Higher-Order Doubts in Simplified Reasoning

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Classical Case of Simplified Reasoning

Tennis Match (modified) from Staffel, 2019

José needs to know the rain-probability for a tennis match he was invited. José doesn't remember, though, where the match is going to be. He narrows it down to three alternatives: Glasgow (g), Hamburg (h) and Madrid (m). For each option, based on his evidence, he assigns the following credences: $c(g) = 0.48$, $c(h) = 0.48$, $c(m) = 0.04$

Question: *How to calculate the probability of the proposition that it will rain during the match (r)?*

To compute this unconditional probability, José needs some rain probabilities conditional on the match happening in each city, so let's assume the weather app says:

$c(r|g) = 0.7$

$c(r|h) = 0.9$

$c(r|m) = 0.1$

Two Possible Routes of Reasoning

Route 1: Complex Reasoning

$$
\begin{aligned}
c(r) = \\
c(r|g) \times c(g) \\
+c(r|h) \times c(h) \\
+c(r|m) \times c(m) \\
= 0.772
\end{aligned}
$$

Route 2: Simplified Reasoning

Step 1: eliminate

$$
\begin{aligned}
c(g) = 0.48 \rightarrow c(g) = 0.50 \\
c(h) = 0.48 \rightarrow c(h) = 0.50 \\
c(m) = 0.04 \rightarrow c(m) = 0
\end{aligned}
$$

Step 2: compute

$$
\begin{aligned}
c(r) = \\
c(r|g) \times c(g) \\
+c(r|h) \times c(h) \\
= 0.8
\end{aligned}
$$

Staffel, 2019

This example is a very simple illustration of the general idea that reducing the number of possibilities under consideration simplifies reasoning problems, both of the theoretical and the practical kind. This observation helps explain why it makes sense for limited human reasoners to have outright beliefs in addition to credences: outright beliefs let us eliminate improbable options from consideration in framing reasoning problems, thus making them easier to solve. (5)

Simplified Reasoning

- I will understand reasoning in general as a distinctive cognitive process by which an agent forms a certain doxastic attitude (a credence, a belief) as a result of certain operations on other doxastic attitudes.
- My interest will be specifically in cases of reasoning done by one person (as opposed to groups).
- In SR, the formation of the doxastic attitude is a result of an automatic cognitive process that simplifies the complexity involved in taking into account very unlikely alternatives.
- **Caution:** While I concentrate on doxastic attitudes, the practical counterparts (conative attitudes like intentions, plans and preferences) are also formed and changed in simplified reasoning.

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Simplified Reasoning

- Following Staffel, I will understand **credences** as doxastic attitudes that encode a subject's uncertainty about something and **beliefs** as attitudes that don't encode uncertainty
- In **Tennis Match**, José has several conditional and and unconditional credences, like for example $c(g) = 0.48$ and $c(r|g) = 0.7$.
- The outright beliefs that José has, however, are going to be represented only as states that obtain credence 1.
- This means that, by definition, credences are understood as encoding uncertainty, unless they are extreme: $0 < c(p) < 1$ and $B(p) \iff c(p) = 1$
- **Caution:** on this understanding, credences $\neq$ evidential probabilities (probabilities given a certain evidence), since the levels of confidence in the type of reasoning I'm considering are subjective by definition. Bayesianism usually generalizes by stipulating credences of an ideally rational agent, thus assuming a close connection between credence and evidential probability. This is not the case in simplified reasoning.

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Simplified Reasoning

- Things that counts as beliefs in this sense:
  - Before eliminating the improbable alternative under consideration: $(\boldsymbol{g} \vee \boldsymbol{h} \vee \boldsymbol{m})$.
  - After eliminating the improbable alternative under consideration: $(\boldsymbol{g} \vee \boldsymbol{h})$.
- This can be generalized (credence 1 is not essential for this model):
  - Credence is a function $c(\cdot) = x$ for any $x \in [0, 1]$, and belief $B(p) \Longleftrightarrow c(p) \geq t$ for a contextually-specified t.
  - Further conditions can be put in place for weaker attitudes. For if you are Ben Holguín (2022) you want to restrict **thinking** to $t \leq c(p) \leq r$ for any context-dependent range [t,r].
  - Consider: José doesn't think the match is going to be in Madrid, but he can reasonably come to think either that the match is happening in Glasgow or that the match is happening in Hamburg, even if either credence is below 0.5.

