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Dynamic Experiments for Learning Basic Modeling

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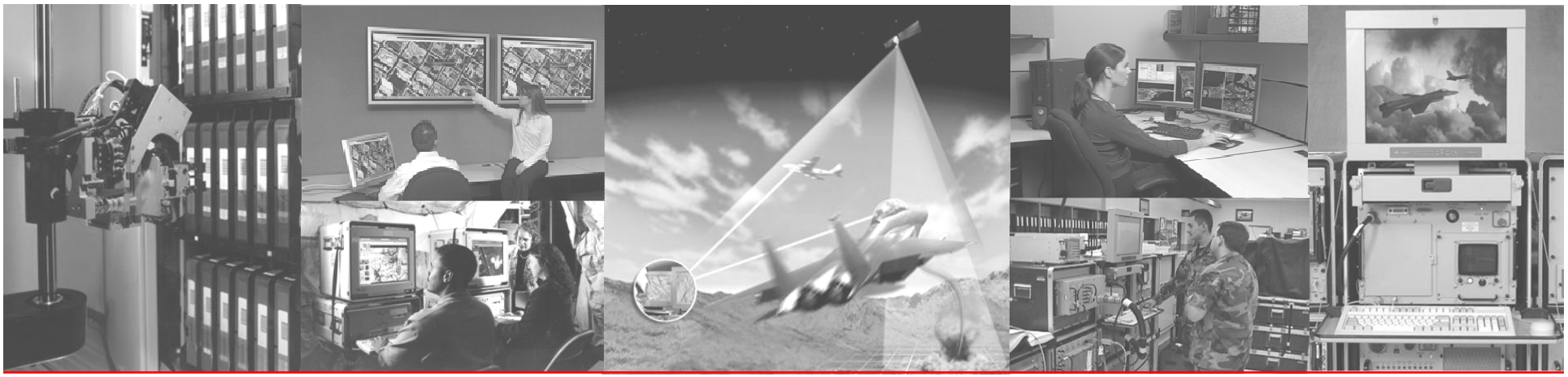

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Summary

- This workshop teaches the basics of modeling using dynamic experiments which are brief, exciting, memorable, and involve workshop participants.
- The participants act as observers who collect behavioral data "real-time" from the experiment.
- The participants discuss their observations of the experiment and their understanding of the data.
- A dynamic hypothesis is drawn out by the workshop moderator as a Causal Loop Diagram based on the outcome of the discussion.
- A model (built prior) is simulated to reproduce the observed dynamics.

Abstract

Demonstrating the benefits of simulation modeling to new audiences is not an easy task. Models that solve real-world dynamic problems may take weeks, months, or even years to develop. Audiences new to System Dynamics may have a hard time relating model behavior to the real-world problem because of their unfamiliarity with the problem being modeled, or simply because of the separation between their world experience and its representation in the computer.

- This workshop teaches the basics of modeling using dynamic experiments which are brief, exciting, memorable, and involve workshop participants.
- The participants act as observers who collect behavioral data "real-time" from the experiment.
- The participants discuss their observations of the experiment and their understanding of the data.
- A dynamic hypothesis is drawn out by the workshop moderator as a Causal Loop Diagram based on the outcome of the discussion.
- A model (built prior) is simulated to reproduce the observed dynamics.
- From the model behavior, the participants suggest a manageable change to the experiment which is then rerun (using data collection) and the results are compared to the simulation model runs.

