

Communicating Modelling Studies to Policy

Expressing complex ideas in simple terms



THE UNIVERSITY of EDINBURGH
School of Physics
and Astronomy

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Outline

- Some brief background on me
- What are ways scientists' might engage with policy
- 3 examples
 - Bovine TB (“Peacetime” Operational)
 - COVID-19 (Emergency Operational)
 - Avian influenza (Strategic)
- An open question – what is parsimony in scientific advice?

My background

- 1995 - Ph.D. Computational Physics (Soft-Condensed Matter)
- 1996-1999 - PDRA – AgResearch NZ
- 1999-2003 - PDRA – Inst Animal Health/Univ Oxford
- 2003-2007 - Wellcome Trust Fellowship - Univ Oxford
- 2007-2017 - Wellcome Trust Sen Fellowship/Prof. – Univ Glasgow
- 2007-now – Univ Edin (Roslin/SoPA)

My background

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- 2007-now – Univ Edin (Roslin/SoPA)

Supported NEEG during 2007, 2008, 2009 epidemics of bluetongue virus, avian influenza & FMD

Chief Scientist's Group (2001 FMD epidemic)

SPI-M/SPI-M-O (COVID-19 and aftermath)

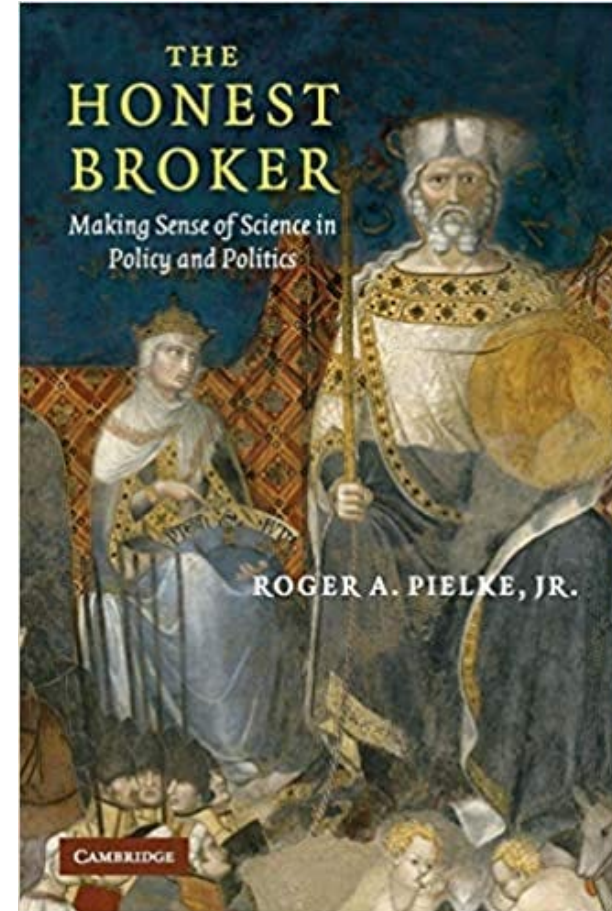
Member Defra Science Advisory Council, Chair

Chair, Defra Committee on Exotic and Emergent Diseases (SAC-ED)

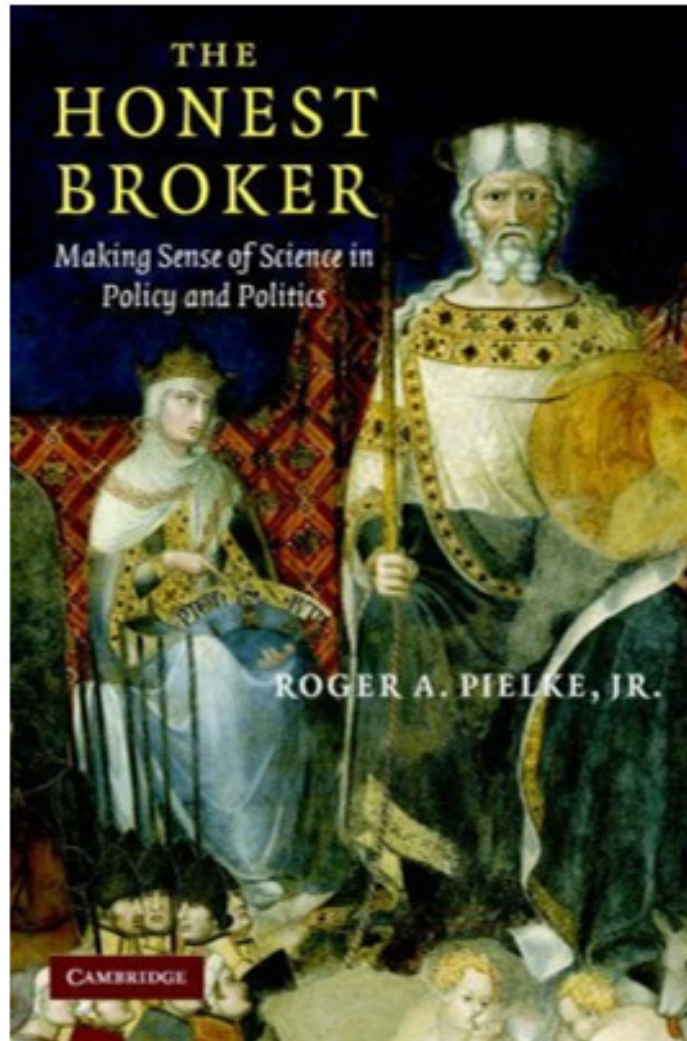
Member Defra Bovine TB Partnership (Govt/Industry/Academia)

Scientific Roles

- Framework for understanding ways that science can interact with policy
- Recognition of the need for science to act 'outside' (historical) scientific roles



