

Transcript

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Welcome to After the End from the Ethoc Centre at the University of Oxford, funded by the Wellcome Discovery Award Scheme.

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I'm Patricia Kingori, Professor of Global Health Ethics at the University of Oxford.

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In this series, we explore endings and their aftermaths.

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Who decides when an end has been reached, whether the end for one person is the end for everybody, and what happens after these so-called endings?

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In this podcast, we hear from epidemiologist Lucas Engelmann from the University of Edinburgh on infectious disease modelling and when and if an epidemic or pandemic can be said to be over.

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I'm a senior lecturer and a Chancellor's Fellow here at the University of Edinburgh.

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I'm a historian of medicine and I work predominantly on the history of epidemics.

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My PhD was on HIV and AIDS.

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And after that, I've worked a bit on

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the third plague pandemic, which was at the beginning of the 20th century, the kind of recurrence of an ancient or medieval disease in modern times, and more recently, specifically on the history of epidemiology, of how epidemiology became the authoritative science that it is today.

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Epidemics have always been a staple of human history, and some people have gone so far to say epidemics are somewhat engines of history and have always had a

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fundamental role in the development of human civilization, in the development and transformation of human culture, with regards to technological progress, industrial progress.

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Epidemics have been obstacles to overcome, but also reasons to aspire for better living conditions, better conditions of communication, travel, transport, and so on and so on.

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There are many, many facets in which epidemics are part and parcel

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of human history.

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But I think there's a specific story that needs to be told and needs to be captured, and that is the kind of way in which epidemics feature in the modern history of human societies.

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And in modern history, on the one hand, the epidemic seems to become synonymous in modern times with a phenomenon of the past, that modern society, with its technological capabilities, should be able to overcome, should be able to contain, and should be able to immunize against.

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But at the same time, many of the aspects of modern societies are, of course, conducive to epidemic spread.

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Global transport, global communicability, global mobility, all of these aspects of modern life and modern society are, of course, engines that also become increasingly identified with epidemic spread.

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Long story short is we need to study epidemics, we need to understand epidemics because we want to understand what human society is on the global, on a national, on a regional and on a local scale.

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The historian Charles Rosenberg famously wrote in the 1970s that epidemics allow us to almost put a looking glass at society and we can use the history of epidemics as a sampling device to understand how societies are structured, what are the weaknesses, what are the vulnerabilities of societies.

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What are the kind of values and what are the strong beliefs that structure societies?

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And once we look through the lens of epidemics on the human history, these kind of dimensions become quite obvious and quite visible, because at the time of epidemic crisis, societies tend to fall back on what matters.

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Modeling came along in the early 20th century as a relatively new method to think about epidemics,

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moving away from a kind of long-standing tradition of looking at epidemics through historical means.

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It's an empirical field that would usually study how epidemics have been in the past to get a better grasp and a better approach to how epidemics might behave if they've come back or if they emerge in different places, and so on and so on.

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And we see this shift away from

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epidemiology as a field dedicated to the archive, to becoming a field dedicated to the abstract reasoning about epidemics as generalized models of contagious spread.

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And that is a huge transformation in the field that then for a long time I would say coexists with other traditions.

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In the mid-20th century, the rise of social epidemiology, social determinants of health is another tradition that has become hugely important.

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But only really in the late 20th century, I would say on the back of the HIV AIDS epidemic, does this shift become a wholesale shift and modeling really take on to define what an epidemiological argument is.

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But at the heart of all of this sits what is called an SIR model, which is in mathematical or in more technical terms, a compartmental model, which means that it distributes

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population into three different compartments.

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One is the susceptible compartment, that is the compartment of a society that is not yet affected by an infectious disease or an infectious agent or an infectious phenomenon, doesn't have to be a disease.

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There is the compartment I, which is the infected part of the population, and there's the compartment R, which is the recovered compartment of the population.

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And the appeal of this model is its simplicity.

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And with that simplicity, the model can be used to create an epidemic dynamic, how the population shifts between infected and susceptible or between susceptible and becoming infected and from infected to becoming recovered.

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And then we can also introduce additional elements into these models like a vaccination.

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which then we can group together with the recovered if we assume that recovered means that they are not permanently, but for a significant amount of time immune against that disease.

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And if you plot these things on the model like you do, then you can define certain variables, like the rate of infection.

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You can say we have a society that has X amount of contact to each other with a pathogenic agent that seems to have that kind of infectivity on that kind of level.

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So we assume the rate with which people switch from susceptible to being infected is 5 or 3 or 1.

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And on the same account, we can then calculate what the mortality rate is.

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What is fascinating to me is that the SIR model does away with a lot of the assumption that we usually work with when we think about epidemics.