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Workshop Participants

- This workshop supports two audiences:
- Non-modelers or newcomers to System Dynamics who wish to learn to how to build a model from direct observation of a "real time" dynamic situation
- Experts, or anyone in-between, who wish to learn some methods for creating dynamic experiments that can run in the classroom (or boardroom)

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Explosions

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Dynamics of Human Systems

- Feedback is everywhere…
- The “Giggle Loop” from the BBC TV series “Coupling”

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Water Pouring Experiment

1. One volunteer holds glass while another pours water to near full
   - Results: water is poured to near top of glass
2. Next volunteer closes their eyes and pours water to near full
   - Results: water is also poured to near top of glass (but very slowly)
   - Volunteer relied on their ears to hear when the glass was near full
3. Repeat experiment with volunteer closing their eyes, humming to themselves, and pouring into ceramic mug
   - Results: water spilled over the top of the mug

- Experiment 3. removed all forms of sensory feedback, preventing volunteer from determining when the glass was near full

- See model ***water_in_glass.mdl***

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Argument Experiment

- No volunteers required (maybe…)
- Set up data collection
- Subjective data – personal interpretation of the situation, but quantified and time-series
  - Subjective Observation Scale (handout)
  - Observer Input forms (handout)
  - **Observer_Input.xls** spreadsheet (file)
- Sound recorder – Audacity
  - audio recording (open source)
  - http://audacity.sourceforge.net

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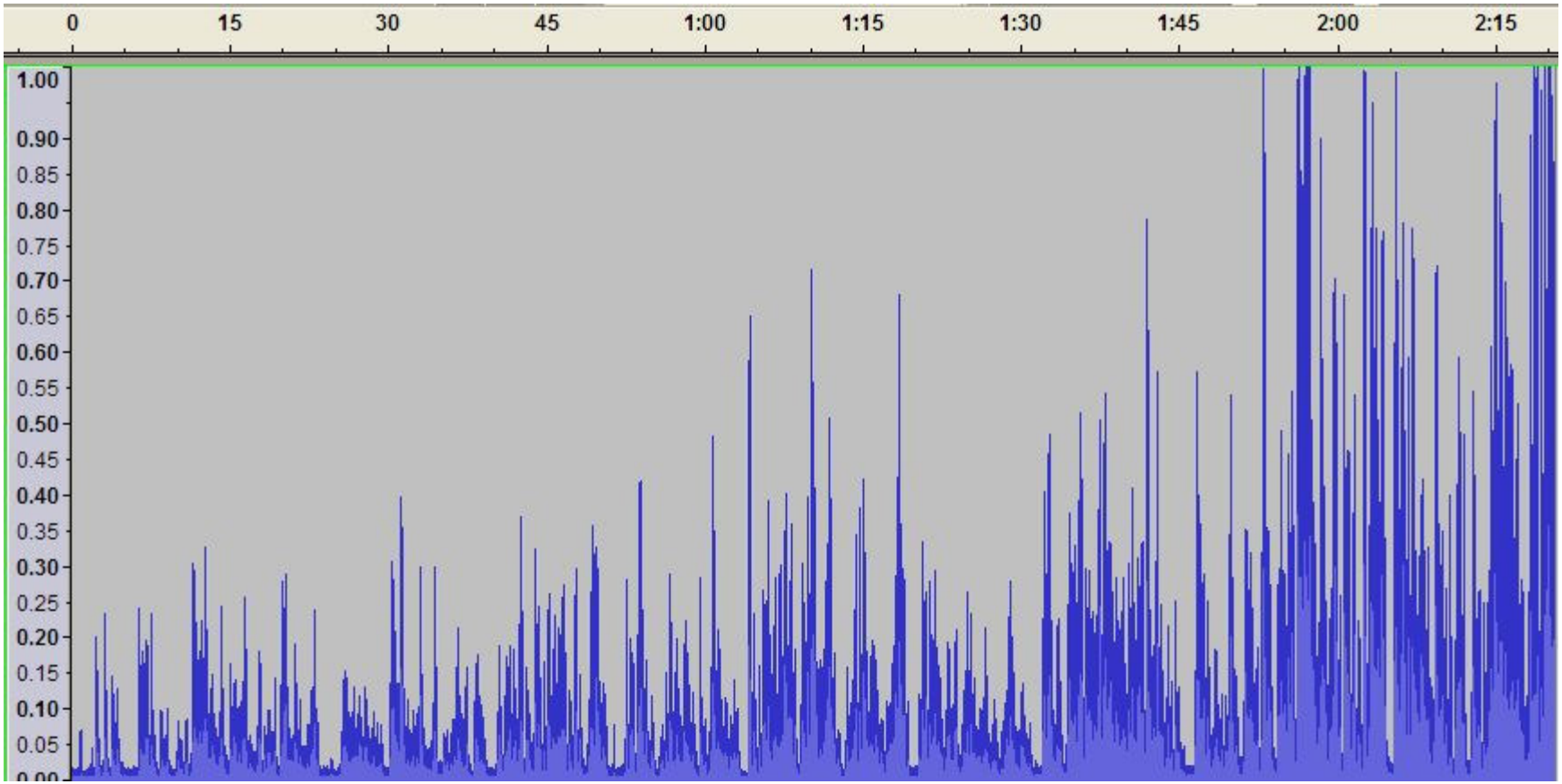
Sound File of Argument



