

Vaccine Hesitancy and the Reluctance to “Tempt Fate”

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Abstract

This paper offers an explanation for subjects’ lack of confidence in vaccines’ safety, which in turn is widely recognized as one of the main determinants of vaccine hesitancy. I argue that among the psychological roots of this lack of confidence there is a kind of intuitive thinking that can be traced back to a specific superstitious belief: the belief that “it is bad luck to tempt fate”. Under certain conditions, subjects perceive the choice to undergo vaccinations as an action that “tempts fate”, and this leads them to overestimate its risks. When an action is perceived as “tempting fate”, indeed, its possible negative outcomes are anticipated as highly aversive, and as such they capture subjects’ imagination, thereby feeling more subjectively probable. This has important consequences for practical pro-vaccine interventions. Part of what makes an action perceived as “tempting fate” is its being free, arbitrary, and departing from one’s typical behaviour: insofar as vaccine hesitancy is driven by beliefs about tempting fate, then, we can predict the success of interventions that make vaccinations nearly mandatory, or build vaccination opportunities into health care routines as opt-out, rather than opt-in options, making them closer to something that subjects passively accept rather actively seek.

Keywords

Vaccine hesitancy; Superstitious-magical thinking; Cognitive biases; Confidence; Vaccine mandates; Defaults.

1. Introduction

Vaccine hesitancy – broadly defined as a “delay in acceptance or refusal of safe vaccines despite availability of vaccine services” (MacDonald et al. 2015) – is considered among the top global health threats (WHO 2019), and now more than ever in the COVID era it has become pressing. The phenomenon is complex and heterogeneous and it takes different forms, ranging from mild cases of simple indecision to more radical and vocal cases of militant anti-vaxxers. These different forms of hesitancy may have different causes, and even in one and the same form there are often different contributing factors; but one factor that plays a major role in most cases of hesitancy is lack of confidence in vaccines’ safety (see e.g. Larson et al. 2014; Betsch et al. 2018; Neumann-Bohme et al. 2020; Karlsson et al. 2021).

In this paper I argue that among the psychological roots of this lack of confidence there is a kind of intuitive thinking that can be traced back to a specific superstitious belief: the superstitious belief that “it is bad luck to tempt fate” (Risen and Gilovich 2007, 2008). Under certain circumstances, subjects perceive the choice to undergo vaccinations as an action that “tempts fate”, and this leads them to overestimate its risks. When an action is perceived as “tempting fate”, indeed, its possible negative outcomes are anticipated as highly aversive, and as such they are likely to capture the subject’s imagination, thereby feeling more

subjectively probable. Peculiar social conditions contribute to explain why this mechanism is at play only in some cases and not always – hence why vaccine hesitancy is not universal, but limited to some groups of people.

In Section 1, I introduce superstitious beliefs about tempting fate and the psychological mechanisms that – according to some prominent models – underly them. In Section 2, I explain why such beliefs – or something fairly close to them – are likely to be at play in people’s reasoning about (COVID-19, but also other) vaccines. In so doing, I examine their interactions with other factors that are taken to play a key role in vaccine hesitancy, such as other forms of intuitive thinking, on the one hand, and some key social/structural factors (like group identity dynamics and conspiratorial ideation), on the other. I show how the interplay between those different factors can explain different varieties of hesitancy, as well as its limits. In Section 3, I explore some consequences of my proposal for practical pro-vaccine interventions. Part of what makes an action perceived as “tempting fate” is the fact of its being free, arbitrary, and departing from one’s typical behaviour: insofar as hesitancy is driven by superstitious beliefs on tempting fate, then, we can predict the success of interventions that make vaccinations nearly mandatory, or that build vaccination opportunities into health care routines as “opt out”, rather than “opt in” options, making them closer to something that subjects passively accept rather actively seek. Before concluding, I discuss some normative implications of these (and other similar) interventions.

2. When It Is Bad Luck to Tempt Fate...

It is a widespread superstitious belief that negative outcomes are especially likely to occur as a result of actions that “tempt fate”. So, for instance, people report that a candidate student is more likely to get rejected by her top-choice university if she presumptuously wears a T-shirt from that university while waiting for their decision, than if she doesn’t wear it; that one is more likely to be called on at random during a class if she came to that class unprepared than if she was prepared; that it is more likely that it will rain if one ignores the forecast and goes out without bringing her umbrella, than if one brings it; that exchanging one’s lottery ticket with a different ticket makes the exchanged ticket more likely to win; and so on (Risen and Gilovich 2007; 2008; for further findings in line with these, see e.g. Kogut & Ritov 2011; Zhang, Risen & Hosey 2014). These superstitious-magical beliefs influence people’s behaviour and reactions – meaning that those who hold them are often reluctant to perform the “tempting fate” actions in question, or anyway feel uncomfortable in performing them, even when such actions would clearly be in their best interest (as in the case in which people are offered monetary incentives for lottery tickets’ exchanges – cf. Bar-Hillel & Nether 1996).¹

This is rather puzzling, especially because such beliefs are common also among educated and fairly rational people who would otherwise deny believing in the very existence of fate, or of anything like that (Risen and Gilovich 2008; Risen 2016). According to Jane Risen and colleagues, who more (and more influentially) than anyone else have

¹ Here I speak of superstitious “beliefs”, assuming that the mental states in question are doxastic in nature. Elsewhere, I defended a non-doxastic account of (most forms of) superstitions, arguing that they are better described in different terms – such as imaginings, or other sorts of non-doxastic states (Ichino 2020). I do still think that non-doxasticism about superstitions is correct; but this does not really matter much for the sake of my argument in this paper – which is why I will keep speaking in the common terms of belief, using “belief” in a deliberately broad way.

researched into this topic, considerable insight into the nature of such beliefs is provided by “two systems” accounts of human cognition, which explain how people can often be “of two minds”: endorsing something at an intuitive, “system 1” level even when their rational assessment at the “system 2” level pulls in the opposite direction. Despite explicit belief that fate does not exist or anyway cannot be “tempted” as the traditional superstition suggests, then, people may still cherish the intuitive belief that it does. Surely, there are also cases in which that belief is fully and unambiguously endorsed, but they need not be the norm – as a closer look at the interplay between systems 1 and 2 illustrates.

