

**Sample Space Ignorance:
An Unknown Unknown**

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"All you need in life is ignorance and confidence— Then success is sure." Mark Twain

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3. Review relevant empirical research
4. Point to avenues for further research and theoretical development

Are uncertainties simply differences in degree or are there different kinds as well?

Type	Outcomes	Preferences	Utilities	Probabilities
Risk	Known	Complete	Known	Known
Ambiguity 1	Known	Complete	Known	Vague
Ambiguity 2	Known	Complete	Vague	Vague/Known
Ambiguity 3	Known	Incomplete	Vague/Kn.	Vague/Known
S.S. Ignorance	Unknown	Incomplete(?)	Vague(?)	Vague(?)

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Conflict 1				Conflicting
Conflict 2			Conflicting	
Conflict 3		Conflicting		
Conflict 4	Conflicting			

We have plenty of evidence that, in terms of “amount of uncertainty,”

SSI > ambiguity > risk

What about conflict?

Conflict > Ambiguity? Conflict Aversion

Smithson (1999) found evidence for two hypotheses:

1. Conflicting unambiguous messages from two equally believable sources are dispreferred to two informatively equivalent, ambiguous, but agreeing messages from the same sources (i.e., *conflict aversion*); and
2. Conflicting unambiguous sources are perceived as less credible than ambiguous but agreeing sources.

Cabantous (2006) replicated the conflict aversion finding with a sample of expert judges (actuaries assigning premiums to insurance risks).

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But

SSI ??? conflict

→ New area for research

Prescriptive frameworks for SSI or conflict?

Few and far between.

- Even generalized probability frameworks (e.g., belief functions, capacities, imprecise probability theories) usually assume a known or privileged partition.
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However:

- Walley (1991, 1996) proposes four principles for judging probabilities under SSI and proposes a family of imprecise probability frameworks that adhere to those principles.
- Hájek (2004) and Smithson & Hájek (in preparation) present arguments that necessitate and constrain imprecise probabilities under SSI and potentially unbounded utilities.

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2. *Symmetry principle.* In the absence of any prior information, the same prior upper and lower probabilities should be assigned to all elements of the sample space.
3. *Embedding principle.* The initial upper and lower probabilities for any event should not depend on the partition of the sample space.
4. *Representation invariance principle.* The posterior upper and lower probabilities for any event should not depend on the current or prior partition of the sample space.

Some Consequences

All elementary and compound events are treated identically regardless of the partition.

This equivalence includes the categories of unconceived outcomes and unobserved but already conceived outcomes.

In this sense, SSI is reduced to imprecise (ambiguous) probabilities.

Is it “rational” to treat unconceived outcomes the same as unobserved but already conceived outcomes?

1. For imprecise probability assignments? Perhaps. In at least some frameworks, yes.
2. For preference assignments? No.

What do people do?

Vacuous Prior Probabilities Principle

- Smithson, Bartos & Takemura (2000) found that under SSI, 60%-78% of their respondents assigned vacuous prior lower and upper probabilities to simple events.
- However, they found that these percentages declined markedly for the “any other” compound event (16%-35%). Many people did not want to assign 0 as a lower probability to “any other event.”
- Smithson & Segale (2006) found that only 1%-28% made vacuous assignments under ambiguity (i.e., when primed for specific partitions).

Symmetry Principle

- Smithson, Bartos & Takemura (2000) found that under SSI, 61% of their respondents assigned the same lower and upper probabilities to a simple event and a compound event.
- Smithson & Segale (2006) found that only 0%-24% did so for complementary events under ambiguity (i.e., when primed for specific partitions).

Embedding and Representation Invariance Principles

These principles are important because:

- Even when specifying a focal event of interest, we may implicitly be primed by ourselves or others to think of a particular partition.
- In many real-world situations, partitions are partly known or simply assumed.
- The evidence itself suggests a partition that can prime our updating.

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Relevant empirical research

- Direct tests (Smithson et al. 2000).
- Catch-All Under-estimation Bias and Support Theory.
- Partition-priming effects on probability judgments.

