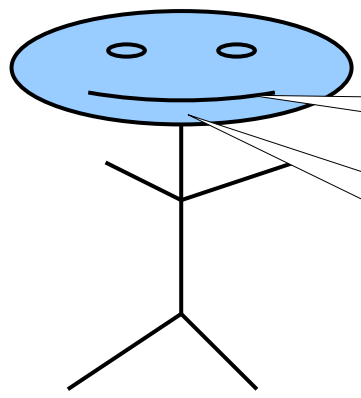


Hello, I am an electronic Vet!



BEWARE!
 Laugh is an infectious disease!

Do not worry, I will use this poster
 To do a model

MATERIAL & METHODS: Theory of Modeling and Simulation

Theory of modeling and simulation gives us a framework to simulate models of dynamic systems (see figure 1). Models of dynamic systems can be composed of several dynamic systems interacting together. This is called hierarchical decomposition (see figure 2). We use a formalism called ZEN with which we can simulate structure and behaviors of systems specified with other formalisms such as continuous systems (e.g. differential equations) or discrete time systems (Lagier et al. 2000).

OBJECTIVES
 Simulate the sampling performed by the surveillance system, the associated control of the disease, and the epidemic spread, in order to:

- Quantitatively evaluate the adequacy between surveillance system estimation and real epidemic in different scenarios.
- Optimize the sampling process parameterization.
- Present the surveillance system sampling strategy in a didactic and/or contextualized way in order to discuss it with every actor of the surveillance.

Figure 1: Block system concept
 The block system concept is used to model the system structure, a block is a system module. The modeling of the system is done by connecting blocks to each other.

Figure 2: Hierarchical decomposition of a system
 A system can be composed of several subsystems.

PRESENTATION OF THE SIMULATION TOOL

We study the system composed of three sub-systems: The disease spread system, the surveillance system, and the control system (see figure 3). Then each sub-system is itself decomposed (see respectively figures 4 and boxes 1 and 2).

Box 1: The disease spread system
 The disease spread system is composed of three sub-systems: the disease spread system, the surveillance system, and the control system (see figure 3). Then each sub-system is itself decomposed (see respectively figures 4 and boxes 1 and 2).

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 The control system is composed of three sub-systems: the disease spread system, the surveillance system, and the control system (see figure 3). Then each sub-system is itself decomposed (see respectively figures 4 and boxes 1 and 2).

USE OF THE SIMULATION TOOL

Model states can be monitored during the simulation and presented in a contextualized way (see figure 5). This kind of use should be done together with reverse simulation (pass after for sensitivity analysis or optimization). For this purpose, an interface with the R statistical software has been developed.

DISCUSSION
 A disease spreading in a network at county or regional scale can not be entirely monitored. Thus, surveillance and control policies can hardly be quantitatively evaluated. Using modeling and simulation, we can evaluate such policies in virtual worlds. However, different initial worlds (models) can be built that could influence policies decisions in different ways. This tool should enable us to evaluate different policies with different models. Thanks to modularity of system composition, we can change only some components of the global system.

Figure 3: Overview of the simulation tool
 The simulation tool is composed of three main parts: the disease spread system, the surveillance system, and the control system.

Figure 4: Hierarchical decomposition of the simulation tool
 The simulation tool is composed of several subsystems.

