



Ignorance and Uncertainty in Sickness and in Health

Michael Smithson

Department of Psychology, The Australian National University

Facing Unknowns:

Evidence-based practice has had successes... However ...

1. Practitioners often must make decisions without full information
2. Policies and laws must be crafted under the shadow of an unknowable future
3. The consequences of major public health decisions, policies, and laws often cannot be known for a long time.
4. Some new kinds of health risks involve unknowns on a grander scale than older risks.

So, the unknown is omnipresent and important →
What do we know about the unknown
and how to deal with it?

A few “bold” claims about the unknown:

1. Ignorance or uncertainty is not unitary. People think and act as if there are different kinds.

A few “bold” claims about the unknown:

1. Ignorance or uncertainty is not unitary. People think and act as if there are different kinds.
2. Many important unknowns cannot be eliminated or regulated.

A few “bold” claims about the unknown:

1. Ignorance or uncertainty is not unitary. People think and act as if there are different kinds.
2. Many important unknowns cannot be eliminated or regulated.
3. People have uses for uncertainty, and some of those uses underpin important forms of social capital. Reducing those uncertainties destroys social capital.

A few “bold” claims about the unknown:

1. Ignorance or uncertainty is not unitary. People think and act as if there are different kinds.
2. Many important unknowns cannot be eliminated or regulated.
3. People have uses for uncertainty, and some of those uses underpin important forms of social capital. Reducing those uncertainties destroys social capital.
4. We always trade away something when we try to reduce uncertainties. Sometimes we should be reluctant to make the trade.

Different kinds of unknowns?

The website of the Centre for Evidence-Based Medicine at the University of Toronto example of a female patient whose serum ferritin test for diagnosing iron deficiency anaemia yields 40 mmol/l.

$P(\text{anaemia}|\text{test}) = 70/85 \rightarrow$ Recommend treatment.

serum ferritin test result	iron deficiency anaemia		Likelihood Ratio
	Present	Absent	
positive (≤ 45 mmol/l)	70	15	8.24
negative (> 45 mmol/l)	15	135	0.20
	85	150	

Different kinds of unknowns?

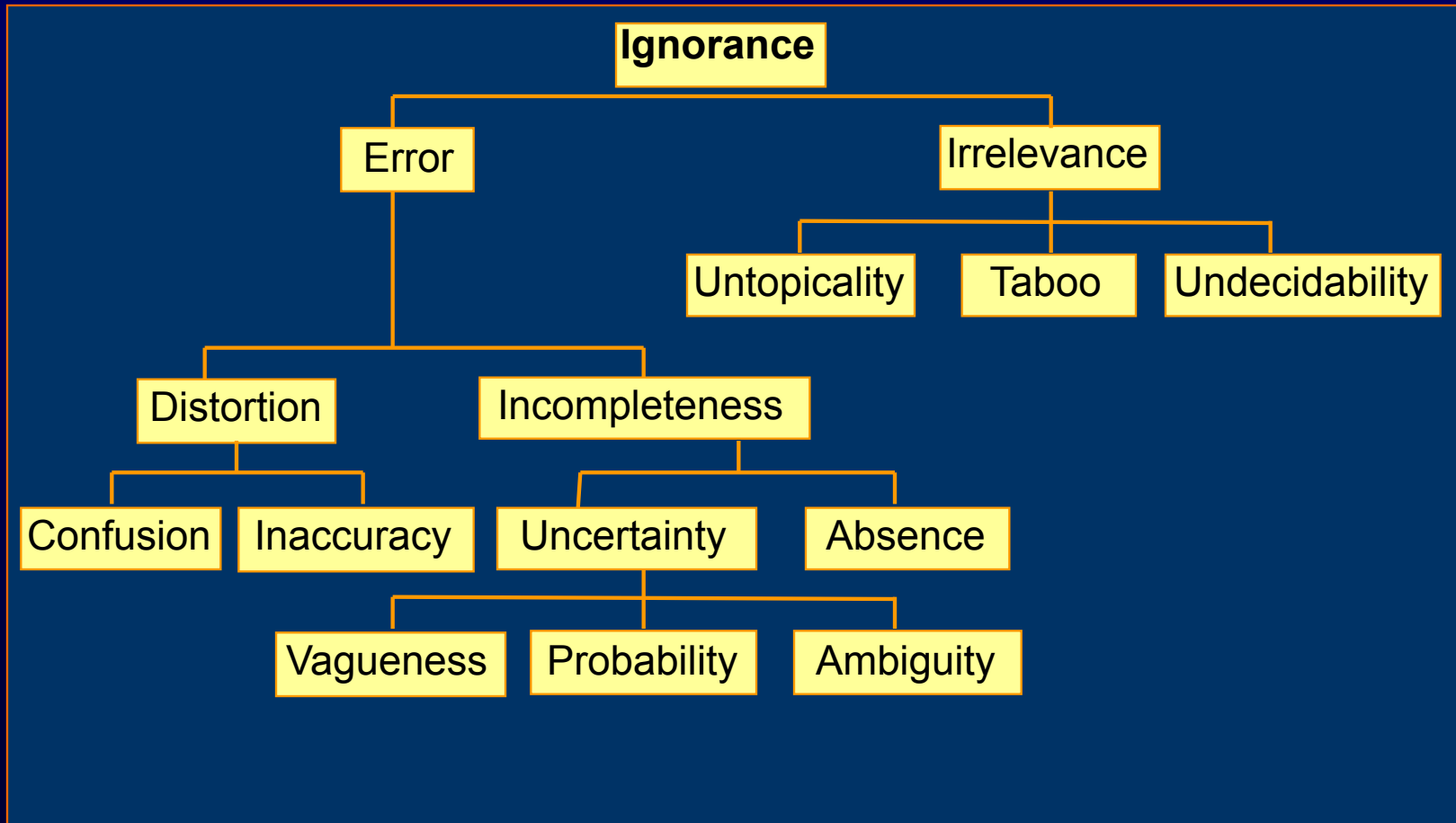
But what if the partition used for the serum ferritin test was the one shown below? Now,

