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Publication date

2020

Document Version

Final published version

Published in

10th International Congress on Environmental Modelling and Software

Citation (APA)

Peters, N., Nikolic, I., & de Vries, G. (2020). Modelling social learning during participatory modeling processes. In *10th International Congress on Environmental Modelling and Software* International Environmental Modelling and Software Society (iEMSs).

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Modelling social learning during participatory modeling processes

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“Modelling the modelling process”

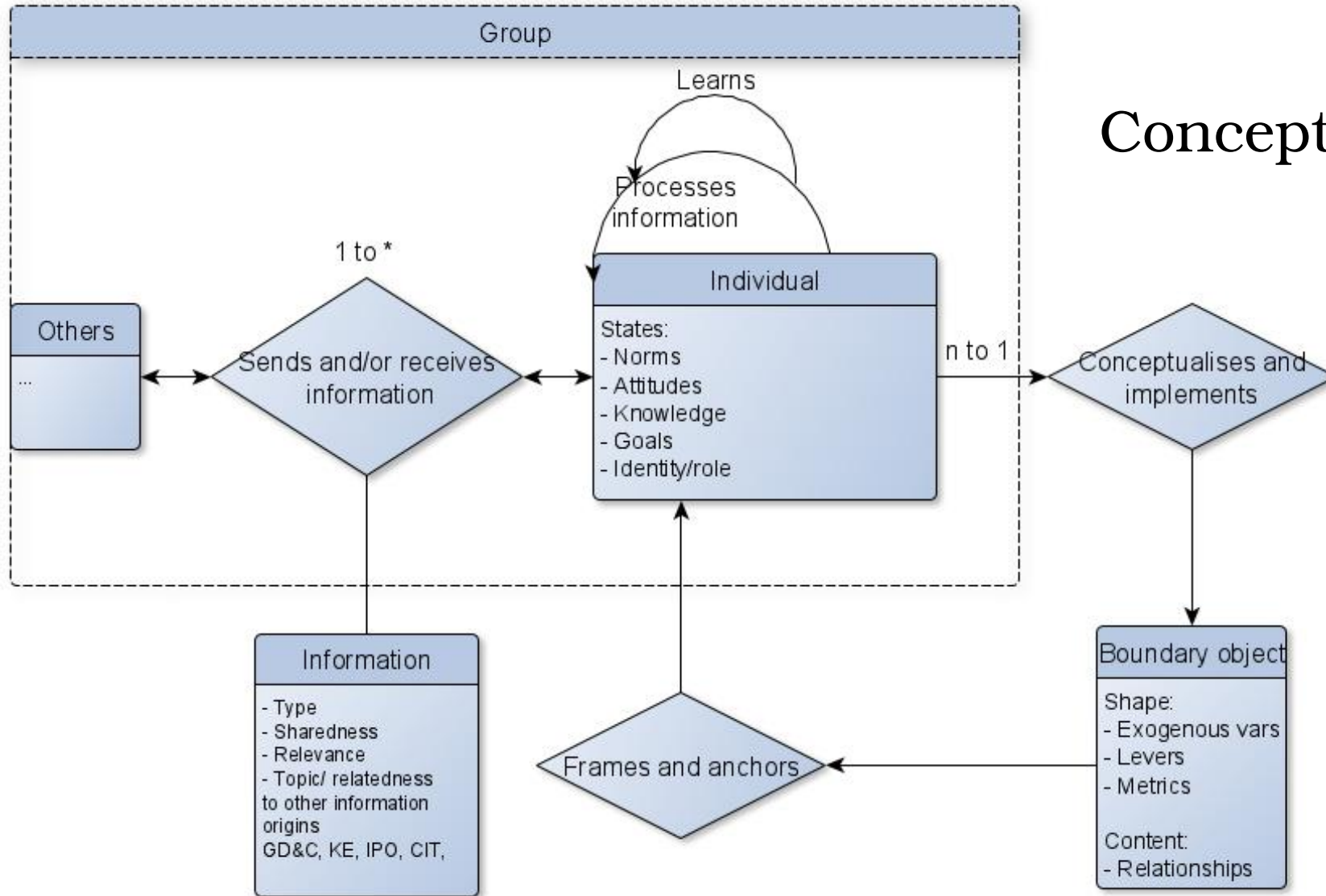
- What?
 - Attempting to develop a theory of mechanism occurring during participatory (multi-)modelling
- Why?
 - to purposefully design (more) effective participatory modelling processes
- How?
 - Developing a ABM based on a transdisciplinary theoretical synthesis and case studies
- Where?
 - First theoretical framework, model implementation and initial results