Introducing Doubts

- We can construct a non-skeptical case similar to **Tennis Match** in which José is doubting whether or not simplification lead to an accurate result.
- Unlikely alternatives sometimes obtain, and making them salient (by way of asking a question or by offering a bet, thus increasing the costs of miscalculation) could affect the attitudes we take towards the ways in which we reason.
- Simplified reasoning can thus be doubted in a familiar way: by pointing out relevant cognitive limitations that are operative in our case.
- Evidence for g, h, and m come from familiar sources: perception, memory, testimony and results of previous inferences.
- José knows that sometimes he underestimates the likelihood of possibilities based on his selective memory, so perhaps his evidence e supports *a different* $c(m)$, thus affecting the final result that matters to the question.
- This happens in everyday cases of simplified reasoning (coming examples).

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Misplaced Ricardo

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Catalina is trying to figure out where her friend Ricardo lives, and is using her most updated address book to get an answer. Cata ends up believing that her friend lives at the city center instead of the suburbs, where Ricardo moved last month. She goes to pay him a surprise visit, but discovers she was wrong. Now Cata is questioning her way of searching her friends' addresses. Moving forward, Cata is gonna be less confident about her opinions about her friends addresses when she forms them using the most updated address book.

Phy the Physician

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Phy the Physician doesn't know what the overall best course of action is for treating certain disease D. She does know the best treatment currently available, which is also known to have downsides. She receives cases on a daily basis of patients suffering from D, and she confidently prescribes courses of treatment based on individual factors of the patients and the best evidence available of courses of treatment. However, a recent literature review reveals that 85 % of physicians overestimate the severity of symptoms of D and prescribe too strong a treatment, risking their patients to adverse side effects of the prescriptions. Her current patient is suffering from D, and based on her evidence, she is confident that the right treatment is A. However, the recent paper she read makes her think that she should be less confident that the right treatment is A.

Judy the Judge

Judy the Judge

Judy the Judge doesn't know the overall best way of deciding on bail. She does know that the formal requirements of the law makes it overly complicated to apply them in each and every case on an everyday basis. So, she usually denies bail if the prosecution opposes it; if not, she denies it if a prior judge has denied it; if not, she denies it if police opposes it; and otherwise, she grants bail (Gigerenzer 2008, 49). Now, Judy is watching a documentary on the widespread prejudice in the judicial system and in police training, and is doubting whether to use the same principle in assessing the bail request of her following case.

Everyday Cases of SR

- I claim that all these cases are everyday instances of simplified reasoning
  - Catalina discounts the possibility that Ricardo has moved since she last updated her address book.
  - Phy routinely discounts the possibility that she is overestimating her patient's symptoms.
  - Judy often discounts that recommendations of the prosecution (or bail denials of previous judges or recommendations of the police) led her astray.
- Evidence received of possible errors is always empirical evidence (not from apriori reflection).
- By stipulation, these cases are not *necessarily* cases of misleading evidence or cognitive failure: they might or might not be misleading. The subject is thus genuinely unsure about how this evidence bears on the attitudes she should have given her evidence.

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Two Questions About Doubts

- **1. Taxonomy Question:** What type of doubts are these?
- **Answer:** These are higher-order doubts. Required: Model simplified reasoning (SR) using probabilistic frames (Williamson 2014, Dorst 2019).
- **2. Normative Question** How Catalina, Phy and Judy's attitudes *should* change in response to the doubts?
- **Answer:** We treat them as cases of Higher-Order Uncertainty, so we have the usual options as people do in that debate: split, merge, conciliate or be a skeptic.

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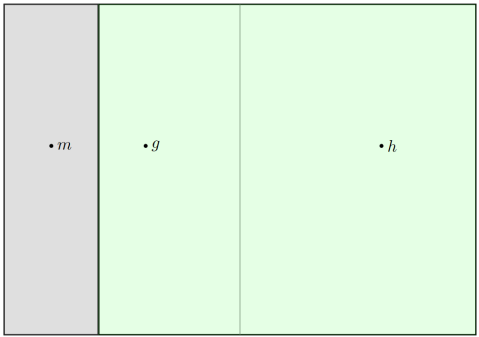
Staffel's Theory of Simplified Reasoning

- Based on Norby 2014 and Weisberg 2020:
  - Automatic filtering processes select subspaces of possibilities.
  - Memory-based credences are not stored, but constructed "on the fly".
- We can represent possibilities in a possible-worlds frame: José represents this space of possibilities as the hypothesis that the match is happening in $W = \{g, h, m\}$.
- At a context (for the task of calculating $c(r)$), José selects a subset of this space for consideration $W_1 = \{g, h\}$.