(Showing only the top half of the waveform amplitude)

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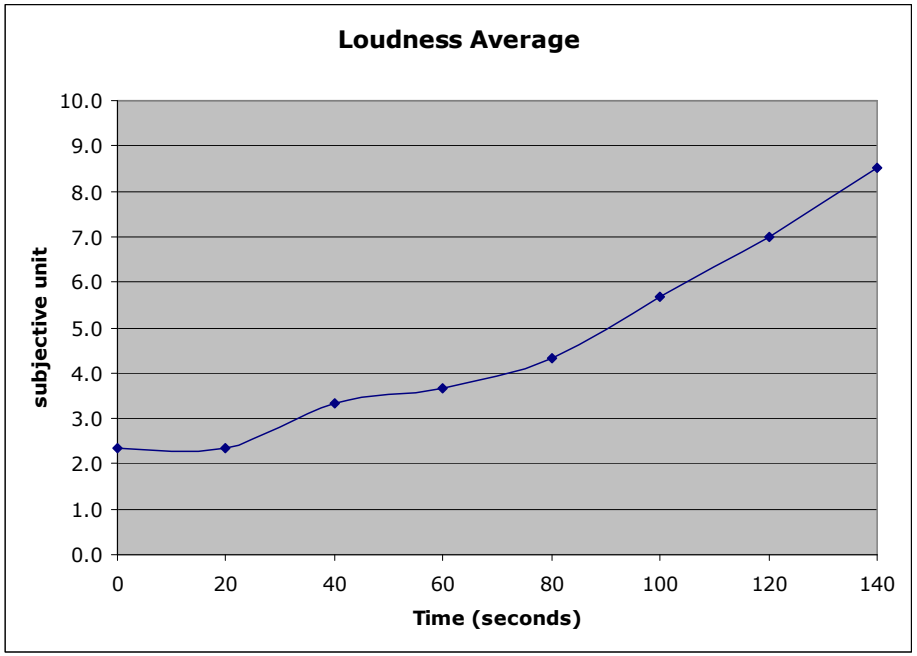
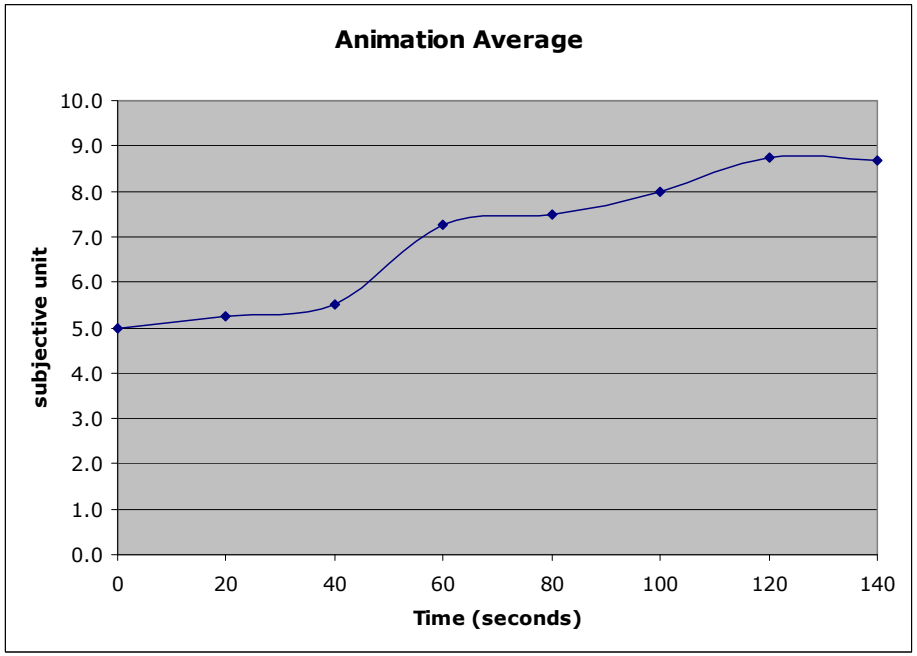
Subjective Data from Observers

