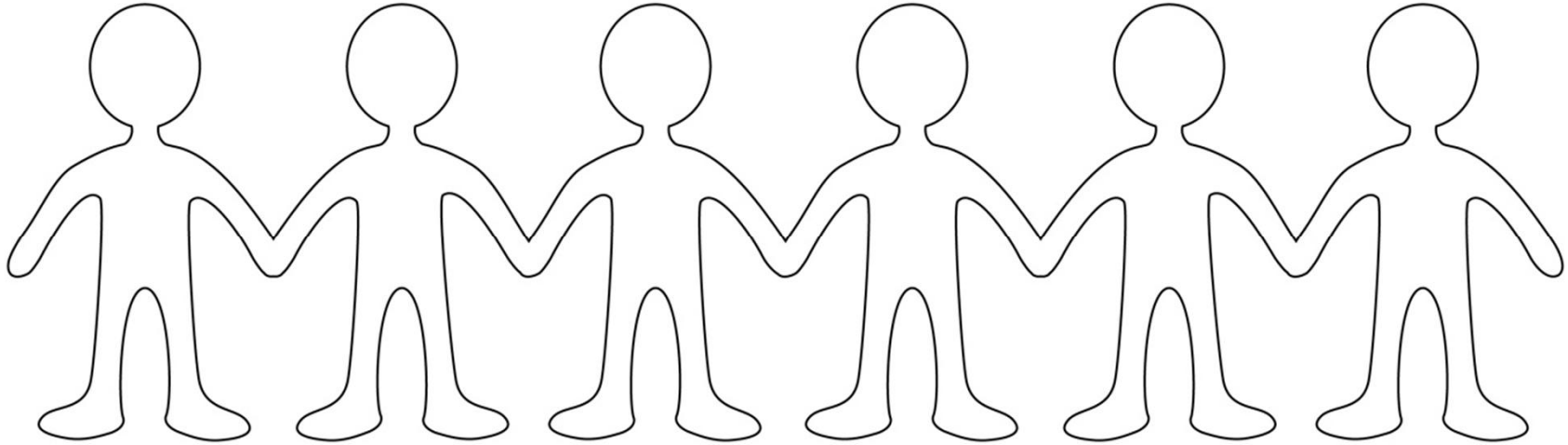
What's the role of the modeller in hydrological modelling?



Lieke Melsen
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"a hypothesis of how a system works, codified in quantitative terms"

Savenije, H. (2009), HESS opinions: The Art of Hydrology, *Hydrol. Earth Syst. Sci.*, *13*, 157–161, 2009.

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Multiple hypotheses needed to overcome "***parental affection***"

(Chamberlin, 1890, hydrologic modelling: Clark et al., 2011)

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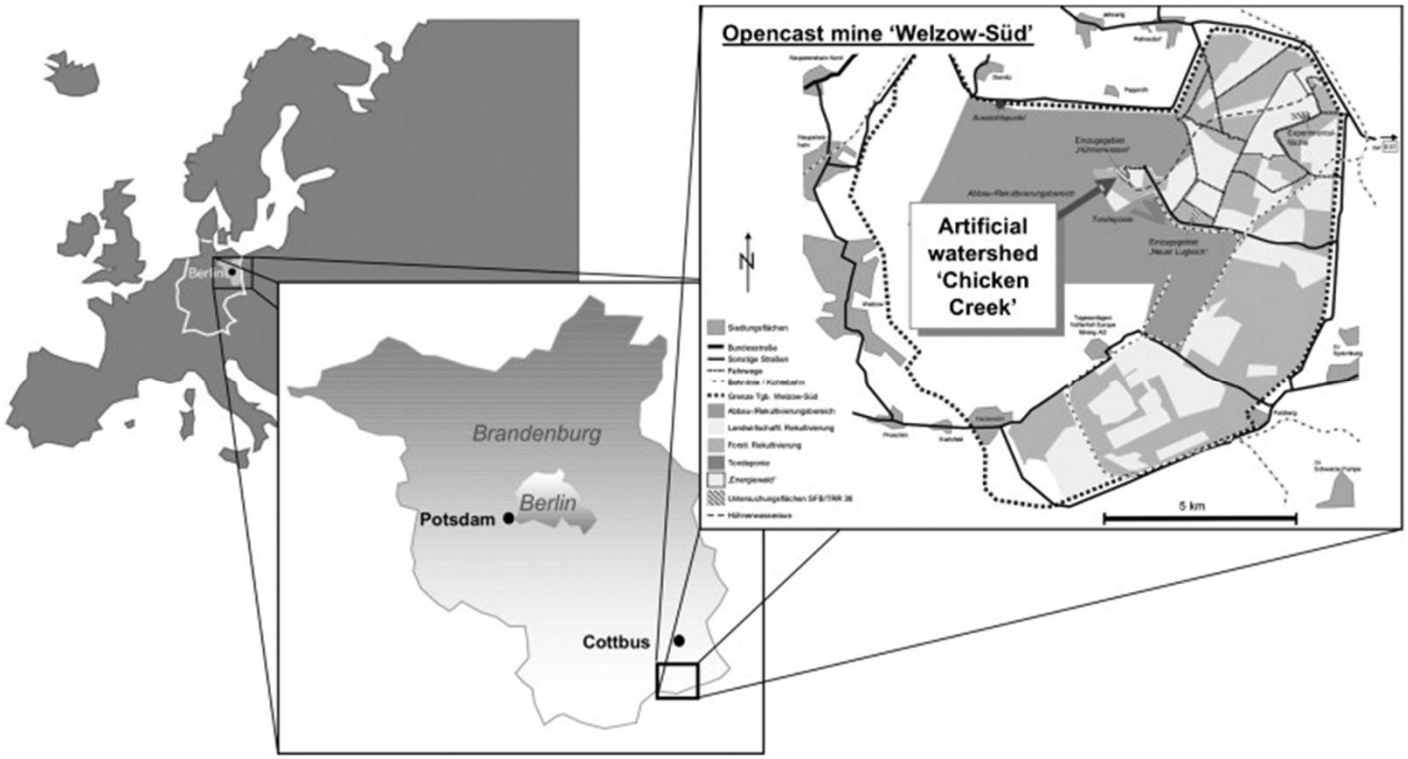
Chicken Creek artificial catchment