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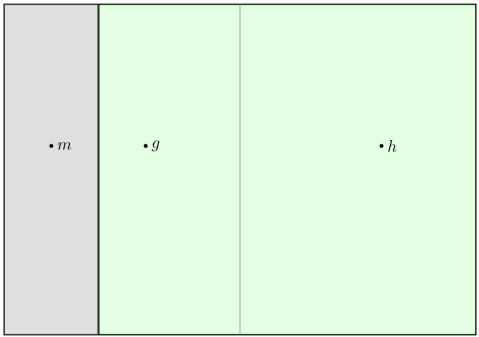

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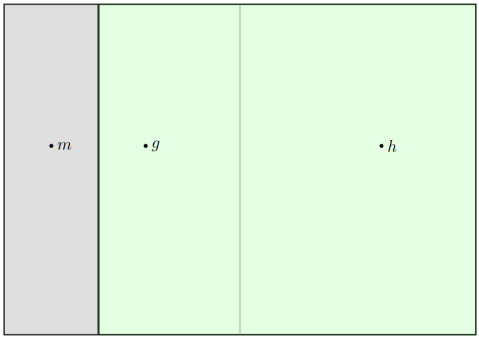

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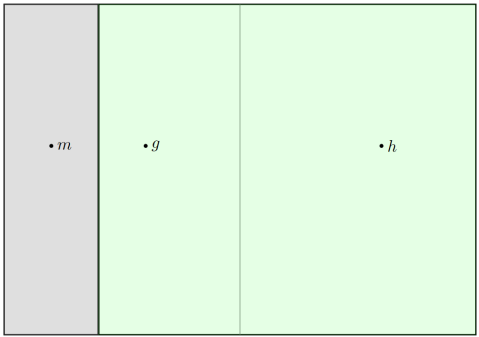

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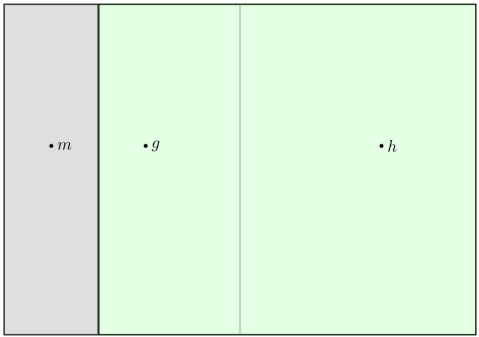

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- **Influence Thesis:** cognitive characteristics of the reasoner and the context (easyness of recall, salience) influence which possibilities are selected for consideration at a context. These influences are likely adaptive: they were adapted to cope with certain judgement and decision-making environments.
- **Descriptive Incoherence:** By not entering into consideration, possibilities leave a "blindspot", and thus simplified reasoning introduces synchronic and diachronic probabilistic incoherence.
- **Normative Non-Self Defeat:** Whatever norms apply to simplified reasoning, they must not make simplification a complex process. This means: it must not work via conditioning-like computations, but more like a heuristic process. By classical Bayesian lights its bad, but is adaptively good.

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2. Modeling Doubts

2.1 Doubting SR

- Recall the Taxonomy Question: What type of doubts are those in which some piece of empirical evidence provides doubts for the rationality of simplification?
- By stipulation, this is not misleading: it provides grounds for doubting that are relevant at the reasoning context (i.e. they are called to attention, they resemble our actual situation, etc.)
- So we need a model of doubts that allows us to model a situation in which we are uncertain about whether our credences are the ones warranted by our evidence.
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- So we need a model of doubts that allows us to model a situation in which we are uncertain about whether our credences are the ones warranted by our evidence.
- Such a model has been developed in Williamson 2014 for evidential probabilities and Dorst 2019 for rational credences.