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We think about the kind of way in which an epidemic emerges as a crisis and emerges as something catastrophic into society, whereas the SIR model rather assumes that an epidemic is almost like a permanent condition that is only then problematic when certain rates get out of control.

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So infections always happen, forms of distribution always happen.

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But with the SIR model, the only thing that matters is really to find out what are the critical rates where those kinds of distributions become problematic, become too much, become a threat to the integrity of population at large.

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And that's also where the utility of these models lies.

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They are extremely good to create scenarios.

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These are never reliable scenarios, but they're what's been dubbed in COVID by the SAGE committee or by the relevant committees that were working to advise the government, worst-case scenarios.

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And these are very good devices, SR models, to create these worst-case scenarios to show

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If the rate of infection remains this for a period of time, then we can plot a curve that looks very much like this.

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And we see that at that point in time in the future, we exceed the capacity that we have in our national health system to deal with the kind of cases that are emerging.

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Or we can see this developing into a curve that very quickly indicates that this is an unacceptable loss of life, societally or politically, and so on and so on.

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And so they take on a very interesting function.

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They're not measurement devices.

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They're not used to make an account of what's happening currently with COVID in this week or last week or the months before.

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But they're instruments that are supposed to mimic or simulate a kind of world in which epidemics follow certain laws.

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And when we accept those laws, we can then calculate what to expect from certain scenarios of how this epidemic, of how this outbreak might develop in the future.

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And that then allows us to create evidence.

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A colleague, Carrie Lancaster, and her colleague, Tim Rhodes, have called this evidence enough for policy to get into action.

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I think what we've seen in COVID was that SIR modeling, or epidemic modeling more generally, became incredibly popular.

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at the science policy interface because it was so useful to create some indication of what scenarios might emerge that gave some sort of orientation for policy to develop a form of decision-making that then could still argue that there are science-led policy or evidence-based policy, while the evidence itself, if we look at it very straight on, entirely speculative.

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And that was just something that I found extremely intriguing, looking at COVID and how this developed, that we have

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At the heart of this narrative of science-led policy for COVID and for epidemics, a kind of science that is in itself concerned with the production of good theories as tools of orientation for how to deal with epidemics.

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Another thing is the appeal of modeling, because that's what they can do really well.

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Good, convincing theories of how the future might unfold on the basis of certain indicators of the present and the past.

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I was invited to present my work on the history of modeling at this workshop in Oxford after the end.

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It prompted 2 lines of thinking.

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For me, on the one hand, it helped me to appreciate a bit more clearly how modeling introduces a very different way of thinking about time in epidemiology and epidemics.

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So if we contrast the world of modeling to the older world of epidemiology, where epidemics were historical phenomena,

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In the old model, we have a very clear idea of a beginning, a middle, and an end.

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There's the emergence of an epidemic, there's a dramatic increase that has forms of crisis attached to them, and then there's an aftermath that's usually kind of tapering out, not always a sudden end, but sometimes a sudden end.

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And there are lots of historiographical questions about how to make sense of these different periods, both in terms of where do we pay attention to when we think about the history of epidemics, but also

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How do we make sense of this historical pattering of time?

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And how do we also narrate these kind of histories?

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I think epidemiology for a long time was a field that was attached to having almost developed and invented a convention of how to talk about epidemics as these phenomena that develop in time, that have a deep history, that repeats itself from outbreak to outbreak.

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and then becomes almost a narrative device to make sense of certain outbreaks.

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So for example, with plague, when we have the third plague pandemic emerging in the United States in the 1900s, 1990, 1, 2, 3, the standard response by most of the medical officers involved in dealing with this very unusual disease was first of all to point to medieval times and early modern times and said, this is a disease of the past.

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we know of this disease in the past, it has behaved like this and this and this.

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What is happening right here, right now?

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What is different right here, right now?

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And it was very important to establish at that time that there's a difference between the individual clinical case of having plague and a city suffering from an outbreak of plague.

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Not just because it's not always possible to compare the individual body to a social body, there are lots of things attached to that, but because there are diametrically opposed dynamics.

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An individual case of plague

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after the point of infection, a body usually succumbs to the disease in four to five days.

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But that really fast onset of an individual case means that it's a very slow epidemic when it arrives somewhere.

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It usually only comes to the eyes of anyone who observes or anyone who's interested in the epidemic locally when there's a good amount of cases already established in the community.

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So

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These kind of historical narratives were really important to make sense of the different kinds of time patterning that epidemics might have compared to individual clinical cases.

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And then modeling comes along and says, but we can take these temporalities of an epidemic and generalize them and remove them from a kind of temporal universe in

which things have chronological order and instead think about epidemics as something that just happens from step to step to step to step.