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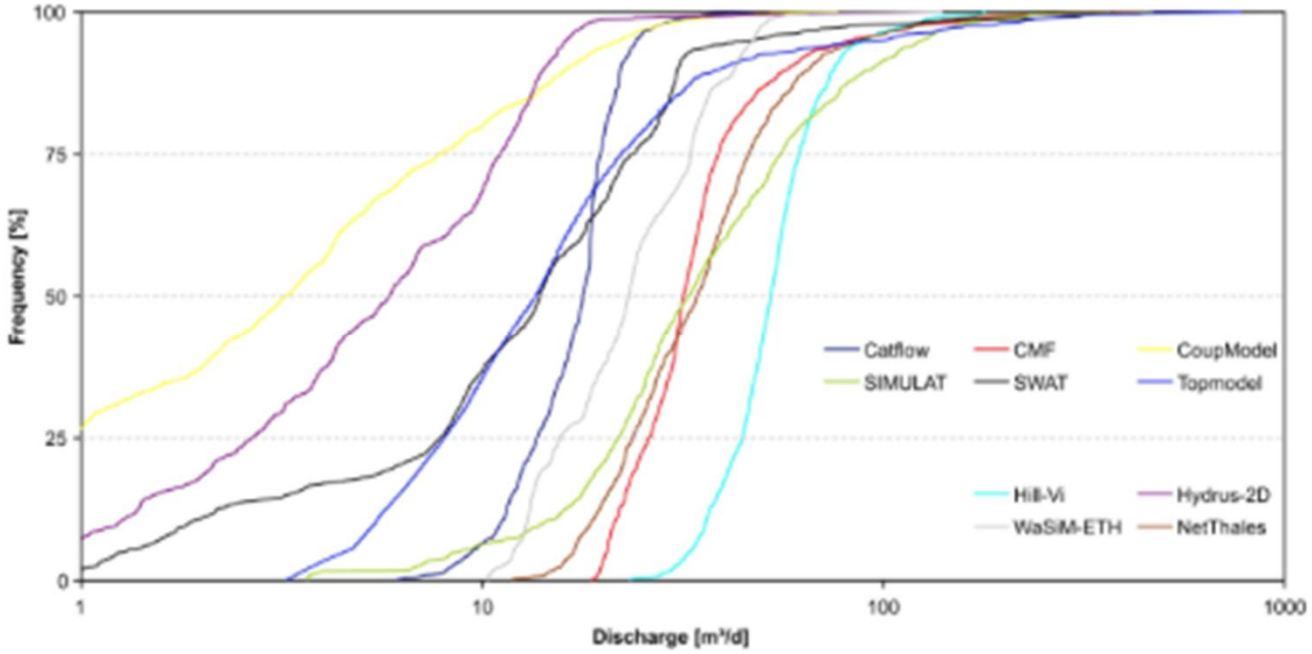

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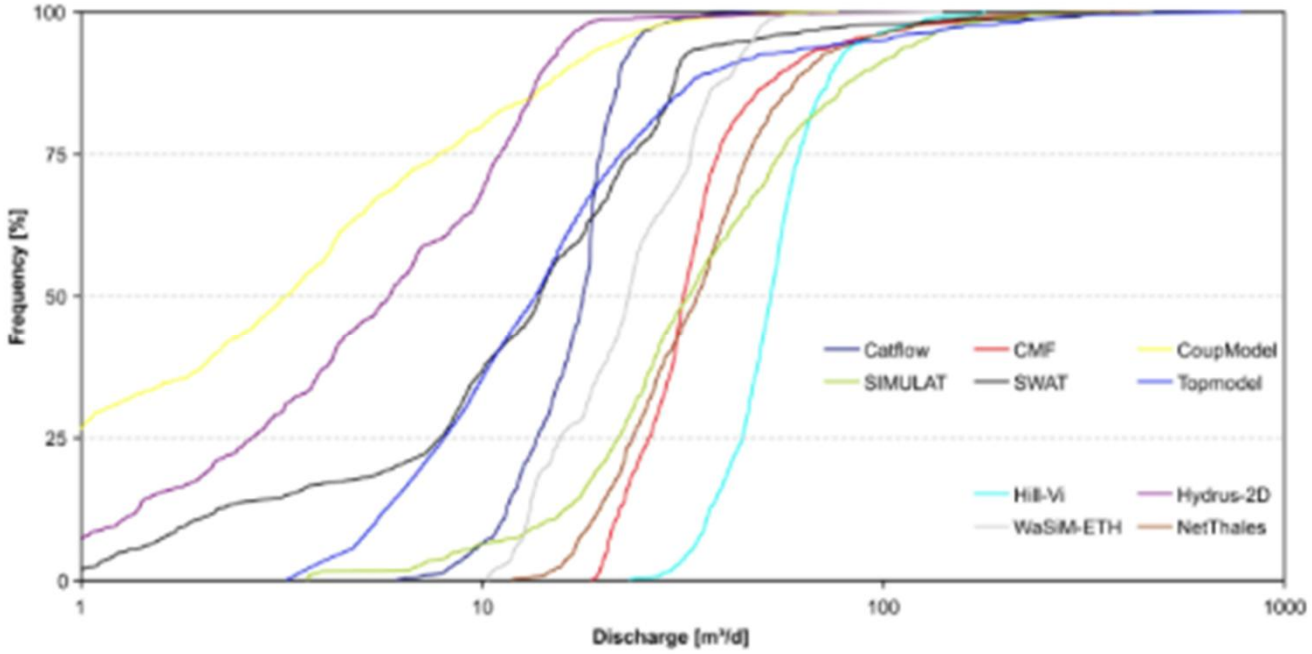

"The experience of a modeller is crucial in the (subjective) process of deciding upon the dominant processes that seem to be sufficiently important to be incorporated into the model."

