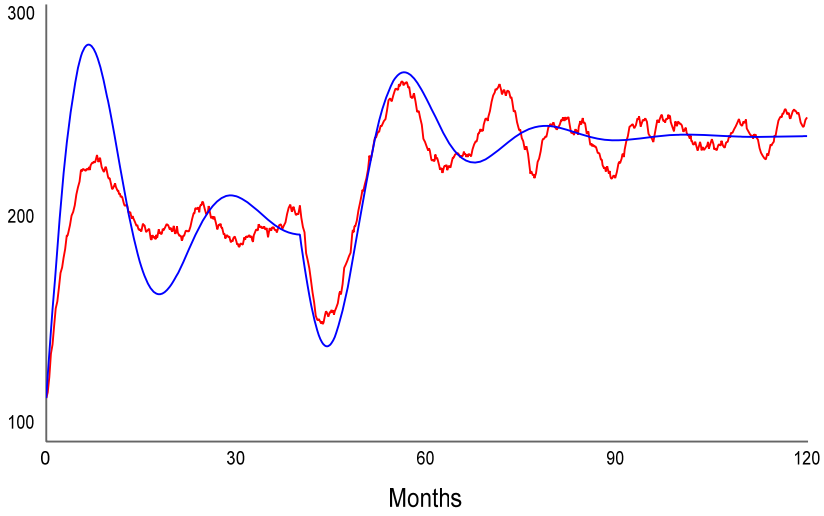
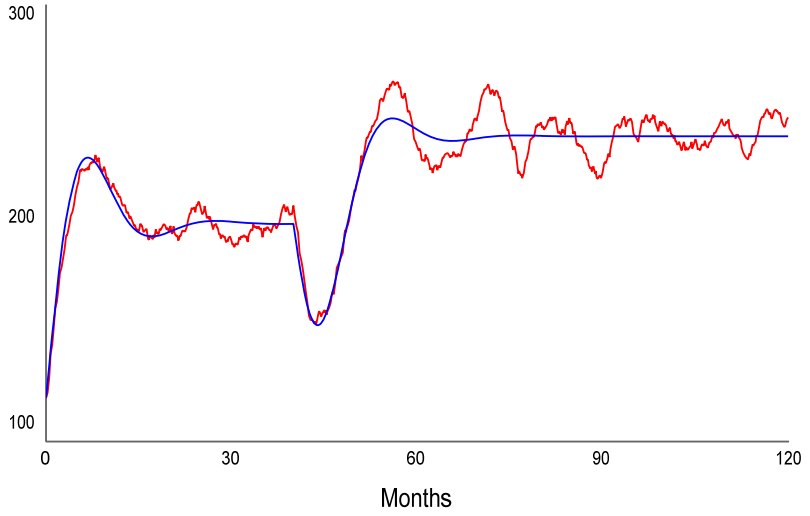
Calibration and Data Handling





