

Representing and expressing uncertainties and risk in a scientific context

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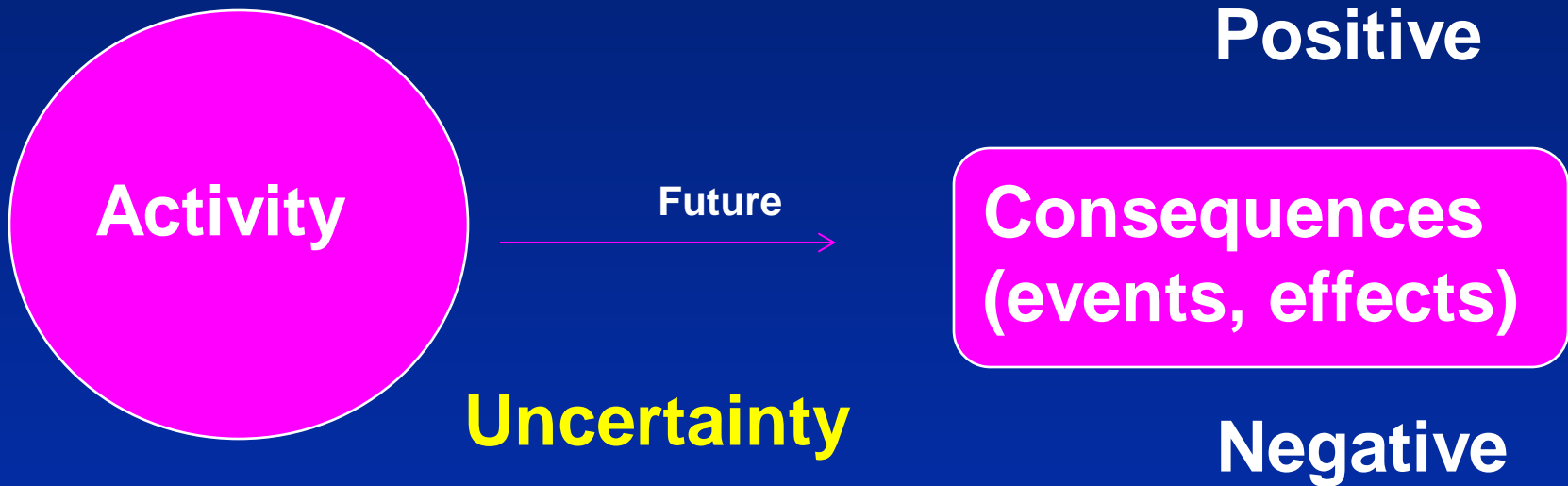
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How is it possible to meaningfully communicate uncertainty and risk, when an interpretation of the most basic tool – probability – is not available? It is simply not possible. It will fail.

Successful communication of risk and uncertainties requires a proper scientific platform. Unfortunately, such a platform is missing in the EFSA guidance document.

Uncertainties

Risk



Expressing uncertainty

Expressing uncertainty

Probability

Knowledge



Subjective/knowledge-based probability

Imprecision interval

Uncertainty

Imprecision

Probability is used for all !

Variation

Frequentist probability, probability models



**Frequentist
probability**

P_f

**A: Pin down when throwing the
pin**

**$P_f(A) = p$ is unknown and is
estimated**

Subjective probability

Subjective probabilities

The probability of the event A , $P(A)$, equals the amount of money that the assigner would be willing to put on the table if he/she would receive a single unit of payment in the case that the event A were to occur, and nothing otherwise ...

Many other such interpretations exist (Ramsey, Savage ...)
Common in the economic literature and among decision analysts



1930
Bruno de
Finetti

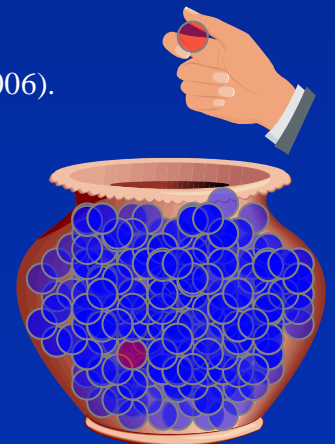
Subjective probabilities

A mixture of uncertainty assessments and value judgments

It should not be used !!!

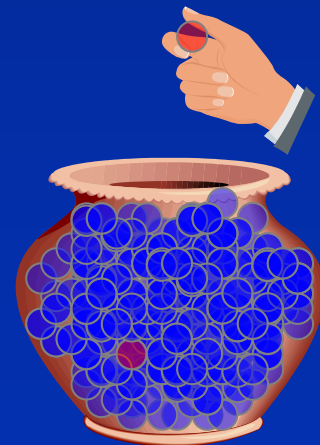
Subjective/knowledge-based/judgmental probability

- $P(A) = 0.95$
- The assessor compares his/her uncertainty (degree of belief) about the event A to be true (occur) with drawing a red ball from an urn that contains 100 balls where 95 are red (Kaplan and Garrick 1981, Lindley, 1970, 2006).



Imprecise probability

- $P(A) \geq 0.95$
- The assessor compares his/her uncertainty (degree of belief) about the event A to be true (occur) with drawing a red ball from an urn that contains 100 balls where 95 or more are red



$P(A | K)$

K: background knowledge

$$P(A \mid \text{assumption}) < 0.0000001$$

- Subjective probabilities $P(A|K)$ can always be assigned
- But the strength of K also needs to be reflected

Expressing uncertainty

**Judgemental/
knowledge-based,
subjective
probabilities P**

Knowledge

K

**Assessor's expression
of uncertainty – a
degree of belief**

The food is safe if

- the **judged probabilities** of undesirable events (suitably defined) are sufficiently small, and
- the **knowledge** supporting the probabilities is sufficiently strong

- Uncertainty is a key component of risk
- Expressing uncertainty:

Probability

Knowledge



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- Extra

Food x is safe

Confidence

**Evidence,
knowledge,
science**

Humbleness

**Uncertainties,
risks**

Strength of knowledge

- *The reasonability of assumptions*
- *Amount of reliable data and information*
- *Degree of agreement/consensus among experts (coming from different 'schools')*
- *The degree to which relevant phenomena involved are considered well understood*
- *The degree to which the knowledge basis has been thoroughly examined*

- Has a risk assessment of the deviations from assumptions been conducted (an assumption deviation risk assessment)?
- Have attempts been made to strengthen the knowledge where it is not considered strong?
- Have special efforts been made to uncover potential surprises of the type, unknown knowns?

- Have special efforts been made to uncover any weaknesses or holes in the knowledge on which the analysis group has built their analysis?
- Have special efforts been made to assess the validity of the judgements made where events are ignored because of low judged probability?
- Have people and expertise, not belonging to the initial analysis group, been used to detect such conditions?