0'



Neglect of data for risk analysis



Flights with no incidents were ignored; logistic regression analysis shows a significant increase in failure probability.

Variability of risk aversion: willingness to pay to avoid the risk



The attraction of convexity

- Antifragility means more to gain than to lose; more upside than downside.
- If you make more when you are right than you lose if you are wrong, then you will benefit, in the long run, from volatility.



Asymmetry of collective risk and personal reward

- At UBS, in early summer 2007, a \$10 billion trade was urgently executed so that a mark-to-market profit of \$30 million could be racked up just in time to contribute to the traders' bonus pool.
- Sixteen months later, the \$10 billion trade was marked down to just \$2 billion, realizing a loss of \$8 billion.



Passive asymmetry in regulatory errors

TYPE-I ERROR False Positive

Premature closure of a financial institution.

TYPE-II ERROR False Negative

Wait until a financial institution defaults on its obligations.

Financial regulators may be sued for premature closure of a solvent firm. The penalty for acting late is perceived to be much smaller.



Asymmetry of personal risk and collective reward



In 1960 Frances Kelsey began working for the Food and Drugs Administration (FDA) as a medical officer reviewing new drugs licensing applications.

In her first month, and against great pressure, she denied a licence to the drug thalidomide because of the lack of clinical evidence about its side effects. Shortly after, thalidomide's devastating effects became known.

Who gets the reward and who takes the risk?

Class A

Individuals who take on personal risk for substantial societal reward



Class B

Individuals who take on personal risk for substantial individual as well as societal reward

Class C

Individuals who subject others to substantial risk for their own personal reward.



American University of the Caribbean School of Medicine



The government of Montserrat granted AUC a 25-acre parcel of land near Plymouth, where a new campus of 17 buildings was built. AUC began conducting classes at its new campus in Montserrat in January 1980.

On September 17, 1989, Hurricane Hugo hit the island, severely damaging the campus.

The Montserrat campus was rebuilt and AUC reopened it for classes in September 1990.

Thought to be dormant, the Soufrière Hills volcano on Montserrat erupted on 18 July 1995, rendering much of the island uninhabitable, including the entire city of Plymouth.

Students and faculty were evacuated, and the campus was buried under volcanic ash.