with Stella®

the presentation will begin shortly…

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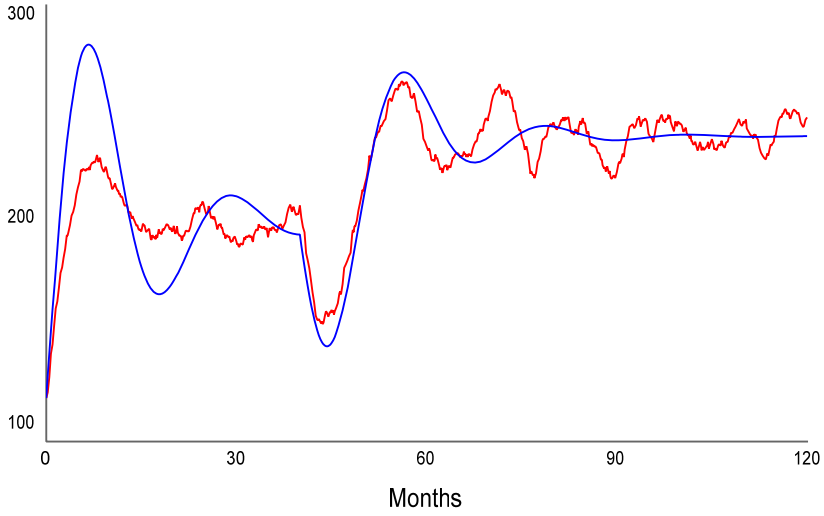
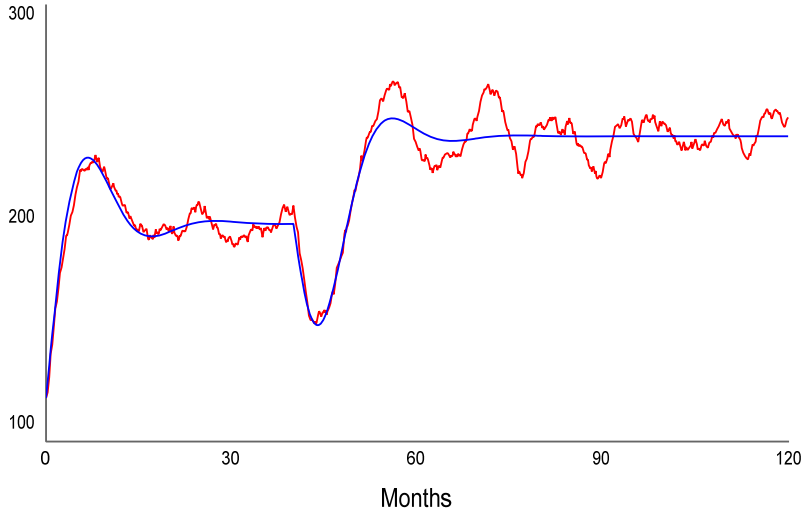




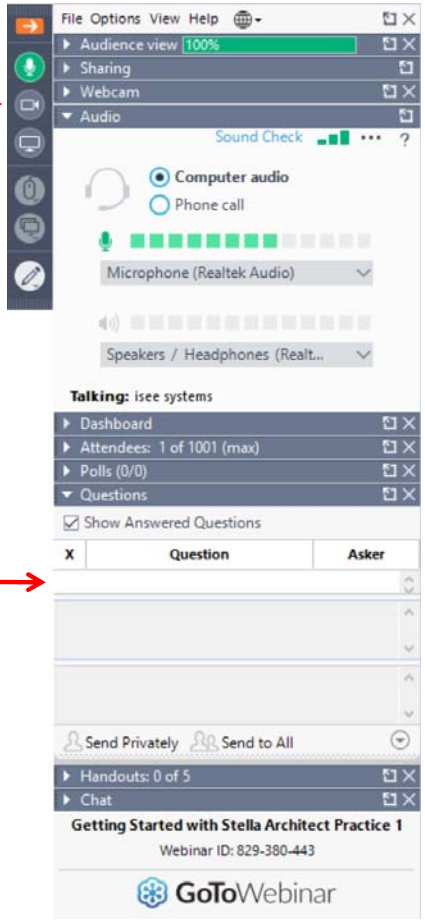
with Stella®

Presented by Bob Eberlein --- January 30, 2019

Webinar Mechanics

Grab tab
Enables you to hide or display control panel and toggle between full-screen and window mode