2.1. A Dual-System Account of Beliefs About Tempting Fate

On Risen and Gilovich (2007, 2008) and Risen (2016)’s model, the superstitious belief that it is bad luck to tempt fate is largely the result of two automatic system 1 processes: a first one having to do with the so-called *negativity bias*, by virtue of which our minds tend to be disproportionately captured by negative stimuli and prospects over positive or neutral ones; and a second one having to do with the so-called *availability heuristic*, by virtue of which distorted probability judgements are formed on the basis of irrelevant factors such as, notably, subjective accessibility.²

What happens, on this view, is that subjects anticipate that if they performed an action that they perceive as “tempting fate” (such as exchanging their lottery ticket) and a negative outcome then obtained (such as their exchanged ticket, rather than the new one they got, turning out to be the winning one), they would feel especially bad – being tormented by regret and counterfactual thoughts like “I shouldn’t have done that!”. Whether or not this prediction is correct, the fact of being associated with such negative feelings makes the negative outcome in question particularly aversive, and therefore more likely to grab subjects’ attention, stick into their memory, and engage their imagination.³ Having thereby captured their cognitive resources, such an outcome becomes more easily available, increasing its subjective probability. This is why the likelihood that one’s ticket wins the lottery if it has been exchanged – or that it rains if one hasn’t taken one’s umbrella with her, or that one is called on at random in a class if she has come to class unprepared, etc. – looks significantly higher than it would look if the subjects’ involved hadn’t performed the relevant “tempting fate” actions.

This model enjoys empirical support from the above-mentioned studies by Risen and Gilovich. In these studies, subjects who read stories in which the protagonist performed an action that tempts fate were significantly faster (with respect to subjects who read neutral stories in which no tempting fate occurred) to recognize a bad outcome as a ‘logical’ conclusion of the stories in question – a result explained by the ease with which such outcome was imagined, and its subsequent increased accessibility. The more negative were the outcomes, the faster participants were in recognizing them as ‘logical’ story endings, rather than non-sequiturs. And the faster participants were in doing that, the more likely they rated those story endings to be (Risen and Gilovich 2007, Studies 3 and 4; 2008, Studies 1 and 2). The tight link between negativity, accessibility, and perceived likelihood was

² Both these mechanisms are well attested and documented (see Kahneman 2011: Ch. 12 and 28 for overviews of each of them).

³ Risen and Gilovich seem to hold that the prediction in question is correct: there is indeed evidence that we tend to engage in tormenting counterfactual thinking and self-blame for things we regret having done. However, some studies suggest that we’re better than we think at overcoming regret and forgiving ourselves for past mistakes (see Gilbert et al. 2004). At least in some cases, then, we may anticipate more regret than we’ll actually end up experiencing.

thereby evidenced. The mediating role of enhanced accessibility in determining subject's distorted probability judgements was also tested by manipulating accessibility itself with suitable priming techniques: when subjects who read 'neutral' stories with no tempting fate involved (hence arguably did *not* spontaneously imagine negative outcomes), were subliminally primed with the same negative outcomes that supposedly spring to mind in thinking about tempting fate, they too ended up rating those outcomes as more likely (Risen and Gilovich 2008, Studies 4 and 5).

The idea that all these processes underlying the belief that it is bad luck to tempt fate can be traced back to the operations of system 1 was supported by the observation that those beliefs increased when subjects were under cognitive load (Risen and Gilovich 2008, Study 6) and when they were explicitly encouraged to respond on the basis of their gut feelings, rather than of their considered judgement (Risen and Gilovich 2007, Studies 1 and 2). The fact that, vice versa, by explicitly encouraging people to respond rationally the said beliefs were reported much less often (Risen and Gilovich 2007, replication of Study 1) suggests that for many people those beliefs are in conflict with system 2 rational judgements.

Importantly, even when the conflict is recognized as such, the pull of the intuitive system 1 belief may remain strong and it may influence subjects' cognition, emotions, and behaviour – through a process that Risen (2016) dubbed “acquiescence”, which allows us to endorse (and act upon) powerful intuitions even when we rationally acknowledge them to be ungrounded. While being fully convinced at a rational level that no harm can come from reading out loud: “no one I know will ever get a tragic car accident”, for instance, most of us may still feel reluctant to do so.⁴ In such cases, our system 2 does detect a mistake in system 1-generated intuitions, but let such intuitions stand nonetheless.

