Toulouse School of Economics

IAST
INSTITUTE for ADVANCED STUDY in TOULOUSE

Workshop on the Culture of Dysfunctional Institutions
World Bank 6-7 February 2016

How narratives bias inference: testing hypotheses from evolutionary psychology

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Worshippers thronging to place offerings in the collection at a Revival week service of the Assemblies of God in Accra, Ghana

Shortly after this the choir sang a hymn whose refrain was:

I had a debt I could not pay
He paid a debt he did not owe
I needed someone
To wash my sins away

Austerity in Athens

The Greek tragedy as a moral drama (I)

- “When we are in a crisis situation and others want to help you it is insulting to try to save one’s skin rather than to face one’s responsibilities,” Christian Estrosi (UMP), 1 November 2011

- "There are no words for how irresponsible this behaviour is towards their own people and also their partners in the Union”. *Suddeutsche Zeitung*, 9 February 2012

- “Five years of negotiations that have achieved virtually nothing (the few reforms that had been adopted, like a small reduction in the inflated number of public sector employees, have since been reversed by the Syriza-lead coalition). It is pretty clear that the Greeks have no appetite for modernising their society” – Francesco Giavazzi, 9 June 2015.

The Greek tragedy as a moral drama (II)

- In fact: public sector employment fell from 907,351 in 2009 to 651,717 in 2014, a drop of > 25% (source: EU Commission)
- Fiscal deficit fell from 15.9% of GDP to 2.5% in same period
- A US state default (California? Puerto Rico?) would not threaten the dollar – why should the bankruptcy of a Eurozone country threaten the Euro?
- The Greek economy produces < 3% of EU GDP (a fifth of California) – how has it come to pose an existential threat to the euro/EU?
- The answer is in the narrative…

Outline of presentation

- What is narrative?
- How formerly adaptive narratives bias our strategic inferences today
- Some formerly adaptive narrative types and their key features
- Existing evidence for parts of the argument
- A simple model
- Extensions and a program for testing

What is narrative?

- A report (in words or images or both) of a sequence of events, presented so as to imply a connection (often but not always causal) between them
- As used here: an implied causal connection between an action and an outcome, presented by a ***story*** in which a ***character*** takes the ***action*** and the ***outcome*** ensues
- Not to be confused with “narrative” in the sense of “pretext”, “excuse” or “justification”
- Means more than just solicitation via human characters

How formerly adaptive narratives bias our strategic inferences today (I)

- Preliterate foraging and agricultural societies used narratives to convey important information about adaptive behavior in the context of environmental and social dangers and social norms
- Storytelling served both to *reinforce* and *apply* narratives
- We have inherited cognitive dispositions to process and apply either
  - Narratives from a specific, prehistorically adaptive set
  - Whichever narratives are sufficiently reinforced in our culture at a sufficiently young age

How formerly adaptive narratives bias our strategic inferences today (II)

- The narratives we reinforce and apply in modern societies are disproportionately composed of those that
  - Are inherited by oral or literate transmission from preliterate societies
  - Were once adaptive in preliterate societies (where outside options were limited) but are less adaptive or positively maladaptive today
- These narratives predispose us to give higher credence to some strategic hypotheses than Bayesian rationality would warrant
- Other agents ("narrative entrepreneurs") use these narratives to influence our actions to their own advantage – in a process that is distinct from ordinary strategic signaling

Some formerly adaptive narrative types

- **Heroic**: an individual refuses to give up in the face of adverse environmental shocks;
- **Courtship**: a person refuses to take no for an answer from the object of their affection and is ultimately rewarded with acceptance;
- **Betrayal**: cheating on one's friends brings inevitably a large penalty;
- **Redemption**: great sacrifices win back the approval of one's group or of a powerful individual, such as a person previously cheated;
- **Tough love**: past generosity towards someone (such as an adolescent child or other dependent relative) is abused and the generous individual has to reject further demands for the receiver's own good.

Key features of these narrative types

- They mostly assume that
  - Agents' outside options are very limited, so giving up is very costly, possibly even fatal
  - Agents' actions cannot be kept hidden from the community for long
  - Gender norms are unequal so that refusals do not necessarily have to be respected
  - Apparent generosity is just that – not self-interest in disguise
- Modern life is no longer exactly like that, except in certain areas (cancer treatments, politicians' sex lives...)
- But narratives continue to fascinate, in politics, business, love...

Existing evidence for parts of the argument (I)

- For inherited cognitive dispositions:
  - The Wason selection task (Cosmides & Tooby 1992)
  - The conjunction fallacy (Kahneman & Tversky 1982):
- For inherited transmission of particular narratives from preliterate societies
  - Da Silva & Tehrani (Royal Society Open Science 2016): “Comparative phylogenetic analyses uncover the ancient roots of Indo-European folktales”
- Other corroborative evidence:
  - Baretta et all (Psychol. Neurosci. 2009): “Inference making while reading narrative and expository texts: an ERP study ”

The conjunction fallacy

- “Linda is 31 years old, single, outspoken and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations”.

- Which is more probable?
  - Linda is a bank teller
  - Linda is a bank teller and is active in the feminist movement

- Comes in intrasubjective version (respondents faced with both options ascribe higher probability to the second) and intersubjective version (subjects faced with second option ascribe higher probability then those faced with the first); only intersubjective version needed for our argument

Existing evidence for parts of the argument (II)

- Economists are often reluctant to think that economic agents might hold beliefs that are not justified by evidence, or might not update their beliefs in a Bayesian way (the rational expectations revolution still exerts a strong sway)

- This project belongs in a growing body of work that is exploring alternative hypotheses

- An empirical example: experiments we have been conducting in Ghana leads us to conclude that
  - Donations to Pentecostalist churches have some insurance motive
  - But the insurance is expected from God, not from the church!

A simple model

- There are two players, one speaker (she), one listener (he)
- The speaker observes between one and three signals and decides whether to transmit some or all of them to the listener
- Then the listener chooses between a safe action and a risky action. The risky action's payoff depends on whether a good event or a bad event occurs
- Signals may be relevant to the probability of the good event, or they may be "narrative" signals which activate a "narrative inference" in the listener, increasing the probability that he chooses the risky action

The signals

- The first signal, observed by the speaker at zero cost and with probability 1, allows her (and the listener, if he observes it) to update her probability of the good event according to Bayes Law
- The second signal is also observed by the speaker at zero cost but only with probability q, and also allows for updating the probability according to Bayes Law
- The third signal can only be observed if the speaker choses to do so at a cost $\varepsilon > 0$. It captures one dimension of a narrative event that is a strict subset of the good event
- The narrative signal, if observed, induces the listener to overweight the posterior probability of the good event compared to Bayesian updating

The order of events

- Speaker observes first signal
- Speaker may observe second signal, with probability *q*
- Speaker chooses whether to observe narrative signal, at cost ε
- Speaker chooses which signals, if any, to transmit to listener
- Signals are verifiable (speaker cannot lie or distort signals transmitted)
- INITIAL ASSUMPTION (useful for explaining intuition, not essential): Listener is NAÏVE, and does not calculate the speaker's strategic interest in concealing signals from her or in paying to observe narrative signals. She acts as though these were generated randomly, not strategically