Questions
Submit your questions here at anytime during the Webinar



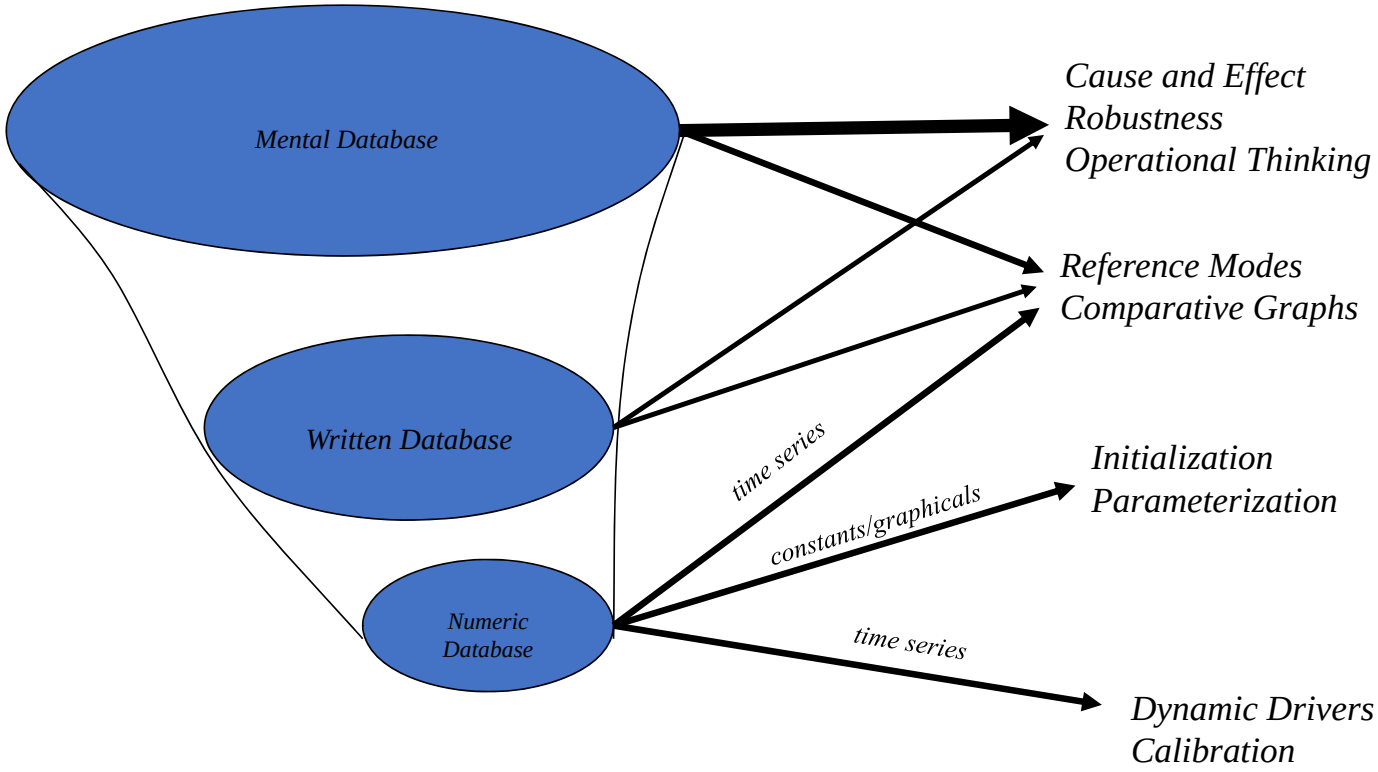
Audio setup
Allows you to test your audio

Also make sure your volume is turned up and your speakers are not muted.

Today's Topics

- Perspective on Data
- Importing parameters and graphical function values
- Exporting results
- Importing time varying values
  - As controls and as runs
- Calibration
  - Payoffs, data sources and weights
  - Calibration control
  - Confidence bounds
- Summary observations
- Q & A

Perspective on Data



Importing Parameters Background

- We put parameters and initial values into equations
  - Definitional
    - Units conversion
    - Normally not imported
  - Derived
    - Theory or measurement
    - Importing allows like assumptions to be put together into a single place
  - Assumed
    - Used to control scenarios or experiments
    - Importing allows easy organization of different assumption sets
- Graphicals are used to describe nonlinear x,y relationships
  - Typically these are derived, though sometimes assumed
  - Time can be the x axis
    - Time varying parameters which will be discussed more

Importing Parameters Mechanics (import01)

- The import process is the same regardless of purpose
- Build the model
- Organize the Content
  - Excel or CSV files
  - Row or Column Headers (software figures out which)
    - Must be model variables, or one dimensional array slices (* or Dimension name)
    - Graphicals are fully specified
      - Can be only y or x and y
  - Values
    - One for a parameter
    - Multiple for array slices – each is an array element
    - Multiple for graphicals – each is an entry in the graphical
      - Paired (equal number of entries) for explicit x,y

