Misinformation During a Norovirus Outbreak: An Agent-based model

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FAKE NEWS

Research Questions: How could fake news change a disease outbreak? What strategy could counter effects of fake news?
Design: Agent-based Model, many stochastic elements
Behaviour response: Reckless behaviour (physical contact, sharing food, not disinfecting or washing): increasing chances of catching disease.
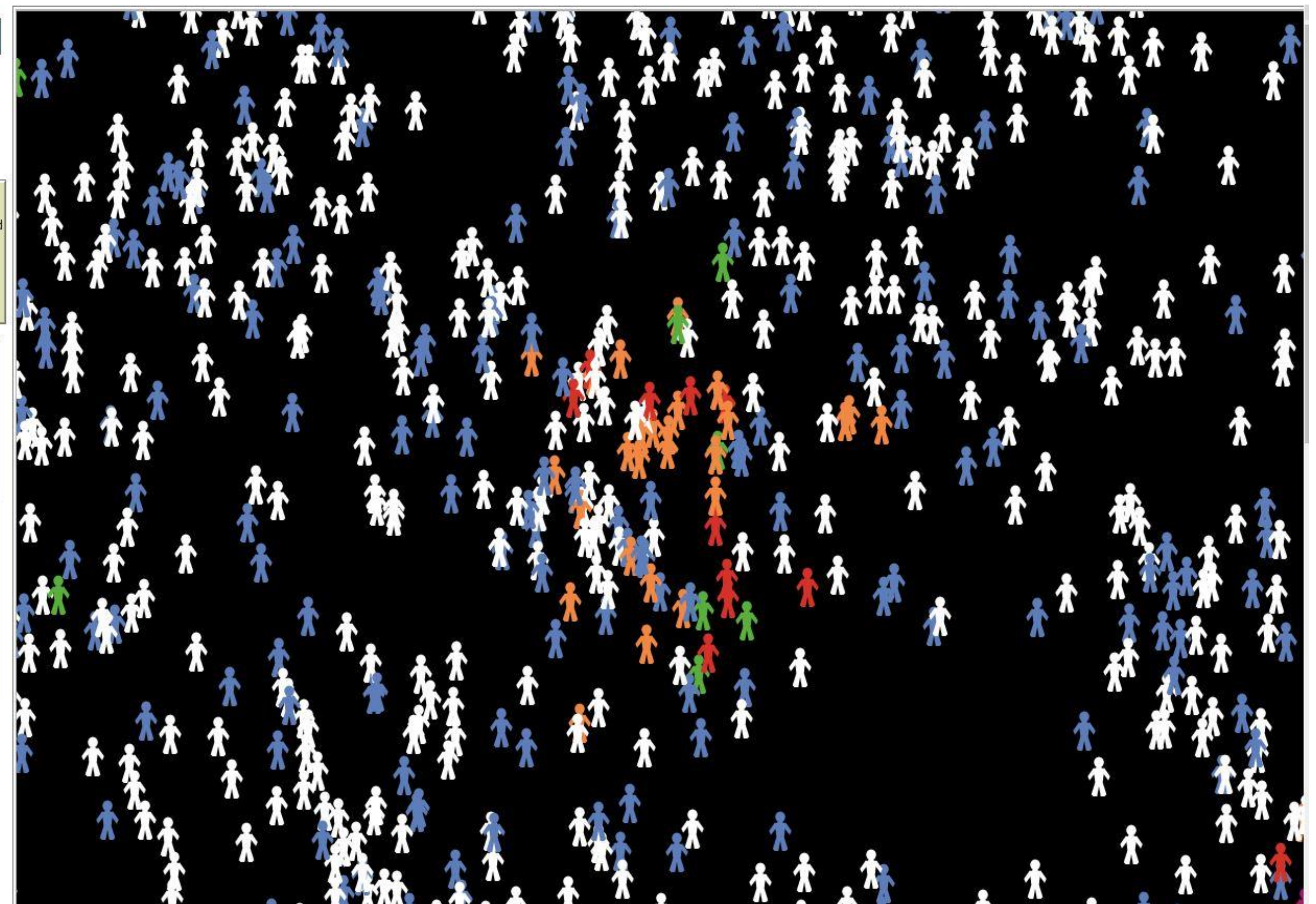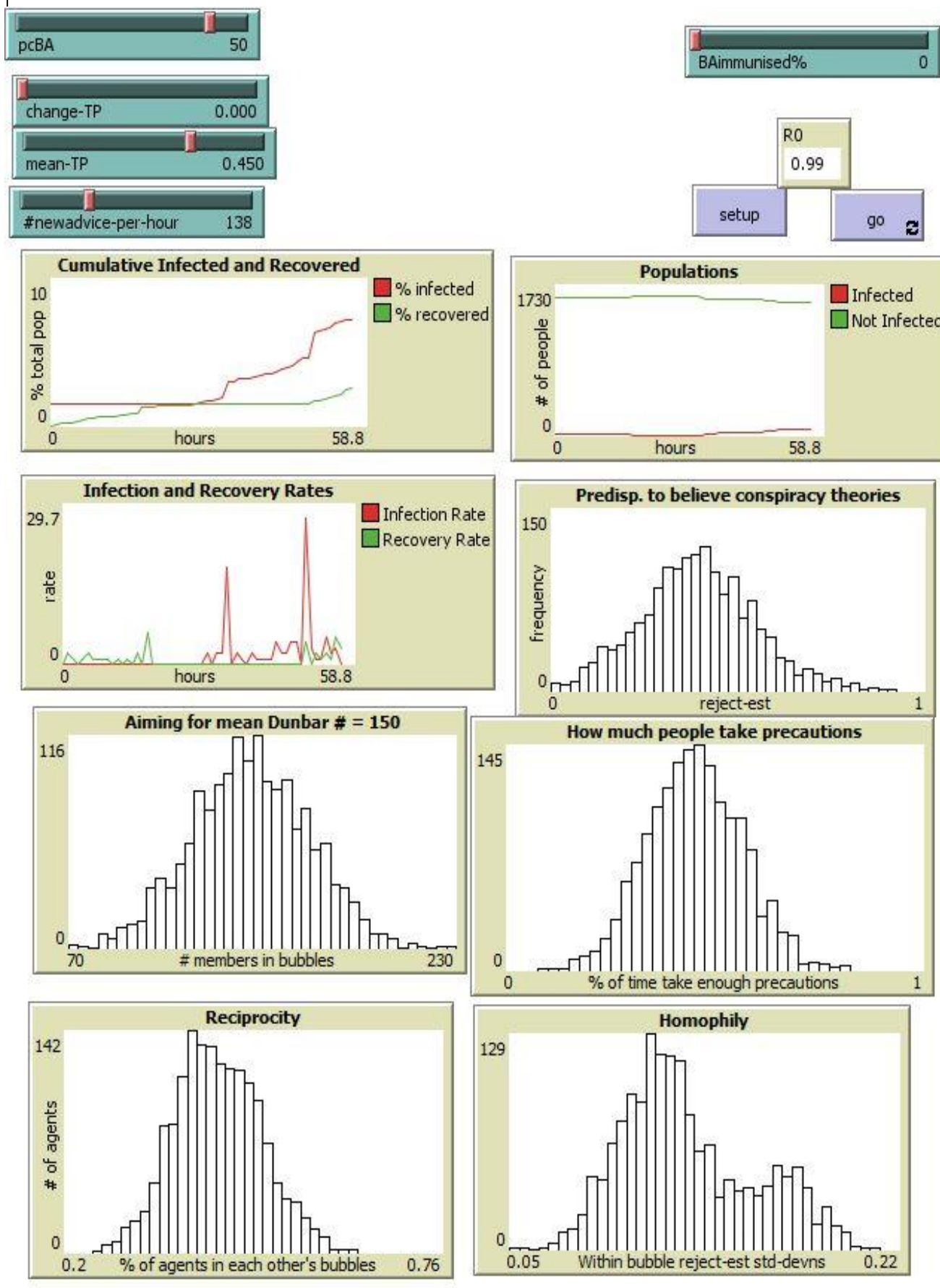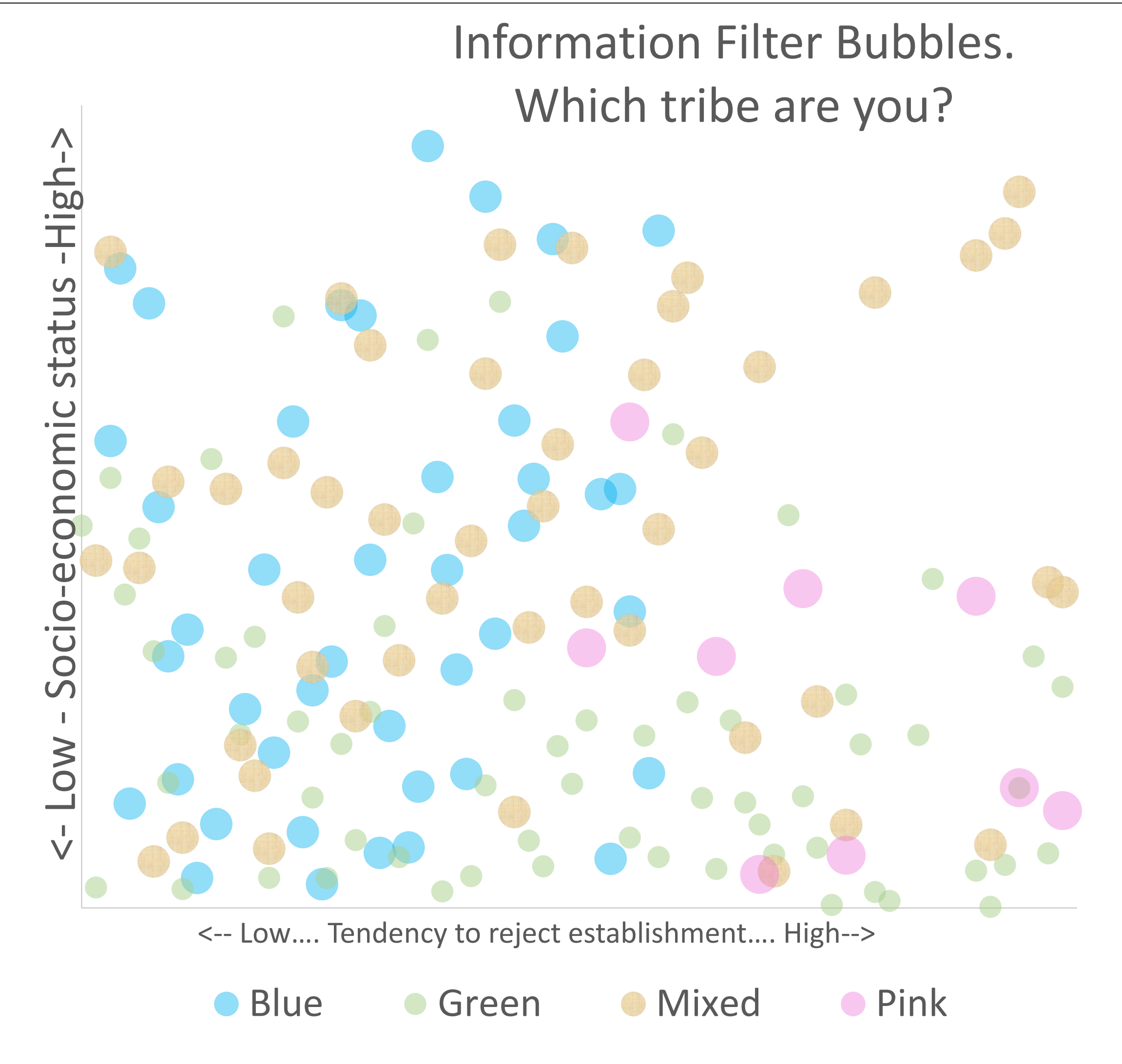**Disease**: Norovirus because it won't cause panic or flight,(and it's not flu).
How information spreads: Mostly within 'bubbles' of like-minded individuals (no direct contact required to share information)
How disease spreads: With direct contact between agents
3 model Stages: 1) no info spread, 2) info making an outbreak worse, 3) testing two strategies to counter misinformation (using multiple iterations)
RESULTS: Reduce bad advice from 50% to 40% of circulating info, or make 20% of agents non-responsive to bad advice -> outbreak is no worse than when no information was spreading. But need drastic changes in proportion of good/bad advice to reduce r0 to < 1.0.