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- Recall that credences encode uncertainties, so that a credence function $c(\cdot)$ describes situations in which we are uncertain about something (say, whether the tennis match is in Glasgow, Hamburg or Madrid).
- But we don't always adopt the credences that our evidence warrants, so we need another function $r(\cdot)$ that describes the credences that our evidence warrants in a situation of uncertainty.
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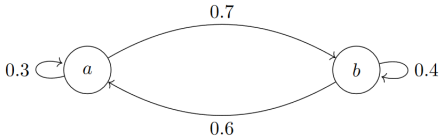
- Take the following toy case:
- Two worlds: $\{a, b\}$.
- At a your evidence warrants $c_a(a) = 0.3$ and $c_a(b) = 0.7$.
- At b your evidence warrants $c_b(a) = 0.6$ and $c_b(b) = 0.4$.
- **Key:** Assume these credences are rational. Whereas at a the rational credence assigned for being in a is 0.3, the rational credence assigned at b for being in a is 0.6.



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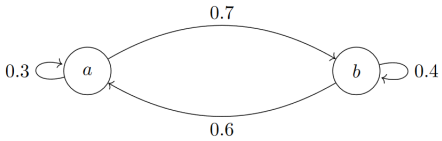

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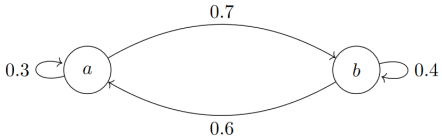

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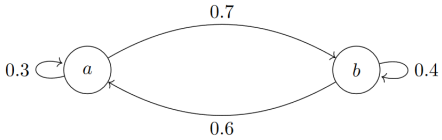

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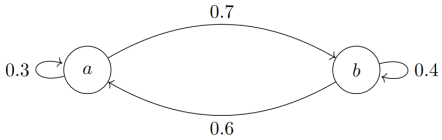

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- This means that, if you are to have any uncertainty (not knowing whether you are in a or in b), you would be rational to wonder whether your actual credence corresponds to the one that obtains at the world where you are at.
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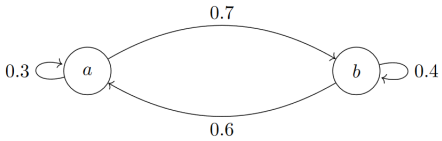

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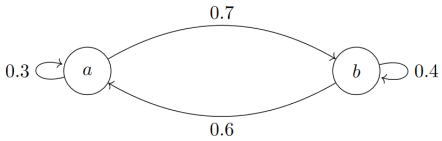

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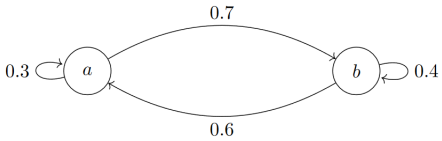

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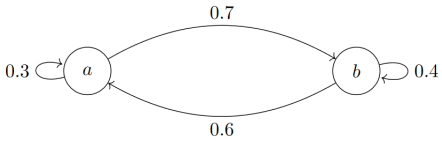
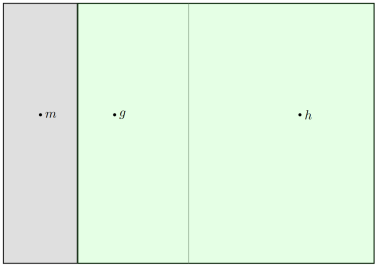


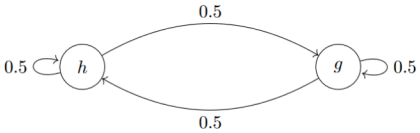
2.5 Credal-probability frame

- Take José's case in Tennis Match and higher-order doubts. How confident should José be that his credences are warranted by his evidence? José's question could be:
  - "Are my actual credences the ones warranted by my evidence $\Big[c(\cdot) = r(\cdot)\Big]$ or are they not $\Big[c(\cdot) \neq r(\cdot)\Big]$?"
    - Translation: $\Big[r\Big(c(\cdot) = r(\cdot)\Big) \leq 1\Big]$
- Now, *we* know that José's simplification introduced some incoherence in his credence distribution at the context in which he simplified.
- This is to say that *we* need to account for José's being rationally doubting whether his credences are rational, because we know they are *not*.