Four ways to link science & policy



VIEW OF DEMOCRACY

Interest group pluralism

Elite Conflict

VIEW OF SCIENCE IN SOCIETY

Linear Model

Stakeholder Model

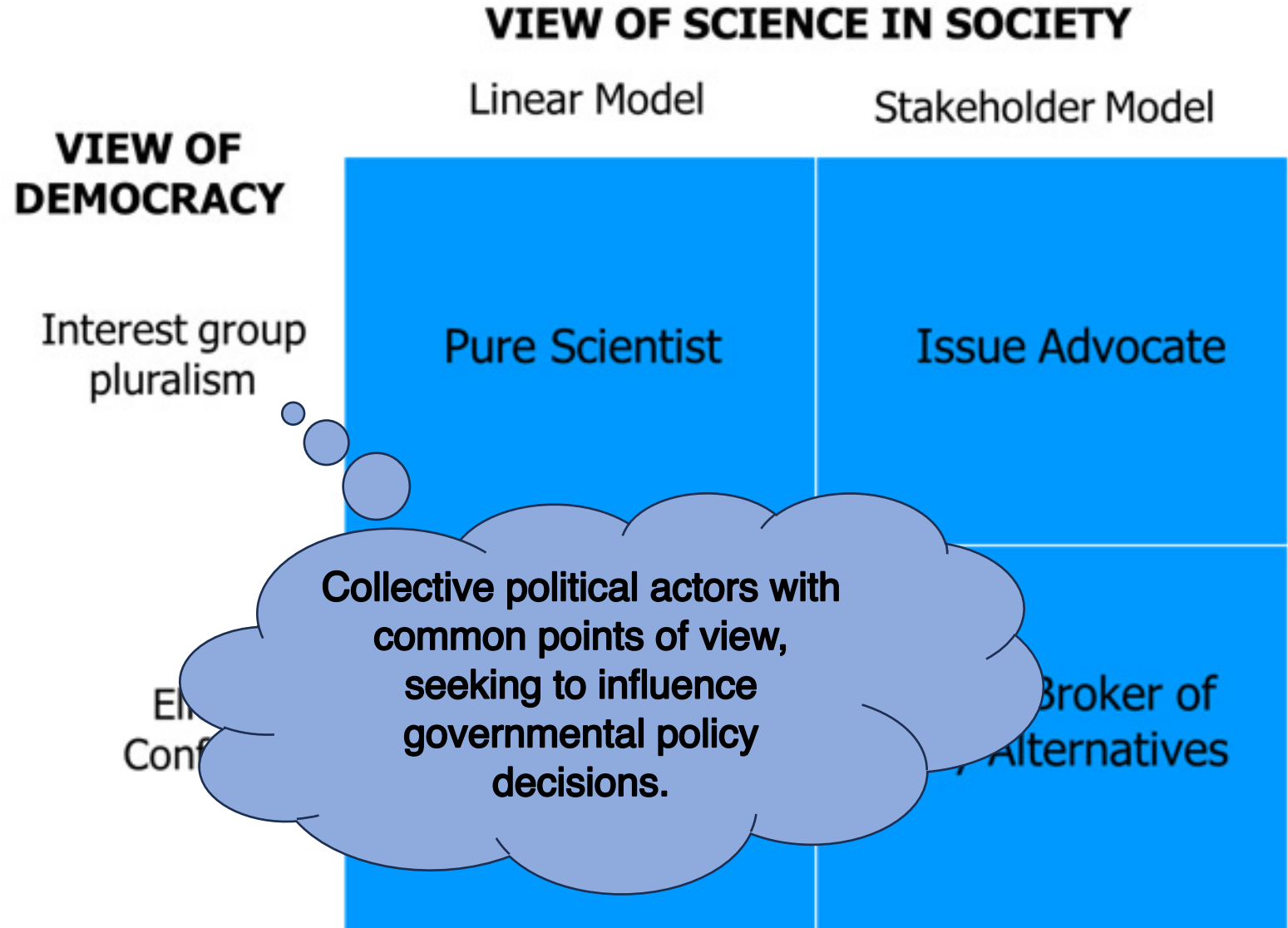
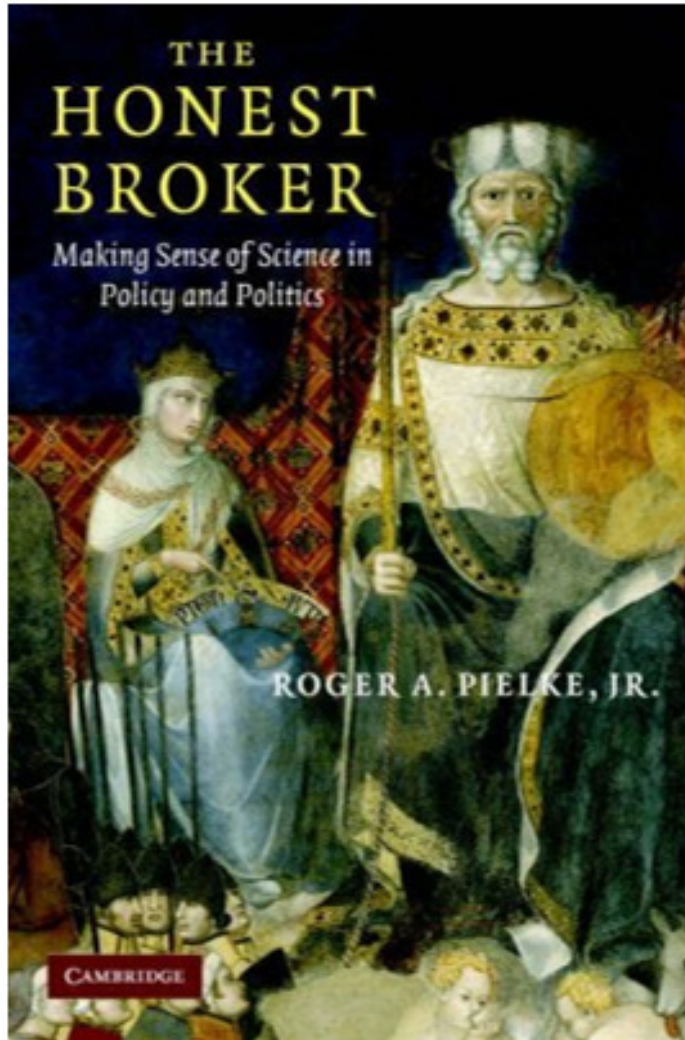
Pure Scientist

Issue Advocate

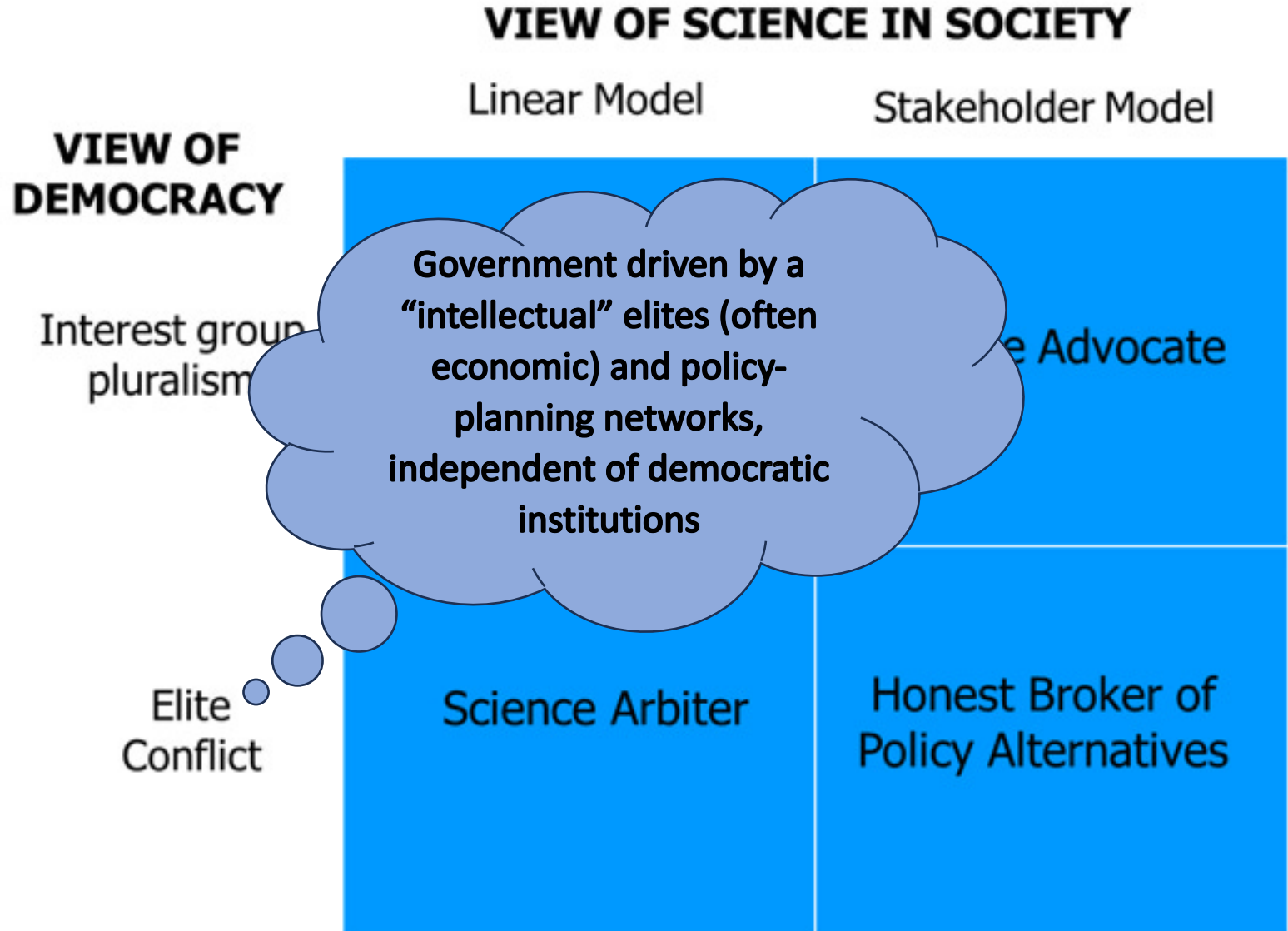
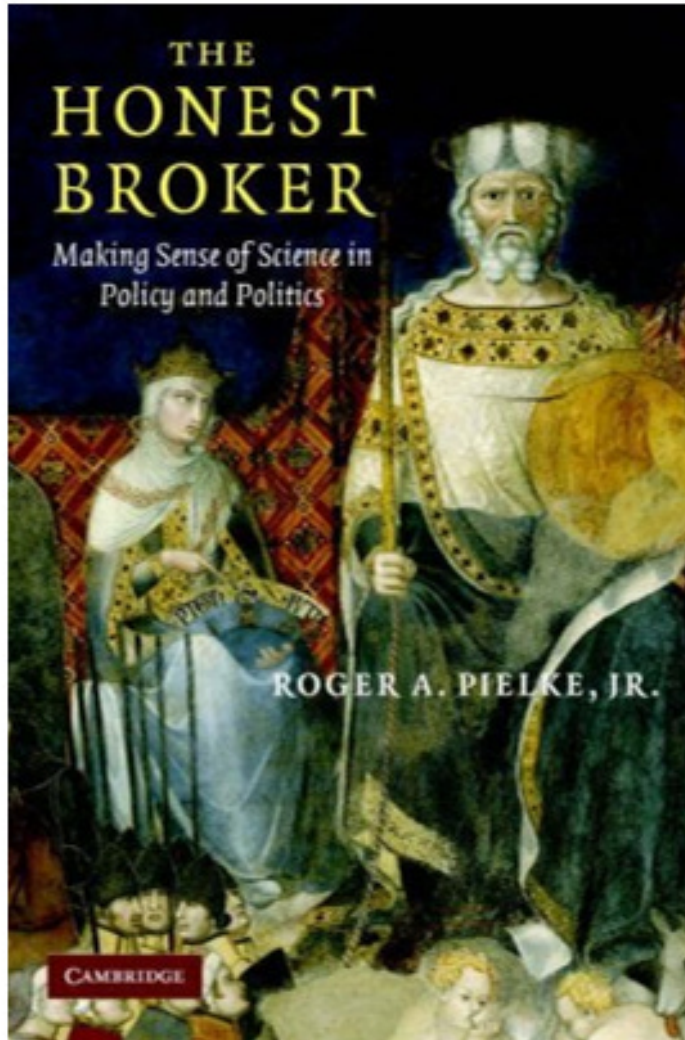
Science Arbiter