Figure 5: Monitoring of model states
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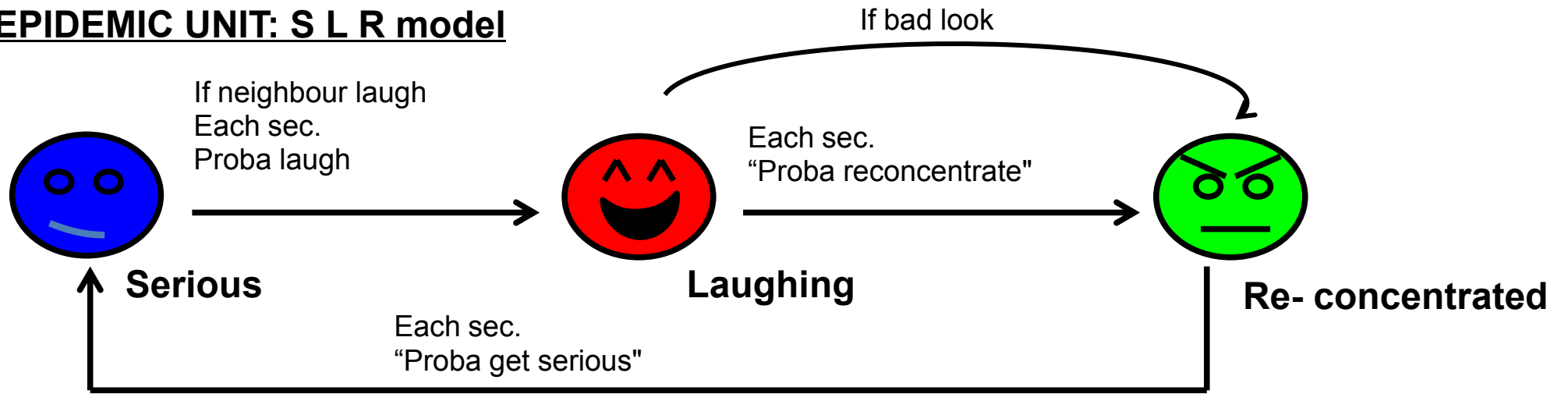
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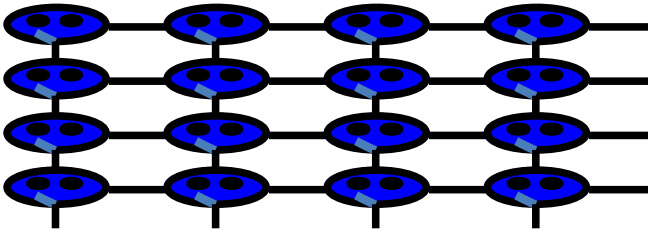
- > ***** MODEL DEFINITION *****
- > Disease: Laugh
- > System: A conference room
- > Epidemic unit: The participant
- > Infectious contact: Proximity
- > Surveillance system: A Shh ! Report
- > Control: Bad look from the presenter
- > _

E-poster animation for: A modular simulation tool to help designing epidemics surveillance
 B. Bonté, R. Duboz