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Repeatability and Reproducibility

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Ceola et al., Virtual laboratories: new opportunities for collaborative water science, HESS, 2015

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"*The objective of this experiment is to test the reproducibility of the TUWmodel results on the 15 study catchments when implemented and run independently by different research groups"* – 2 different protocols

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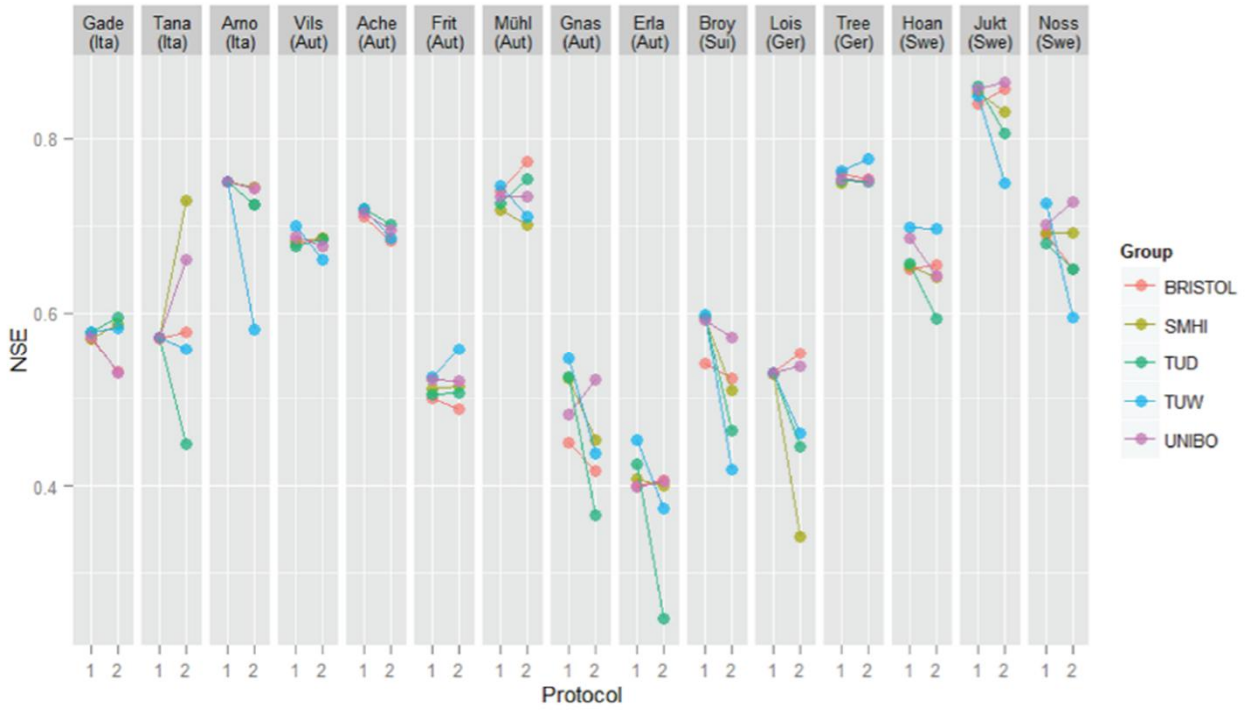

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Model choice?

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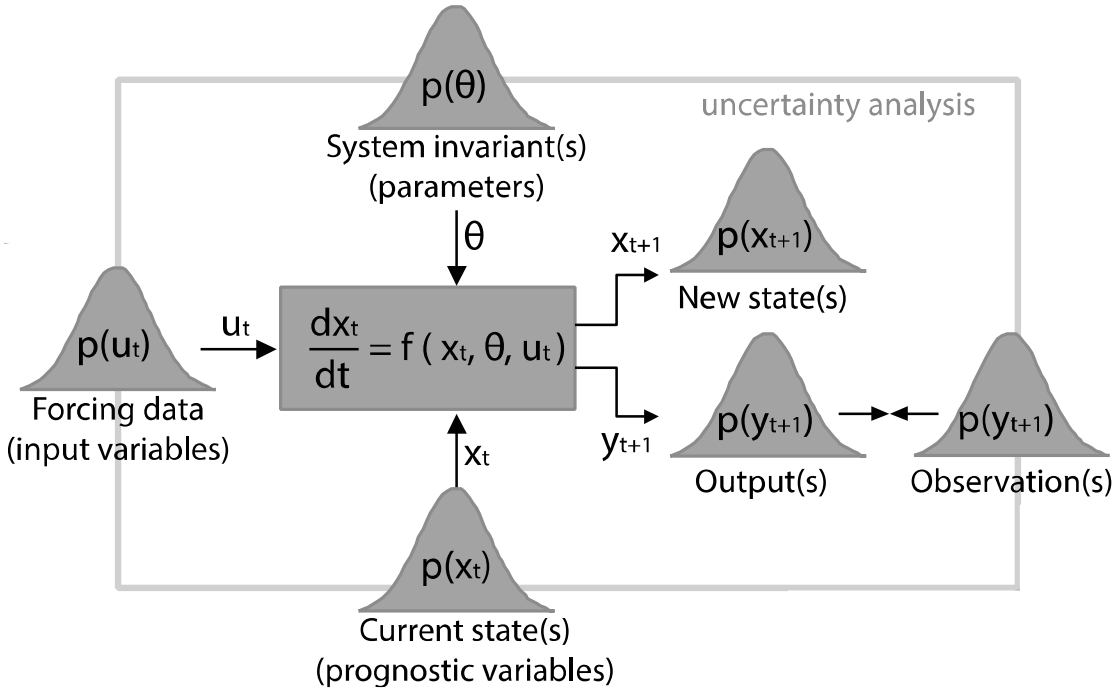