Direct Tests

- To date there have been few direct tests, particularly of what happens as people learn a sample space “on the fly.”
- Smithson, Bartos & Takemura (2000) found no difference in their participants’ probability assignments between one condition where they observed only 2 colors of marbles being drawn and another equal-sized sample where multiple colors were drawn.
- However, they did find that people assigned higher probabilities for the compound “any new color” event than for a specific unobserved color (e.g., orange). Again, the “any new event” category was treated specially.

CAUB and Support Theory

- CAUB refers to a tendency for people to under-allocate probability to heretofore unobserved events (Fischhoff et al. 1978; Russo & Kozlow 1994).
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- An implication is that under partial SSI, we are vulnerable to CAUB and also influenced by the extent to which possible outcomes are “unpacked” into special-case events.
- Another implication is that even under complete SSI, we may be influenced by verbal cues or stereotypes.

Partition-Priming Effects

- Fox & Rottenstreich (2003) demonstrated that precise probability judgments are strongly influenced by the partition that the judges are primed to use.
- The nature of this influence is twofold:
 - (1) Anchoring prior probability assignments around the “ignorance prior” induced by the partition; and
 - (2) Insufficient adjustment away from the ignorance prior given evidence.

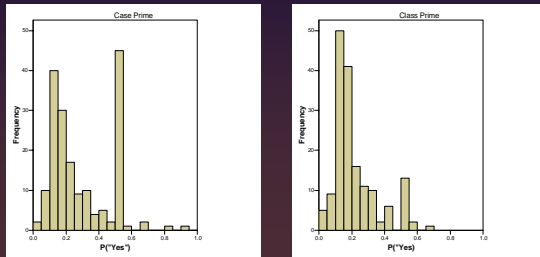
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- The nature of this influence is twofold:
 - (1) Anchoring prior probability assignments around the “ignorance prior” induced by the partition; and
 - (2) Insufficient adjustment away from the ignorance prior given evidence.
- Smithson & Segale (2006) found that people are similarly influenced by partition-priming even when permitted to make imprecise probability judgments.
- They also found that when there is a “correct” partition, people’s intervals widen if they are primed with a conflicting partition.

Example: “Highest temperature” task

Case Prime: What is the probability that the temperature at Canberra airport on Sunday will be higher than every other day next week?

Class Prime: What is the probability that the highest temperature of the week at Canberra airport will occur on Sunday?



What do we know about judgment under SSI?

- There is some evidence that people may assign vacuous imprecise probabilities and abide by the symmetry principle.
- However, people treat the “any new event” category as different from already conceived but unobserved events.
- People are suggestible to partition priming, either from external sources or via their own prior conceptions.
- We know very little about how people form ideas about partitions under SSI as they obtain evidence, but current research suggests they are “overly” influenced by prior partition-priming.

Motivations, Appraisals and Emotions

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Counter-examples:

- Entertainment and games (e.g., plot twists, potential to invent new strategies)
- Gift-receiving and other pleasant surprises
- Creative arts, intellectual pursuits, entrepreneurship (SSI → creative potential)
- Solving difficult problems (hoping for new options)
- Sense of freedom (no fixed set of alternatives)

This is an under-researched topic.

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- Hope
- Anticipation and excitement
- “Flow” experiences (e.g., jazz improvisation, the act of painting)
- Curiosity and interest
- Faith and trust

This is also an under-researched topic.

The Social Dimension

Attitudes towards uncertainty have social origins.

Examples:

- Ambiguity aversion sometimes is due to the inference that the missing information may be held by someone else (Frisch & Baron 1988, Chow & Sarin 2002)
- Not knowing the “right” things makes us look ignorant, but knowing too much about the “wrong” things can result in attributions of culpability (as all politicians know).
- Conflict aversion is associated with inferences about the conflicting sources (Smithson 1999), e.g., untrustworthiness.

Could there be a “social dimension” to attitudes about SSI?

Like any other form of uncertainty, SSI is not merely a feature of an unknowable universe.

People have vested interests in creating and maintaining uncertainty, for themselves as well as imposing it on others.

It is not difficult to find motives for imposing uncertainty on others (e.g., strategic advantage of surprise).

It is also easy to find motives and social arrangements for imposing uncertainty on oneself (e.g., denial, respect for privacy, distribution of specialized expertise).

Essentially nothing is known about the social nature of SSI.

Welcome to the unknown unknown.

– THANK YOU –

Questions?