

The Impact on Well-Being of Cognitive Bias about Infectious Diseases

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Existence of Bias in General

Evident from

- political polarization
- personal experience

"WHO vs. WHO"

- WHO Director General, 3rd March 2020: "Globally, about **3.4%** of reported COVID-19 cases have died."
- Ioannidis, WHO Bulletin, 14th October 2020 "Across 51 locations, the median COVID-19 infection fatality rate was **0.27% (corrected 0.23%)**"
- Ioannidis 2021, Infection-fatality rate of **0.15%** based on six pre-vaccine sero-prevalence meta-studies

Existence of Bias in the Population

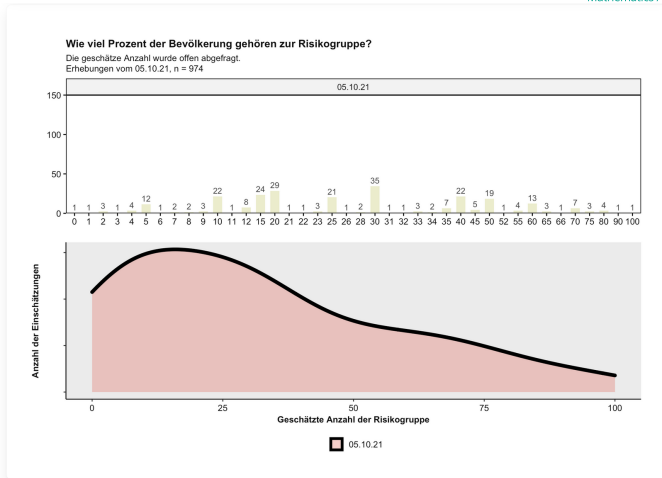
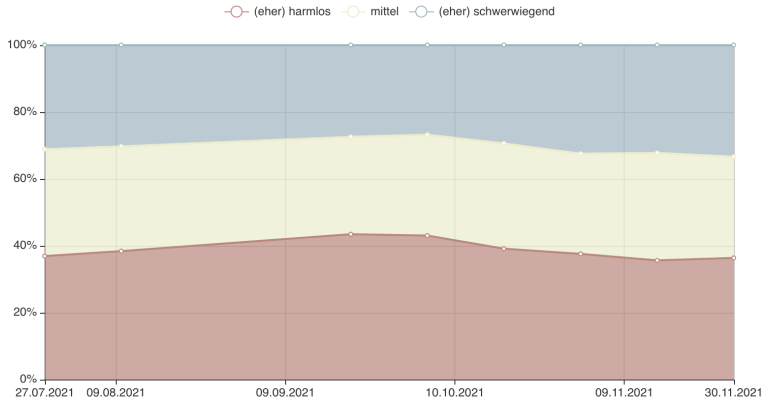


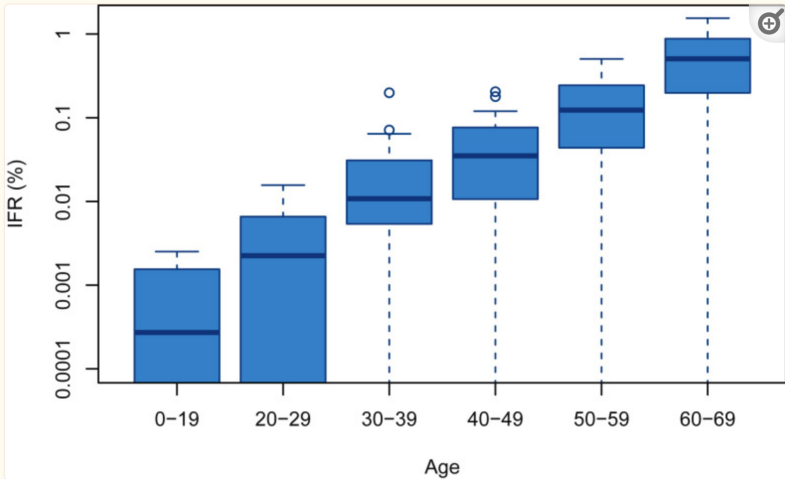
Figure 1: (COSMO 2022)



Wahrgenommener Schweregrad einer Infektion für Kinder

Anteile der einzelnen Antwortmöglichkeiten





[Fig. 2](#)

Box plot of infection fatality rate (IFR) estimates across countries per each specified age bin. Note: The 25th percentile for 0-19 and 20-29 age bins is not shown (0.0000%).

