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The Sounding Line

On things drawn but never there, and things there but never drawn.

A field guide to reality, evidence and absence — companion to the interactive at sahiltayal.com/sounding-line/

How to use this guide. Read it straight through in about forty minutes, or use the exercises (§8) on their own. Claims carry a tag: **[EV]** established evidence, **[AR]** philosophical argument, **[IN]** interpretation, **[SP]** speculation, **[OQ]** open question.

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1 · The disturbance

In late 2012 the Australian research vessel *Southern Surveyor* crossed the Coral Sea toward a place its charts, its scientific datasets and Google Earth all called Sandy Island. The echo sounder reported roughly 1,400 metres of water. There was no island, and as far as anyone can tell there never had been. [EV]

The island had been recorded by the whaler *Velocity* in 1876 and printed on a British Admiralty chart in 1908. Later expeditions failed to find it, and some hydrographic offices removed it by the 1970s — yet it survived in the World Vector Shoreline database and from there in digital maps. The expedition's chief scientist, Maria Seton, described the error as entrenched during the conversion from paper to digital charts. [EV]

Now the mirror image. On 1 June 2009 Air France 447 went into the South Atlantic with 228 people aboard. It was real; for almost two years, searches failed to find the wreck. [EV]

> *For over a century, authoritative documents agreed about a place that did not exist. For two years, a real catastrophe left only failed searches. This guide is about the sea between those two facts.*

2 · The distinction

Eight words do most of the work. Keep them apart and many arguments dissolve; blur them and almost any conclusion becomes available.

Ontology	What exists — independent of anyone's records.
Epistemology	What can be known, and how; a question about us and our instruments.
Evidence	What justifies a claim. The whaler's log is evidence; it is not the island.

Experience	What feels real. The crew may truly have seen something — surf, pumice, mirage.
Memory	What is reconstructed. Memory rebuilds; it does not replay.
Documentation	What survives in the record. Copies inherit errors and outlive their sources.
Consensus	What people accept. Fifty copied atlases are one source.
Scientific inference	What evidence supports about the unobserved — the neutrino before 1956.

The rule

Absence of evidence is evidence of absence exactly to the degree that you would have expected to find evidence if the thing were there. [AR] Elliott Sober develops this carefully (2009). In search theory it becomes a formula:

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P(there | searched, not found) = p(1 − d) / [p(1 − d) + (1 − p)]
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Here *p* is your belief before searching and *d* the probability the search would have detected the thing if it were present. If d is near zero, a miss changes nothing; if d is near one, a miss is close to refutation. Two cautions follow. A missing record never proves something did not happen when records would rarely have been made. A present record never proves it did happen when records can be copied, inherited, or produced by the belief they appear to confirm.

3 · Six soundings

Sandy Island — recorded, not real

Recorded in 1876, charted in 1908, dropped by some offices, copied into digital coastlines, formally "undiscovered" in 2012 after amateur radio operators had already noted its absence in 2000. [EV] Seton and colleagues suggest the original sighting may have been a pumice raft on a known pumice route — a hypothesis. [SP] Lesson: consensus built from copies is one witness speaking many times.

Bermeja — recorded, unresolved

Shown in Alonso de Santa Cruz's island atlas of 1539 and on maps for centuries. Not found in a 1997 survey, nor by a 2009 UNAM study for Mexico's Chamber of Deputies at 22°33′N 91°22′W. [EV] Its existence would have extended Mexico's seabed oil claim; theories of sinking, mislocation, copying error and conspiracy compete. [OQ] Lesson: when a fact has a price, absence becomes contested territory.

Air France 447 — real, not found

Two years of failed searches, including a passive acoustic search for the recorders' beacons. Metron analysts built a probability map that included the failed searches and allowed for beacon failure; the 2011 search found the wreck on 3 April after about a week of undersea search, near 14,000 feet down. [EV] Lesson: a failed search is evidence only as good as your estimate of the instrument.

The coelacanth — real, missing from the record

Absent from the fossil record after the Cretaceous and widely assumed extinct; a living one was caught off South Africa in 1938 and identified by J. L. B. Smith. [EV] The fossil record has low d for deep-water fish. [AR] Lesson: judge silence by the medium that would have had to speak.

The neutrino — real, inferred before observed

Proposed by Pauli in 1930 to rescue energy conservation; detected by Cowan, Reines and colleagues in 1956. [EV] A precise, quantitative gap that predicts what a detector will see is respectable inference; a vague gap predicts nothing. [AR]

Lost in the mall — experienced, never happened

Loftus and Pickrell embedded a false childhood event among true ones; about a quarter of participants came to report remembering it, wholly or partly. Loftus and Palmer showed question wording shifted speed estimates and false recall of broken glass. [EV] A 2017 systematic review by Brewin and Andrews argued full false-memory rates are lower than often reported. [OQ]

Three ways to read the cases

— **The searcher's view.** Belief is a probability spread over places; every search reshapes it. Weakness: everything rests on priors and honest detection estimates. [AR]

— **The archivist's view.** Ask how a record came to exist and how it travelled. Independence is the key property. Henry Stommel's *Lost Islands* documents the pattern of inheritance across many charted islands later removed. [IN]

— **The institutional view.** A charted island has effects even if absent; records can be socially consequential while physically false. That makes them powerful, not true. [IN]

4 · The experiment, on paper

The interactive Chart Office gives you a 9 × 9 survey box, a report, a navigation era and 18 days of ship time. Lookouts are cheap and weak (d = 50%), satellite tiles broad (d = 60% over 3 × 3), echo-sounder runs strong (d = 90% across three cells). In the practice sea every instrument actually fails a quarter of the time; your model may or may not assume this. A sealed envelope holds the truth, drawn from the same prior. You decide — keep, mark P.D. (position doubtful), mark E.D. (existence doubtful), or delete — and then open it. This is a teaching model of a fictional sea; its numbers are illustrative, not measurements of any real search.