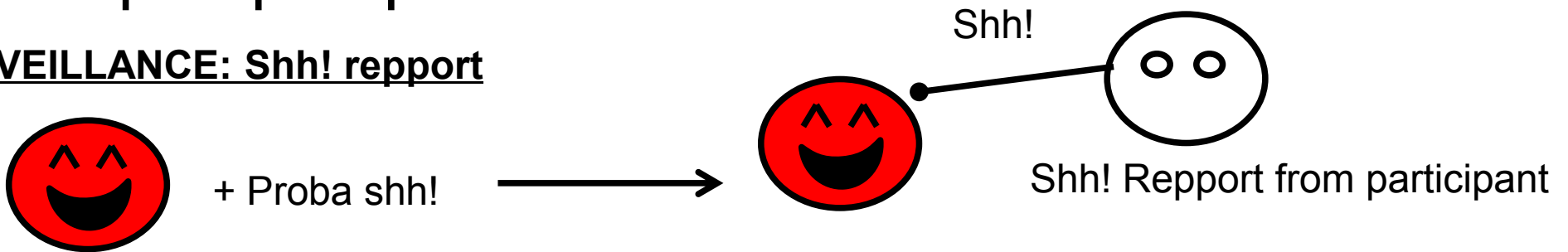
EPIDEMIC UNIT: S L R model



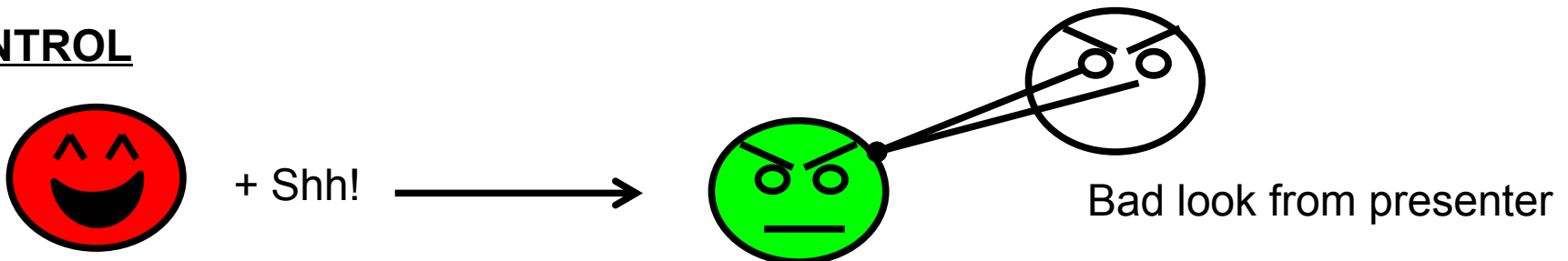
INFECTIOUS CONTACT NETWORK: Lattice



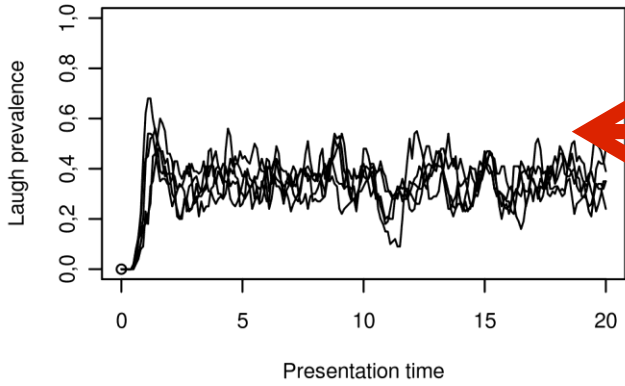
SURVEILLANCE: Shh! repport



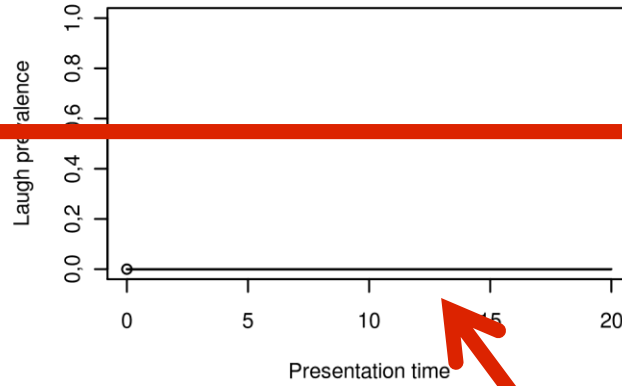
CONTROL



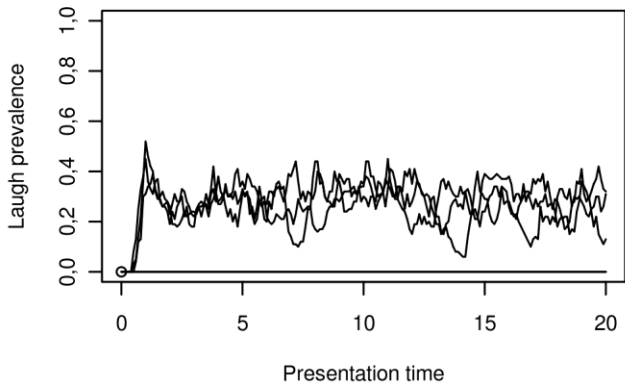
Proba SHH!= 0 (5 simulations)