Theoretical framework : Theory synthesis



- Drawing from :
 - Social psychology
 - (science) communication theory
 - Broad participatory modeling literature
- Core concepts :
 - Information / knowledge
 - Boundary object
 - Individual / group interactions
 - Social learning

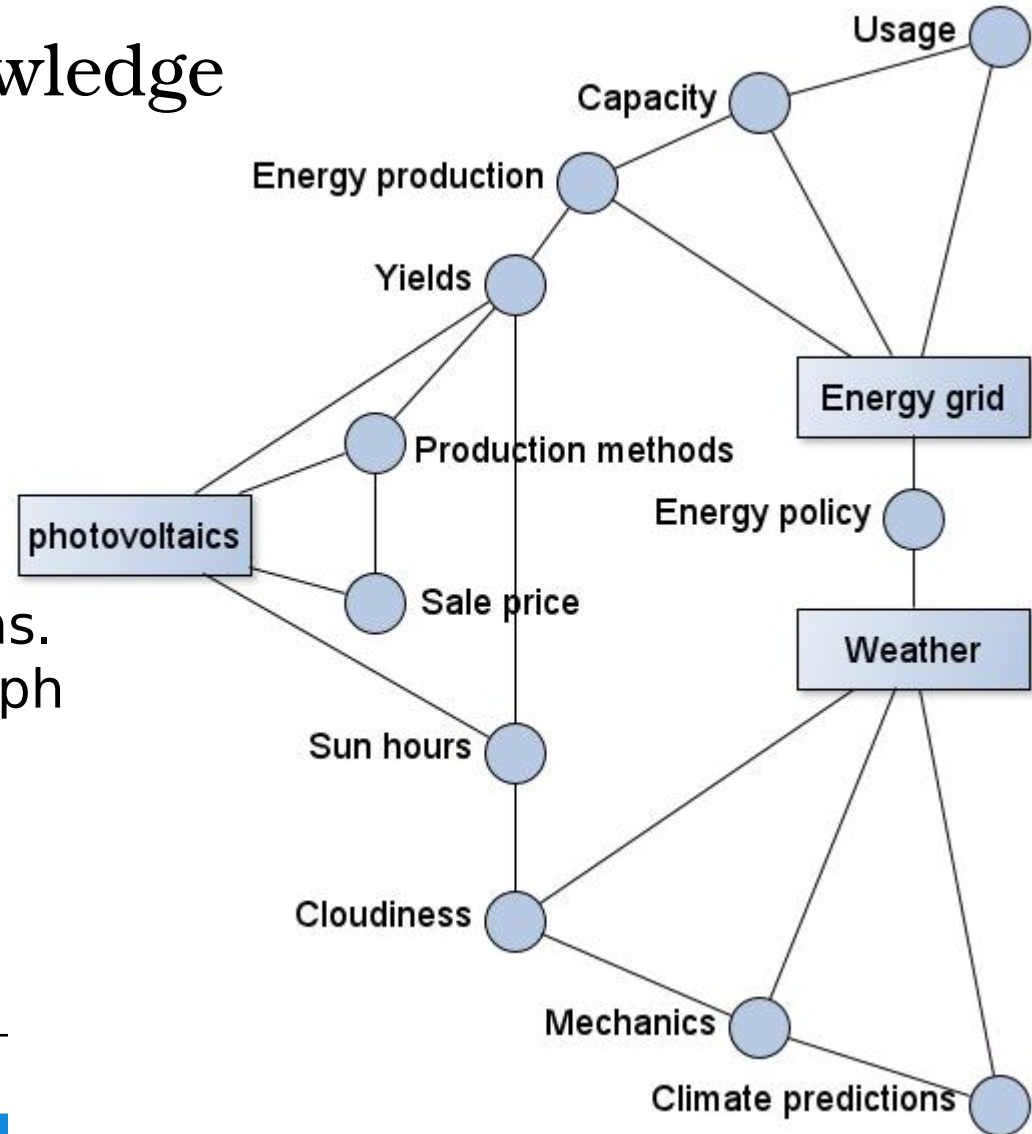
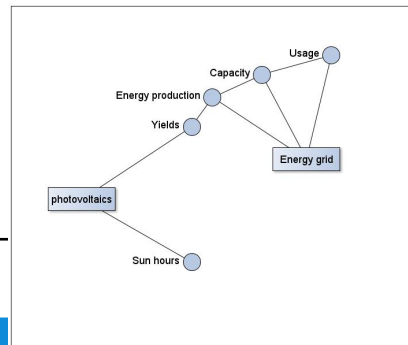
Theory	Origin	Main source - Selection based on modelability, perceived usefulness and (inter)compatibility
<i>Group diversity and conflict theories</i>	Social psychology	<ul style="list-style-type: none"> •Jehn, K. A., Northcraft, G. B., & Neale, M. A. (1999). Why differences make a difference: A field study of diversity, conflict and performance in workgroups. <i>Administrative science quarterly</i>, 44(4), 741-763. •Greer, L. L., Jehn, K. A., & Mannix, E. A. (2008). Conflict transformation: A longitudinal investigation of the relationships between different types of intragroup conflict and the moderating role of conflict resolution. <i>Small group research</i>, 39(3), 278-302.
<i>Social categorisation theory</i>	Social psychology	<ul style="list-style-type: none"> •Hogg, M. A., & Reid, S. A. (2006). Social identity, self-categorization, and the communication of group norms. <i>Communication theory</i>, 16(1), 7-30. •Hogg, M. A., & Tindale, S. (2008). <i>Blackwell handbook of social psychology: Group processes</i>. John Wiley & Sons.
<i>Faceworks</i>	Communication science	Littlejohn, S. W., & Foss, K. A. (2010). <i>Theories of human communication</i> . Waveland press.
<i>Input-process-Output model</i>	Communication science	Littlejohn, S. W., & Foss, K. A. (2010). <i>Theories of human communication</i> . Waveland press.
<i>Common Knowledge effects</i>	Social psychology	Stasser, G., & Titus, W. (1985). Pooling of unshared information in group decision making: Biased information sampling during discussion. <i>Journal of personality and social psychology</i> , 48(6), 1467.
<i>Cognition and information processing theories</i>	Communication science & Social psychology	Littlejohn, S. W., & Foss, K. A. (2010). <i>Theories of human communication</i> . Waveland press.
<i>Information integration theory</i>	Communication science	Littlejohn, S. W., & Foss, K. A. (2010). <i>Theories of human communication</i> . Waveland press.