$P(\text{anaemia}|\text{test}) = 15/85 \rightarrow$ Recommend ??

Same evidence: Different reference class \rightarrow Different decision!

serum ferritin test result	iron deficiency anaemia		Likelihood Ratio
	Present	Absent	
≤ 35 mmol/l	60	3	35.29
$> 35 \leq 75$ mmol/l	15	35	0.76
> 75 mmol/l	10	112	0.16
	85	150	

Different kind of unknowns?



Does it matter?

1. People prefer probabilistic uncertainty to ambiguity:
Ellsberg (1961) experimental effects for ambiguity
Smithson et al. (2000), partial vs complete ignorance
2. Brain imaging evidence:
Hsu et al. (2005), Huettel et al. (2006); greater activation for ambiguity and ambiguity preference in areas distinct from those for risk
Pucharskaya, Liu, Smithson & Joseph (2009) Partially replicate earlier studies and also find evidence that absence is distinct from ambiguity, and ambiguity may be more strongly linked to reward expectancies

Does it matter?

1. People prefer agreement + ambiguity to conflict + precision:
Smithson (1999) and Cabantous (2007) experiments
2. Brain imaging evidence:
Pucharskaya et al. (2009); greater activation for conflict and conflict preference in areas distinct from those for risk, ambiguity, and absence

Does it matter?

People make moral distinctions between kinds of unknowns.

Example: Distortion is worse than incompleteness

Burgoon, Callister and Hunsaker's (1994) study of equivocation or omission versus falsification in doctor-patient interviews found 85% of the doctors admitted to omission but only 34% admitted to falsification.

Some unknowns cannot be eliminated:

In principle: Which of the thousands of medical “facts” learned during one’s professional education will become obsolete or untrue in 5 years’ time?

Some unknowns cannot be eliminated:

In practice: Suppose a disease strikes 1 in 100 people.

We have a test for it with 95% sensitivity and 95% specificity.

We do preventative testing on our population of 10,000.

	Treat	Send home		Error-rate	
Diseased	95	5	100	0.950	Sensitivity
Clear	495	9405	9900	0.950	Specificity
	590	9410	10000		
Diagnost.			0.01		At risk

Some unknowns cannot be eliminated:

In practice: Suppose a disease strikes 1 in 100 people.

We have a test for it with 95% sensitivity and 95% specificity.

We do preventative testing on our population of 10,000.
But there are 495 false positives.

$$\Pr(\text{Diseased}|\text{Test positive}) = 95/590 = .161\dots$$

	Send			
	Treat	home		Error-rate
Diseased	95	5	100	0.950 Sensitivity
Clear	495	9405	9900	0.950 Specificity
	590	9410	10000	
Diagnost.	0.161	0.999	0.01	At risk

Some unknowns cannot be eliminated:

In practice: How accurate would the test have to be to increase $\Pr(\text{Diseased}|\text{Test positive})$ to, say, .75 or better?

Specificity would have to be .997!

What else can we do??

Shorten the odds by testing a more “at risk” subpopulation...

	Send			
	Treat	home		Error-rate
Diseased	95	5	100	0.950 Sensitivity
Clear	30	9870	9900	0.997 Specificity
	125	9875	10000	
Diagnost.	0.760	0.999	0.01	At risk

Some unknowns cannot be eliminated:

In practice: So now let's test a subpopulation where 99% of the people have the disease.

We get the same problem in reverse!

Now $P(\text{Clear}|\text{Test negative}) = .160$.