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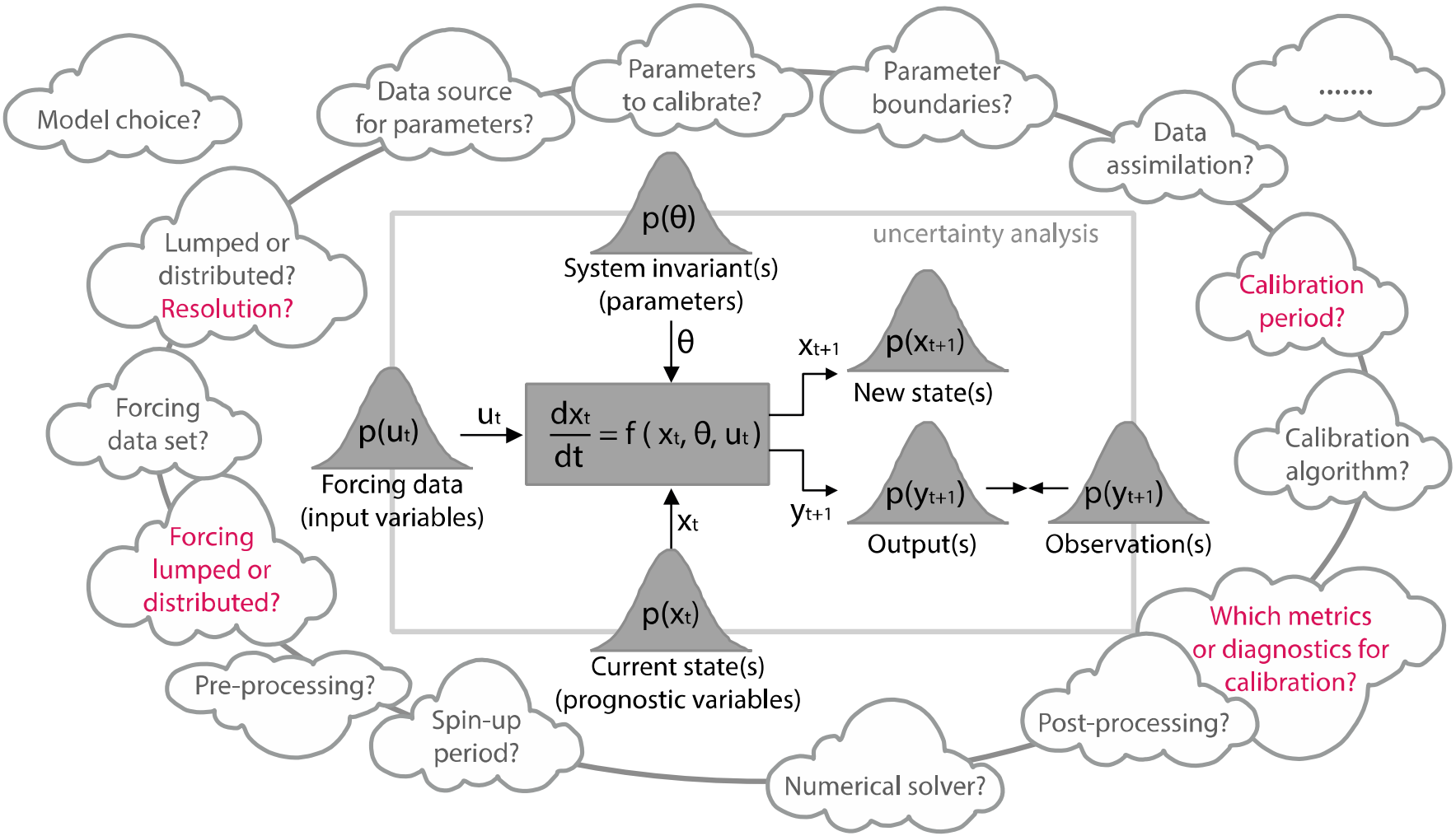
Model choice?
Data source for parameters?
Parameters to calibrate?
Parameter boundaries?
.....
Data assimilation?
Lumped or distributed? Resolution?
Calibration period?
Forcing data set?
Calibration algorithm?
Forcing lumped or distributed?
Which metrics or diagnostics for calibration?
Pre-processing?
Spin-up period?
Numerical solver?
Post-processing?
uncertainty analysis
p(θ)
System invariant(s) (parameters)
θ
p(ut)
Forcing data (input variables)
ut
dxt/dt = f (xt, θ, ut)
xt+1
p(xt+1)
New state(s)
yt+1
p(yt+1)
Output(s)
p(yt+1)
Observation(s)
xt
p(xt)
Current state(s) (prognostic variables)

Test case; Thur basin, NE-Switzerland, 1700 km^2.

Question: Predict a flood-event with a **20-year return period**.
The results need to be ready in **three days**.

Available data: Historically observed discharge data (20+ yrs)
Soil data from the FAO global data-set (1x1km)
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3.Which forcing-data?
readily available lumped ; later available distributed