Honest Broker of Policy Alternatives

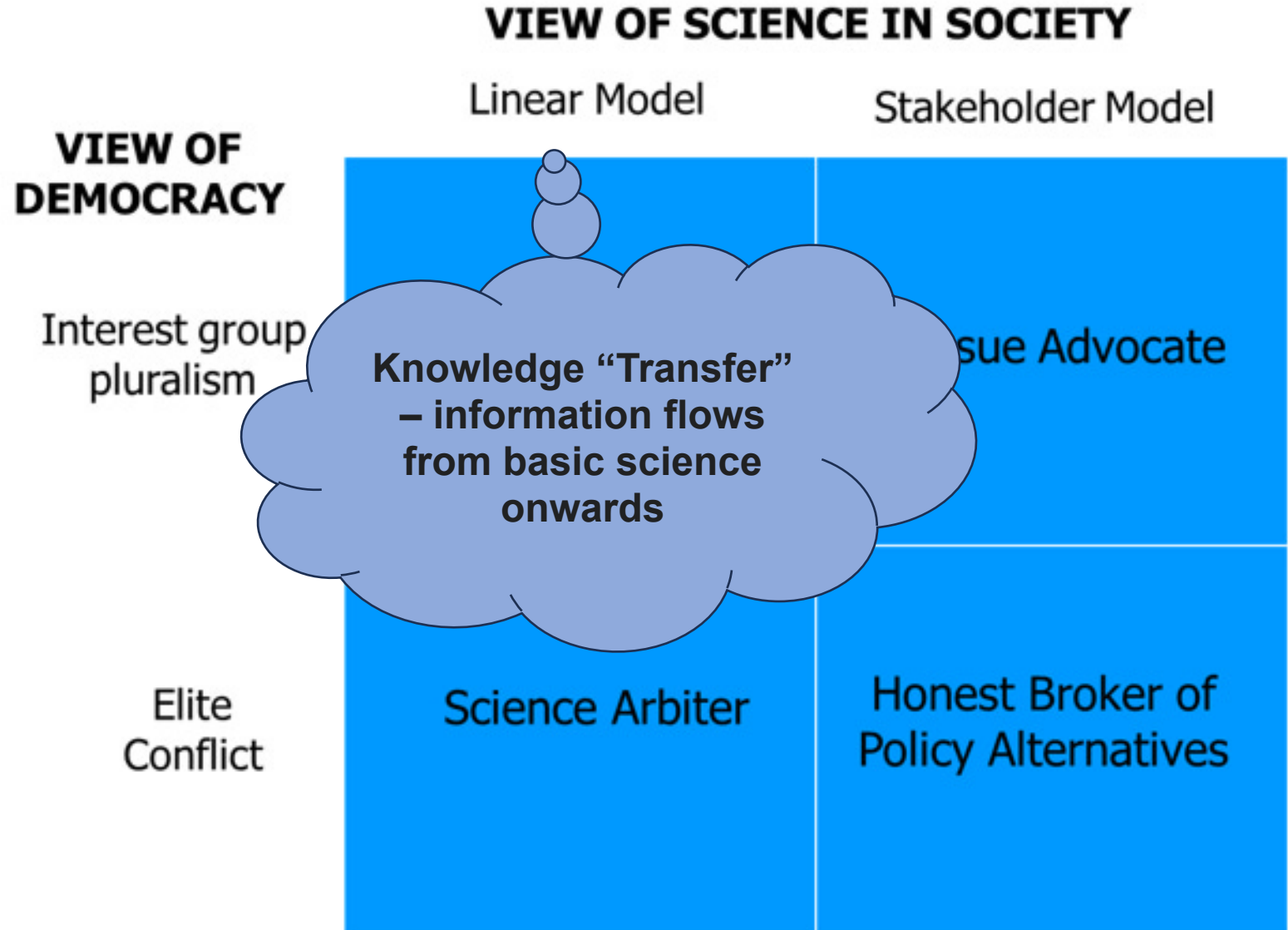
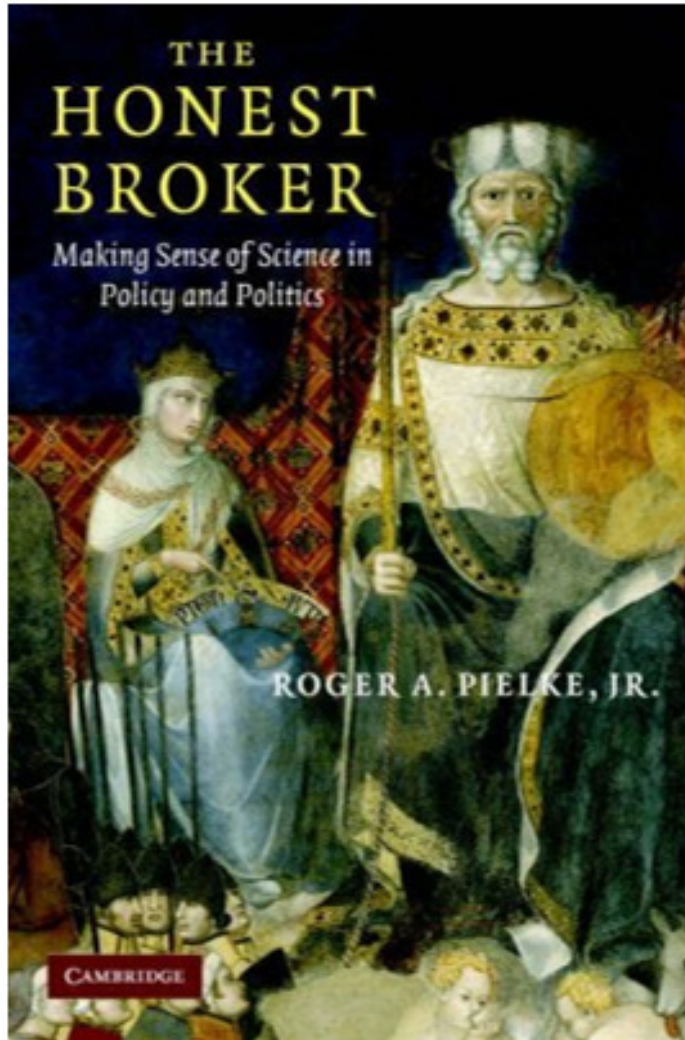
Four ways to link science & policy