Importing Parameters Mechanics 2

- Use the import dialog from the Model menu
- Select the source
  - Select the sheet for excel
- Select what to do with the imported values
  - Set their equations
    - Only constants can be set, and equations are changed
  - Control them
    - The value is used instead of the equation which remains unchanged
- Set the conditions under which they will be read
  - Dynamic – whenever a run is made or things are changed
  - On demand – when action is taken

Exporting Results (Export01)

- Model simulations are stored in a database (isdb) format
- Can also export these results to both csv and Excel files
  - Using Export Data on the Model Menu
    - All results
      - Or at a time
    - Parameter values (changed and unchanged)
    - Table values for tables marked for export
  - Using the Parameter Control panel
    - Saves changed parameter values
      - (subset of parameter values above)
- Notice format of All Results
  - That is our next import format

Importing Time Varying Values (Import02)

- As driving variables
  - This is a variation of the parameter import process
  - More compact and flexible than the graphical imports
    - Missing values are fine
    - Additional interpolation options
- As a run for easy comparison
  - Imported using the data manager (interpolated when displayed)
- Format is the same in both cases
  - Essentially the same as parameters, same as exported
    - With the first row or column presenting time values
- Can use both of these for calibration
  - Payoff definition will take care of data point selection

Transitioning to Computed Values (Projections)

- Put together the data for what has happened
- Create model equations for behavioral response
  - Stocks can't be controlled so need special consideration if included
- Import the data using the Inside option
  - Reverts to the model equation when the data run out (and before they start)
  - Don't need to add switching logic to the model
- Can be used to set up scenarios using Lead In Time
  - On the interface
  - Controls will override the value set in the import file
  - The other interpolation options can be used in this case

Questions on Data?

- Coverage was very fast
  - The models are available for study
- Data format description
  https://iseesystems.com/help#cshid=1108
- Import dialog documentation
  https://iseesystems.com/help#cshid=1046
- Export dialog documentation
  https://iseesystems.com/help#cshid=1042
- Data Manager documentation
  https://iseesystems.com/help#cshid=1039

Calibration - Conceptual Frame

- What?
  - Making a model representative of the system being modeled
  - Adjusting model parameters (and structure) so behavior matches data
- Why?
  - Face validity
  - Finding out what is wrong with the model
    - Theory rejection
- How?
  - Build the model with measured values computed
  - Load in time varying data on those values
  - Define a payoff based on comparison with those values
  - Optimize over an appropriate set of parameters

Example – AIDS Infections and Deaths

- Simple Bass Diffusion (SIR) Model (AIDS01)
  - Open the model
- Early CDC Data (AIDS_data.txt)
  - Bring in the data
- Face Validity
  - Not with the parameters there
  - Can adjust to achieve this
    - Contact rate = 5
    - Initial Infected = 5
- Is that good enough?

Payoff Definition

- For outcome optimization it is relative weights that matter
  - Often based on denominating components the same (for example $)
  - The guidance for calibration is similar
    - But statistical assumptions can help refine the choices
- Calibration payoffs are based on comparison
  - Only when data exist
- Two built in definitions
  - Squared error
    - The normal distribution assumption common in statistics
  - Absolute error
    - Less sensitive to outlying values
  - Both allow a tolerance zone – specialty use

Variance and Weights

- Use 1/Variance of the expected error as the weight
  - Usually we will need to use data to create a variance based on realized values
  - Use the VAR.P function in excel
    - Get 0.003 and 0.005 for infections and deaths respectively
- Stella will do this automatically
  - Using the model predicted values
- This definition allows interpretation of the payoff value
  - Should be approximately equal to the number of data points
    - Across all series
    - By construction at the value where weights are computed
  - Confidence bounds are computable

Optimization Setup

- Same as it is done for outcome optimization
  - average risk tenue – 0.1 - 20
  - average survival time – 0.1 – 20
  - contact rate – 0.5 – 40
  - initial at risk population – 0.0 – 100,000
  - new at risk population – 0.0 – 10,000
  - Initial infected – 0 – 20
- How is the outcome?
  - Experiment with payoff weights
  - What observations can be made?
- Can we reject this model?
  - Yes