Payoffs (excluding signal observation cost)

Player	Safe Action	Risky Action	Risky Action
		Good Event (probability *p*)	**Bad Event** (probability *1-p*)
Listener	*A*	*B*	*-C*
Speaker	*0*	$D + \delta B$	$D - \delta C$

Decision thresholds

- Speaker wants listener to take the risky action iff

$$(1) \qquad 0 < \mathrm{D} + \delta(pB + (1-p)C)$$

- That is, if speaker believes *p* exceeds a threshold value

$$(2) \qquad p' = \frac{\mathrm{C} - \mathrm{D}/\delta}{\mathrm{B} + \mathrm{C}}$$

- This compares with the threshold value for the listener's belief:

$$(3) \qquad p^* = \frac{A + \mathrm{C}}{\mathrm{B} + \mathrm{C}}$$

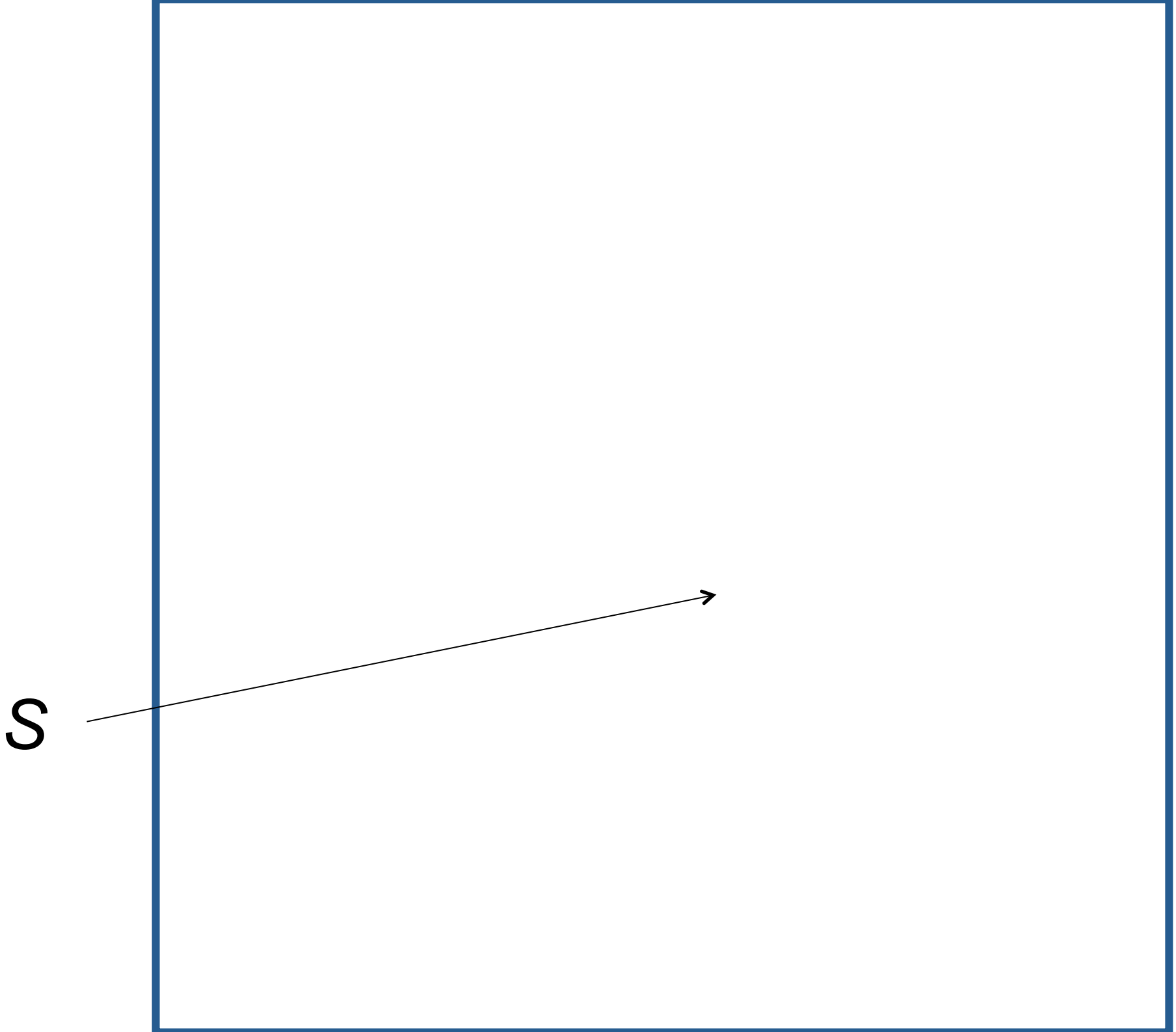
A simple model (naïve listener, verifiable signals)

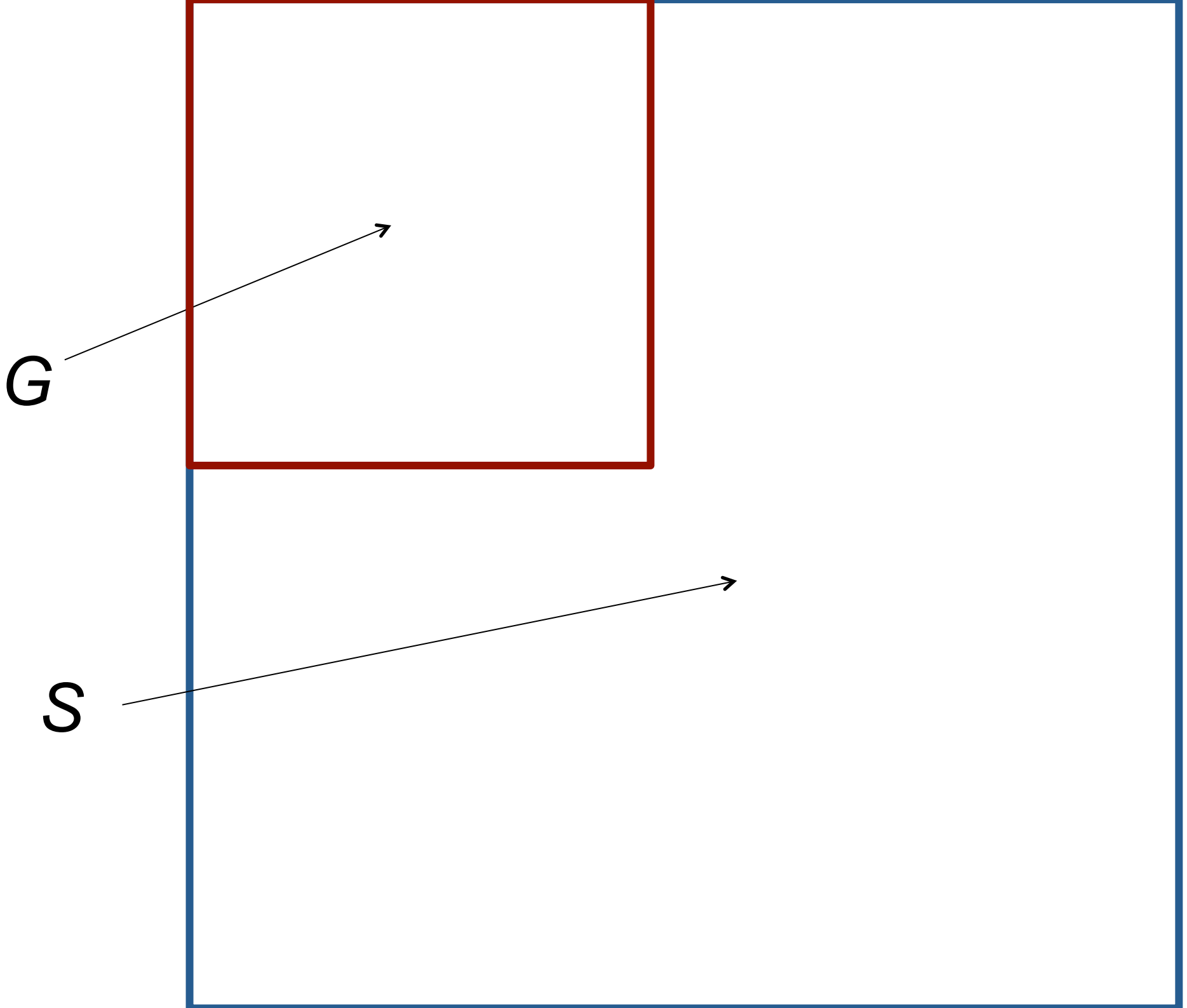
- Thus, there will be a conflict of interest between speaker and listener for values of p such that $p^* < p < p'$
- Speaker's will share listener's interest for high or low values
- In intermediate case speaker has interest in inducing listener to believe that p is higher than it is. How can she do this?
- We distinguish two types of manipulation:
  - Signal concealment
  - Narrative signaling