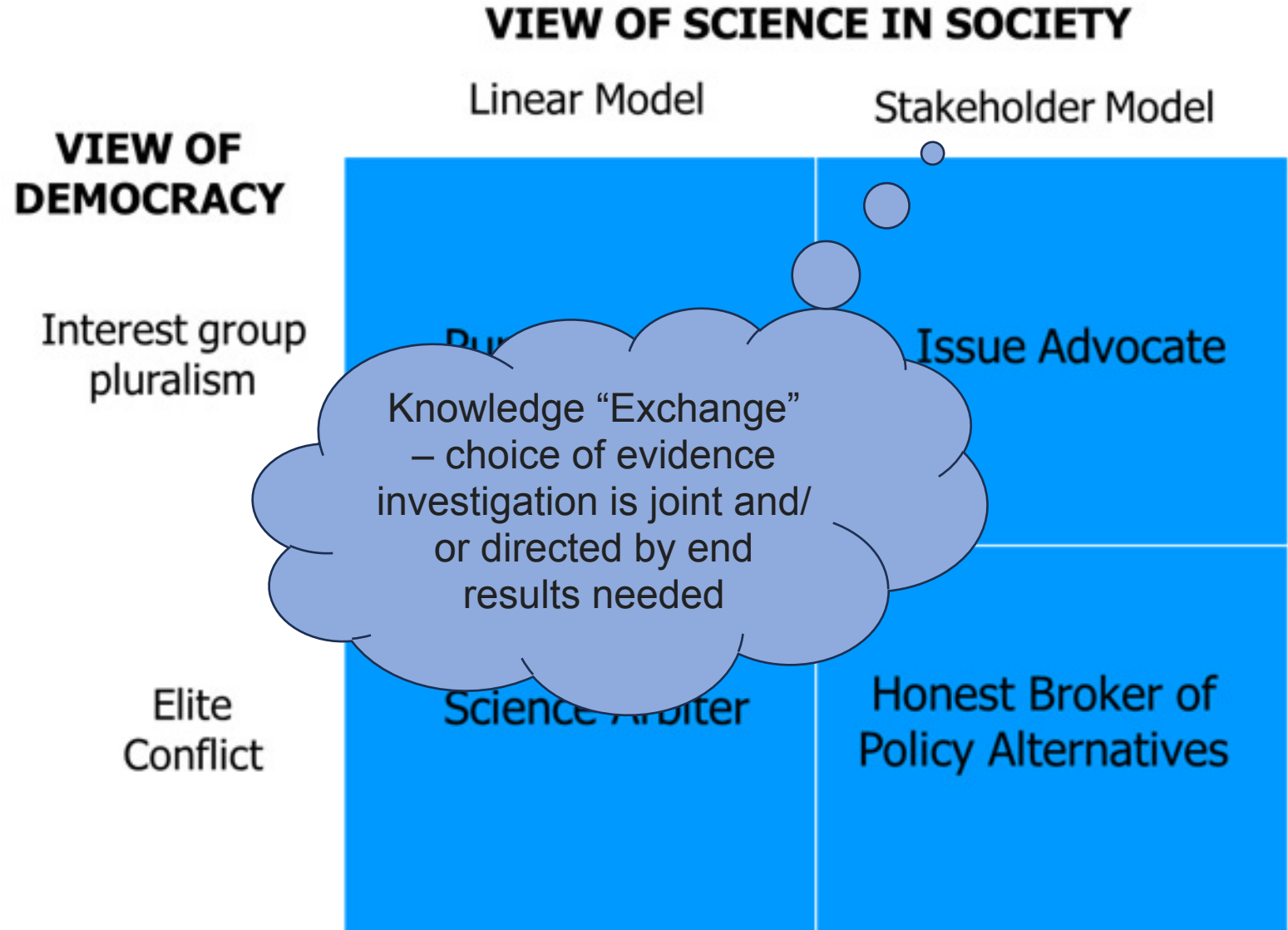
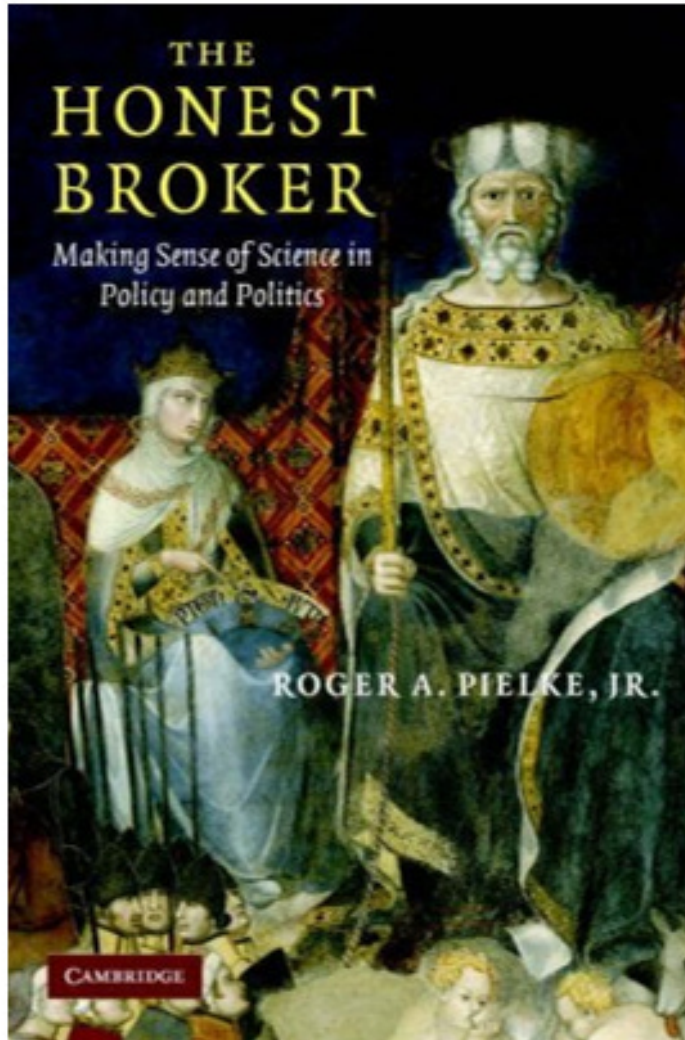
Four ways to link science & policy



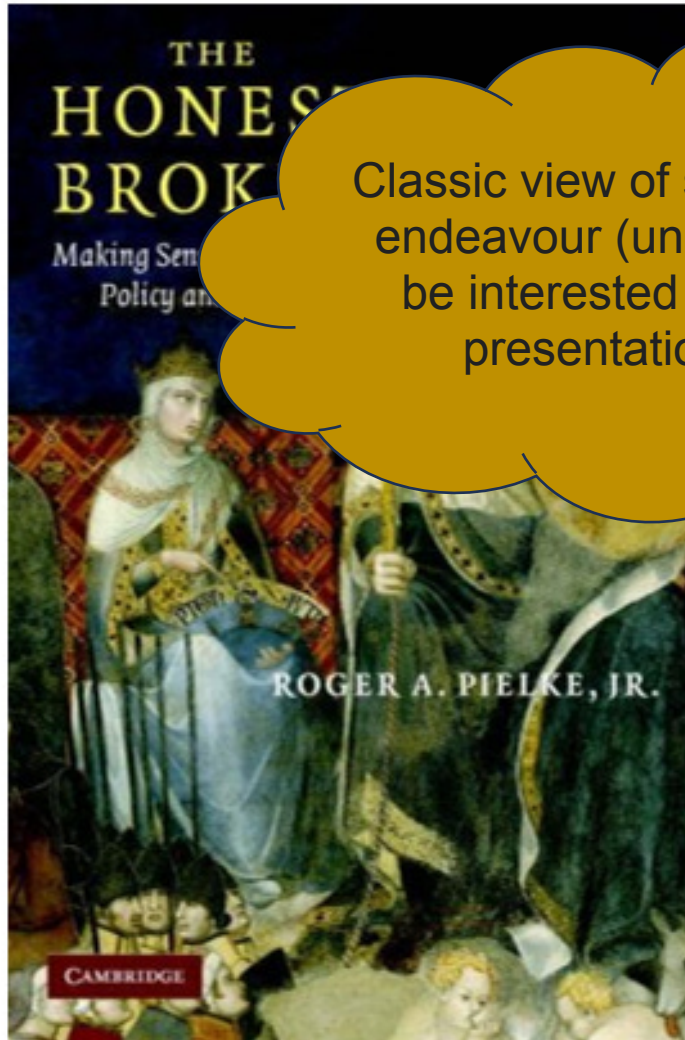
Four ways to link science & policy



Four ways to link science & policy



Four ways to link science & policy



Classic view of scientific endeavour (unlikely to be interested in this presentation!)