	Observer 1	Observer 2	Observer 3	Observer 4	Observer 5	Observer 6	Observer 7
Time	Loudness	Loudness	Loudness	Animation	Animation	Animation	Animation
(seconds)	(0-10)			(0-10)			
0	3	1	3	5	6	3	6
20	3	1	3	5	4	5	7
40	4	2	4	5	5	5	7
60	5	2	4	7	8	6	8
80	5	3	5	7	9	6	8
100	6	5	6	8	8	7	9
120	7	6	8	9	9	8	9
140	9	8			8	10	8





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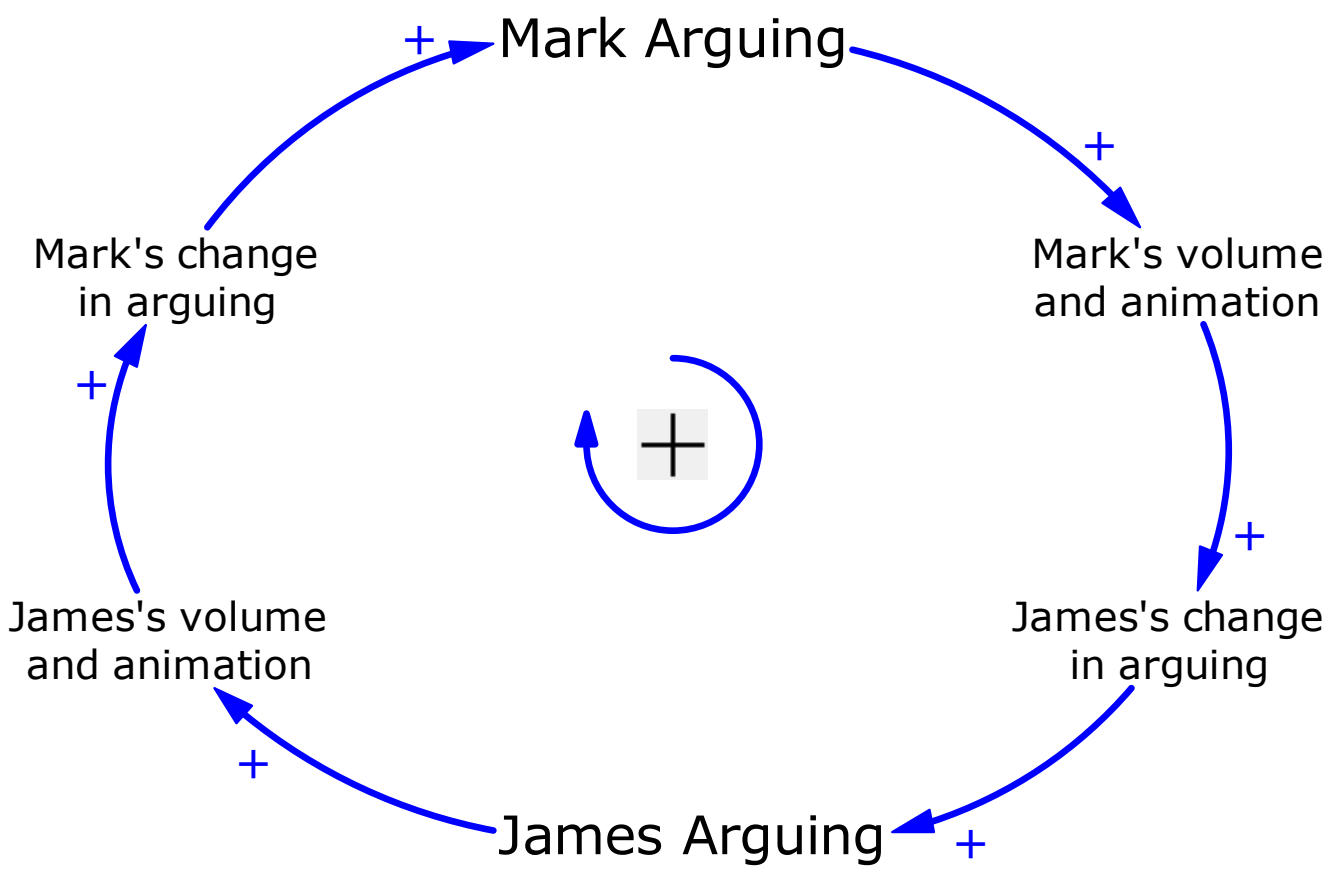
Causal Loop Diagram