In other cases, as in so-called “motivated system 2 reasoning” (cf. Pennycook and Rand 2018), system 2 may be as biased as system 1 and its outputs well aligned with the intuitions of system 1: these will be cases in which people wholeheartedly subscribe to superstitious worldviews, or anyway accept system 1 biased suggestions backing them with some relevant piece of reasoning. But according to Risen and colleagues such cases are not that common nowadays in our post-enlightenment society, where system 1 superstitious intuitions and system 2 analytical judgements are often divergent, and if system 1 ends up prevailing this is more likely because either system 2 is too busy or lazy – as in circumstances of cognitive load – or anyway it is somehow “acquiescent”, hence it fails to engage (Risen 2016; Risen and Gilovich 2007).⁵

2.2. *What Actions Tempt Fate, and Why Are Their Outcomes So Aversive?*

Two further questions remain to be addressed in order to complete the picture of superstitious beliefs about the risks of tempting fate: what sorts of actions are perceived as “tempting fate”, and why are negative outcomes that follow these actions thought to be particularly aversive?

To address the first question, Risen and Gilovich (2008) asked subjects to sort fifty random newspaper articles featuring the term “tempting fate”, and they found two

⁴ Cases like this sound very much like some of the cases for which Gendler (2008) introduced the cognitive category of “aliefs”. Although, as I argued elsewhere (Currie and Ichino 2012), I do not find the case for aliefs overall compelling, I already noted that I am more than open to the view that the sort of superstitious thinking I am discussing here may be better explained in non-doxastic terms than in terms of beliefs (see fn.1 above).

⁵ According to other authors, system 2 endorsement of superstitious intuitions is more common than Risen and colleagues think (see e.g. Vyse 2014).

dominant themes associated with the ordinary understanding of that term: needless risk and hubris. Most typically, actions that are taken to tempt fate are actions that are taken to involve some unnecessary risk-taking, and possibly some arrogance. Risks that tend to be deemed unnecessary, in turn, are those instantiated by actions which are departing from one's typical behaviour, from a socially shared norm, or from a state of physical safety (in this sense, acts of arrogance or hubris can be seen as a sub-species of unnecessarily risky actions, insofar as by definition they depart from a socially shared norm of modesty and acceptance of one's limitations). The risks in question may be actual or merely perceived – but what matters most to us here is that even when they are actual, they tend to be overestimated, due to the mechanisms that Risen and Gilovich describe.

As to the second question, the reason why negative outcomes that follow these sorts of actions are thought to be particularly aversive has to do with the additional pain that people anticipate would characterise those outcomes, due to the feelings of regret that they would involve. In addition to whatever pain is expected for the intrinsic negativity of the outcome, indeed, people anticipate an extra dose of painful regret caused by upsetting counterfactual thoughts about what could have happened “if only they acted differently”; and they anticipate the humiliation caused by the feeling that by tempting fate they somehow deserved to be punished. This feeling of deservedness – and the consequent aversiveness – increases when the negative outcome in question somehow ‘fits the crime’ (e.g., when one thinks about getting caught by a rainstorm after having left home the umbrella, or about being rejected by Stanford University after having worn a Stanford T-shirt) – as if people felt that “the universe is interested not only in punishing certain behaviours but in punishing them in a certain, ironic way” (Risen and Gilovich 2008: 304).

The aversiveness of negative outcomes following tempting fate actions – hence the tendency of such outcomes to grab imagination and become more subjectively likely – is then further increased by the fact that the mechanisms just described are widely shared, and so the idea that tempting fate actions should be avoided tends to consolidate into a shared social rule. The very existence of such a rule leads subjects to anticipate some degree of social reprobation (or, at least, lack of social solidarity) in case they incurred negative outcomes after having performed tempting fate actions – and this adds a further layer of aversiveness to the outcomes in question, which thereby feel even more likely.

As Risen and Gilovich (2007: 20) point out, this pessimistic superstitious thinking mainly applies to outcomes that are by and large outside people's control – such as outcomes involving meteorological conditions, lottery results, or committees' decisions – where “fate” or “luck” do seem indeed to play a key role. With respect to outcomes that are more dependent on their control – such as outcomes that are largely determined by their own abilities and performances – people's expectations are generally more positive, due to a host of self-enhancing psychological mechanisms and optimistic biases which come into play. Like most other superstitious beliefs, then, also beliefs about the risks of “tempting fate” tend to arise in situations of stress and uncertainty in which our need for control becomes especially prominent, and those beliefs may provide at least the illusion to satisfy it (cf. Vyse 2014: 159-160; Risen 2016: 188).

3. Getting Your Shot as Tempting Fate

Having introduced superstitious beliefs about tempting fate, in this section I shall argue that such beliefs – or something fairly close to them – contribute to explain vaccine hesitancy in general, and COVID-19 vaccine hesitancy in particular. More precisely, such superstitious

beliefs contribute to the explanation of what is recognized as one of the key determinants of hesitancy: namely, people's concerns about vaccines' safety (see e.g. Salmon et al. 2005; Mac Donald et al. 2015; Betsch et al 2018; Neuman-Bohme et al 2020; Karlsson et al 2021). I will argue that in a number of cases people perceive the action of getting vaccinated as an action that tempts fate, and this is (part of) why they overestimate its risks, being therefore reluctant – if not altogether unwilling – to perform it (I will of course also explain why this happens only in some cases and not always).

3.1. Vaccination as a Needless Risk – and the Biased Assessment of Such Risk

In the eyes of some people at least, the action of getting vaccinated displays the typical features of tempting fate actions.