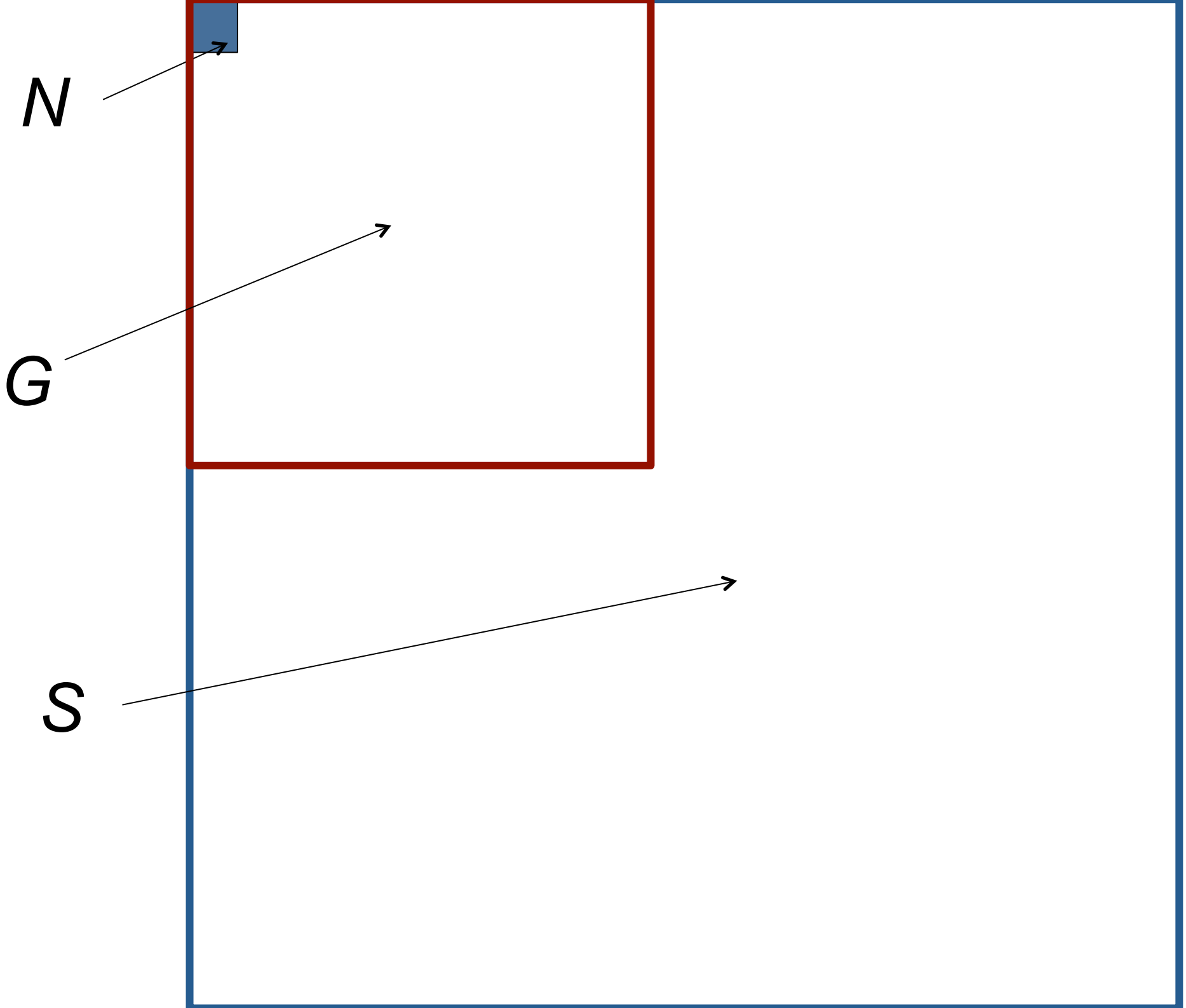
How do signals work?

- Let
  - *S* be the set of all states of the world
  - *G* be the good event, a strict subset of *S*
  - *N* be the narrative event, a strict subset of *G*
  - *P* be a probability measure on *S*, yielding prior probability π of *G*
- A *signal* is a partition of *S* into 2 subsets, one containing possible and one impossible states. We can distinguish
  - Neutral signals for *G*
  - Signals that increase the posterior probability of *G*
  - Signals that reduce the posterior probability of *G*