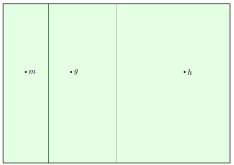
2.6 Credal-probability frame

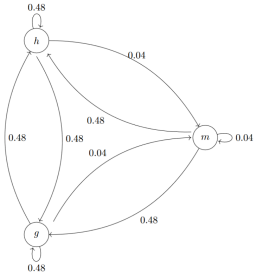
José at t_1





José at t_2





2.7 What are frames good for?

- As Christensen (2007) remarks, cases like of disagreement like this (one disagreeing with one's past self) present "opportunities for epistemic improvement."
- If we gain understanding about why José's credences allow for rational doubts about his actual credences while also knowing that they are not rational, we can gain insight about how unsure we should be when we simplify our reasoning.
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- Frames like these help us also, in Williamson's words "by making it straightforward to check whether our descriptions of examples are consistent and what their consequences are, and by facilitating the identification of structurally appropriate models." (2014, 973)
- In Williamson's case, he famously allow for first-order and higher-order evidence to split radically apart.
- For cases like José's, he can be in a case of "very improbable knowledge", where he receives misleading evidence for the game being in Madrid while being at the Madrid world and knowing that he is.
- But the problem is that (when we have rational credences) there seems to be an intuitive close connection between these attitudes and knowledge.
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3. Higher-Order Approaches

3.1 Higher-Order Evidence

- Recall the Normative Question: How Catalina, Phy and Judy's attitudes *should* change in response to the doubts?
- In the last section, I showed how we can model these doubts, but how consequential is this model for solving the normative question? In this section I suggest a possible connection.
- Higher-order evidence is evidence that you have some limitations, which intuitively affects the attitudes you should take based on your first-order evidence.
- For instance, higher-order evidence can help you focus on the *strength* of you first-order evidence.

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3.2 Higher-Order Evidence

- Think of José: Doubts about simplified reasoning shed light on particular sources of error that were operative in José's reasoning all along.
- Suppose that José's evidence is such that his initial first order evidence e warrants a *unique and precise credence* $c(r)$ (this is an assumption that I have been making all along).
- On this picture, higher-order evidence doesn't make it likely that e doesn't warrant a *unique* $c(r)$, but perhaps precisely *another* one.
- What higher-order evidence highlights is that José should be unsure whether it was $c(r) = 0.8$ all along or another one, perhaps $c(r) = 0.772$, since the credences on which he conditions can be different than what he initially thought.
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3.3 Restrictions

- Cases of higher-order uncertainty are cases where the sources of doubt provide evidence for lowering the confidence that José, Ricardo, Phy and Judy have.
- Conditioning on the new evidence, they are rational to update their original credences warranted by their first-order evidence.
- This means that theories of higher-order uncertainty must not simply disregard higher-order evidence as irrelevant, but must instead give a good argument for disregarding it.
- **Modesty Condition:** Higher-order uncertainty puts agents in a position that requires them to set their first-order evidence apart in order to respect their higher-order evidence (Elga, 2013).
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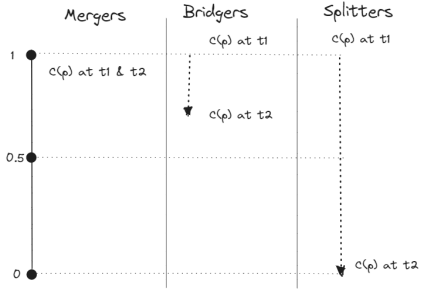
- Conditioning on the new evidence, they are rational to update their original credences warranted by their first-order evidence.
- This means that theories of higher-order uncertainty must not simply disregard higher-order evidence as irrelevant, but must instead give a good argument for disregarding it.
- **Modesty Condition:** Higher-order uncertainty puts agents in a position that requires them to set their first-order evidence apart in order to respect their higher-order evidence (Elga, 2013).
- **Guiding Condition:** First-order evidence puts agents in a position that requires them to have a rationally warranted attitude towards the proposition that the evidence supports (Dorst, 2020).