“What percent of people who get infected with the new coronavirus die from this infection?”

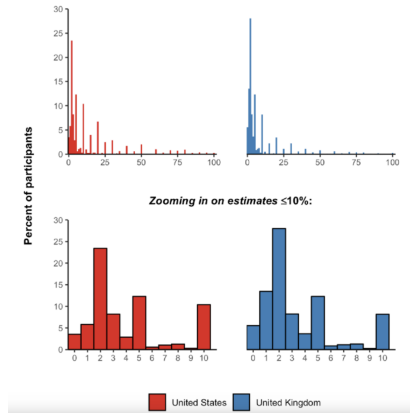
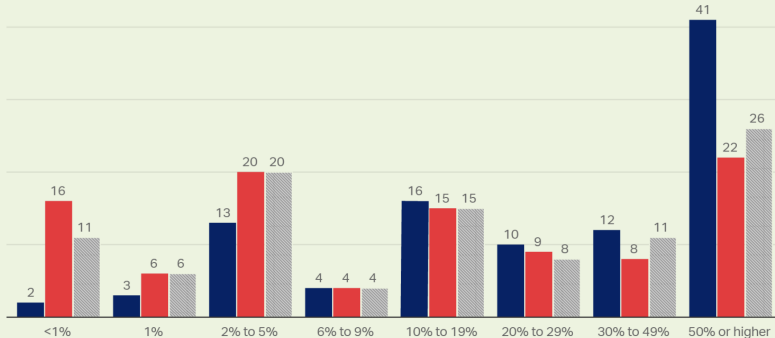


Figure 2: “US and UK participants’ median estimate for the probability of a fatal disease course among those infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was 5.0% (IQR 2.0%-15.0%) and 3.0% (IQR 2.0%-10.0%), respectively.” (Geldsetzer, 2020)

Estimated COVID-19 Hospitalization Risk for Unvaccinated Population, by Political Party

■ % Democrat ■ % Republican ■ % Independent



SOURCE: GALLUP PANEL

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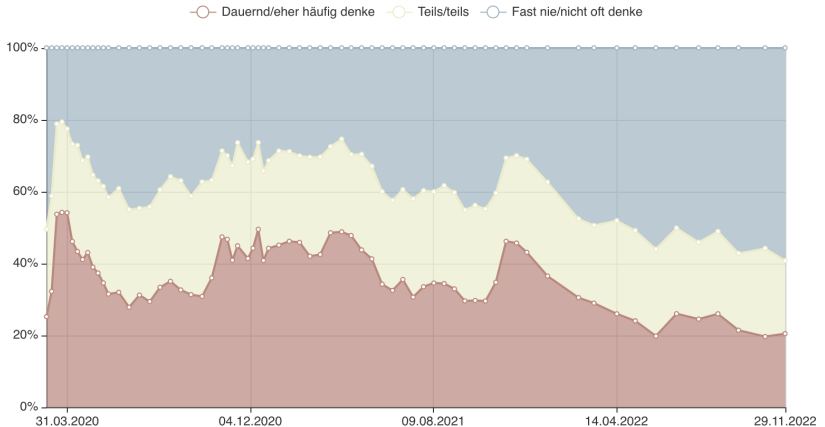
Two possible sources of information:

- Ones own experience
 - Sense experience
 - Memories of sense experiences
 - Deductions from these
- Experiences of others, communicated by
 - individuals
 - organizations (among them media)



Dominanz des Themas

Das Coronavirus ist für mich etwas, woran ich...