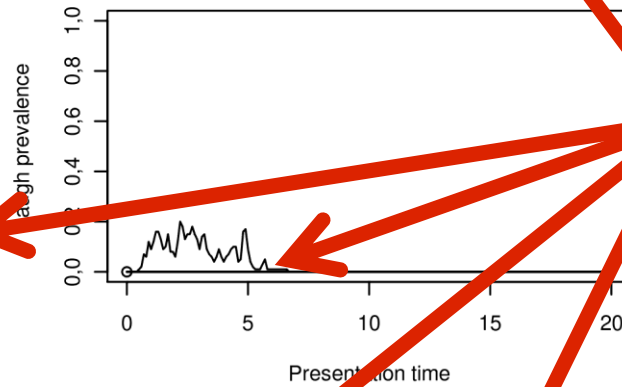
Proba SHH!= 0,3 (5 simulations)



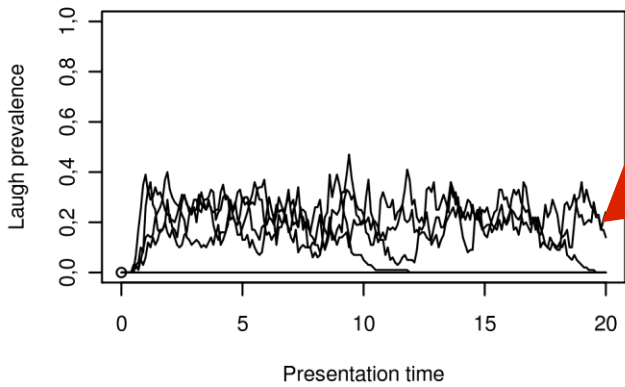
Proba SHH!= 0,1 (5 simulations)



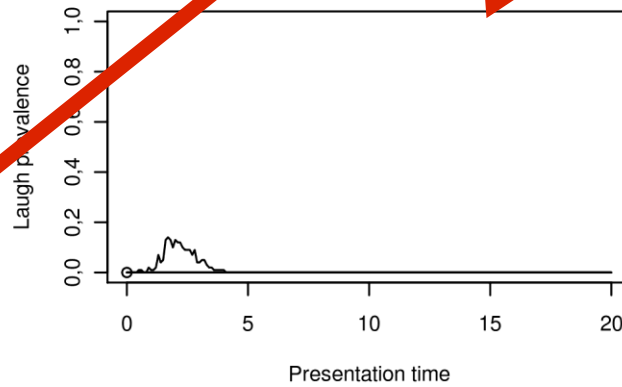
Proba SHH!= 0,4 (5 simulations)



Proba SHH!= 0,2 (5 simulations)

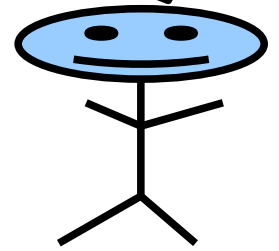


Proba SHH!= 0,5 (5 simulations)

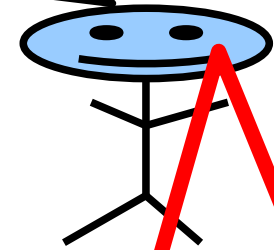


Result:

If no one says SHH!,
35 % of the assistance will
Be laughing during the
Whole presentation..

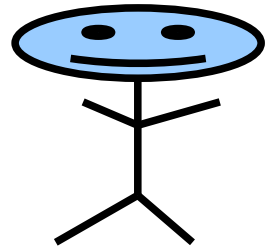


The more people say SHH,
the less people laugh.