Information Filter Bubbles. Which tribe are you?

<-- Low - Socio-economic status -High->
<-- Low.... Tendency to reject establishment.... High-->

● Blue ● Green ● Mixed ● Pink

EXAMPLE mid model run. White = susceptible and taking few precautions, Blue = susceptible but taking precautions. Red = Infectious/no precautions, Magenta=infectious/takes most precautions. Orange = incubating, Green = recovered.

KEY MODEL PARAMETERS ASSUMPTIONS (most from literature)

1600 agents generated on a grid that measures 88 x 90 patches -> daily contact rate mean = 11.7 other individuals (enough contact to transmit disease). Distribution into homophilous* groups that may overlap with other groups; spacing adjusted to achieve target r0.

*Homophilous with regard to predisposition to believe conspiracy theories

Target r0 in no-information spread stage (1) = 1.9, found in literature on community norovirus outbreaks.

Everyone has own 'bubble' of contacts, size= 80-230 agents ("friends", size distribution to conform with Dunbar numbers) to share info with; somewhat clustered near home address, somewhat clustered by tendency to reject establishment & believe in conspiracy theories (mean = 38% for British population)

Information shared to random small % of contacts each hour; exposure to good or bad advice can increase or reduce chances of taking precautions

Ratio of false: true information circulating = 4:1 (from real observations on Twitter)

Likelihood of sharing information about disease: 3% for true information, 12% for untrue information (following sharing patterns observed on Twitter)

85% of information cascades have length = 1, <2% of cascades have length > 4.

Rate that new information is injected to community: 138 times/hour (resulting in 166 relevant cascades with length > 1, per day)

Taking precautions can mean washing hands, avoiding physical contact, disinfection measures, etc.

Chances of taking effective precautions: iteratively found best set to mean = 56.1% to achieve target r0

Change in likelihood of taking precautions: experimented with in model, needs to be small, change set to 7% for each information exposure in Stage 2 model to achieve 40% increase in R0 over R0 in no-information exchange stage (1)

Incubation period & Infectious periods = 36 hours

NHS crisis warning over killer winter bug

BRITAIN is in the grip of an early winter sickness bug crisis that could wreak havoc on the NHS.

By JO WILLEY
PUBLISHED: 00:01, Fri, Nov 7, 2014
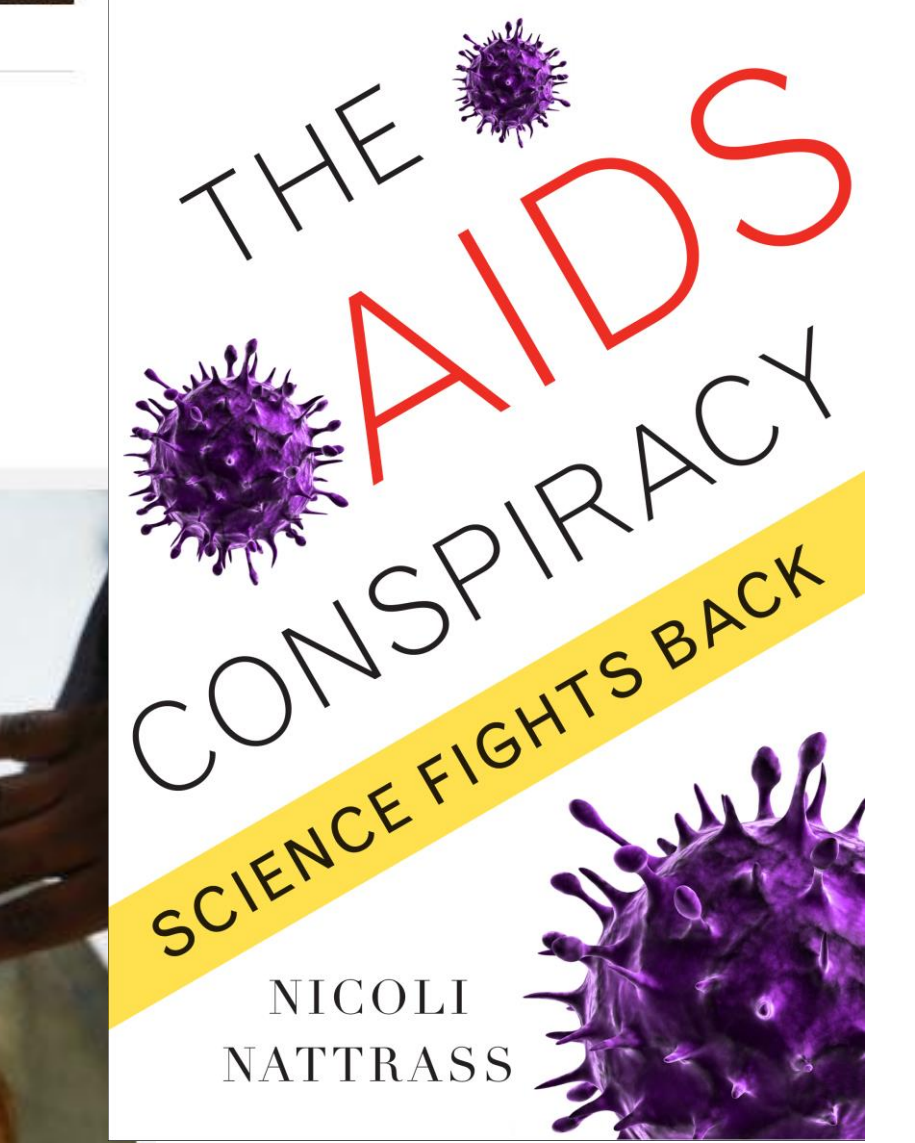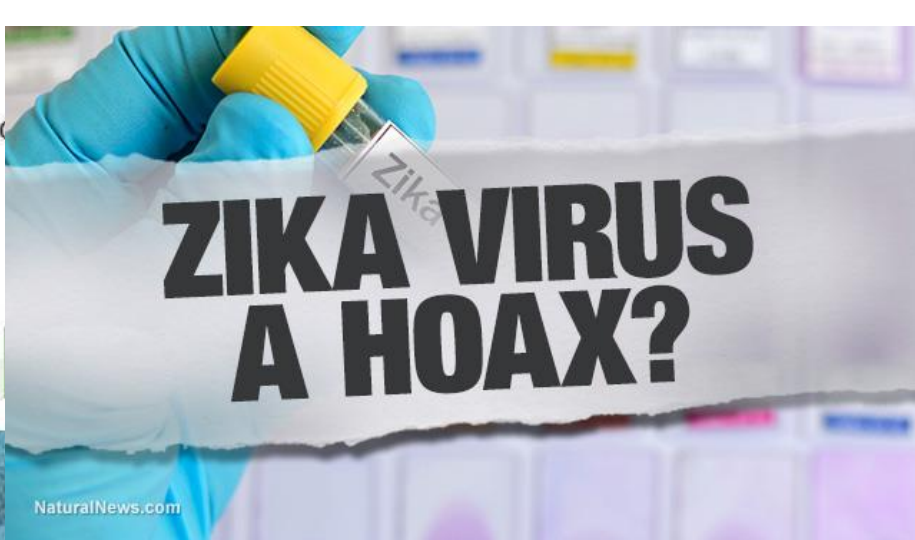
ZIKA VIRUS A HOAX?