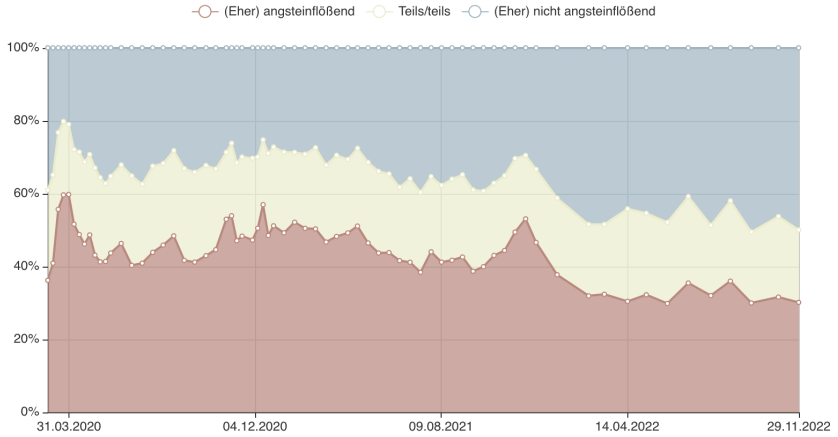


COVID-19 Snapshot Monitoring (COSMO) — www.corona-monitor.de (CC BY-SA 3.0 DE)



Angst

Das Coronavirus ist für mich...



COVID-19 Snapshot Monitoring (COSMO) — www.corona-monitor.de (CC BY-SA 3.0 DE)

Table 1. Fear Appeals in Coronavirus Coverage.

Outlet	Threat	Threat Component			Efficacy Component		
		Fear-Inducing Language		National Impacts	Personal Angle	Individual Measures	Societal Measures
		Headline	Body				
<i>Times</i>	90.5%	26%	51.9%	68.7%	27.5%	29.8%	69.1%
<i>Telegraph</i>	93.5%	37%	54.2%	67.6%	27.5%	38.9%	71%
<i>Mirror</i>	90.1%	46.6%	53.4%	74%	48.1%	40.5%	69.8%
<i>Sun</i>	90.5%	45%	62.6%	67.9%	42.7%	52.3%	70.6%
Overall	91.1%	38.6%	55.5%	69.6%	36.5%	40.4%	70.1%

Table 2. Overview of Different Threats.

Category	Prevalence	Three Most Common Threats within Category (% , Descending)
<i>Health threats</i>	50.9%	Infection (36.6%), Death (10.6%), Insufficient medical treatment (2.2%)
<i>Economic threats</i>	15.9%	Economic uncertainty (13.6%), Job loss (1.9%), Price spike (0.4%)
<i>Political threats</i>	15.7%	Restriction of public life (9.4%), Lack of political governance (5.6%), Rise of Chinese soft power (0.8%)
<i>Other threats</i>	8.6%	Other, openly coded threat (4.7%), Hoarding (1.9%), Racism (0.8%)
<i>No threat identified</i>	8.9%	

(Hase et al., 2022)

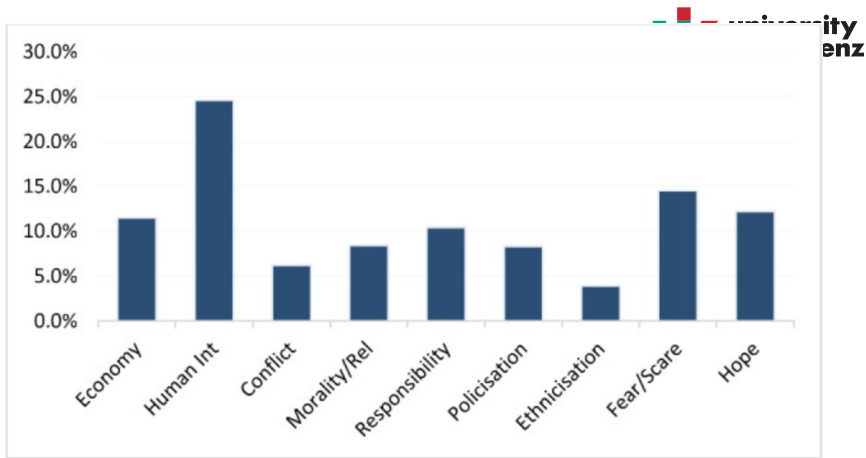


Figure 3: Human interest: positive 479, negative 1040 (Ogbodo et al., 2020)