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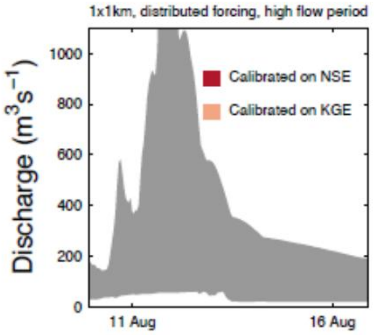
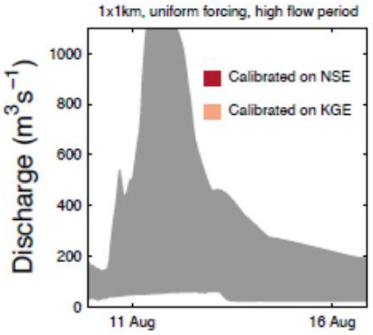
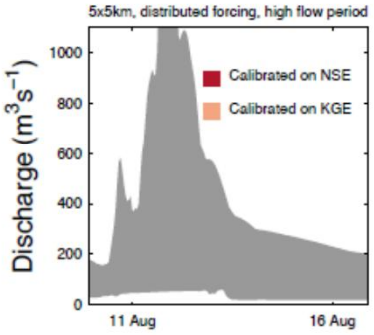
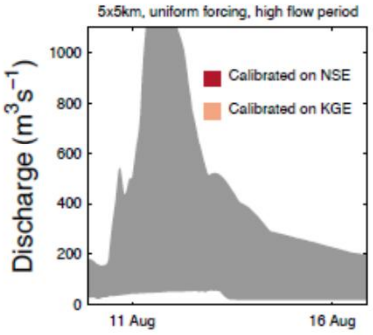
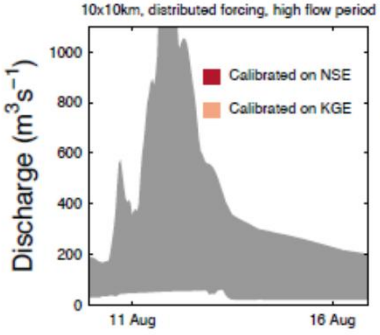
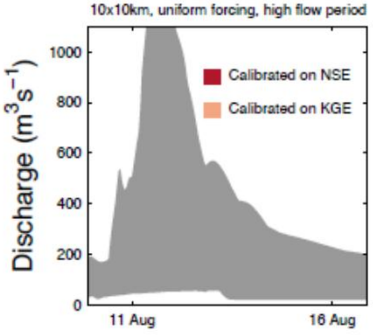
	Distributed	Uniform
1x1 km		
5x5 km		
10x10 km		

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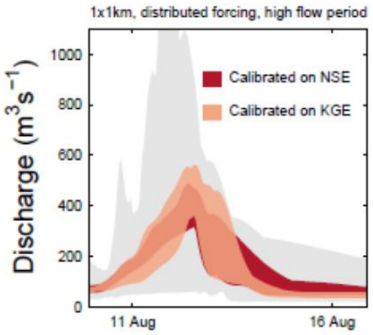
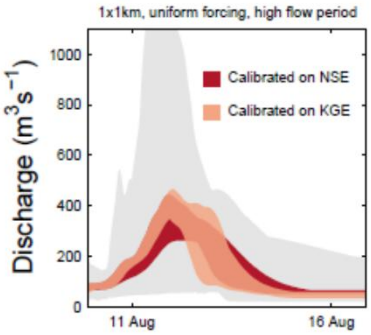
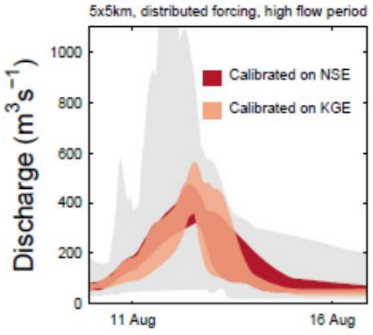
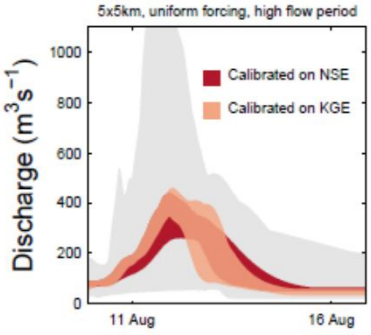
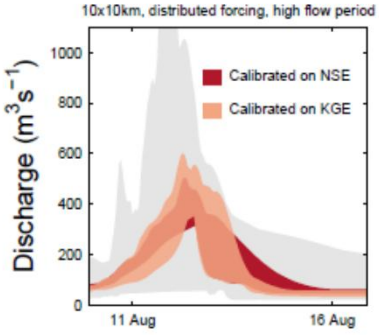
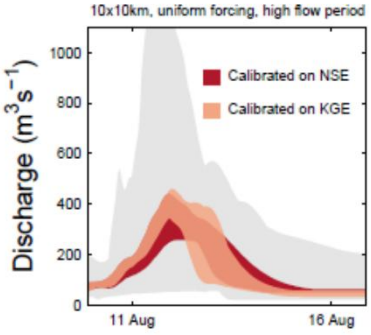
1x1 km		
5x5 km		
10x10 km		

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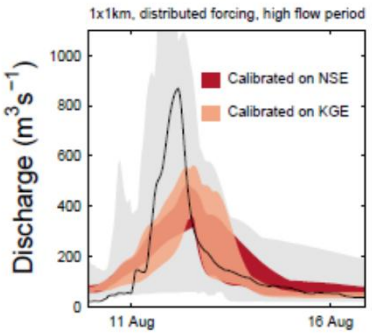
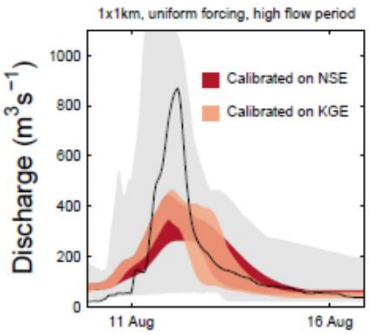
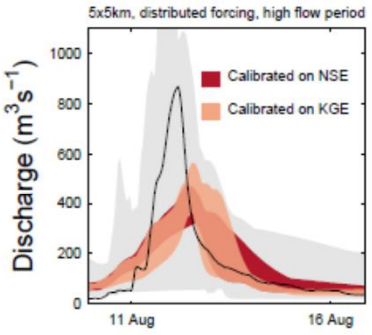
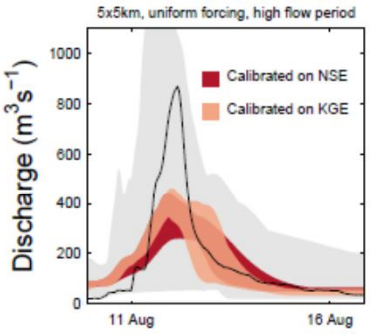
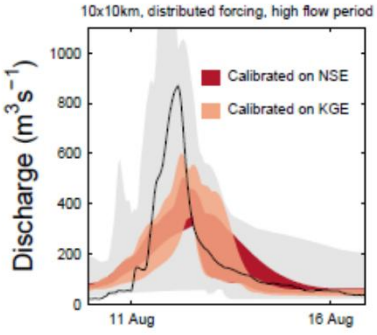
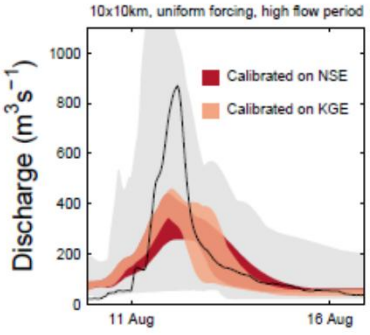
1x1 km		
5x5 km		
10x10 km		