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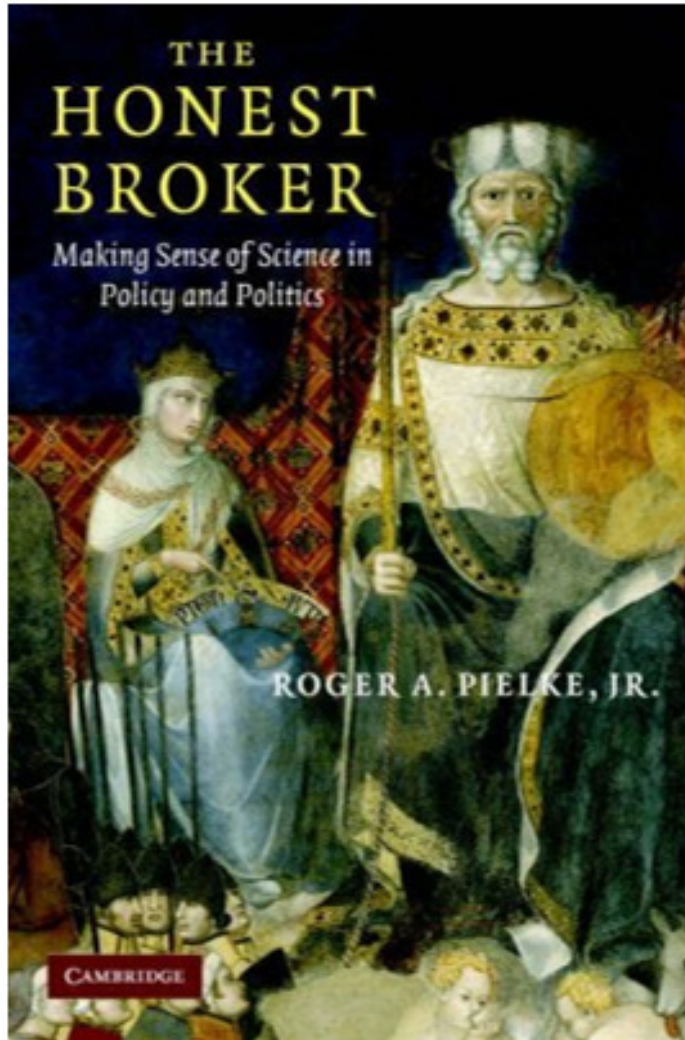
Issue Advocate

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Elite Conflict

Four ways to link science & policy



VIEW
DEMO

Interest group
pluralism

Elite
Conflict

Reduces the scope of available choice, often to a single preferred outcome among many possible outcomes

SCIENCE IN SOCIETY

Stakeholder Model

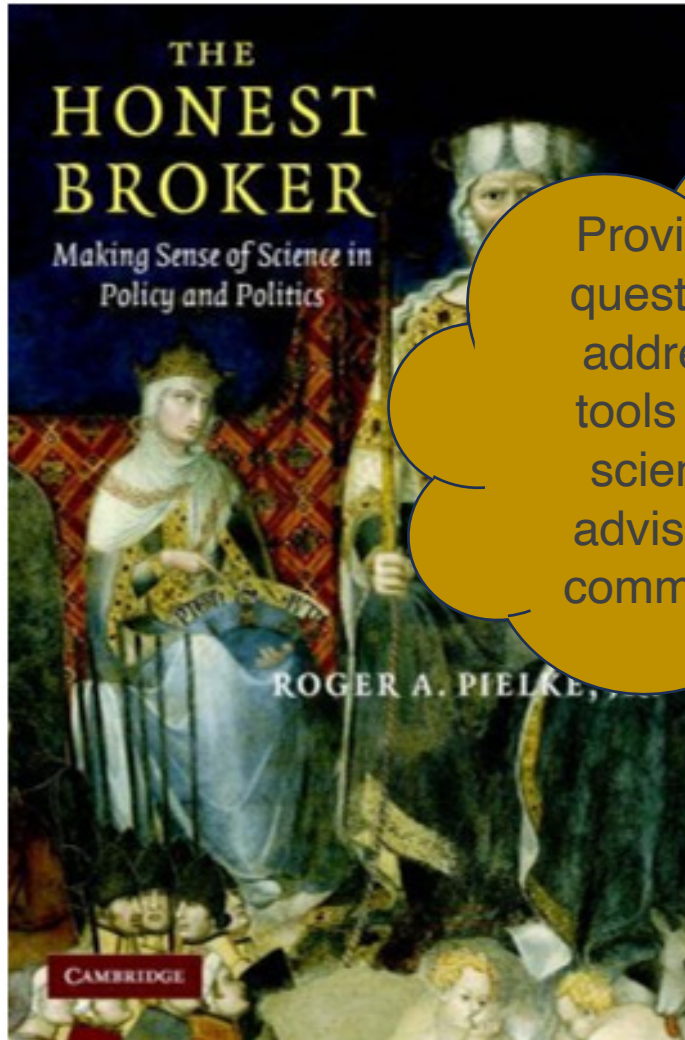
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Providing answers to questions that can be addressed using the tools and methods of science. e.g. expert advisory committees, commissioned reports