For one thing, people know that this action involves some risk: with most vaccines (including those against COVID-19) a chance of undergoing serious side-effects as a result of the inoculation is present and indeed acknowledged by the relevant health authorities. Of course, the chance in question is objectively small, especially if compared to the risk constituted by the disease against which the vaccine is supposed to protect. But this latter point is something that not everyone acknowledges. Research on so-called “complacency” shows that a number of people (the majority of whom do indeed turn out to be vaccine hesitant) take the risk of the relevant diseases – measured as a function both of perceived likelihood infection, and of perceived disease severity – to be negligible (see e.g. Mac Donald et al. 2015; Betsch et al. 2018; Malik et al. 2020; Faasse and Newby 2020; González-Block et al. 2020; Karlsson et. al 2021; Razai et al. 2021). There are a variety of reasons for this “complacent” tendency to underestimate diseases' risks, which at a general level can be traced back to a lack of trust in official information and guidelines.⁶ But what matters most to us here is that, for people who display such tendency, the risk involved in getting vaccinated is likely to be taken, comparatively, as a *needless* risk.⁷

There are also further reasons that may lead people to take the action of getting vaccinated as needlessly risky – some of which apply in particular to getting vaccinated against COVID-19. Remember that, according to Risen and Gilovich, risks that are taken to be needless are typically those instantiated by actions which depart from one's typical behaviour, from a socially shared norm, or from a state of physical safety. For a number of people, the action of receiving their COVID-19 vaccination will fall in one or more of these categories. For many adults, indeed, getting vaccinated is not a “typical behaviour” (surely it wasn't so at the beginning of the vaccination campaign) since most vaccinations are

⁶ As it has been noted, complacency in some cases may also be due to the fact that “vaccinations are victims of their own success” (Janko 2012): they are so effective that people do not see their need anymore. Complacency is also fostered by anti-vax propaganda, which trivialises vaccine-preventable diseases, downplaying their risks (just think of the widespread view - pushed also by prominent political actors like Donald Trump – according to which COVID-19 is “just a flu”).

⁷ Through the superstitious mechanism I've been describing, then, two opposite forms of distorted risk perception that have been highlighted as independent causes of vaccine hesitancy – i.e. people's tendency to underestimate the risks of the relevant diseases, on the one hand, and to overestimate the risks of the vaccines, on the other hand – turn out to be causally linked, at least to some extent: insofar as my suggestion is correct, it is partly because some people tend to perceive the risk the disease as low, that they perceive the action of getting vaccinated as an action that tempts fate, and therefore overestimate its potential dangers. The claim that people's tendency to underestimate the risk of the relevant diseases is part of what leads them to overestimate the risk of the vaccines is compatible with the view that both these opposite forms of distorted risk perception are causally dependent on some further, common factor – such as a generalized mistrust in experts and authorities.

received in childhood.⁸ And, insofar as vaccinations are preventive measures typically administered to people who are not currently infected, it can be seen as a “departure from a state of physical safety”. Moreover, for those who already belong to vaccine sceptics groups, those actions are likely to depart from a socially shared norm – given that within those groups refusing vaccinations is the prevailing rule, while accepting them is considered with suspicion, if not outright reprobation.

For all these reasons, getting vaccinated is likely to be perceived by some people as an unnecessary risk, hence as an “action that tempts fate”, giving rise to the distorted mechanism of risk perception that we have seen in the previous section. So here is what could be going on in a typical case: even if subjects may start with some awareness about the fact that the risk of undergoing serious side-effects after getting vaccinated is relatively small, insofar as they perceive that risk as, to a relevant extent, unnecessary, hence as involving tempting fate, they will anticipate that, in case it became real, they would feel extremely regretful and would be tormented by the thoughts that they shouldn’t have got vaccinated, that by so doing they deserved to be punished, etc... These thoughts make the negative scenario of potential side-effects feel extremely aversive – surely more aversive than negative scenarios that do not follow tempting fate actions but simply ‘happen’, like indeed catching the Sars-CoV-2 virus and getting seriously ill as a result of that. Being attached to such aversive feelings, the scenario of vaccines’ nefarious side-effects will then capture subjects’ imagination and their minds more generally, becoming very accessible and therefore more subjectively likely than the objective assessment of its probability indicates it to be. Hence the tendency to overestimate vaccinations’ risks, and the consequent vaccine hesitancy.

This can explain why even subjects who are aware of the statistics about the safety of the vaccine and do not question them at some general level, may nonetheless feel that the vaccine is highly risky *for them*, i.e. that *if they themselves got vaccinated*, they would be likely to run into serious trouble – in the same way in which a subject who rationally asserts that all tickets in a lottery have the same chance of winning may still feel that *if she exchanged her own ticket*, it would become more likely to win than other tickets.

The idea that this sort of superstitious thinking may characterise people’s reasoning about vaccinations is further supported by the observation that vaccinations’ possible negative outcomes are by and large uncontrollable: once you get your shot, there is basically nothing more you can do to prevent its possible side-effects. This, as we have seen, is another typical triggering condition of beliefs about tempting fate – and indeed of superstitiousness more in general, which is well-known to flourish in times of stress and uncertainty in which we feel powerless and out of control (see again Vyse 2014; Risen 2016). We shouldn’t then be surprised to find superstitious thinking at play in the current

⁸ Actually, there are adults for whom receiving vaccinations is more common: those who get every year an anti-flu shot. But indeed, various studies suggest that those adults are not typically among those who are hesitant towards the COVID-19 vaccine; and that, conversely, *not* being vaccinated against influenza in previous years is often associated with COVID-19 vaccine hesitancy (see e.g. Fisher et al. 2019; Kreps et al. 2020). These results are in line with my suggestion according to which those for whom getting vaccinated is not a “typical behaviour” may be more likely to see that action as tempting fate, hence to be hesitant to perform it. As an anonymous reviewer helpfully pointed out, the emphasis on the *unnaturalness* of vaccines that characterised much recent no-vax rhetoric might also have played a role here – consolidating the feeling that getting vaccinated is a needless departure from standard, ‘natural’ conditions (see the vax-sceptic website www.naturalnews.com for many examples of arguments of this sort; for a general discussion of the role of appeals to ‘nature’ in promoting vaccine hesitant attitudes, see Moran et al. 2016).

pandemic landscape, characterised since its inception by a series of traumatic, unpredictable, and uncontrollable events that subverted the order of our lives.