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ad infinitum.

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Long story short, I would say for modeling the end is when R is 0, when R , the reproduction rate of an infectious disease.

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So the reproduction rate usually defined as the number of cases that are infected by one single cases over a period of time.

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So let's say the period of time is one day.

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A disease has a reproductive rate of 2 if one case infects 2 other cases over a time period of 1.

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Or in the compartmental world of the SIR model,

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It is basically when two of the susceptibles become turned into an infectious entity.

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And so once you apply a formalized understanding of this, even though you're still building models that create curves that are similar to the old narratives, you don't really think anymore about beginnings and endings because all you're really interested in is when is this reproductive rate leading to growth?

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When is this reproductive rate leading to a negative growth of the epidemic, a kind of dying out of the epidemic?

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Or when is this reproductive rate leading to a kind of endemicity, a form of non-distribution in which the cases might still emerge, but they don't lead to anything, so they're not relevant.

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And that creates a form of ending that is not necessarily associated with any of the ideas of ending that we had in epidemiology before, which we're much more concerned with.

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Is the disease eradicated?

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Is the pathogen gone?

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Have the stories ended?

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Are there any clinical cases still around?

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Are there any other things?

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But in the model, the end is just a form of silence or kind of inconspicuous status rather than an absolute end.

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For COVID-19, modeling was essential and was astonishingly authoritative, perhaps particularly in the UK context.

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And that has its own little history that is really interesting, has a lot to do with foot and mouse disease and BSE and the proximity between Imperial College and Westminster and other peculiarities of the UK.

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but also globally.

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Modeling really became a recognized, authoritative scientific field of reckoning with epidemic and epidemic threat.

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And I think it's here to stay.

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I don't necessarily think that's a bad thing.

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Modeling has a somewhat bad reputation of being a heartless science that considers epidemics through forms of obstructions that do not account for the pain and misery that epidemics cause and emotional burden.

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that the aggregated occurrence of death and morbidity is introducing into societies.

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But I think what I often see in my own work, speaking to modelers, is that there are a lot of misunderstandings about what modeling is and what modeling is supposed to do.

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I think every modeler would emphasize that narratives are incredibly important and that a model on itself doesn't do much to help us dealing with an epidemic or understanding an epidemic.

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I would even go further and would say most modelers would not trust their own models to be turned into policy, because models do not make policy.

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Policy is a place where ethical, historical, social, and cultural dimension have come to bear on the decision-making, and models are supposed to provide some form of clarity

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And models have always had a place to disrupt established forms of thinking about epidemics, and often that has been a good thing.

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For example, in the beginning of the 20th century, when models were first introduced, we often find that rhetoric around models, the eugenicists, talking about very bad ideas that some societies might be more or less susceptible to epidemics than others because of some racial factors that were imagined somehow.

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that could not be measured, that could not be theorized in any straightforward way.

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On the other hand, it was the heyday of bacteriology and bacteriological science, and there were lots of bacteriologists, mainly spearheaded also by the bacteriology in France, that believed that all epidemic dynamics should be explained through a variability in the virulence of bacteria.

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So some epidemics take off because bacteria strains can be extremely aggressive and other bacteria strains can be extremely harmless.

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And models came along as like, it's not that simple.

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An epidemic always has to be understood as the complex interplay of different factors, host, pathogen, and environment, or host, causeway, and environment.

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It doesn't have to be a pathogen.

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And only if you really begin to think that interplay, then you begin to develop the dynamic in thinking that allows you to create solutions that are actually workable and that then can be re-translated into concerns about society, concerns about bacteriology, concerns about the kind of environment that is conducive to epidemics and so on.

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But you need to install at the center of it a thinking that

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is so inextricably bound to that complexity that it cannot escape it.

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And the best tool for that was at the time differential calculus, because you can write down actually quite elegantly how you theorize the interdependence of two processes that are developing at the same time in perhaps different rates.

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That's what modeling can do.

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However, when we come to COVID-19, what I found was astonishing was the inability of many modelers to engage in a fruitful conversation with people who were more concerned with social epidemiology or people who were more concerned with the traditional form of epidemiological thinking, questions about what are the social strata in society that make this epidemic to affect different parts of society differently.

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The prototypical modeler's answer to that question would be, does it really matter?

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Because to get a good idea of where this pandemic might go, we probably only need an average idea of what society is and don't need to worry about the different strata.

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It might be important if you want to think about who is affected most, but as a model, I'm not interested in that necessarily because I want to know what the epidemic is going to do.

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There, I think, is a lot more space, and I really hope we can develop that space in the future to create a conversation along those lines.

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And one way I hope this conversation can be developed is to accept some of the assumptions that modelers have introduced that are actually really interesting for social scientists and humanities scholars alike.