Elite
Conflict

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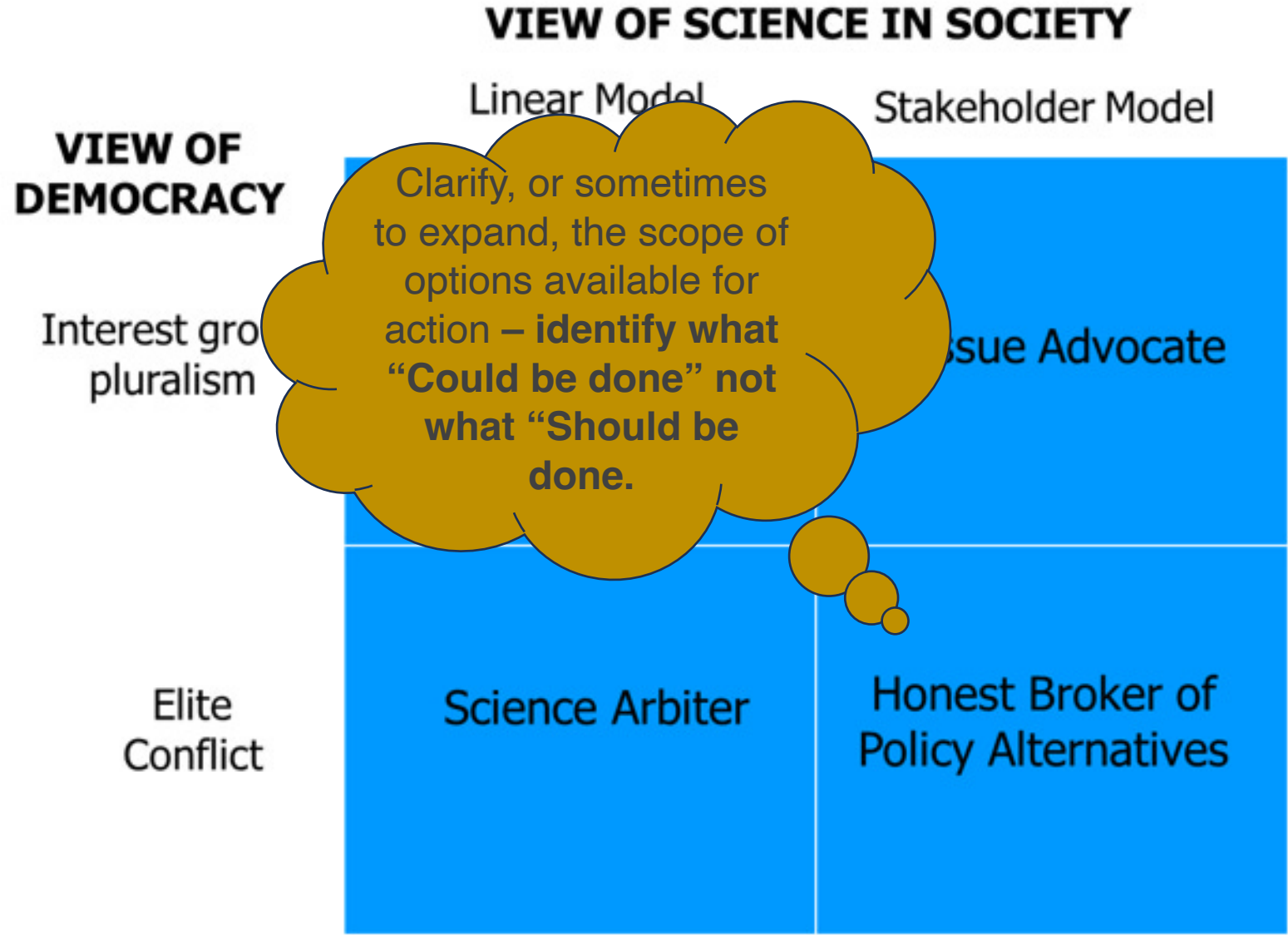
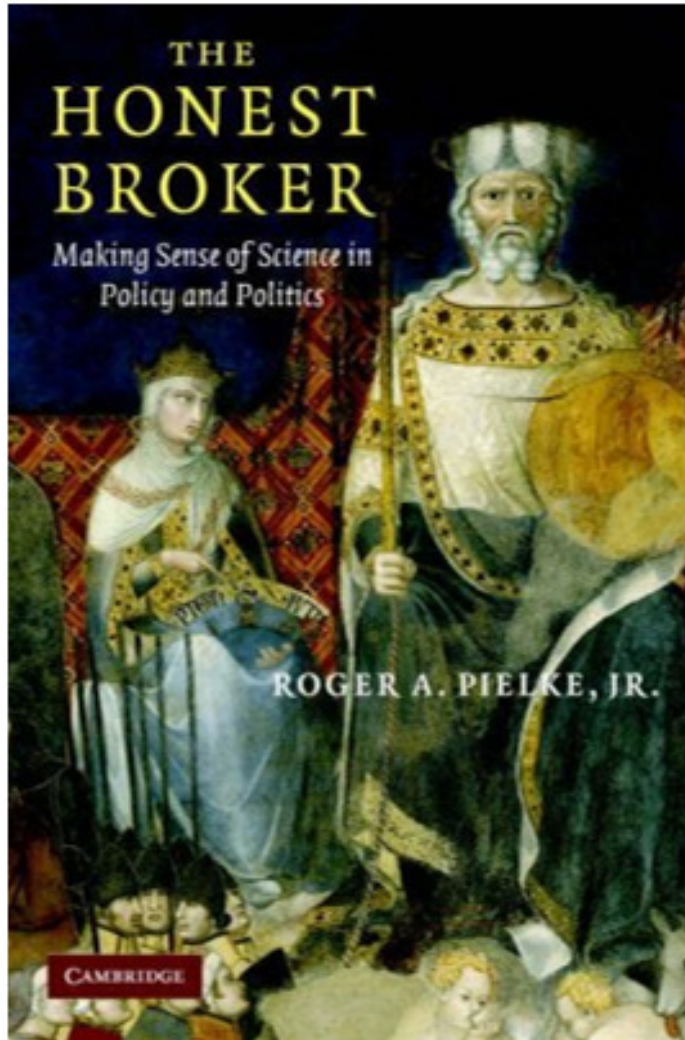
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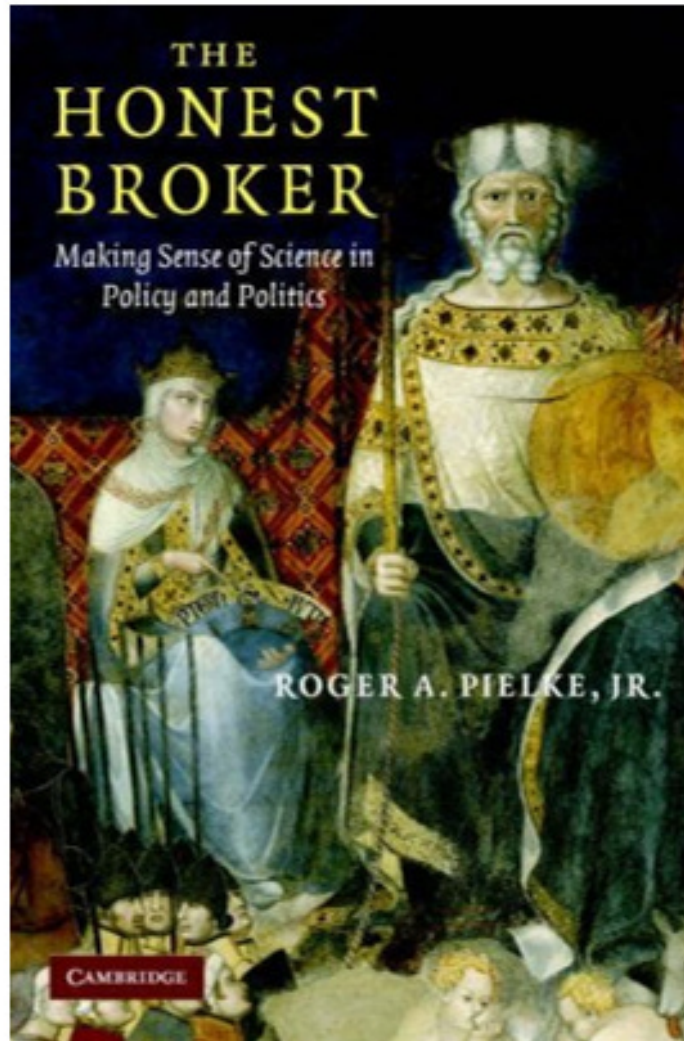
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Four ways to link science & policy



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Government already employs data scientists

- Possible employment directions
- Can be rewarding
- Operational
 - Reactive
 - Immediate impact
 - Close to the data
- Upward career trajectory can become more “strategic”



Operational or Strategic?

- Scientific Pandemic Influenza Modelling Group (SPI-M)
- SPI-M-O (Operational) during the COVID-19 pandemic
- Defra Animal Health Modelling Capacity

- GO-Science plus departmental science advisors
- Science Advisory Councils
 - Public appointments supporting Chief Scientific Advisors
 - Science advisory subgroups