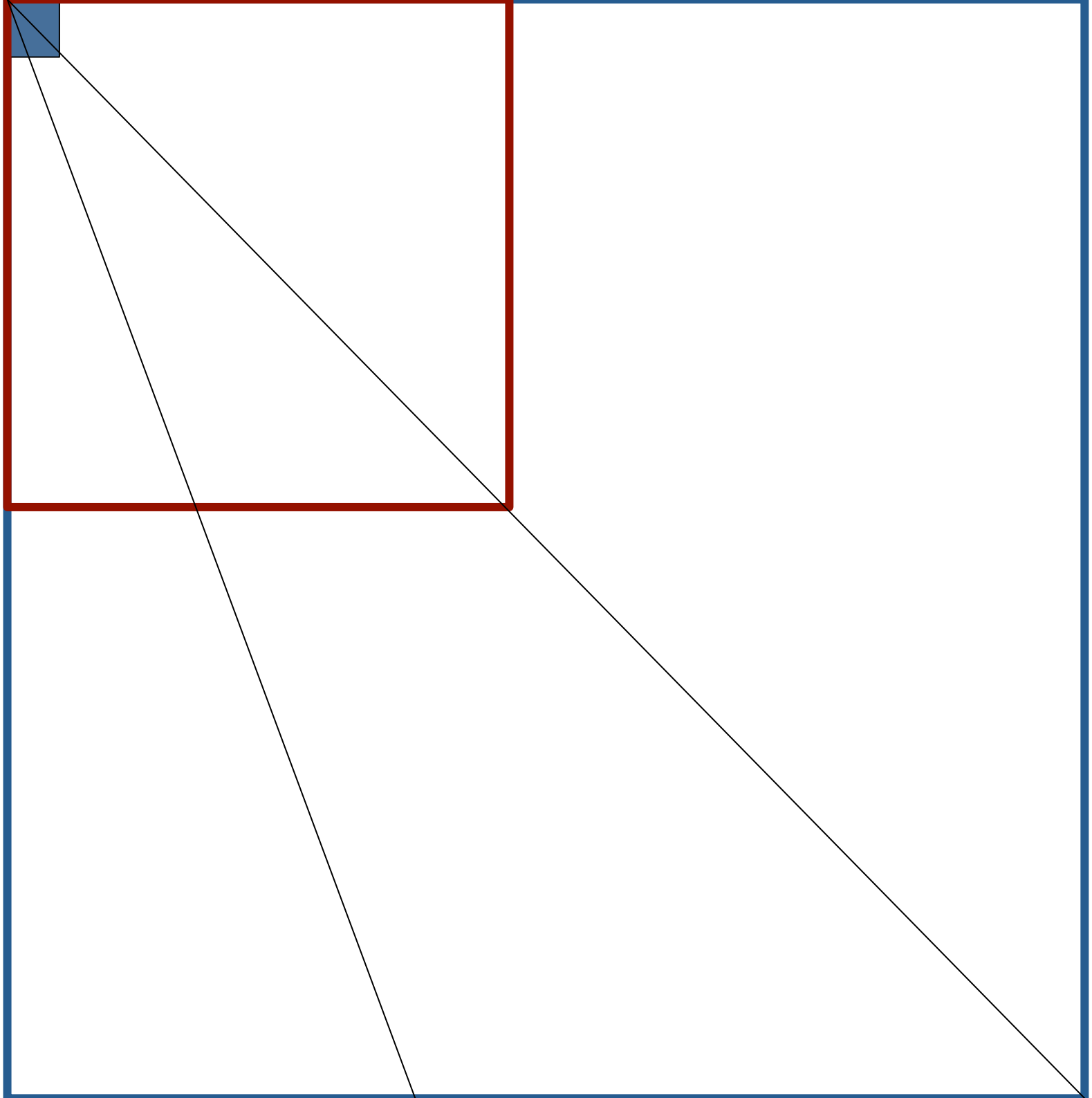
First, here are *S*, *G* and *N* in a two-dimensional space of states, with uniform probability measure