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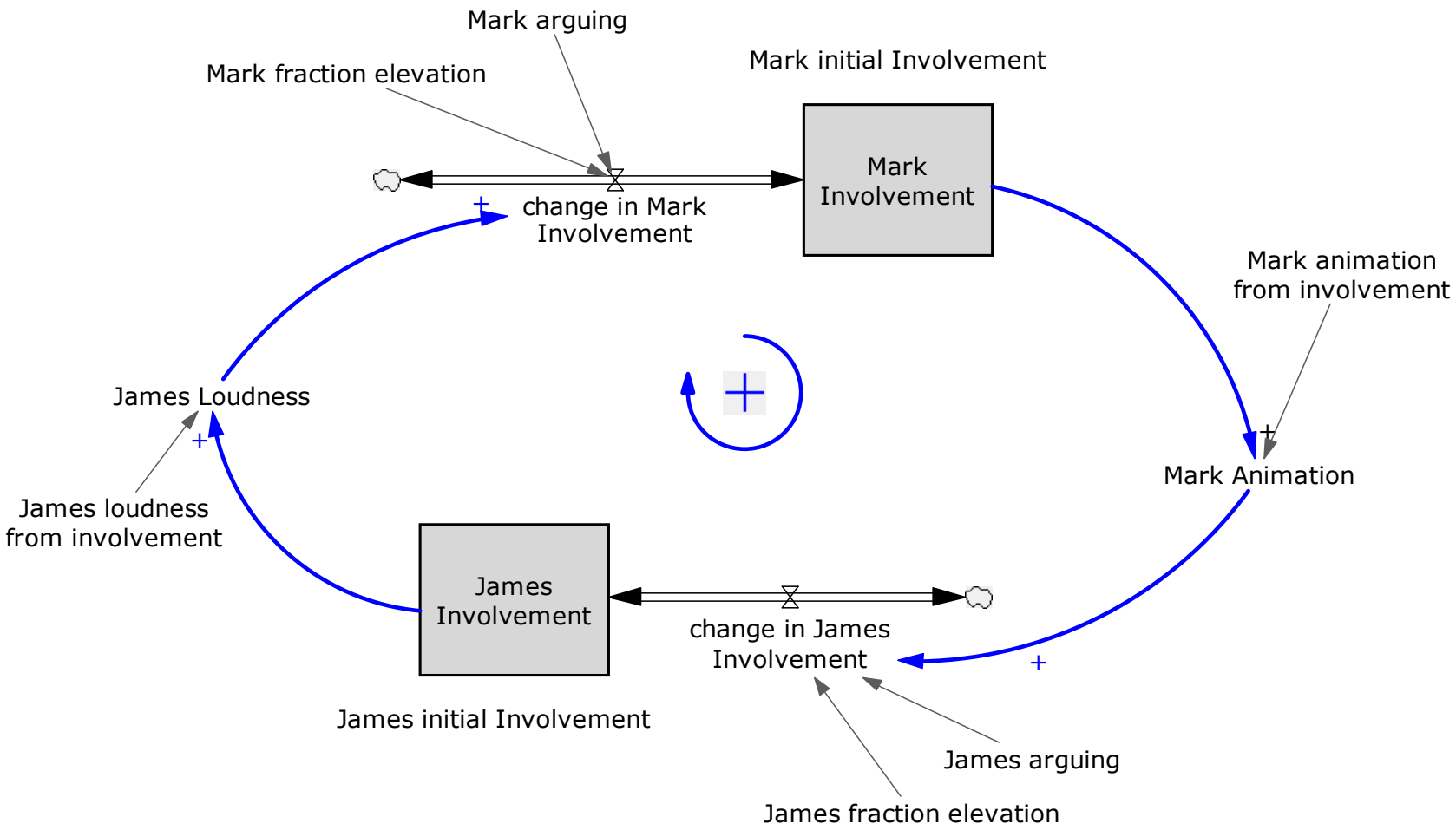
Argument Model