Confidence Bounds – and a Grain of Salt

- Percentages based on an assumption of normal errors
  - Set to 95%
- Shows how much movement is required to change the payoff enough
  - Sensitivity means tighter bounds
  - Not sensitive – might fail
- Add in infection percent as search parameter
  - Results do not change
  - Has a narrow bound
  - Clearly is not derivable just by studying structure

Confidence Bounds – a Cleaner Example

- Open CalibrationConfidenceBounds
  - Run
- Weights are set to automatic
  - Optimize
- Optimize a second time
  - Confidence bounds change
- Pay attention to relative ranges
  - Don’t report values blindly
  - Compute weights independently for better statistics

Calibration - Observations

- It is fun and easy to work with data
  - It grounds model assumptions and results
    - Pick measures people can relate to
- Behavior comparisons are a useful touchstone
  - Not the only one
    - Operational thinking provides many more
- Calibration fits a model to data
  - Its ultimate scientific purpose is to reject
- Validity, or more precisely value, is a bigger question
  - Physics
  - Common sense
  - Measured numeric values

Questions?

More information:
https://iseesystems.com/help#cshid=1100

Upcoming Webinar Topics:

Building Multiplayer Games with Arrays and Wildcards

Using Stella to Trace Causality

Contact

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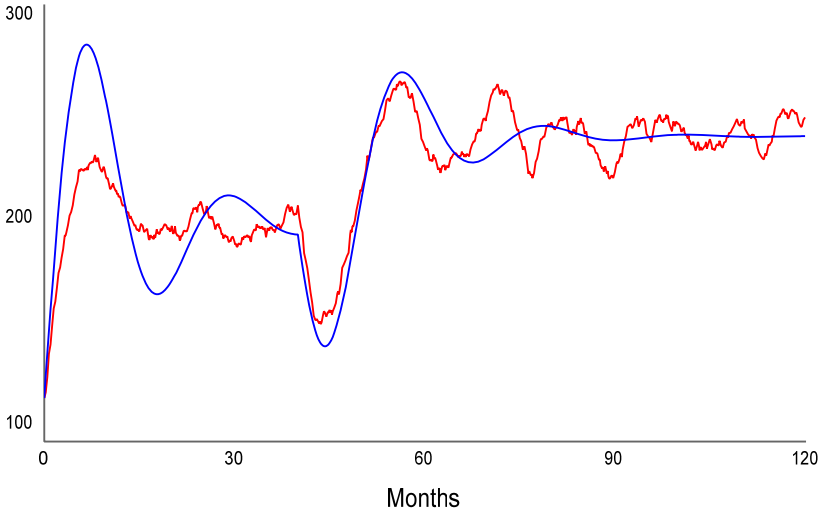

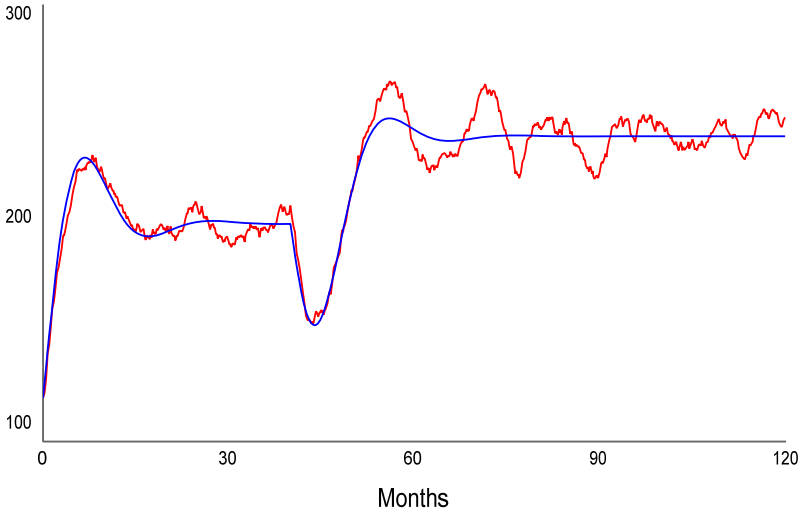

Thank you!