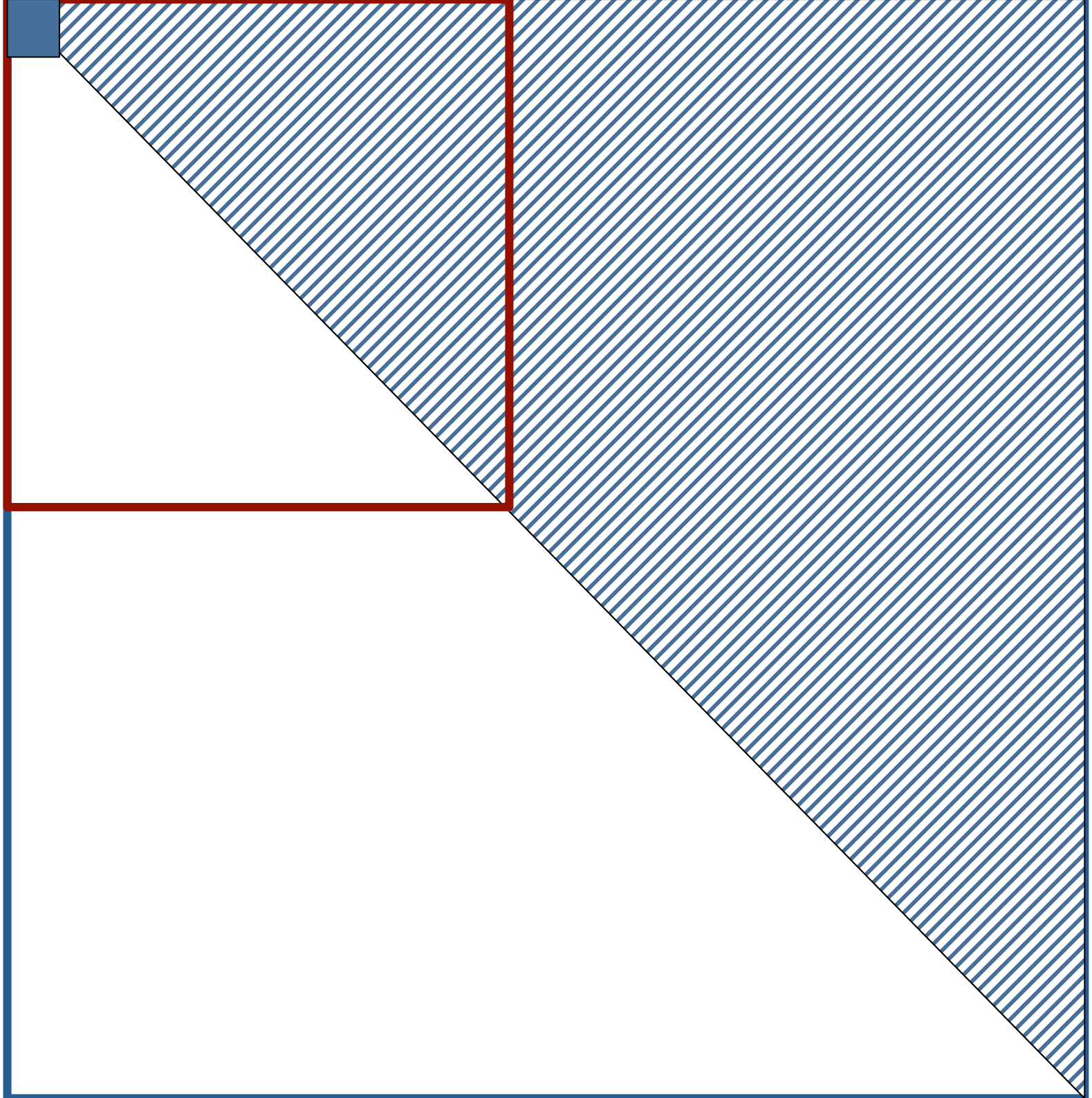

S

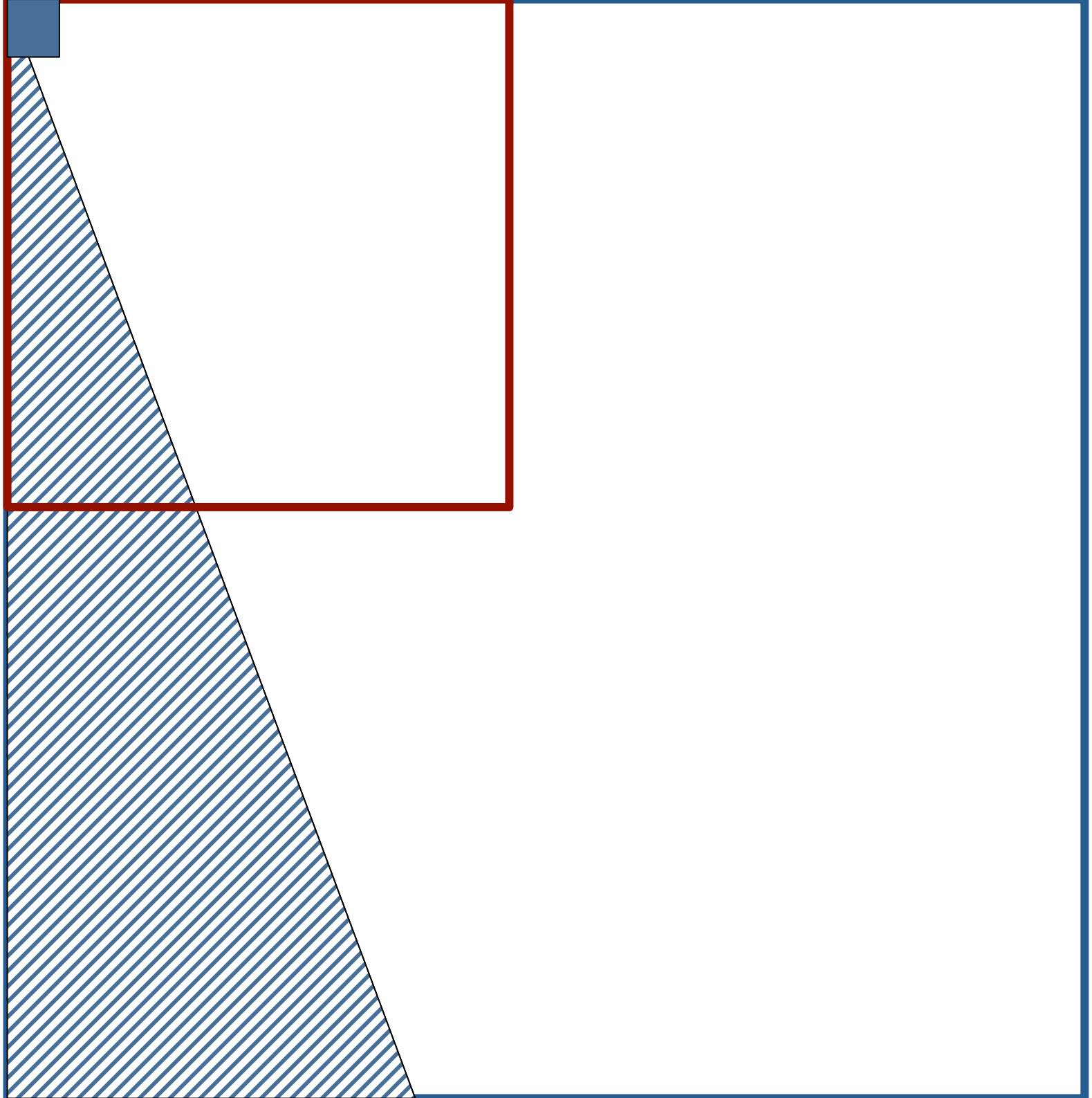

G
S


N
G
S

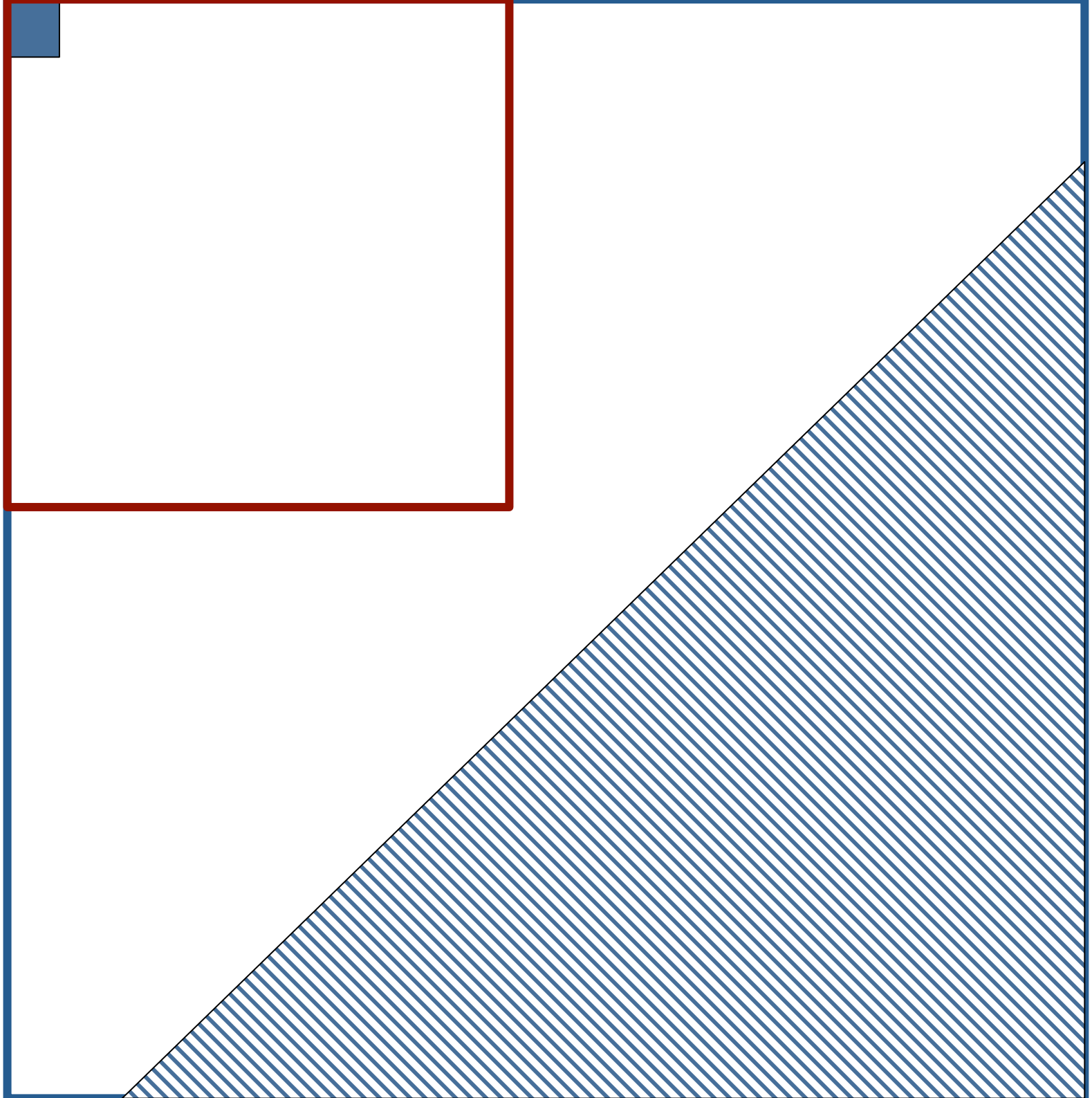
Now, here are some partitions of S that are neutral for G