3.4 Higher-order Theorists



- Mergers want to stick to the **Guiding Condition**, but reject the **Modesty Condition**. (Greco, 2014 Salow, 2018; Smithies, 2011; Titelbaum, 2015; van Inwagen, 1996)
- Splitters want to respect the **Modesty Condition**, but reject the **Guiding Condition**. (Christensen, 2007, 2010; Elga 2013; Sliwa & Horowitz, 2015)
- Bridgers want to give principles that connect both conditions, so that the strong epistemic state that the evidence warrants (**Guiding Condition**) is in some way modulated but not radically defeated by higher-order uncertainty (**Modesty Condition**).
- On Staffel's theory of SR, **Normative Non-Self Defeat** (whatever the norms, they should not make simplification a complex deal!)

3.5 Criticizing José and giving recommendations

- How to identify a brand of higher-order theory for SR? We can look at patterns of criticism!
- **Complex Critic:** You would be subject for criticism if you disregard *relevant* evidence about your cognitive limitations, which makes likely that you are wrong. Complex reasoning is called for in these cases. (cf. Simplified Reasoning's Descriptive Profile).
- **Simple Critic:** But, equally, you would be subject for criticism if you include *irrelevant* evidence about your limitations. Complex reasoning doesn't make you wrong, but it is not called for. (cf. Simplified Reasoning's Non-Self Defeat requirement)
- The *catch* is not only that mostly we ignore the scenario we are in, but that in doing so we assume some *asymmetry*: You are more wrong in **Complex Critic's** light than you are in **Simple Critic's** lights. For if you are wrong this seems to be a stronger reason for criticism than if you are not wrong and just did an extra computational step.

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- But, asymmetry is wrong!
- We should be *symetrically* vulnerable to criticism if we complexify reasoning when simplification was right enough.
- One of the assumptions of **Normative Non-Self defeat** is that simplified reasoning is an adaptive cognitive process: it most likely belongs to an adaptive toolbox that made us successful in coping with our environments.
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3.7 Criticizing José and giving recommendations

- In José's case, how could we argue for a **Reliabilist SR**?
- Intuitively, there is a correlation between José's evidence and the hypotheses that he considers in reasoning.
- How does this correlation work? Call the evidence e and h the claim that *the match will be in Hamburg*.
- We have two different conditional credences: $c(e|h)$ and $c(h|e)$.
- But, assuming José begins at 0.5 (h is not better than the chance of a heads flip coin), conditioning on h will have a very different effect than conditioning on e.
- If José conditions on the match happening in Hamburg, that gives a higher confidence on the evidence that the confidence the evidence provides for the hypothesis.

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- So that makes José's high (comparative) credence $c(h) = 0.48$ more likely if the match is in Hamburg than if the match is in Madrid, which is (comparatively) low: $c(m) = 0.04$.
- In other words, processes that helps us taking for granted things that are highly likely conditioning on having high evidence for them will match worlds in which the environment *also* matches with the evidence we have.
- This could help understand why **Normative Non-Self Defeat** is required and José is symmetrically criticizable when he spends cognitive resources on calculations that don't make an overall difference.

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3.9 Criticizing José and giving recommendations

- This sketch of an argument can also help understand why he is criticizable *once* he gets new evidence that he underestimates unlikely alternatives: this evidence makes it more likely than before that $c(m)$ is higher than he previously thought it was.
- But since the case involves constraints on how much higher he can go up in $c(m)$, it doesn't seem like this new evidence brings way down his initial level of confidence in $c(r)$ which is the unconditional probability that depends on conditioning $c(r|m)$.
- Recommendation: lowering confidence in cases of cognitive malfunction might be correlated with being at a bad environment, and José might want to take a second look at the evidence (i. e. spending more cognitive resources on reflecting what the evidence supports).
- This recommendation seems trivial, but implies a substantive defense of a reliabilist connection between adaptive reasoning processes like simplified reasoning and strong epistemic positions like knowledge.

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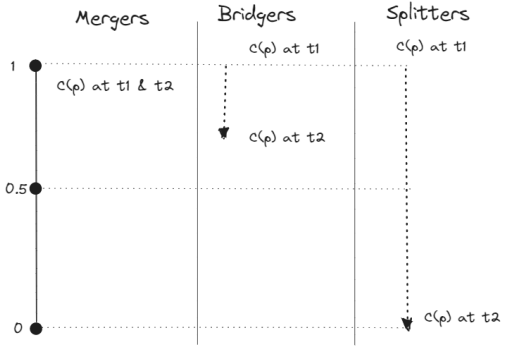
3.10 Picking a brand of theory for SR...