Worked example

Belief the island exists: 50%. If it exists, a 40% chance it is in the charted cell, so belief "in the charted cell" is 0.20. An echo-sounder run (d = 0.9) over that cell finds nothing: the cell drops to 0.02. Total remaining belief: 0.50 + 0.30 + 0.02 = 0.82. Belief it exists: 0.32 / 0.82 ≈ 39%.

One excellent search of the charted spot moved belief only eleven points, because most of the possibility had already migrated to neighbouring cells. If instead the sounder fails a quarter of the time, effective d = 0.675: the cell falls to 0.065, the total to 0.865, and belief to about 42%. Same water, same silence, different conclusion — the difference lies entirely in what you believed about the instrument. [AR]

Try it by hand

— Start at p = 0.8 (two independent reports). Search the charted cell with d = 0.9 three times, assuming the island must be there if it exists. Compute p after each miss. (Answers: about 29%, 4%, 0.4%.)

— Repeat with d = 0.3 (a lookout in haze). How many misses until p falls below 50%? (Answer: four misses take it to about 49%.)

— Now add a 10% chance that the original position is wrong and the island is outside your box. What floor does p approach no matter how often you search the charted cell?

5 · The strongest objections

"The numbers are made up."

Priors and detection estimates are judgments; the AF447 analysts said so explicitly. Reply: the alternative is hidden assumptions. Writing d down exposes it to challenge — which is how beacon failure got considered and the wreck found.

"You can never prove a negative."

Strictly true; practically misleading. Proof is not the standard used for positives either. A large island under clear sky, searched by sounder and satellite, is as refuted as most things we call known.

"Records are reality, for practical purposes."

Courts, states and markets act on documents. Reply: this shows records have power, not truth — which is why record-keeping is a moral job.

"False-memory research shows memory can't be trusted."

Over-reach. Most memories of most events are broadly accurate and lab effect sizes are contested. The research licenses humility about details and suggested events, not dismissal of testimony.

"Some real things leave no trace."

Agreed — and the rule above protects them: when d is near zero, absence counts for almost nothing. The danger is institutions that act as if d were high when it is low.

Common misconceptions

— "No evidence" means "evidence of no" — only when evidence was expected.

— "Many sources agree" — count origins, not copies.

— "Searching the charted spot settles it" — not when the original position was uncertain.

— "A vivid memory is accurate" — vividness and accuracy can come apart.

— "Bayesian means certain" — it means explicit.

— "If it had real effects, it was real" — effects show authority, not truth.

6 · The return

Three questions to carry ashore:

— **If it were true, would I expect to see evidence here?** Estimate your d before you read the silence.

— **How many independent origins does this claim have?** Trace the copies back.

— **How precisely was the original located?** A search of the wrong place proves nothing about the right one.

Where it bites: families remembering one event differently (both are reconstructions); workplaces where "if it isn't in writing it didn't happen" assumes everything important gets written; medicine, where a normal result is strong only if the test is sensitive to the problem; archives and states, whose record-keeping sets the detection probability for everyone else; and the internet, where a thousand pages may share one origin. [IN]

7 · The unresolved question

> *How long should we keep searching for something we cannot find — and who pays for the searching?*

Every chart must eventually decide. Keep the island and ships detour forever around nothing; delete it and, if it was real, someone runs aground. The mathematics says how belief should move. It does not say what an error costs, or whose error matters more. [OQ]

Self-check

— A highly sensitive test and a barely sensitive test both come back negative. Which negative should move you more, and why?

— Forty atlases show an island; all trace to one 1908 chart. How many independent sources support it?

— Why did the coelacanth's long absence from the fossil record not prove it extinct?

Answers: the sensitive test (higher d); one; because the fossil record rarely preserves and reveals such animals, so detection was low.

8 · Reflection exercise: your own phantom island

Ten minutes, with a pen.

One thing I am confident is true but cannot prove:

One thing "everyone knows" that I have never traced to an origin:

For the first: if it were true, what evidence would I expect to exist, and how likely would it be to survive? (My d.)

For the second: how many independent origins can I actually find?

Which would I mark E.D. — existence doubtful — and why?

9 · Reading ladder

— **Start.** Seton et al., "Obituary: Sandy Island (1876–2012)", *Eos* (2013) — two pages on how to report an absence.

— **History.** Henry Stommel, *Lost Islands* (1984).

— **Memory.** Loftus & Pickrell (1995); then Brewin & Andrews (2017) for the critique.

— **Method.** Stone et al., "Search for the Wreckage of Air France Flight AF 447", *Statistical Science* (2014).

— **Philosophy.** Elliott Sober, "Absence of evidence and evidence of absence", *Philosophical Studies* (2009).

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Bermeja: UNAM's 2009 report to the Mexican Chamber of Deputies, as reported in *La Jornada*, 23–24 June 2009.

Research limits: facts were checked against accessible sources in November 2026. Some cited print works were confirmed by bibliographic record rather than full text. The interactive's numbers describe a fictional teaching sea, not any real survey.