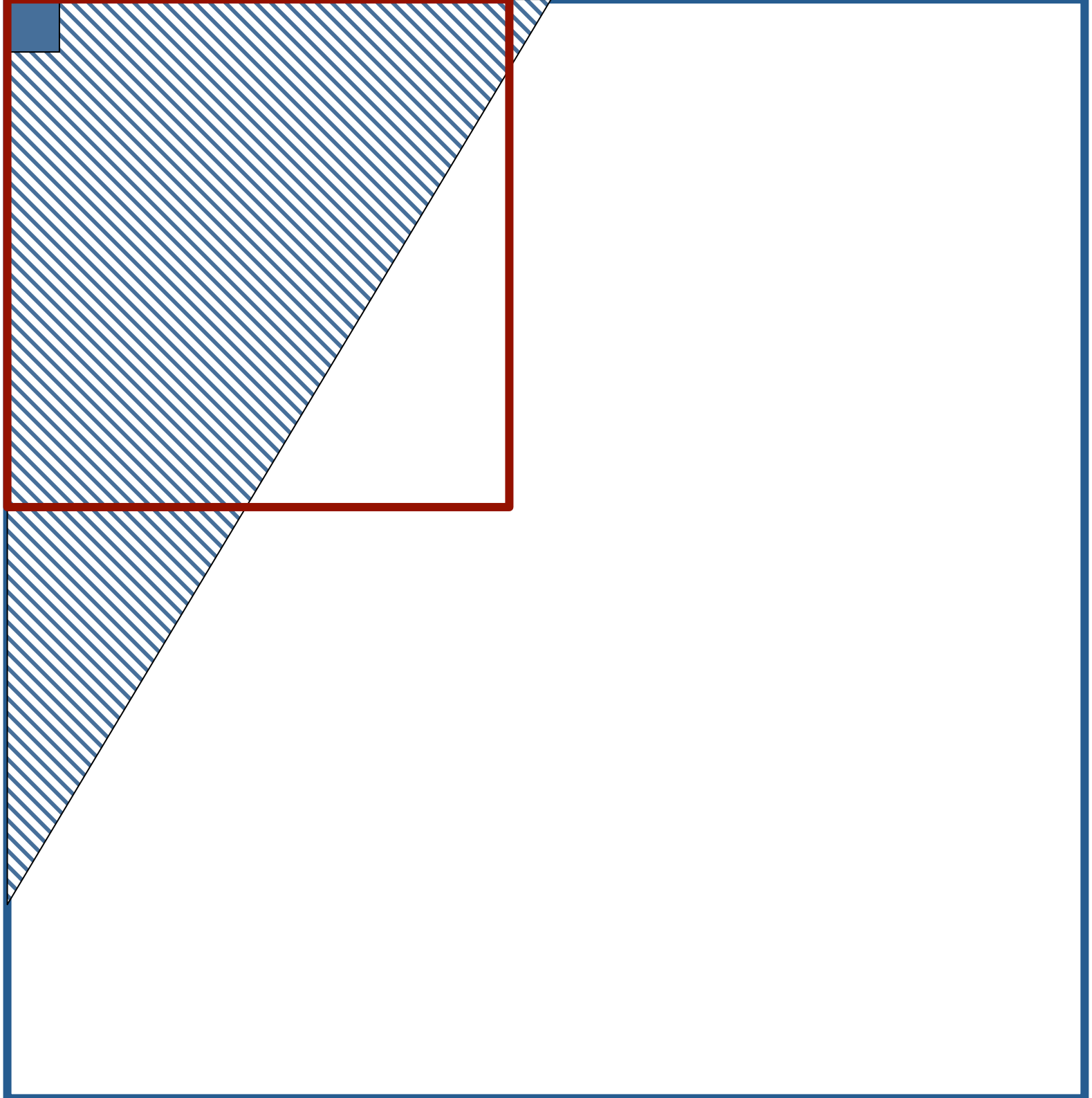




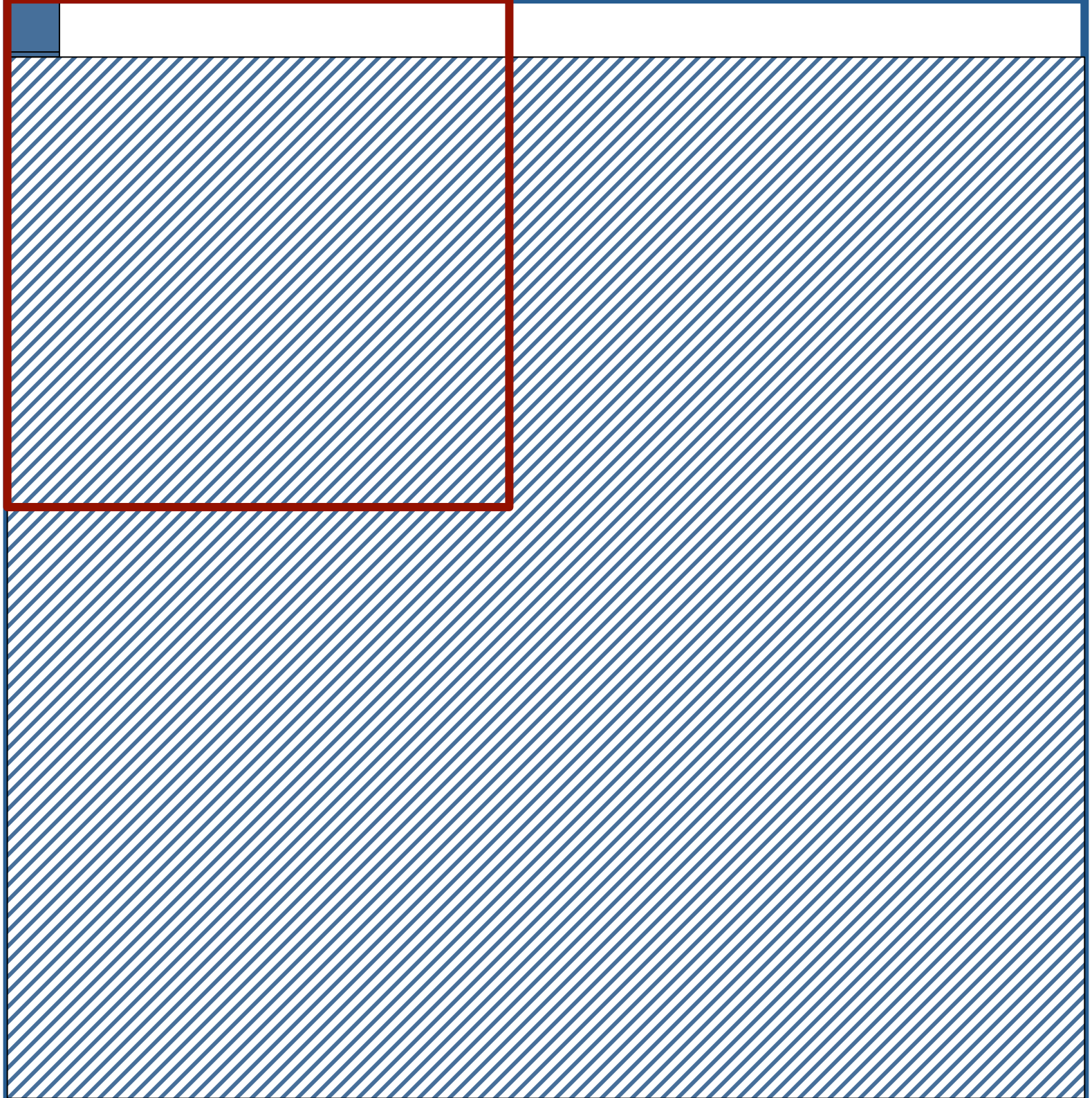
Here is a partition of *S* that increases the posterior probability of *G*