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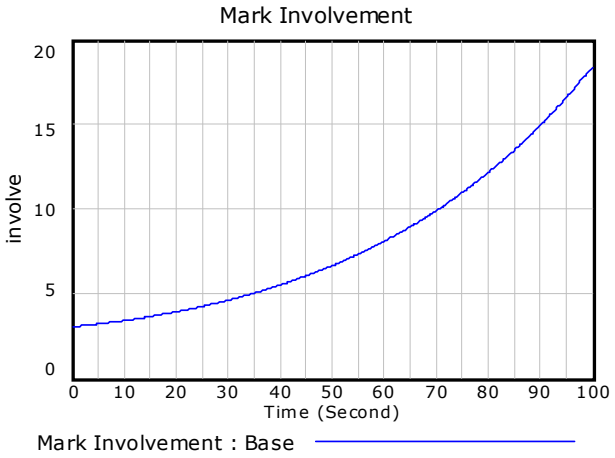
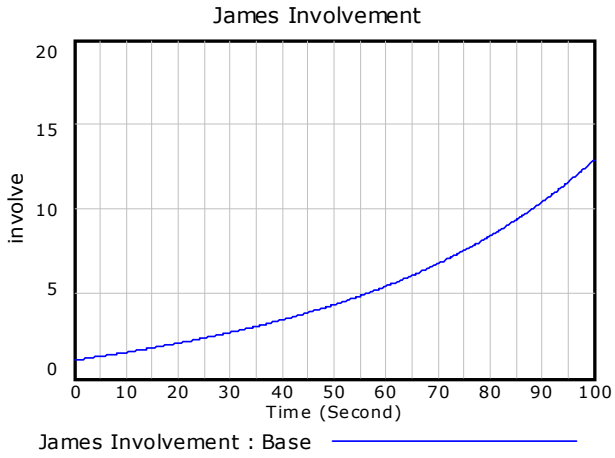
Experiments