Superstitious beliefs about tempting fate may also be seen as a specific instance – or, at least, a variation on the theme – of the so-called *omission bias* (i.e., our tendency to favour erring through omission over erring through action), and the related *status quo bias* (i.e., our preference for preserving a current state of affairs over subverting it), which have both been pointed out to play a role in vaccine hesitancy (Ritov and Baron 1990; Asch et al. 1994; Wroe et al. 2005; Brown et al. 2010; Azarpanah 2021).⁹ As the examples we have discussed indicate, reluctance to tempt fate can indeed be understood as a reluctance to act so as to alter the ‘natural’, usual course of events – whether in practically effective ways (e.g., by exchanging, lottery tickets) or in merely symbolic ways (e.g., by wearing a university T-shirt before a decision on your acceptance has been made by that university). The underlying idea in all these cases seems to be that the very fact of *acting* does in itself amount to *interfering with fate*, which in turn may earn us a ‘deserved’ punishment. And indeed, the omission and status quo biases are commonly explained as the result of mechanisms involving anticipated regret and blame somewhat similar to those that we have seen for tempting fate beliefs (see again, among others, Ritov and Baron 1990; Ash et al. 1994; Wroe et al. 2005; Brown et al. 2010). The view that these two biases may play a role in vaccine hesitancy does then bring further support to my suggestion about the role of played by superstitious beliefs on tempting fate.

In relation to this, it is worth noticing that explanations of hesitancy appealing to omission and status quo biases were more popular in the early wave of studies on parents’ hesitancy to vaccinate their children in the 1990s and first decade of 2000 (cf. the above-mentioned references), than they have been in most recent research on COVID-19 vaccine hesitancy, where I could actually find only one study that explicitly mentions it (i.e., Azarpanah et al. 2021). This may reflect a more general trend in recent approaches to vaccine hesitancy, which are shifting their focus from cognitive biases and psychological explanations more generally, to explanations that give greater weight to social, systemic factors.¹⁰ What I shall say in the next sub-section will hopefully bridge the gap between these two sorts of approaches, which in fact are not alternative to each other, but fully complementary.

3.2. *The Social Dimension of Superstitious Thinking About Vaccinations and the Varieties of Vaccine Hesitancy*

Superstitious thinking, cognitive biases, and more in general the sort of intuitive thinking we have been discussing so far are universal traits of human cognition. So, one could observe at this point, they cannot be the whole story when it comes to explaining vaccine hesitancy, otherwise we would *all* be vaccine hesitant.

To be sure, I never said that they are the whole story: I repeatedly acknowledged that vaccine hesitancy is a complex phenomenon with stratified causes, which are hardly exhausted by superstitious thinking about tempting fate. Yet, we have seen reasons to take such thinking to play a relevant role in determining vaccine hesitancy, and a fuller response to the observation just raised can already be evinced from the arguments I gave.

⁹ According to some authors, the status quo bias is in itself an effect of the omission bias – see Ritov and Baron (1992) for an extensive discussion of the relation between the two.

¹⁰ See Goldenberg (2021) for an extensive and paradigmatic example; see also Levy (2021) for a thoroughly social approach to phenomena like vaccine hesitancy and the “bad beliefs” they involve.

To begin, even though it is true that superstitious thinking in general is universally widespread and not restricted to any particular class of people, the kind of superstitious beliefs that we have been discussing here – superstitious beliefs about tempting fate – have some peculiarities that can make them more context-dependent than other kinds of superstitious beliefs. As we have seen, social factors seem indeed to play a twofold role in superstitious beliefs about tempting fate. On the one hand, we have seen that what is perceived as “tempting fate” varies depending on the social context (since tempting fate actions are typically identified with actions that involve an unnecessary risk – where the judgement of ‘unnecessity’ depends on them being actions that depart from socially shared norms).¹¹ On the other hand, we have seen that social contexts contribute to determine the anticipated aversiveness of negative outcomes following tempting fate actions – and so (due to the mechanism described in Section 1) subjects’ perceived likelihood of such outcomes, since subjects are sensitive to the expected blame from members of the social group to which they belong.

Applied to the case of reasoning about vaccines, this might then explain why the superstitious belief that “getting your COVID-19 shot involves tempting fate”, with the subsequent overstatement of the risk of getting your shot, tends to arise in some specific conditions – such as in subjects who belong to (or, at least, are somewhat influenced from) social circles in which getting vaccinated is not the norm and is rather considered with suspicion or blame.¹²

This said, it is also important to notice that the (correct) observation that superstitious thinking is universally widespread does not in itself imply that we all, always, display superstitious beliefs and engage in superstitious actions. To see this point, recall the “two systems” account of superstitious thinking defended by Risen and Gilovich. On that account, superstitious intuitions are the product of a system 1 which is constantly active in everyone’s mind, but then different interactions with system 2 determine different roles that such intuitions end up playing in different subjects’ cognitive economy and observable behaviour. In a number of cases, system 1 intuitions are simply overridden by system 2 rational reasoning.