Scientist as “Operational” Policy Advisor

Taking advantage of your expertise

Example 1: Bovine Tuberculosis

bovine Tuberculosis – a re-emergent problem



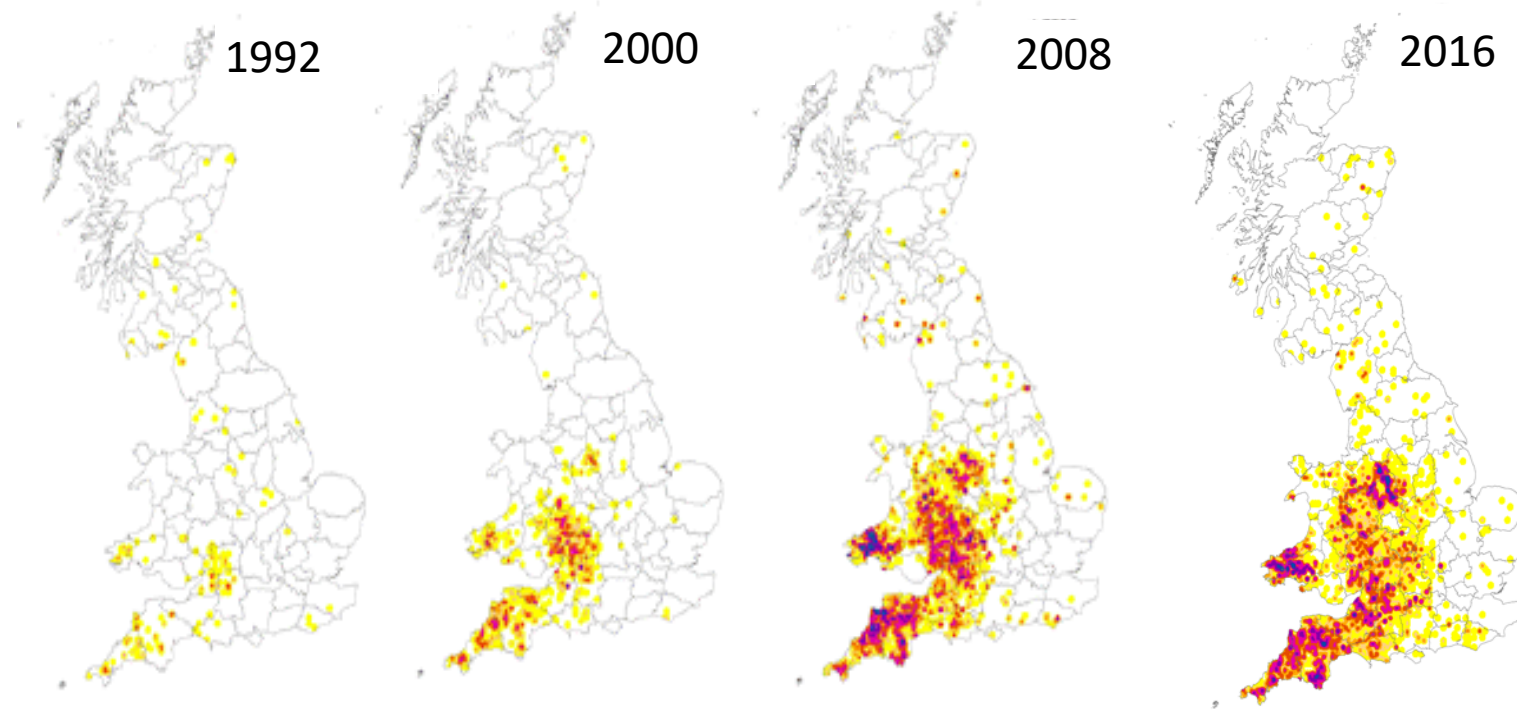
- *Mycobacterium bovis* (MTB complex)
- Multiple hosts
- Slow and variable progression to disease

- Zoonotic (symptoms like human Tb)
- Economic and Animal Welfare considerations
- ~ £100m per annum cost to GB public

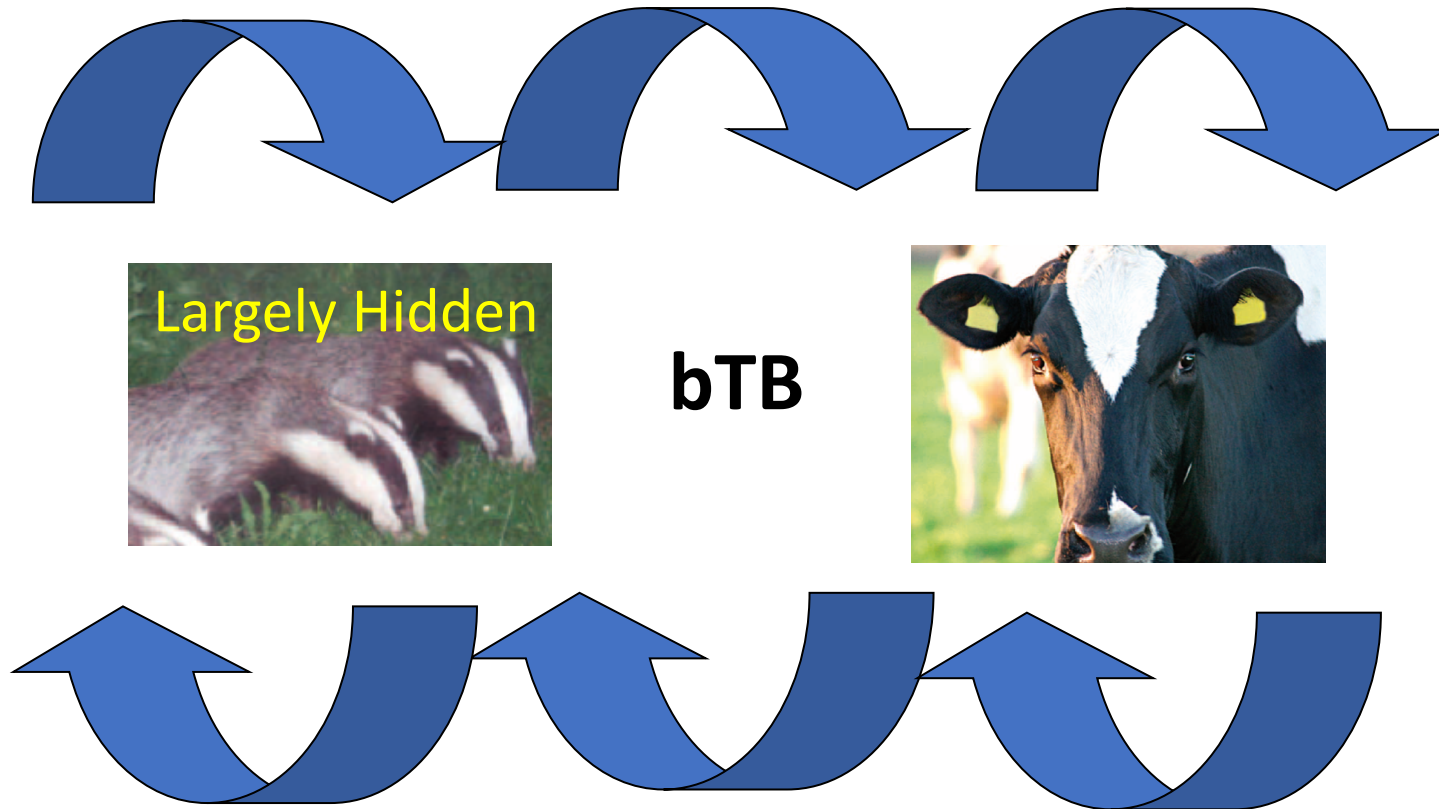
Bovine Tuberculosis (bTB) in Great Britain

Almost eradicated in cattle by the 80s,

... but an increasing problem thereafter



A multi-host pathogen



Identifying good control options and projecting outcomes are particularly difficult

A Very British Problem

Control in badgers is highly controversial (evidence of both positive and negative effects)



Badgers

Devon police under fire for proposal to suspend badger protection law

Devon and Cornwall force's idea to ease the pressure of policing the cull was termed 'appalling'

Steven Morris

@stevenmorris20
Sun 28 Jan 2018
13.48 GMT



<
1948



▲ Taking, killing or injuring badgers is punishable by fine or imprisonment under the 1992 Protection of Badgers Act. Photograph: Ben Birchall/PA

A police force has been strongly criticised by animal rights campaigners after

Identifying good
outcomes

Modeling to support changes in Tb surveillance

- Scotland officially free of bovine Tuberculosis in 2009
- Opportunity to save £ on surveillance
- Exploitation of large databases (daily record of all individual cattle movements, regular cattle herd testing data, geo-locations of all cattle farms)
- Statistical model to identify herds at highest risk of having an outbreak
- **Scoring system to identify herds that could be test-exempt**
 - Work directly with Scottish Animal Health Division

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EPIDEMIOLOGY AND INFECTION

Cambridge University Press

[Epidemiol Infect.](#) 2013 Feb; 141(2): 314–323.