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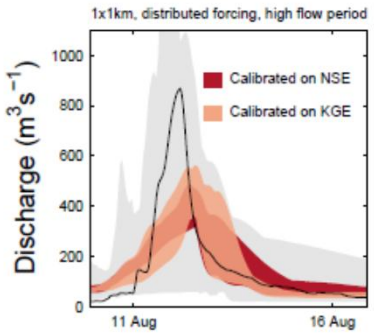

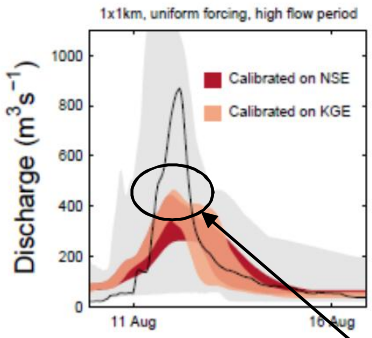

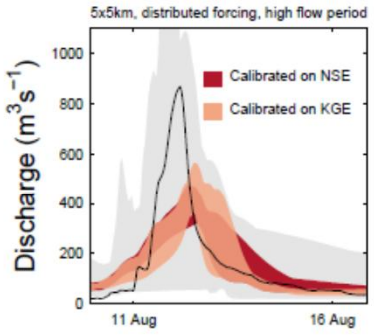

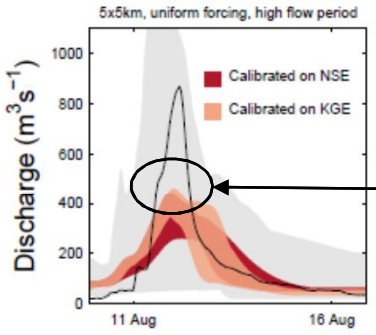

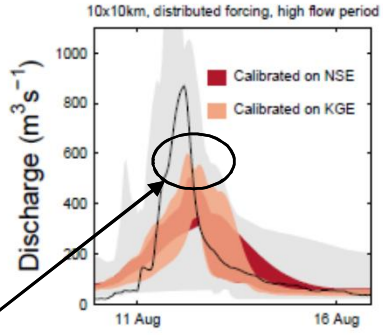

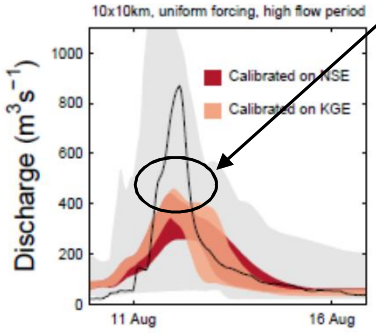

Peak timing

Peak height

"flood event"?

Different modellers make different decisions based on the same information.

Different modellers make **conciously and unconciously** different decisions based on the same information.

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Implications for Water Management

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Melsen et al., What's the role of the model in socio-hydrology? Comment on 'Prediction in a socio-hydrological world', Hydr. Sci. J, submitted

Implications for Water Management

1. Modellers take decisions that influence the model results

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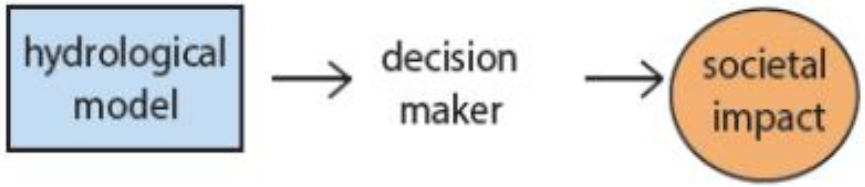
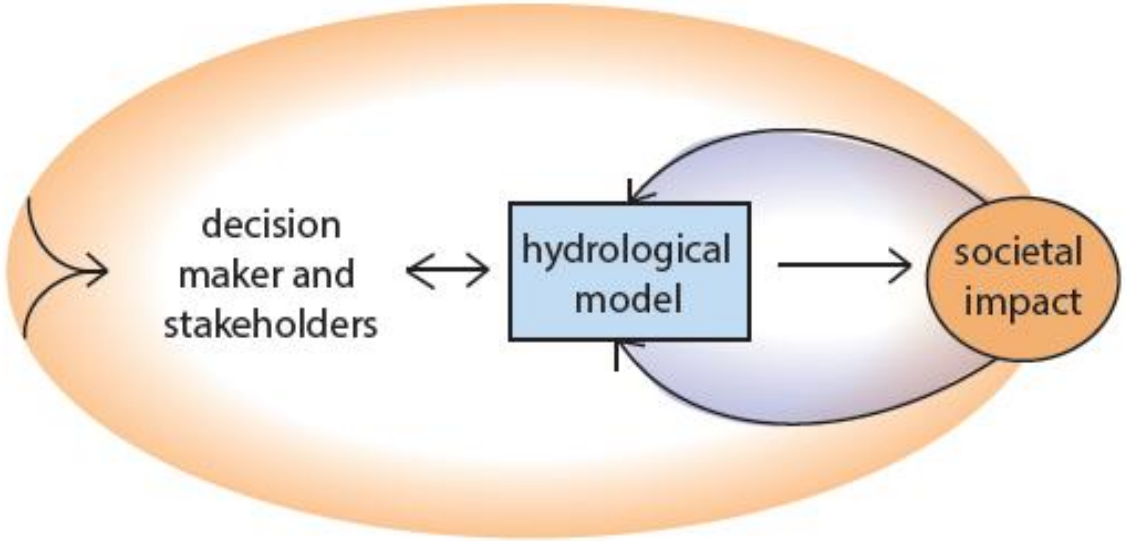
Assumptions of technological determinism not valid:
Social shaping of technolgy (Social Construction of Technology)