Conceptual model



Conceptualization of knowledge

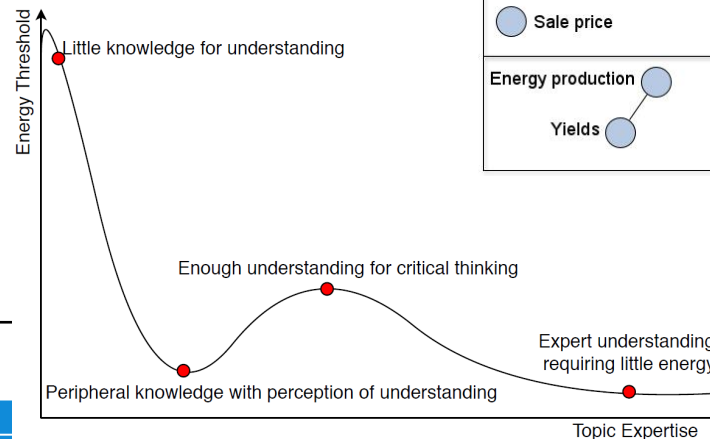
- Multidimensional network
- complete knowledge set exists
- topics 
- information items 
- Relations (links) between these items.
- Individual knows a subset of the graph



Sharing and learning of knowledge

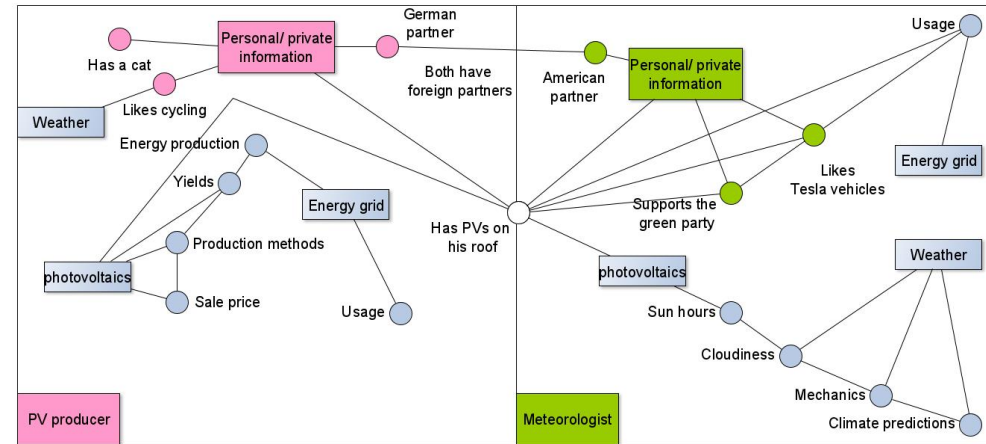
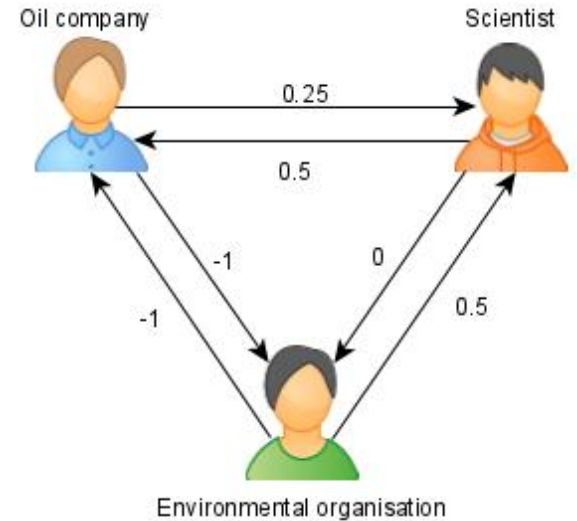
- Individuals may share known items, links and topics.
- Sharing influenced by perceived relevance of that information.
- Individuals receive information : process or reject it based on
 - expertise / familiarity with the topic.
 - energy needed to process information.
 - available energy : relevance and attitude towards the sender .
- Required energy related to expertise

Visualisation	Description	Information weight	Required relative energy
	Topic	No real information requires elaboration	0