Published online 2012 Apr 26. doi: [10.1017/S0950268812000635](https://doi.org/10.1017/S0950268812000635)

PMCID: PMC3556830

PMID: [22717109](https://pubmed.ncbi.nlm.nih.gov/22717109/)

Developing a framework for risk-based surveillance of tuberculosis in cattle: a case study of its application in Scotland

[P. R. BESSELL](#), [R. ORTON](#), [A. O'HARE](#), [D. J. MELLOR](#), [D. LOGUE](#), and [R. R. KAO](#)

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Responsive modelling

- Tightly defined question – little room for novel approaches
- Builds upon previous research background and existing expertise
- **Timeliness** and **robustness** more important than **methodological sophistication**
- **Working with policy developers has most direct impact**

Research Excellence
Framework (REF) Impact
Case study

Finalist UK Civil Service
Award (Evidence to
Policy)

RISK-BASED SURVEILLANCE AND TESTING DEFINES GOVERNMENT POLICY ON BOVINE TUBERCULOSIS

Published: 11 July 2014

Our research has developed a revised surveillance model for bovine tuberculosis (bTB) that underpins a new Scottish Government policy on bTB testing in Scotland. This has exempted 30% of Scottish herds from routine testing, with savings to Government of £150,000/year and a further £100,000 across the farming industry.

Example 2: COVID-19

An infectious disease in no need of introduction

JHU Ceased Updates at:
3/10/2023, 1:21 PM
[See Terms of Use for more info](#)

Total Cases
676,609,955

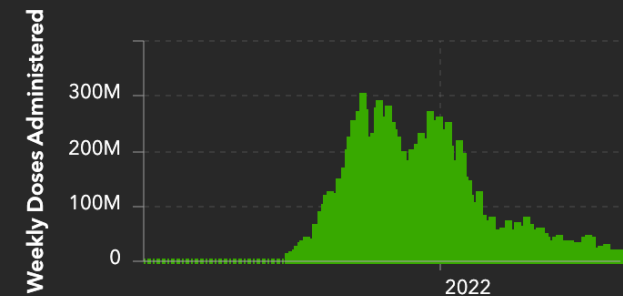
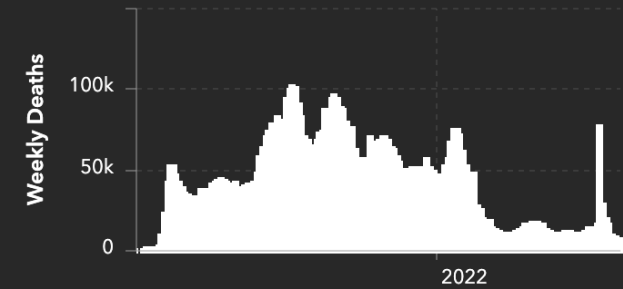
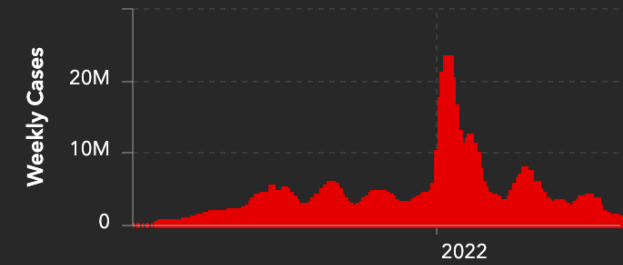
Total Deaths
6,881,955

Total Vaccine Doses Administered
13,338,833,198

28-Day Cases
4,035,254

28-Day Deaths
28,018

28-Day Vaccine Doses Administered
28,156,730



Weekly 28-Day

Cases | Deaths by Country/Region/Sovereignty

US
28-Day: **959,794** | **9,451**
Totals: **103,804,263** | **1,123,836**

Japan
28-Day: **418,671** | **2,804**
Totals: **33,329,551** | **73,046**

Germany
28-Day: **355,168** | **2,275**
Totals: **38,249,060** | **168,935**

Russia
28-Day: **350,549** | **989**
Totals: **22,086,064** | **388,521**

Korea, South
28-Day: **290,039** | **396**
Totals: **30,615,522** | **34,093**

Taiwan*
28-Day: **216,931** | **778**
Totals: **0,070,037** | **17,472**



Esri, FAO, NOAA, USGS

Admin0

28-Day

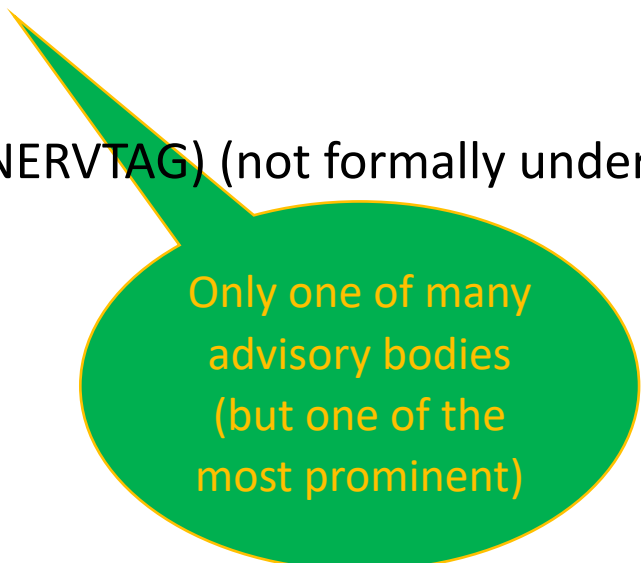
Most impactful single event since WWII

COVID-19 worldwide impact

- In 2019, Novel virus with no pre-existing therapies or protections
- Rapid spread due to:
 - Worldwide travel
 - Symptoms only after infectiousness
 - No prior immune protection
 - Unusual age susceptibility profile (adults at serious risk of infection)
- Unprecedented mobilization of scientific resources

Modelling during the COVID-19 Pandemic

- “Scientific Advisory Group for Emergencies” (SAGE)
 - **Scientific Pandemic Influenza Group for Modelling (SPI-M-O)**
 - Scientific Pandemic Insights Group on Behaviour (SPI-B)
 - COVID-19 Clinical Information Network (CO-CIN)
 - New and Emerging Respiratory Virus Threats Advisory Group (NERVTAG) (not formally under SAGE)
 - Environmental Modelling Group (EMG)
 - Children’s Task and Finish Working Group (TFC)
 - Hospital Onset COVID-19 Working Group (HOCl)
 - Ethnicity Sub Group
 - Social Care Working Group (SCWG)



Only one of many
advisory bodies
(but one of the
most prominent)

Coordination of advice at the highest level (rather than in teams)

National ABM for Scotland (w/ SPI-M or SG)

- Adapted from livestock model in 6 weeks
- Explicit network model with 6m+ agents
- Fit to data using ABC-SMC
- Estimate R numbers
- Intervention efficacy
- Identify differences in variants

SCoVMod – a spatially explicit mobility and deprivation adjusted model of first wave COVID-19 transmission dynamics [version 1; peer review: 2 approved]

Christopher J. Banks , Ewan Colman , Thomas Doherty , Oliver Tearne, Mark Arnold, Katherine E. Atkins, Daniel Balaz, Gaël Beaunée, Paul R. Bessell, Jessica Enright , Adam Kleczkowski, Gianluigi Rossi, Anne-Sophie Ruget, Rowland R. Kao  



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Collection

Coronavirus (COVID-19): modelling the epidemic

arXiv > q-bio > arXiv:2211.13704

[Help](#) | [Advanced](#)

[Quantitative Biology](#) > [Populations and Evolution](#)

COVID-19 e-print

Important: e-prints posted on arXiv are not peer-reviewed by arXiv; they should not be relied upon without context to guide clinical practice or health-related behavior and should not be reported in news media as established information without consulting multiple experts in the field.

[Submitted on 24 Nov 2022]

Modelling plausible scenarios for the Omicron SARS-CoV-2 variant from early-stage surveillance

[Christopher J. Banks](#), [Ewan Colman](#), [Anthony Wood](#), [Thomas Doherty](#), [Rowland R. Kao](#)

Spatial analysis of COVID-19 booster vaccine uptake in Scotland, and projection of future distributions

A. Wood, A. MacKintosh, +1 author R. Kao • Published in medRxiv 2 September 2022 • Environmental Science

Vaccine hesitancy is one of the critical challenges for the implementation of a successful vaccination strategy. Rates of vaccine hesitancy and refusal vary substantially across different