In the domain we are considering of reasoning about vaccines, this means that people may harbour the intuitive superstitious belief that getting vaccinated is a high-risk tempting fate action, and indeed they may experience some worries when they first consider getting their shot, even though at a rational system 2 level they realize that such belief and worries are ungrounded, since they do trust healthcare authorities and data after all – and eventually these trustful system 2 beliefs are powerful enough to thoroughly persuade them about vaccines’ safety. Insofar as this is right, the superstitious belief that “getting your shot is tempting fate” might indeed be rather widespread, but in a number of cases it then gets somehow suppressed along the way.

A close consideration of the possible interactions between system 1 and system 2 in superstitious thinking about tempting fate does not just explain why such thinking doesn’t

¹¹ Here note also that the above-mentioned “complacency” - i.e. people’s tendency to underestimate the risk of the relevant vaccine preventable diseases, which we identified as one of the reasons why people take vaccinations as involving a needless risk – is circumscribed to specific social groups.

¹² As we shall see by the end of this section, these subjects of course may have also other reasons to distrust vaccines and take them to be unsafe – such as past negative experiences with the healthcare system (Goldenberg 2021), and/or the endorsement of no-vax conspiracy theories (Soveri et al. 2021). My point is just that the belief that getting their shot is tempting fate is *one* of the factors that contribute to their distrust in vaccines and their distorted risk-evaluation.

always lead to vaccine hesitancy; it also helps to explain the different forms that vaccine hesitancy, once it arises, may take.

One of such forms is that of militant “anti-vaxxers”, who not only refuse vaccinations, but do that vocally, advocating their choice on social media and other public forums. Classic cases of this sort are cases of subjects who endorse conspiracy theories and similar ideological worldviews, according to which powerful élites seek to deceive us into getting vaccinated, covering up the real risks of vaccines – an idea that resonates with the intuitive superstitious idea about vaccines’ risks. In cases like these, indeed, the superstitious system 1 risk assessment that I described seems to be fully in line with the reasoning that subjects carry out at the level of system 2 on ideological bases: the two systems produce basically the same output, which is therefore endorsed with conviction.

Being so vocal and explicit, these cases of hesitancy are by their very nature the most visible and salient in the public debate – and they have received lots of attention also in the scholarly literature (see Soveri et al. 2021 for a review). This does not mean that they are the majority, though, nor necessarily the most representative. Not all vaccine hesitant subjects are so convinced about their positions and back them with ideological beliefs (Dubé 2013; Larson et al. 2014). In many cases subjects may simply be influenced by the biased risk judgements delivered by their system 1 on the basis of superstitious thinking, while their system 2 fails to properly engage. This, as we have seen, may happen for a number of reasons: system 2 may be too busy with other tasks, it can be somewhat lazy, or else “acquiescent” (i.e., detecting an error but lacking the motivation to correct it – cf. Section 1.1 above). In cases like these, subjects need not have principled reasons to distrust vaccines and refuse them. They may simply be overwhelmed by a visceral *fear* of vaccines’ risks. Their intuitive superstitious thinking leads them to overestimate such risks and, lacking the time, cognitive resources, or motivation, to critically assess those risk judgements, they end up following them to some extent – even just by delaying for a while the decision of whether being vaccinated or not (cf. Luthy et al. 2009; Larson et al. 2014; Kissinger 2021). In terms of underlying mechanisms, an important difference between these cases and cases of more vocal vaccine hesitancy is that here system 2 fails to engage, rather than engaging in a motivated way: subjects simply end up following their system 1 intuitive beliefs since system 2 remains, so to say, silent.

There is also a further form of hesitancy which has received increasing attention in recent studies – that of so-called “hesitant compliers”: subjects who do get vaccinated, but still foster many doubts about such choice (Enkel et al. 2018; Walker et al. 2020; Willis et al. 2022). A recent study interviewing subjects during the fifteen-minutes wait time after the COVID-19 vaccine had been administered, for instance, found that 60% of those who had just been vaccinated express some degree of hesitancy: 31% declare to be still “a little hesitant”, 19% to be “somewhat hesitant”, and 10% to be “very hesitant” (Willis et al. 2022). These results can be explained by the fact that – as we have seen in Section 1 – even when system 2 does engage, detecting (and even correcting) a mistake in system 1’s biased intuitions, the ‘voice’ of such intuitions may nonetheless remain present in people’s mind, exerting some influence on their thoughts, emotions, and (at least verbal) actions.

Distinguishing these (and possibly other) forms of vaccine hesitancy based on the different mechanisms that underly them is important also to devise effective practical interventions upon them – as we shall see in the next section.

4. Practical and Normative Implications: Vaccines Mandates, Defaults, and ‘Required Choices’

I have argued that superstitious beliefs about the risks of “tempting fate” are likely to be at least partly responsible for subjects’ lack of confidence in the safety of (COVID-19, but also other kinds of) vaccines – which in turn is one of the main determinants of vaccine hesitancy. According to the mechanism I described, subjects perceive the action of getting vaccinated as an action that tempts fate, and this is part of what leads them to overestimate its risks: they anticipate that negative outcomes following that action would be particularly aversive (more aversive than negative outcomes that do not follow tempting fate actions, like being seriously ill after catching COVID-19), and so such outcomes grab their imagination and become very accessible, therefore very subjectively likely.