Human interest	Semetko and Valkenburg ¹⁸ explain that journalists give “a human face or an emotional angle to the presentation of an event, issue, or problem”	“Mother dies from coronavirus hours after giving birth to her first child in Ukrainian hospital”. ²¹
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Figure 4: (Ogbodo et al., 2020)

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(UK Gov 2020)

Persuasion

2. *Perceived threat*: A substantial number of people still do not feel sufficiently personally threatened; it could be that they are reassured by the low death rate in their demographic group (8), although levels of concern may be rising (9). Having a good understanding of the risk has been found to be positively associated with adoption of COVID-19 social distancing measures in Hong Kong (10). **The perceived level of personal threat needs to be increased among those who are complacent, using hard-hitting emotional messaging. To be effective this must also empower people by making clear the actions they can take to reduce the threat (11).**
3. *Responsibility to others*: There seems to be insufficient understanding of, or feelings of responsibility about, people's role in transmitting the infection to others. This may have resulted in part from messaging around the low level of risk to most people and talk of the desirability of building 'herd immunity'. **Messaging needs to emphasise and explain the duty to protect others (12, 13).**

Incentivisation

6. *Social approval*: Social approval can be a powerful source of reward. Not only can this be provided directly by highlighting examples of good practice and providing strong social encouragement and approval in communications; members of the community can be encouraged to provide it to each other. This can have a beneficial spill-over effect of promoting social cohesion (15). **Communication strategies should provide social approval for desired behaviours and promote social approval within the community.**
8. *Social disapproval*: Social disapproval from one's community can play an important role in preventing anti-social behaviour or discouraging failure to enact pro-social behaviour (15). However, this needs to be carefully managed to avoid victimisation, scapegoating and misdirected criticism. It needs to be accompanied by clear messaging and promotion of strong collective identity. **Consideration should be given to use of social disapproval but with a strong caveat around unwanted negative consequences.**

5 June, 2020

ity
enz

Matt Hancock | Health Secretary

👍 Have you seen the v interesting Ara Darzi survey? 15:31



Patrick Vallance | Government Chief Scientific Adviser

Haven't seen it yet but heard a verbal output a couple of days ago. Will try to find it now 16:49

Ok seen it now. Very good and consistent with the **ONS** study. All pointing in the same positive direction 17:09



Matt Hancock

Yep. Just done presser where the media interest is only in the gloomy Cambridge survey 🙄 17:57



But, if we want people to behave themselves maybe that's no bad thing 17:57



Patrick Vallance

Agree, suck up their miserable interpretation and over deliver 17:58

(Lockdown Files, 2023)

Rather than doing too much forward signalling, we can roll pitch with the new strain

11:15

Matt Hancock

We frighten the pants of everyone with the new strain

11:17

but the complication with that Brexit is taking the top line

11:17



Damon Poole

Yep that's what will get proper bahviour change

11:17

Matt Hancock

When do we deploy the new variant

11:35



Damon Poole

Been thinking more about this and think we need to be more cautious

12:49

The strain that is

12:50

Think you made the point earlier but we need to keep schools off paperwork / agenda

13:45

Matt Hancock
Yes

14:24



Damon Poole

Worth doing a bit about no leaking at the top I think

16:34

Big risk with the variant, right wing papers go for a renewed push for let it rip on the basis the vaccines strategy is undermined.

19:16

Matt Hancock

That's why we reassure on the vaccine

19:47

10 January, 2021



Simon Case | Permanent Secretary at No 10

More mask-wearing might be the only thing to consider. Effectively free and has a very visible impact? Wear masks in all settings outside home and in more workplaces?

12:17

Am not sure that got us much further, did it? Basically, we need to get compliance up

14:20

We actually ought to be careful with stuff like angling - we should sort them, but quietly. We will be parodied galore if it looks like we have suddenly decided fishing is the first step towards tier 5!

14:21



Matt Hancock | Health Secretary

yep. I think the problem is that the levers not in the hands of No10 & DHSC are harder to pull

14:21



I honestly wouldn't move on any small things unless we move on a lot.

14:22

The only big remaining things are nurseries and workplaces

14:23



Simon Case

I agree - I think that is exactly right. Small stuff looks ridiculous. Ramping up messaging - the fear/guilt factor vital

14:23

I suspect London Nightingale coming into use will feel like a big public moment. Especially as I guess it will be full with a couple of days (based on current data)

19:14

4 a. Worst case verdeutlichen!