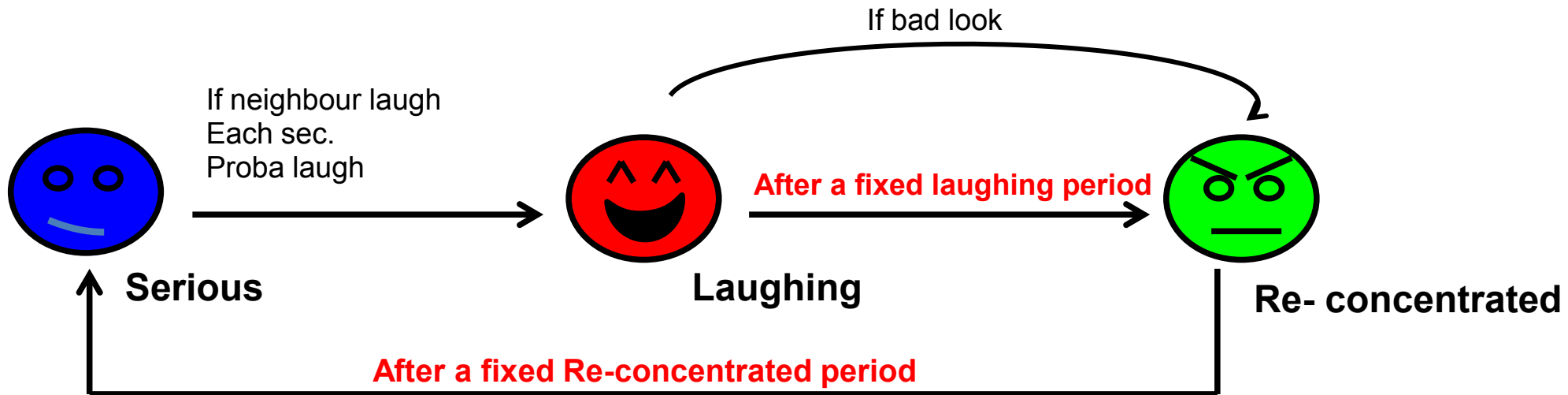


Conclusion:
Please say SHH! as much
as you can

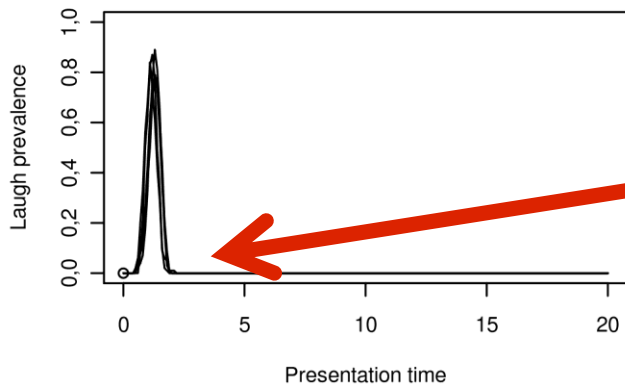
But do I have the good Epidemic model ?
I learned that infectious periods usually have a normal distribution..
Let's try a new Epidemic unit model !



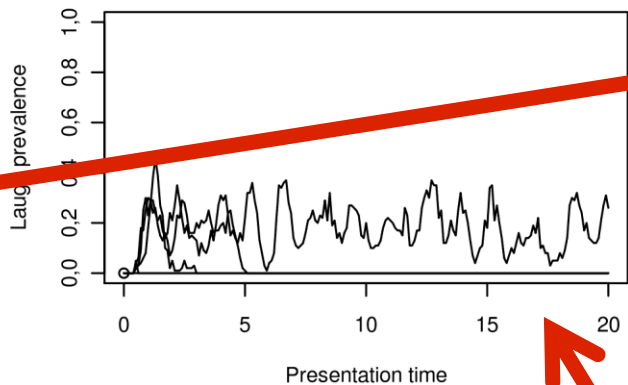
EPIDEMIC UNIT: S L R model



Proba SHH!= 0 (5 simulations)

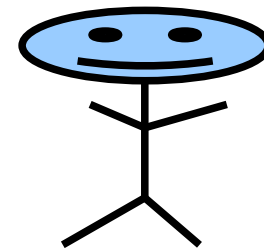


Proba SHH!= 0,3 (5 simulations)