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It's a point that I developed for my talk at this workshop, and it's a point that I keep coming back to, is that at the heart of the idea of a compartmental model like the SIR model,

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is that population is made-up of individual entities that are susceptible.

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And the premise of susceptibility at the heart of a social theory is an enormously productive instrument to think about society.

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It's much more productive to think about a society through that lens than through a society that is in a fixed form of historical structure.

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And it allows us also to theorize things like affect.

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It provides us with a kind of language, which is only to some extent mathematical, in which the dependence of individuals in the society on each other, in their interconnectedness, in their constant risk and ability to affect and infect each other becomes at the heart of how we want to live and how we want to establish a society.

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SIR models place that at the heart of how we think about societies.

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And I think that hasn't been valued enough when we criticize models for not taking into account what different aspects a virus like the coronavirus had on different parts of society, which is still a relevant point.

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But there are more complex ways, I think, to think through that bring us to what I think would be a productive conversation.

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And so understanding who modelers are,

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and what drives them in the development of models, I think will be really helpful to create a conversation about how models work and what models are supposed to do and what they intend to achieve.

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And then we should be in a position where we can bring that into conversation with what we need to do to be prepared for the next epidemic.

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That kind of synchronicity

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that we experienced in COVID-19.

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It's A radical new challenge of how we deal with epidemics and how we deal with epidemiological knowledge.

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There is a lot of talk about epidemic preparedness, and unfortunately, most of that talk is focused on technological solutions.

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More modeling, more data, more decision sciences, more surveillance, more

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insight into even more fine-grained aspects of society on a global scale to capture pandemics earlier, when they develop, to get a better sense of the earliest points and to move on from there.

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But I think if anything, COVID-19 has shown us that what we need is epistemic preparedness, an ability to create dynamic forms of thinking required to engage with a challenge that is unlike any others that we had before.

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An ability

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to step back when a new challenge and new crisis emerges, such as COVID-19, and say, what are the resources that we need to build up here to understand this in its full breadth?

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And I think what became clear over COVID, what became clear in the aftermath of COVID was

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that to rely very narrowly on the expertise of modelers might allow governments to produce a quite strong, focused policy, but it did not lead to a wholesale increase of trust in public health.

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It did not lead to a wholesale increase of trust in governance.

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And it did not lead to a global community unified in taking this challenge on.

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And that, I think, are the challenges that we need to address, and modeling alone cannot solve that.

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but it can be a piece of the puzzle.

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So I think modeling doesn't have an end.

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It will permutate into something else.

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I can't see anything on the horizon to replace modeling, and I think nobody has that insight or foresight.

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But I can say that the past will never disappear in the way we engage with epidemics and also in the way we engage with modeling.

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And that, I think, has two quite important ramifications.

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On the one hand, the past is not written.

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The past is also not set in stone.

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the past has a form of coming back as a kind of obstacle in our way of thinking forward.

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And I think it's an obstacle we should embrace and should engage productively.

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That doesn't mean to repackage epidemics of the past, but it is a way of engaging epidemics of the past to better understand what is at stake in epidemics and what are the fundamental mistakes that have been done in the past.

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There are ethical and moral lessons that we can take away from some of the histories of epidemics that we know about and that we have studied well.

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We know that racism is a huge problem in almost all of epidemic containment through the beginning of the 20th century and has never led to any productive way forward and shouldn't ever.

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We also know that homophobia has been one of the key aspects that allowed AIDS to become the crisis that it was.

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and that it still is.

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These are moral instances that we can return to and where we can take them to tell really powerful stories.

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And that's, I think, where the history of epidemics continues to matter for how we approach future epidemics, of how we invoke a sense of epidemic and epistemic preparedness.

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by having these narratives of past epidemics at our fingertips to challenge the ways we decide what is at stake.

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That might mean that we expand the scope of epidemic preparedness from a technological surveillance machine that's trying to capture that what might emerge and find ways to, as quickly as possible, exterminate any kind of threat.

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and return maybe to an idea of public health and social medicine and ask, what are the conditions that we need to change permanently in society so that epidemics become less likely to be devastating, to be a threat?

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And that, I think, brings us back to this question, like, to what extent is epidemiology

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a field that is charged with a form of political agenda of what is a more healthy society, what is a more robust society, what is a more stable society that is actually prepared.

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That brings us to the end of this podcast.

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Thank you for listening.

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Next time, Lucas Engelmann joins me and Bobby Farsides for an exploration of ethics and endings in the context of public health.

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I'm Patisha Kinguri, and you've been listening to After the End, brought to you by the Ethoc Centre at the University of Oxford, funded by the Wellcome Discovery Award Scheme.

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