Melsen et al., What's the role of the model in socio-hydrology? Comment on 'Prediction in a socio-hydrological world', Hydr. Sci. J, submitted

loading-dock model (technological determinism)



social construction of technology (SCOT)



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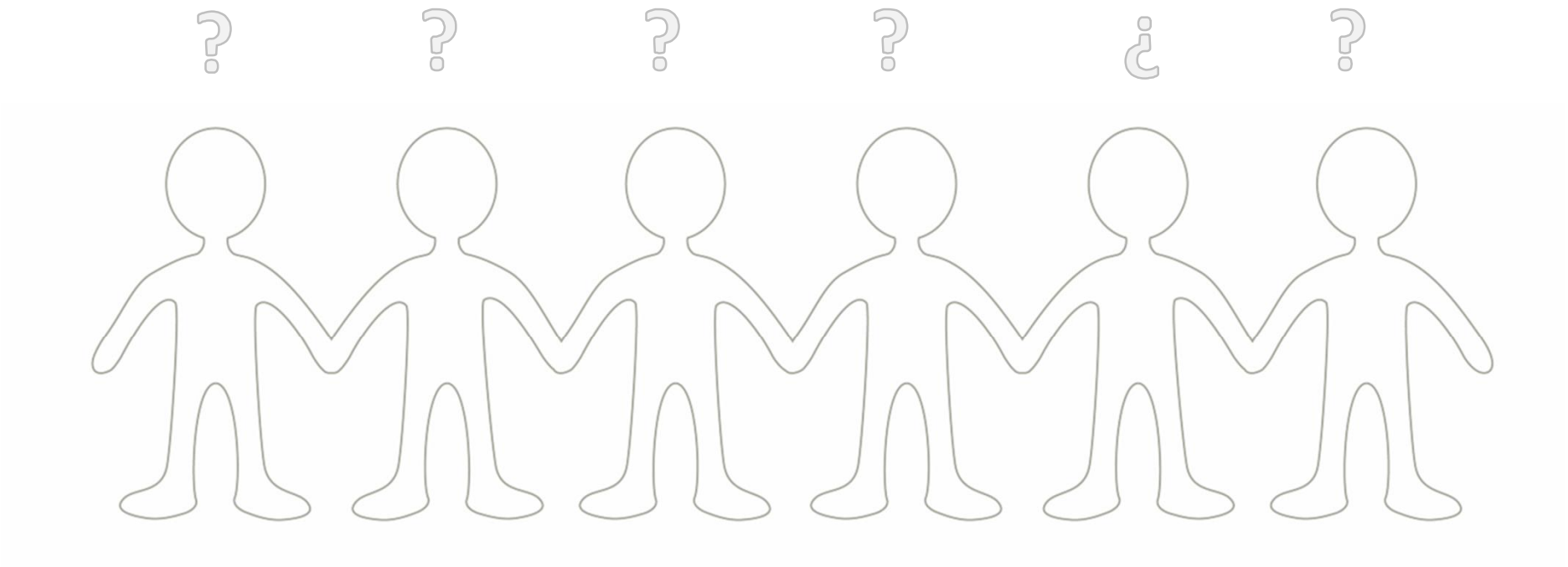
Models are no 'value-free' objective tools, but social constructs.



Thank you.

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Proposal Model intercomparison study