If only we knew how to ensure a 50-50 risk of disease ... 😊

	Send			
	Treat	home		Error-rate
Diseased	1900	100	2000	0.950 Sensitivity
Clear	1	19	20	0.950 Specificity
	1901	119	2020	
Diagnost.	0.999	0.160	0.99	At risk

People have good reasons for deciding not to know some things:

1. Satisficing (or satiation), ignoring information that has insufficient value, deciding when to stop foraging

People have good reasons for deciding not to know some things:

1. Satisficing (or satiation); eschewing information that has insufficient value, deciding when to stop foraging
2. Excessive psychological or social costs, confirmation bias

People have good reasons for deciding not to know some things:

1. Satisficing (or satiation); eschewing information that has insufficient value, deciding when to stop foraging
2. Excessive psychological or social costs, confirmation bias
3. Hedonic payoff from temporary ignorance for enjoying “pleasant” surprises

“There is only one thing that can kill the movies, and that is education.”

~Will Rogers

People have good reasons for deciding not to know some things:

1. Satisficing (or satiation); eschewing information that has insufficient value, deciding when to stop foraging
2. Excessive psychological or social costs, confirmation bias
3. Hedonic payoff from temporary ignorance for enjoying “pleasant” surprises
4. “Pleasure paradox:” Hedonic payoff in not demystifying unexpected events with positive outcomes

“All you need in this life is ignorance and confidence, then success is sure.”

~Mark Twain

People have good reasons for deciding not to know some things:

1. Satisficing (or satiation); eschewing information that has insufficient value, deciding when to stop foraging
2. Excessive psychological or social costs, confirmation bias
3. Hedonic payoff from temporary ignorance for enjoying “pleasant” surprises
4. “Pleasure paradox:” Hedonic payoff in not demystifying unexpected events with positive outcomes
5. Uncertainty about the future is essential to a sense of freedom, free will, or genuine choice

**Some positive emotional and mental states require
(temporary but renewable) ignorance:**

1. Emotions: Hope, excitement, positive anticipation, interest/curiosity & avoiding resignation or hopelessness

**Some positive emotional and mental states require
(temporary but renewable) ignorance:**

1. Emotions: Hope, excitement, positive anticipation, interest/curiosity & avoiding resignation or hopelessness
2. Mental states/processes: Intentional learning, discovery or serendipity, flow, intentionally creative undertakings

“If a man will begin with certainties, he shall end in doubts; but if he will be content to begin with doubts, he shall end in certainties.”

~Francis Bacon

Uncertainty and ignorance underpin some forms of social capital.

Uncertainty and ignorance underpin some forms of social capital.

1. Politeness and civility

Uncertainty and ignorance underpin some forms of social capital.

1. Politeness and civility
2. Trust and friendship relations

“Where people wish to attach, they should always be ignorant. To come with a well-informed mind, is ... an inability of administering to the vanity of others...”

~Jane Austen

Uncertainty and ignorance underpin some forms of social capital.

1. Politeness and civility
2. Trust and friendship relations
3. Specialised knowledge is organised ignorance that spreads risk

Uncertainty and ignorance underpin some forms of social capital.

1. Politeness and civility
2. Trust and friendship relations
3. Specialised knowledge
4. Privacy and confidentiality

Dealing with uncertainty and ignorance involves tradeoffs:

1. Vagueness versus error: Any estimate can avoid being wrong by being vague. However, vagueness is uninformative and indecisive.
2. Collingridge's tradeoff: The less well-entrenched a system is and the shorter the time it has been operating, the more easily and inexpensively it can be changed; but the greater is our ignorance of its likely effects or problems. By the time we know enough about the system, it is too expensive and difficult to change it.
3. Close-coupling tradeoffs: Unknowns across domains may be strongly linked, and not always positively. Uncertainty reduction in one domain may increase uncertainty in another.
4. Indemnity tradeoffs: A mixture of a collective tradeoff and a public goods dilemma. Health-promoting measures and medical treatment all require at least some risk-taking. However, a risk-averse public, aided by opportunistic lawyers and profit-oriented insurers, can create a litigious market in which some forms of medical practice or health promotion are unaffordable.

Dealing with uncertainty and ignorance involves dilemmas:

1. Education versus info-glut: Any party with an educational or persuasive interest will wish to broadcast its message in a public forum. Too many messages in an unregulated forum, however, may result in the public tuning out messages altogether.
2. Mattera's dilemma: The greater the attempts to regulate behavior, the more reactive people become and the more they generate ignorance by way of preserving their freedom. Attempts to gain information about people may motivate people to withhold information or to give false information.
3. Opposed authorities dilemma: Opposing experts who publicly disagree may lose credibility and trust. But any concession to the opposing viewpoint by either authority can be exploited by their opponent.

Dealing with unknowns

is a mixed-motive undertaking—

Even in matters of sickness and health.

Some pitfalls that can be avoided:

1. Excessive curtailment of liberty and opportunity in the name of prevention and risk-aversion
2. Pursuit of unattainable certainties (e.g., a zero-risk world)
3. Excessive blaming and litigation by denying that there are factors beyond our control
4. Erosion of trust, privacy and confidentiality in the pursuit of knowledge at all costs

Remember...

Everyone else is trying to cope with unknowns too.

“You can’t fool me– I’m too ignorant.”

~Joe Penner