Here is a partition of *S* that reduces the posterior probability of *G*



Here is a *narrative signal* – it identifies quite closely one dimension of the narrative set

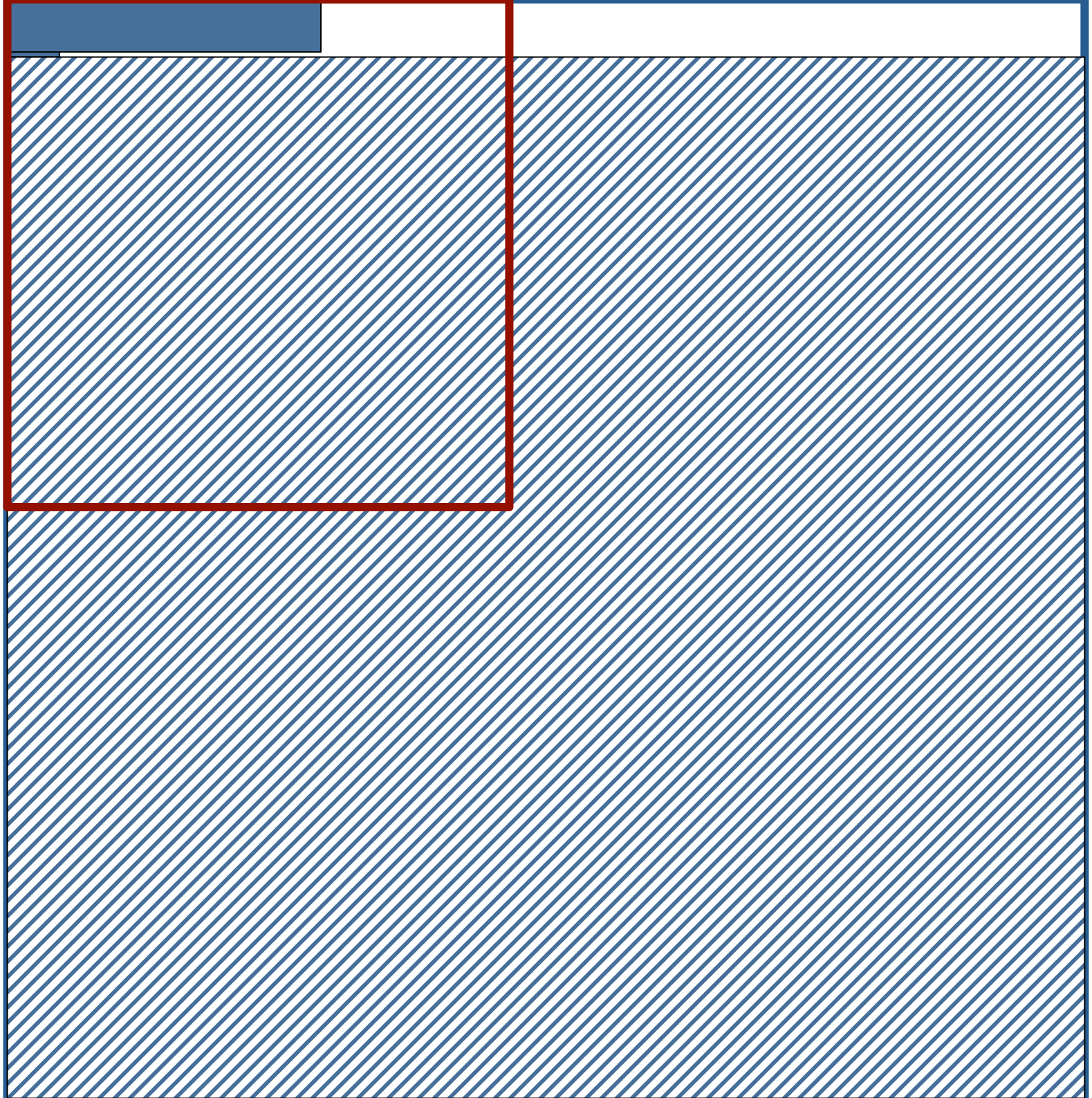


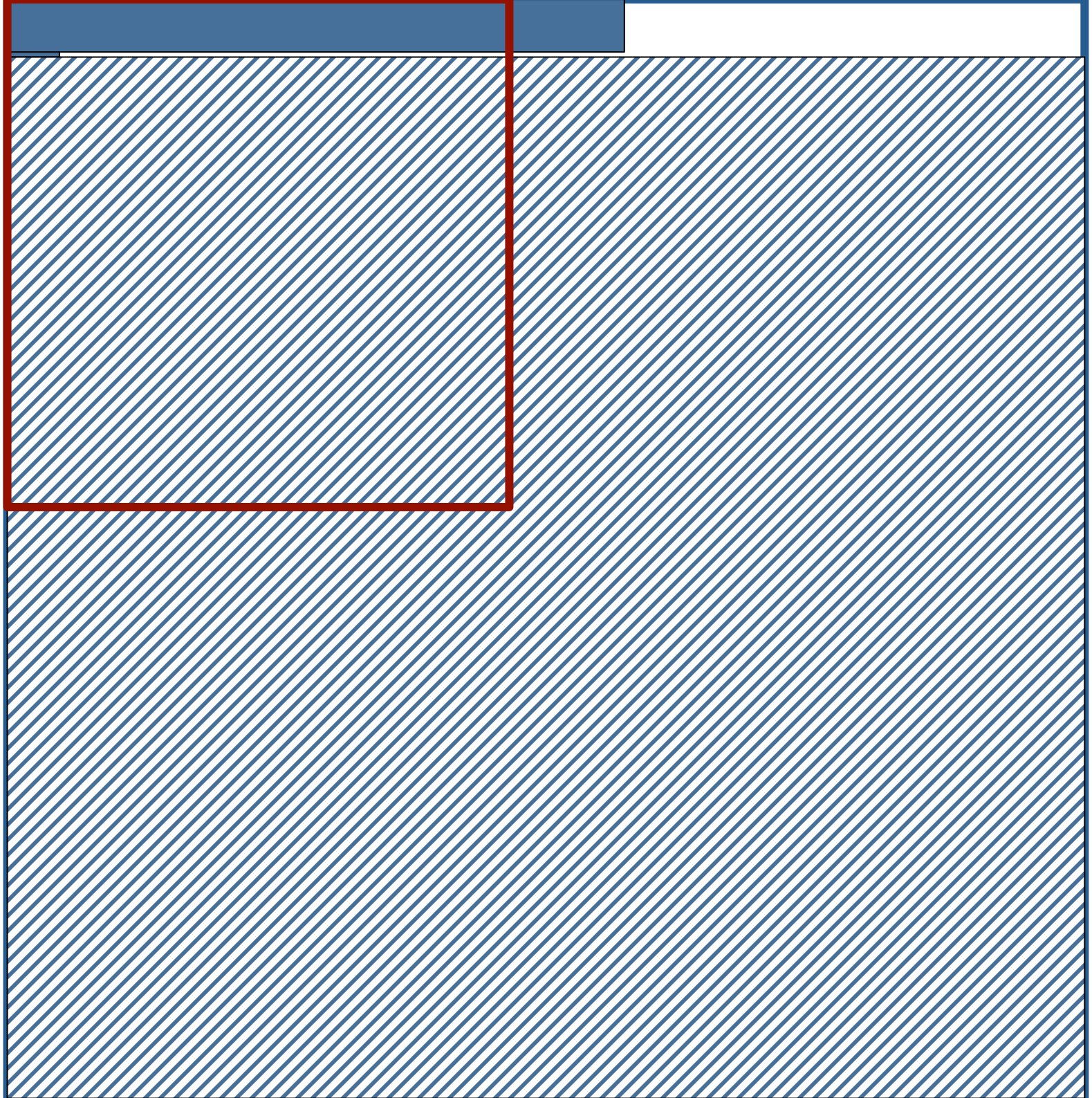
When could the sender want to use a non-narrative signal manipulatively?

- Suppose the sender observes one signal that, by itself, increases the posterior probability of the good event to above the level that would induce the listener to take the risky action
- But that she also observes a second signal that reduces the posterior probability of the good event; the combine posterior p is such that $p^* < p < p'$
- Then the sender will conceal the second signal if she can
- Of course, if the listener is not naive, that may be harder than for a naive listener unless q is small

When could the sender want to use a narrative signal manipulatively? (I)

- Suppose the receiver over-estimates the posterior probability of the narrative event, but this is still below that of the good event
- Then there is nothing manipulative about revealing the narrative signal – the listener still has correct (albeit naive) posterior
- Now suppose instead that the receiver engages in the conjunction fallacy – gives the narrative event higher probability than he would have given the good event by itself
- Then, could sending the narrative signal induce the listener to take the decision as though the good event had a higher posterior probability than it actually does?





When could the sender want to use a narrative signal manipulatively? (II)

- Notice that this is not strictly the conjunction fallacy – the manipulation works if the decision is driven by the narrative probability, not the probability of the good event
- In effect, the causal mechanism would work if
  - Observing the narrative signal leads the listener to over-estimate the posterior probability of the narrative event so that it exceeds the posterior probability of the good event, AND
  - This overestimated probability is inherited by the estimated posterior probability of the good event
- So, is it likely that this happens, and can we test for it?

Extensions to the model

- A sophisticated listener who knows that, with some probability, the sender observed signal(s) she did not report
- An even more sophisticated listener who knows that he is prone to overestimate posterior probabilities based on narrative signals, and knows the sender may have used such a signal
- Non-verifiable signals, so opportunities for lying (at some cost)
- A listener who derives anticipatory utility from narrative signals, and whose susceptibility increases with the number he hears
- Example: romantic movies, war games

A project for empirical testing (I)

- The aim is to present subjects with inferential tasks (such as to estimate the frequency of red balls in an urn through repeated draws with replacement)

- Some tasks would have an adaptive narrative frame (eg “Dave comes from a poor family which struggled to send him to college; he estimating his chances of succeeding as a start-up entrepreneur instead of in his steady but unexciting job”)

- The controls would need to have frames that a) use non-adaptive narratives, or b) refer to people but not in a narrative way, or c) do not refer to people at all

A project for empirical testing (II)