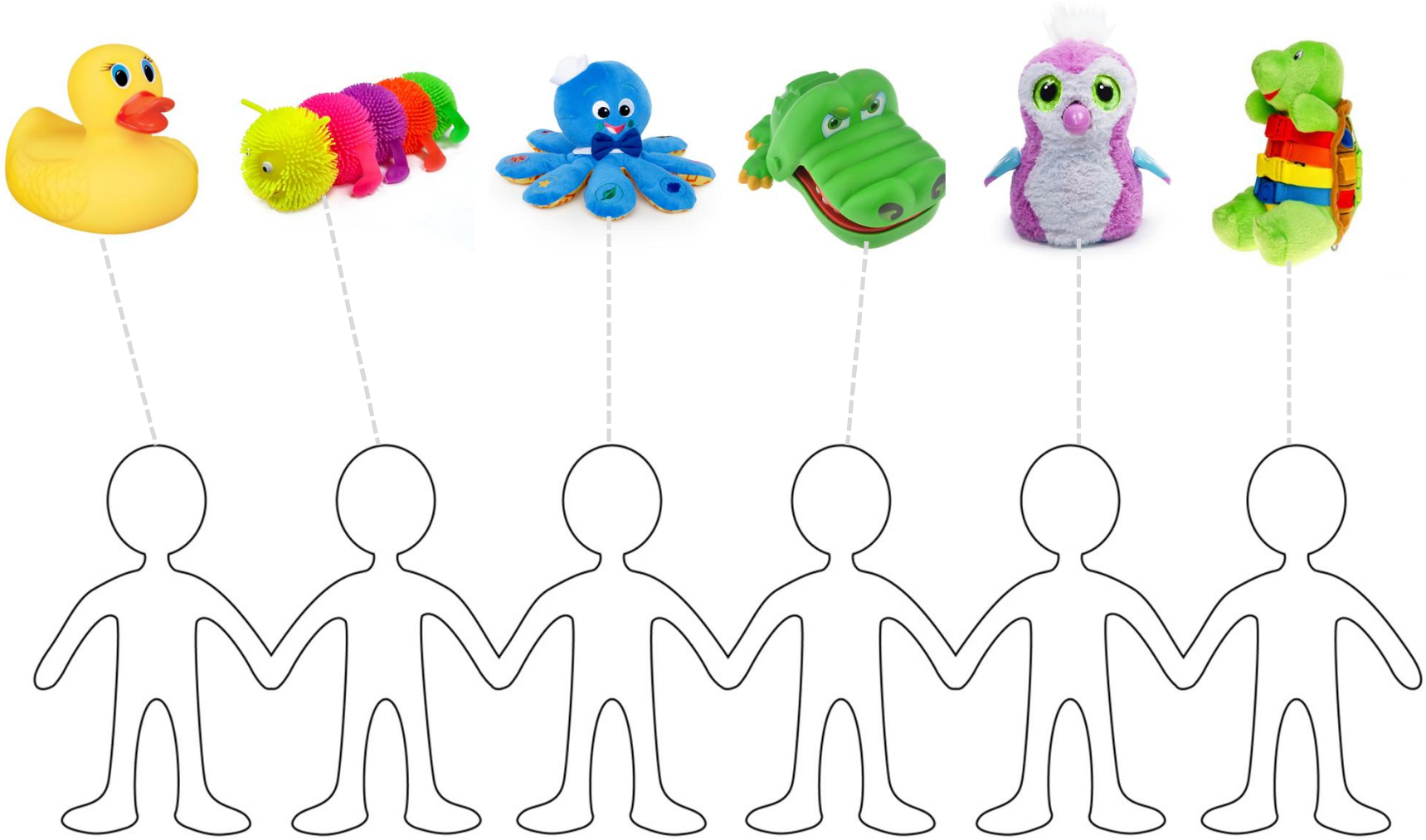
Lieke Melsen

Research question:

What's the influence of the modeller on the model results?

Rationale:

Subjective modelling decisions influence model results. Experience with a specific model can influence the modelling decisions.



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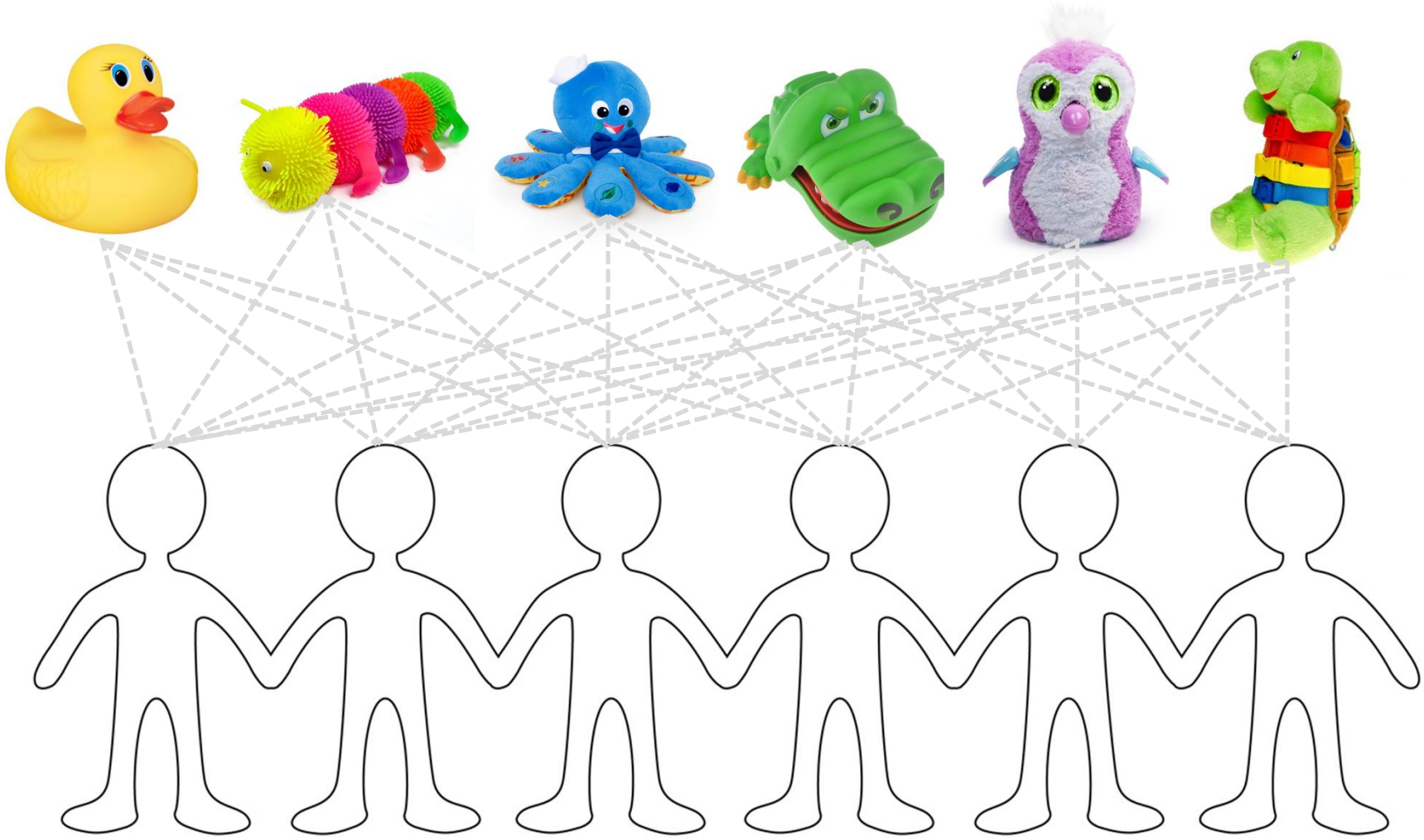

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Proposal Model intercomparison study

Method:

A protocol describes input data, output variables to evaluate (start with Q only?), and calibration data (or even: calibration-strategy?). All modellers run all models.

Proposal Model intercomparison study

H0:
The model performance is independent from the modeller who ran the model

H1:
The model performance differs when the same model is run by different modellers. The model performance is not related to the experience of the modeller with that model.

H2:
The model performance differs when the same model is run by different modellers. The model performance is related to the experience of the modeller with that model.

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