This account has implications for practical interventions aimed at mitigating vaccine hesitancy. On this account, as we have seen, the aversiveness – hence the increased subjective likelihood – of negative outcomes following vaccinations depends on the fact that the action of getting vaccinated is perceived as deliberate and to a relevant extent arbitrary, involving an ‘unnecessary risk’: this is why subjects anticipate feeling very regretful in case negative outcomes followed such action, since they think they would feel unbearably responsible for them. This suggests that one way to correct the distorted risk judgements that determine subjects’ vaccine hesitancy might be to change the way in which they perceive the very action of getting vaccinated, seeking to externalize the responsibility they feel for that action so as to reduce their anticipated self-blame for its possible negative consequences. By lifting some of the weight of the vaccination choice from subjects’ shoulders, we might also reduce their superstitious thinking about that choice and their related hesitance to go for it.

Perhaps the most obvious way to achieve this aim is the establishment of vaccine mandates or vaccine passes – which require subjects to get vaccinated in order to access a number of services and public spaces (such as schools, workplaces, public transport, restaurants), and/or fine non-vaccinated subjects with relevant sanctions.¹³ Such mandates and passes do not physically enforce vaccinations upon subjects, but they certainly go in the direction of making vaccination (nearly) compulsory by altering subjects’ choice set so as to make the no-vax option rather costly. In so doing, vaccine mandates shift the responsibility for the action of getting vaccinated from the self to other agents, making that action less deliberate and ‘arbitrary’ – something that, as I suggested, may reduce the feeling that it involves tempting fate, hence the related anticipated regret for its possible adverse consequences. If my suggestion is correct, measures like mandates and passes would then have the potential to promote a more objective assessment of the probability of vaccines’ negative outcomes – and this might be part of what explains why such measures are overall pretty successful in contrasting vaccine hesitancy (cf. for instance Mill and Ruttenauer 2022; Karaivanov et al. 2021; Omer et al. 2019; Omer et al. 2006).¹⁴

One worry that is often raised against vaccine mandates is that they do not tackle the root causes of vaccine hesitancy: they are just symptomatic, short-term remedies to the

¹³ For a comprehensive review, taxonomy, and assessment of vaccine mandates across different countries in the last decades, see Atwell and Navin (2019).

¹⁴ Of course, I’m not suggesting that the success of vaccine mandates and passes depends entirely on the mechanism I described; other factors – such as indeed the costs of not getting vaccinated – surely play a key role. But the mechanism I described can play an important role, especially in the long run, since it tackles one of the roots of vaccine hesitancy.

problem, which in the long run may actually end up backfiring, fostering even more radical opposition from the most committed vaccine refusers (for arguments – and some data – along this lines, see e.g. Helps et al. 2018; Bardosh et al. 2022; Petterson 2022). Insofar as my argument is right, however, vaccine mandates may actually tackle at least one root cause of hesitancy – namely the sort of superstitious thinking that I described: by making subjects less directly responsible for the choice of getting vaccinated, they may reduce subjects' feeling that by performing such action they are tempting fate, which is one of the determinants of their distorted perception of vaccinations' risks. In this sense, at least for a class of 'mild' hesitant who oppose vaccines more out of fear than out of ideological reasons, vaccine mandates may indeed help to tackle vaccine hesitancy at (one of its) roots.

Admittedly, the same may not be true for convinced, militant anti-vaxxers. So-called "reactance" – defined as subjects' tendency to defend their own freedom of action when they perceive that others are trying to limit it – has been indicated as a possible determinant of vaccine hesitancy (see e.g. Hornsey et al. 2018; Soveri et al. 2021); and the worry that vaccine mandates might, for some people at least, radicalize opposition to vaccines should then be taken seriously. This is why even some prominent advocates of such mandates suggest that allowing the possibility of non-medical exemptions – i.e., exemptions based on personal convictions, such as religious views, etc. – may be a good idea. According to Omer et al. (2019: 471), for instance: "various findings suggest that the most effective approach when it comes to mandating vaccination could be to allow non-medical exemptions, but to make them hard to obtain. Removing the choice of opting out entirely might simply induce [subjects] to seek loopholes, and, worse, fuel negative attitudes towards vaccination".¹⁵

This said, there may be more principled moral and political reasons against the use of vaccine mandates (in general, or in specific contexts): even granting that they can be effective, many take them to be illegitimate measures which infringe subjects' right of self-determination (see e.g. Navin and Largent 2017).

I actually think that – especially in a context like the current pandemic, in which our actions and choices have heavy unavoidable consequences on people around us – imposing stricter than usual limits on personal freedom and self-determination may be warranted (insofar as it is done for the sake of common good, of course). Without entering further into this tricky terrain of debate, however, here I will limit myself to point out that the introduction of vaccine mandates or passes is not the only measure that can be undertaken in order to 'lighten' subjects' own responsibility for choosing to get vaccinated – thereby reducing their anticipated regret for that choice and their consequent hesitancy.