BLESSED ANTI-EBOLA SALT

More than a thousand people have been struck by norovirus since July

Cases of deadly norovirus have been gathering pace in the past month and experts are warning of the impact on hospitals.

Thanks for the measles yet again, Andy
Posted by Orac on May 1, 2017

THE AIDS CONSPIRACY
SCIENCE FIGHTS BACK
NICOLI NATTRASS

RESULTS. Stage 1 (no misinformation), stage 2 (outbreak exacerbated by bad advice), and stage 3 (testing intervention strategies against misinformation). Mean values for given outbreak characteristics in multiple model runs, with 5-95th percentile range.

	r0	Duration (days)	Final Attack Rate	Prevalence of illness at peak	# of iterations
Stage 1	1.90	29.3	78.5%	15.0%	100
5-95th percentiles	1.73-2.06	21.5-42.3	71.8-83.2%	11.2-19.6%	
Stage 2	2.70	23.5	92.0%	22.0%	100
5-95th percentile	2.50-2.90	19.1-30.1	89.9-93.7%	18.2-26.6%	
Stage 3 models					
Good:Bad advice ratio is 60:40	1.78	28.3	74.7%	15.3%	100
5-95th percentile range	1.63-1.95	21.1-37.6	68.5-80.5%	10.9-19.7%	
Good:Bad advice ratio is 80:20	0.96	13.8	17.9%	5.4%	100
5-95th percentile range	0.85-1.06	11.6-17.1	9.3-27.3%	2.4-8.9%	
20% of agents are 'immunised'	1.80	27.6	75.2%	15.7%	100
5-95th percentile range	1.61-1.92	19.1-36.2	70.5-79.0%	11.1-19.7%	
90% of agents are 'immunised'	0.97	13.0	19.0%	6.0%	100
5-95th percentile range	0.85-1.07	11.2-16.1	10.6-27.7%	2.6-10.1%	

Note: 'immunised' means immunity against believing or sharing bad advice, rather than immunity against norovirus.

Public Health England

NHS National Institute for Health Research

Health Protection Research Unit in Emergency Preparedness and Response

UEA University of East Anglia | NORWICH MEDICAL SCHOOL