Wir müssen wegkommen von einer Kommunikation, die auf die Fallsterblichkeitsrate zentriert ist. Bei einer prozentual unerheblich klingenden Fallsterblichkeitsrate, die vor allem die Älteren betrifft, denken sich viele dann unbewusst und uneingestanden: «Naja, so werden wir die Alten los, die unsere Wirtschaft nach unten ziehen, wir sind sowieso schon zu viele auf der Erde, und mit ein bisschen Glück erbe ich so schon ein bisschen früher». Diese Mechanismen haben in der Vergangenheit sicher zur Verharmlosung der Epidemie beigetragen.

Um die gewünschte Schockwirkung zu erzielen, müssen die konkreten Auswirkungen einer Durchseuchung auf die menschliche Gesellschaft verdeutlicht werden:

(FDR Gov 2020)

(Bavel et al., 2020 in Nature)

- "Methods to **increase certainty** include helping people feel knowledgeable about their new attitude and **making them feel that their new attitude is the 'moral' one to have.**"
- "**People are also more likely to cooperate when they believe that others are cooperating.** [...] This suggests that leaders and the media can promote cooperation by making [...] [cooperative] behaviours more observable."
- "[Psychological] Inoculation follows the biomedical analogy: people are exposed to a severely weakened dose of a persuasive argument, strong enough to trigger the immune system but not so strong as to overwhelm it. **A meta-analysis has found inoculation effective in protecting attitudes from persuasion.**"
- "thus, **focusing on worst-case scenarios**, even if they are uncertain, may encourage people to make sacrifices for others."

As well as overt warnings about the danger of the virus, the Government has been accused of feeding the public a non-stop diet of bad news, such as deaths and hospitalisations, without ever putting the figures in context with news of how many people have recovered, or whether daily death tolls are above or below seasonal averages.

Another member of SPI-B said they were "stunned by the weaponisation of behavioural psychology" during the pandemic, and that "psychologists didn't seem to notice when it stopped being altruistic and became manipulative. They have too much power and it intoxicates them".

(Rayner, 2021 in The Telegraph, "State of fear: how ministers 'used covert tactics' to keep scared public at home")

One regular Sage attendee said: “The British people have been subjected to an unevaluated psychological experiment without being told that is what’s happening.”

“All of this is about trying to steer behaviour in the direction an elite has decided, rather than deciding if it is the right thing or the ethical thing to do.”

(Reichelt, 2022)

"Der Streit da ging um die Corona-Berichterstattung insgesamt, wo Friede Springer die Vorstellung hatte – und das mir gegenüber auch sehr deutlich gemacht hat – dass Bild in der beginnenden Corona-Krise, das war ganz zu Anfang, **ab sofort unterstützend für die Bundesregierung und die Kanzlerin berichten sollte.** Und das war nicht meine Auffassung von Journalismus."

Marc Walder, Ringier Medien in (von Matt 2022)

"Wir hatten in allen Ländern, wo wir tätig sind - und da wäre ich froh, wenn das in diesem Kreis bleibt -, auf meine Initiative hin gesagt, **wir wollen die Regierung unterstützen durch unsere mediale Berichterstattung,** damit wir alle gut durch die Krise kommen."

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Question

Given that Governments are subservient to the wellbeing of the population, the natural question is:

Does bias about infectious disease increase wellbeing or not?

- Behavioral-Epidemiological modeling focused on wellbeing.
- Introduction of rational choice and social welfare into epidemiological modeling.
- Explicit evaluative (normative) model with a new proof for the utilitarian principle.