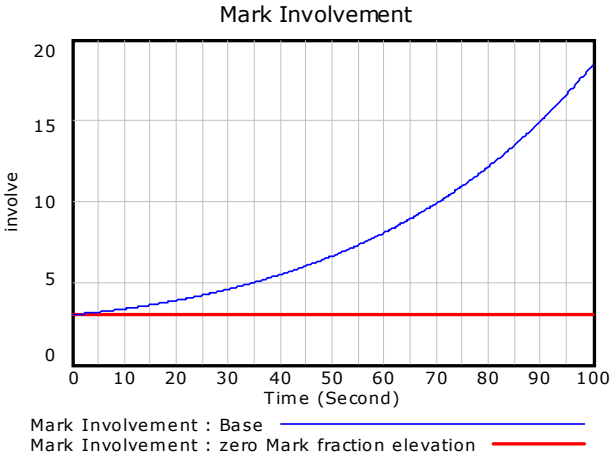
1. Basic argument

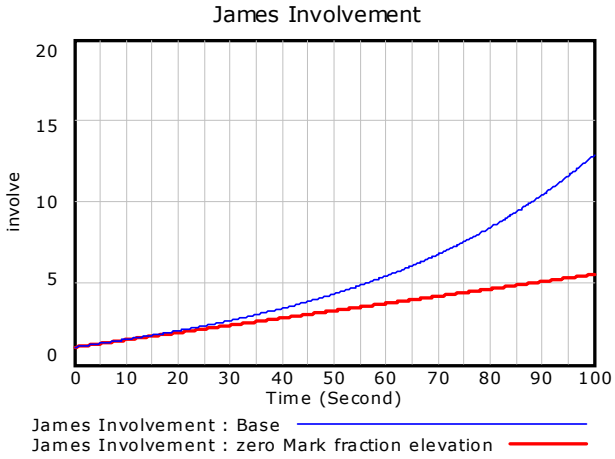




2. Mark does not elevate his involvement

Set **Mark elevation fraction** to zero





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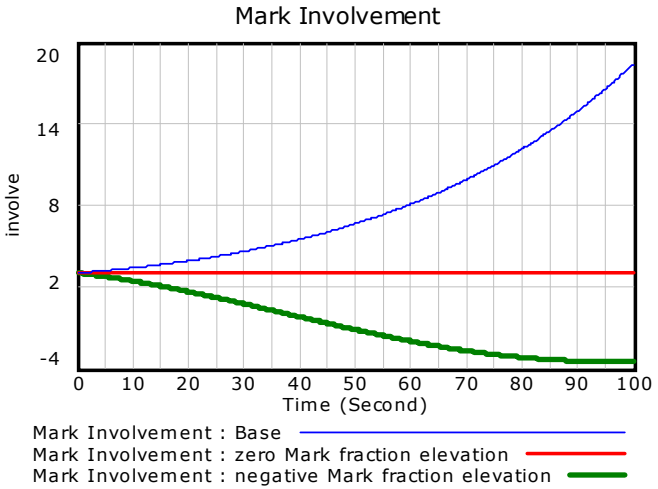
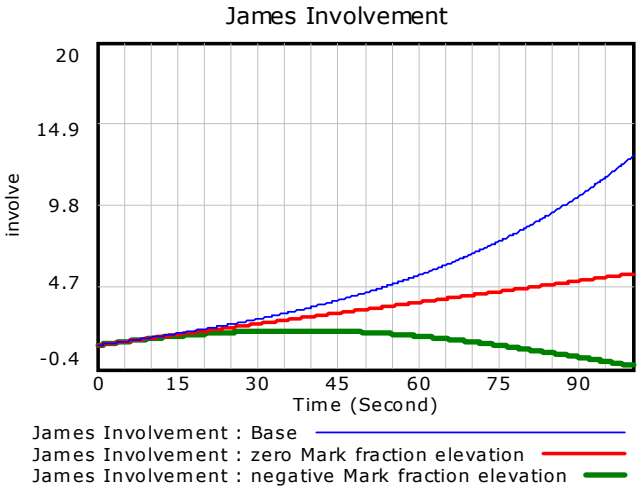
Experiments – 2

1. Mark reduces his involvement based on James's involvement

Set **Mark elevation fraction** to a negative value

– 0.05





Green line shows Mark lowering involvement (into negative territory) while James is drawn along also (after an initial rise)