- Which brands of higher-order theories of SR does the argument for symmetry support?
- Merging seems looks bad because it rejects modesty, and José is intuitively criticizable.
- Splitting is a hard choice: while lowering the confidence in the initial attitude seems correct, allowing for a radical split between first-order and higher-order attitudes doesn't seem correct either: the evidence seems to put a limit on how low can José's confidence go.
- Bridging seems the right choice, because it allows modesty while allowing the evidence to still guide good judgements.

Conclusions

So there we have it...

- In considering cases of simplified reasoning, we can discern a pattern of uncertainty that is familiar from the literature on higher-order evidence.
- Taxonomy Question: What types of doubts are these? Answer: Model them as cases of higher-order uncertainty.
- Normative Question: How should people react to evidence for higher-order uncertainty? Answer: We need to strike some balance between respecting the first-order and the higher-order evidence, so restrict to the **Guiding Condition** (evidence provides a guide to the truth) and the **Modesty Condition** (leave open that evidence is a weak guide in some cases).

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So there we have it...

- Plus: From the theory of SR, **Normative Non-Self Defeat** place restrictions in how much criticism is due in cases of disregarding relevant alternatives.
- Since SR is adaptive, its causal profile is fairly reliable.
- We might want to take a closer look at specific features of the interaction between our cognition and our environment in order to have guides for cognitive improvement.

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For your attention...

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6.1 Complex and Simple Calculations

Route 1: Complex Calculation

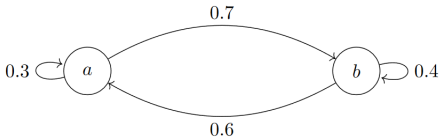
$$
\begin{aligned}
c(r) = \\
&+c(r|g) \times c(g) \\
&+c(r|h) \times c(h) \\
&+c(r|m) \times c(m) \\
&= +0.7 \times 0.48 \\
&+0.9 \times 0.48 \\
&+0.1 \times 0.04 \\
&= 0.772
\end{aligned}
$$

Route 2: Simplified Calculation

$$
\begin{aligned}
c(r) = \\
&c(r|g) \times c(g) \\
&+c(r|h) \times c(h) \\
&= 0.7 \times 0.5 \\
&+0.9 \times 0.5 \\
&= 0.8
\end{aligned}
$$

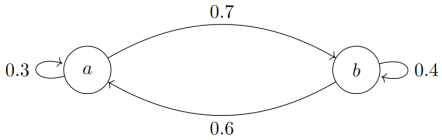
6.2 Toy example of credal-probability frame

- Take the following toy case:
- You are wondering whether a: *the wall is painted all red* or if b: *the wall is painted all white*.
- Set of possible worlds with two worlds: $W = \{a, b\}$
- At a your evidence warrants $c_a(a) = 0.3$ and $c_a(b) = 0.7$.
- At b your evidence warrants $c_b(a) = 0.6$ and $c_b(b) = 0.4$.
- Evidence for a at a is less warranted than it is at b: $c_a(b) < c_b(a)$.



6.3 Toy example of credal-probability frame

- The world in which the wall is painted all red the rational credence assigned for being at a is 0.3. This means that the evidence for a is not very good precisely at the world at which a is true. Perhaps at this world you have fair, but not conclusive evidence that there is some red light affecting a white wall, causing you to lower the confidence that the wall is painted red when actually it is painted all red.



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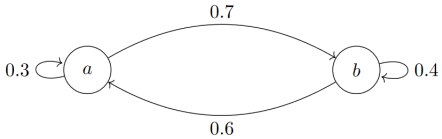
- Meanwhile, the world at which the wall is painted all white is one in which the credence for the wall being painted all red is higher, because perhaps you haven't received evidence that the lights are affecting the wall.



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- This means that, if you are to have any uncertainty (not knowing whether you are in a or in b), you would be rational to wonder whether your actual credence corresponds to the one that obtains at the world where you are at: it is either 0.3 likely that a or 0.6? At a, you might want to be cautious and say: "Look, I have some evidence that there are red lights affecting the wall, but this doesn't mean that the wall is definitely not red, perhaps it is!"