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(cf. Kermack/McKendrick 1927, Martcheva 2010)

- The population of agents, N , is for each time step subdivided into three distinct classes
 - susceptibles $S(t)$
 - infected $I(t)$
 - recovered $R(t)$
- At the beginning of each time step, susceptibles choose the level of effort $a \in [0, 1]$ they are going to make in order to avoid an infection.
- After that each susceptible makes one random contact uniformly distributed over the whole population.
 - If the agent makes a contact with an infected he gets infected with probability $\beta(1 - a)$.
Otherwise he stays susceptible.
 - If the agent makes a contact with any other kind of agent (susceptible, recovered) he stays susceptible.
- Infected agents recover with probability γ
- Recovered agents stay recovered

$$\mathbb{E}(\Delta S) = -\beta(1-a)\frac{I}{N}S$$

$$\mathbb{E}(\Delta I) = \beta(1-a)\frac{I}{N}S - \gamma I$$

$$\mathbb{E}(\Delta R) = \gamma I$$

This contains the dynamics of the standard discrete time SIR-Model if $a = 0$.¹

¹The expectations are conditioned on $S(t)$

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Agents have a sense of their own wellbeing and act accordingly as follows:

- (Myopic Rationality) Agents choose the level of effort with the highest expected value for the present moment (von Neumann/Morgenstern, 1947).
- Effort to avoid an infection bears a cost $c(a)$, $c' > 0$ in terms of the agents wellbeing with constantly increasing marginal costs $c'' = \text{const.} > 0$
- Getting an infection bears an average health cost θ for the agents wellbeing.
- The following, possibly distorted, information is available to the agent (in addition to the parameters above)
 - effort cost function c
 - the transmission probability β
 - perceived distribution of disease severity $\tilde{\Theta}$ (with mean $\tilde{\theta}$)
 - the probability of meeting an infected I/N

Agents have thus the following decision problem:

$$\max_{a \in [0,1]} v(I, a) := \underbrace{-\kappa a^2}_{\text{effort cost}} + \underbrace{-\tilde{\theta}\beta(1-a)\frac{I}{N}}_{\text{expected health impact}}$$

$$\implies a = \min\left\{\frac{\tilde{\theta}\beta\frac{I}{N}}{2\kappa}, 1\right\}$$

Since the value function is homogenous in the cost parameters, we can set $\kappa = 1$ without loss of generality.

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A social welfare judgement is the judgement of an impartial, ethical observer on the comparative value of two social states, i.e. it is a judgement on whether one social state is better than another (cf. D'Aspermont 2002, Ng 2000).²

Unanimity If *all* agents are better off in one social state than in another with one individual being at least strictly better off, then the former state is strictly preferred by the ethical observer.

Impartiality All agents are treated equal. The wellbeing of one agent is not considered more important than that of others.

Eudaimonism The observer is indifferent between two states, if the well-being of individuals is exactly the same in both states.

²Methods to evaluate wellbeing: empathizing, neuroscience, willingness to pay, (discounted) income, quality of life measures etc...

Individualism When comparing two social states, the judgement depends only on the difference in well-being between these two states.

Maximum Domain The set of societal states S which the observer can compare includes all possible variations in well-being.

The social welfare ordering of the impartial observer is then given by $\sum_i w(x, i)$ in the following sense:

$$\sum_i w(x, i) > \sum_i w(y, i) \quad \text{iff } x \text{ is judged to be better than } y$$

$$\sum_i w(x, i) = \sum_i w(y, i) \quad \text{iff } x \text{ is judged to be equivalent to } y$$

where w denotes the wellbeing of agent i in state x .

Finally, we define $w(i)$ to be the cumulative reward an agent receives over the course of the epidemic (cf. Kahneman, 1997):

- Episodic wellbeing: $w(T) := \sum_t^T v(I(t), a(t))$
- Per capita Welfare: $W(T) := \frac{\sum_i w(T)}{N} = \sum_t^T v(t) \frac{S(t)}{N}$

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Continuous Time, Infinite Population

Taking the continuous population limit, and assuming that the time steps were sufficiently small we get the following dynamics:

$$a(I) = \min\left\{\frac{\tilde{\theta}\beta I}{2N}, 1\right\}$$
$$\frac{dS}{dt} = -\beta(1 - a(I))\frac{I}{N}S$$
$$\frac{dI}{dt} = \beta(1 - a(I))\frac{I}{N}S - \gamma I$$
$$\frac{dR}{dt} = \gamma I$$
$$\frac{dW}{dt} = (a(I)^2 + \bar{\theta}\beta(1 - a(I))\frac{I}{N})\frac{S}{N}$$

where $\tilde{\theta} = 0$ gives us the standard SIR-Model again, and $\bar{\theta}$ is the real severity.