A softer kind of measure going in this direction, which has indeed proved effective, is to build vaccination opportunities into health care routines as "opt-out", rather than "opt-in" options – where the default is to obtain the vaccine, while refusing it requires some effortful practice (Saleska and Choi 2021; Brewer et al. 2017; Community Preventive Services Task Force, 2016).¹⁶ This sort of measure can be implemented in a number of ways – from

¹⁵ As various authors pointed out, mandates cannot in any case be the only solution: they should always be accompanied by a number of (surely trickier to envisage and implement, but crucial) measures aimed at improving social justice, cohesion, and transparent, trustful relationships between citizens and institutions/experts (see Goldenberg 2021 for an extensive discussion; see also Omer et al. 2019: 471; Mills and Ruttenauer 2021: 22).

¹⁶ Making the *refusal* of vaccinations more practically difficult should go hand in hand with making the *access* to them smoother and easier, thereby tackling another important root of vaccine hesitancy that has been identified in the literature: what in the "5 Cs" model of vaccine hesitancy is often labelled as "convenience",

framing clinical recommendations regarding vaccinations as “presumptive announcements” (Moss et al. 2016; Brewer et al. 2017) to requiring subjects who refuse vaccinations to go and sign forms that certify their refusal (these may include legal responsibility forms for harms caused to third persons in case they got ill with the relevant vaccine-preventable diseases – cf. Atwell and Navin 2019).

Also measures of this sort – which may be classified as (more or less gentle) *nudges* – can of course raise some concerns. According to Goldenberg (2021), for instance, nudging tactics may be perceived as manipulative and paternalistic, thereby eroding that public trust in authorities which would be the key to effectively fighting vaccine hesitancy. As she writes: “nudges are frustrating for the target audience when they perceive the ‘red tape’ burden as manipulative, even if the burden is minor. This is not conducive to building good relations between the public and government institutions” (Goldenberg 2021: 68).

As argued by Levy (2021), however, nudges are not necessarily manipulative, nor, importantly, they are necessarily perceived as such. Nudges of the sort we are discussing here, for instance, which involve the setting of *default* options to influence people’s behaviour, are typically understood by ordinary people as a form of implicit communication involving authoritative recommendations (in our case, the recommendation to get vaccinated) – and as such they are treated as higher-order evidence in favour of the nudged option. Far from bypassing rational cognition, these sorts of nudges contribute to our processes of rational deliberation by providing a relevant kind evidence for us to weigh (Levy 2021: 140). While Goldenberg is surely right on the importance of fostering trustful relationships between the public and the experts/institutions, then, it is not really clear that nudging strategies are in tension with that.

For those still unconvinced about the legitimacy of nudges and defaults, anyway, there is also a further kind of intervention that my arguments in this paper would predict to be successful: what Thaler and Sunstein (2021: 110) call “required choices”, or “active choosing” – i.e. forcing subjects to make their own choices, *whatever they are*, in an active way. In the domain of vaccination choices this would mean that neither getting your shot nor *not* getting it would be set as the default, but whichever of the two options you choose, you are required choose it actively – e.g., again, by filling a form in which you explicitly state that such is your decision. No passive choice – like simply avoiding getting your shot, or keeping delaying that decision – would be allowed anymore. This would arguably be a way to make subjects realize that also *not* being vaccinated is, in fact, a full-fledged action, and one that they could very much regret. Thinking about it in these terms – especially if they are invited to carefully consider the potential costs of such action – may then lead at least some to think that refusing vaccinations, rather than accepting them, is what should actually be taken to “tempt fate”, and should therefore be avoided.¹⁷

which has to do with the practical barriers that may get in the way of subjects’ adherence to vaccination campaigns (see e.g. Betsch et al. 2018; Razai et al. 2021).

¹⁷ My discussion here is not meant to exhaust the list of practical interventions that my account would predict to be successful. Insofar as I am right that subjects’ overestimation of vaccines’ risks is indirectly influenced by their underestimation of the risks of the relevant vaccine preventable diseases – i.e., by so-called “complacency” – another obvious measure that could prove effective to reduce lack of confidence in vaccines’ safety would involve addressing complacency itself, by promoting a better awareness of the relevant diseases’ risks.

5. Conclusion

I have offered one explanation for subjects' lack of confidence in vaccines' safety, which in turn is widely recognized as one of the main causes of vaccine hesitancy. This explanation traces such lack of confidence back to a particular form of superstitious-magical thinking: namely, the superstitious belief that "it is bad luck to tempt fate". I have argued that in some conditions people see getting vaccinated as an action that "tempts fate", and this – via a number of psychological mechanisms I explored – brings them to overestimate vaccines' risks.

This explanation is not alternative to (but can rather work in conjunction with) others that have been offered for lack of confidence in vaccines' safety, such as those that give a prominent role to factors like conspiracist thinking and distrust of experts/authorities. Yet, the superstitious-magical thinking that I described can work also independently from those further factors – and this explains why vaccine hesitancy is not displayed only by conspiracy theorists, science-deniers, or otherwise sceptical people, but is also found among subjects who do trust scientific authorities and experts' opinion in general, and are simply scared about the prospect of nefarious side-effects which they deem disproportionately probable.

This explanation is of course also compatible with the view that there are further causes of vaccine hesitancy beyond lack of confidence in vaccines' safety. In discussing how superstitious beliefs about tempting fate influence subjects' confidence in vaccines, indeed, we have seen how subjects' lack of confidence may be intertwined with another cause of vaccine hesitancy that is well-documented in the literature, i.e., so-called "complacency" – as well as with other such causes, like so-called "reactance" and "convenience".

Recognizing the role of this superstitious-magical thinking in explaining vaccine hesitancy is important to devise practical pro-vaccine interventions, which in order to be effective should take into account all the different factors that may lead subjects to hesitate.

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