- As well as testing to see whether subjects' estimation of observed frequencies is biased by the narrative treatment, we need to test for the conjunction fallacy – eg do subjects in a treatment group ascribe higher probability to success in the presence of conjunction events (eg "Dave succeeds in his start-up thanks to a former friend who admired him in college") than when observing just simple events ("Dave succeeds in his start-up")

- Observing bias with observed experimental frequencies is a high standard (a weaker standard is to make inferences about real-world probabilities)

Conclusions

- Worshippers' decisions about giving money to the Church, like policymakers' decisions about how to manage the Greek crisis, are complex challenges in which statistical inference is difficult
- In both domains the scope for narrative inference is high, and the field wide open to narrative entrepreneurs (of redemption narratives in Ghana and tough love narratives in Greece)
- While inherited narratives seem to exercize a continued fascination for us today, the mechanisms by which they operate are not well understood

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The Wason Selection Task

A scientist is investigating a hypothesis that states "people with two X chromosomes have mind recognition skills that score above 25 on the Baron Cohen test". She has information about the following groups, who are independent samples of the population. In each case she either
a) knows the chromosomes of the individuals and can investigate to test their mind recognition skills; or
b) knows their mind recognition skills, and can investigate their chromosomes

She wants to find out whether any groups violate this hypothesis

Group A: Two X chromosomes	Group B: One X chromosome	Group C: mind recognition skills >25	Group D: Mind recognition Skills <25

Which groups should she investigate?

A government passes a law stating that "households that own a television must have a licence".
It has information about the following groups, who are independent samples of the population. In each case it either
a) knows whether they have a television, and can investigate to see whether they have a licence; or
b) knows whether they have a licence, and can investigate to see whether they have a television

It wants to fine any people who have broken this law

Group A: own a television	Group B: don't own a television	Group C: have a licence	Group D: don't have a licence

Which groups should it investigate?

A government is investigating the state of digital connectedness of its population, and specifically wishes to test the hypothesis that television users also have a broadband internet connection.
It has information about the following groups, who are independent samples of the population. In each case it either
a) knows whether they have a television, and can investigate to see whether they have a broadband internet connection; or
b) knows whether they have a broadband internet connection, and can investigate to see whether they have a television

It wants to find out whether any groups violate this hypothesis

Group A: own a television	Group B: don't own a television	Group C: have internet	Group D: don't have internet

Which groups should it investigate?

Numbers of respondents on Wason selection task (2013)

	Checked A	Checked B	Checked C	Checked D
Baron-Cohen Test	**59**	**16**	**38**	**42**
Digital Test	**35**	**7**	**17**	**13**
TV Test	**37**	**2**	**5**	**28**