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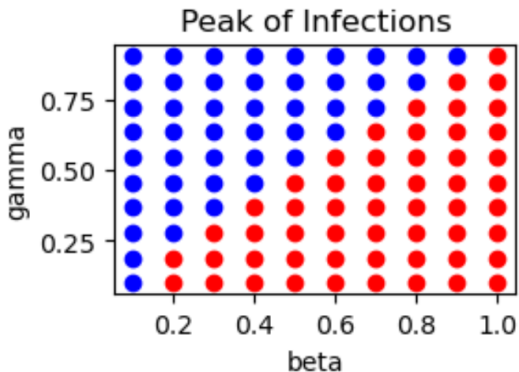
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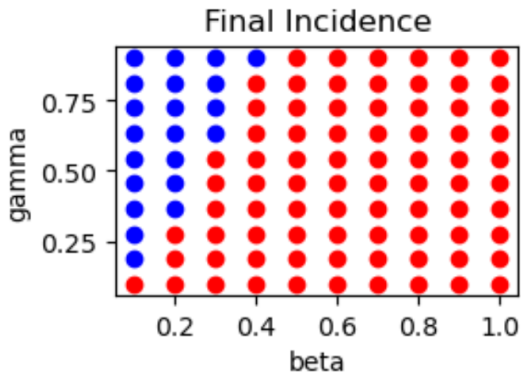
The model has four parameters in total (after normalizing the population size):

- Epidemiological:
 - Transmission-Rate β
 - Recovery-Rate γ
 - Real severity $\bar{\theta}$
- Behavioral: Expected/Perceived severity $\tilde{\theta}$

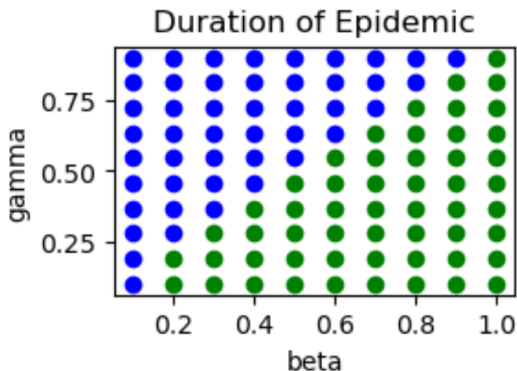
Impact on Infections



Impact on Incidence



Impact on Duration



Impact on Welfare

	> 0	$= 0$	< 0	other
ΔW_∞	30.3%	0.0%	21.5%	48.2%
$\Delta^2 W_\infty$	21.5%	30.3%	0.0%	48.2%

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- Focusing on small determinant parts of wellbeing is in general insufficient.
- Trade-offs need to be made between prolonged/increased effort and health improvements.
- Optimal control of psychological variables of a population requires data on wellbeing, perceived and real threats as well as costs.
- However, psychological control raises some fundamental issues, relevant for future modeling.

Fundamental Issues with Psychological Control

- Loss of democratic legitimacy: "state-manufactured consent of the governed" does not establish a rule of the governed.
- Polarization: Perceived shift in the locus of control leads to fundamental opposition.
- Mal-government:
 - "doom loop" (Laura Dodsworth) leads to mal-adaptive decision procedures in Government and in the general population
 - High risk of abuse, if there are no protective rights against psychological control by the state!

Protective rights against psychological control by the state

Polities with no protective rights against psychological control by the state are bound to suffer in terms of the above.

Fundamental Issues with Psychological Control

- Fixating opinions presupposes that the fixating agency infallibly knows the truth.
- Strictly impossible in empirical matters as per Descartes' Dream Argument (among others).
- Large groups are actually in error as seen above.
- Empirical science requires many leaps of faith.

Methodic doubt as a means for scientific progress

- a guard against error,
- a remedy against ideology and group think (= "social error"),
- a stimulant in the search for reasons/justifications (knowledge := justified, true belief).

- Vastness of economic literature building on rational choice and social welfare proves the fertility of these concepts.
- Interplay of political and opinion dynamics during pandemics.

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