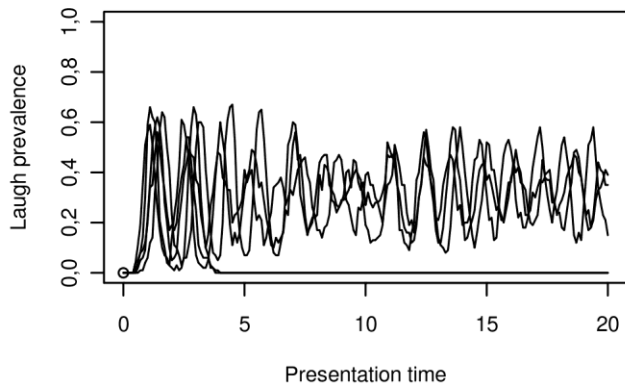


Results:

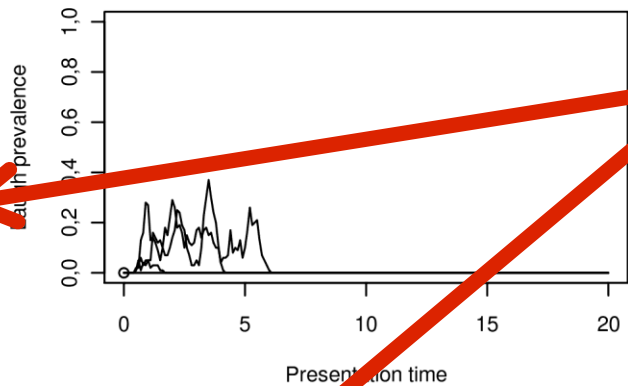
If Nobody says SHH! :
wave of Laughing lasts 2 min.



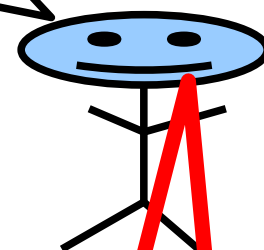
Proba SHH!= 0,1 (5 simulations)



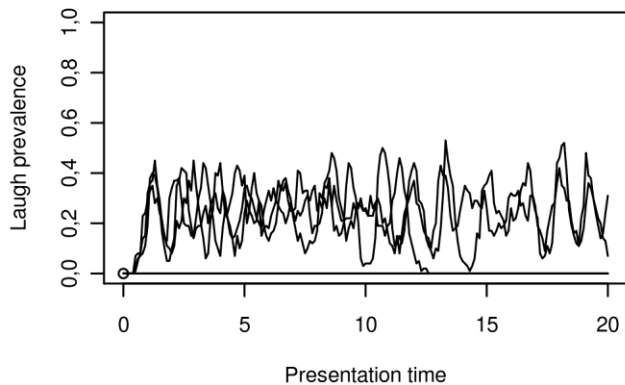
Proba SHH!= 0,4 (5 simulations)



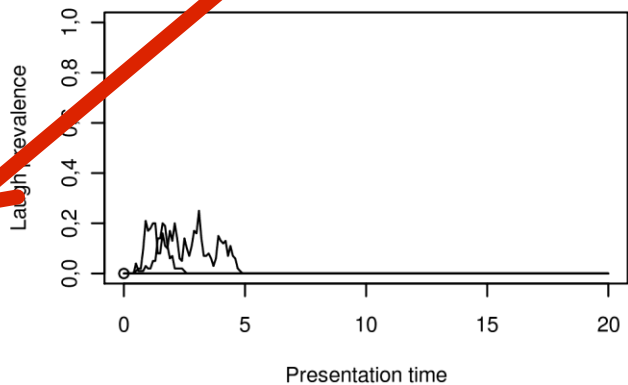
Few people say SHH! :
Laughing do not stop!



Proba SHH!= 0,2 (5 simulations)



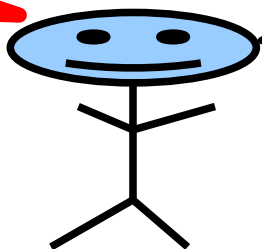
Proba SHH!= 0,5 (5 simulations)



Conclusion:
NEVER say SHH !!

Conclusion of conclusions

A good tool should enable to test both: Policies AND Models



What do you think ?

A simulation with NO Shh!
and fixed periods

A simulation with Shh! ($p=0.2$)
and fixed periods