	Relation between topics	Useful if many information items are known requires elaboration otherwise	1
	Relation without information item(s)	Relation without information item(s)	2
	Information item(s)	Building blocks of knowledge. Required for knowledge creation	3
	Relation and information item(s)	Relation and information item(s)	4



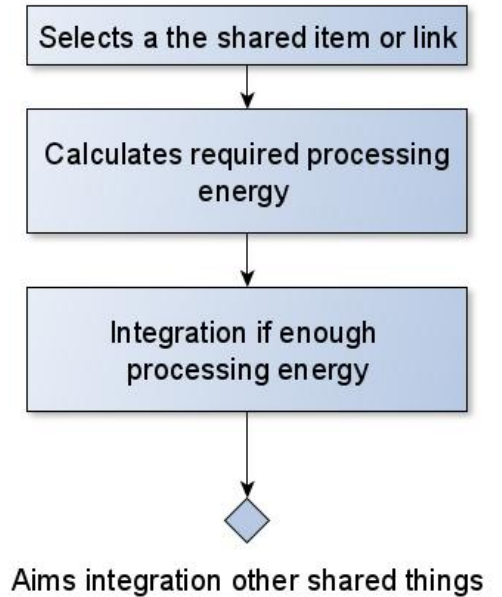
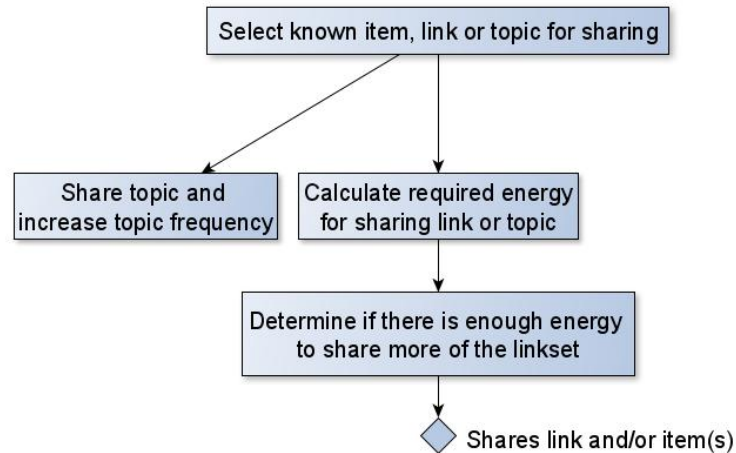
Attitude and energy

- Attitudes are asymmetrical and modify energy required for communication
- affected by
 - sharing and processing of (personal) info
 - Information already known : lower effect on attitudes.
 - preference for specific information



Model narrative

- 1) Collaborative session (content related interaction)
- 2) Integration of knowledge
- 3) Break (personal information related interaction)
- 4) Integration of knowledge



Model implementation : NetLogo + nw extension

reporting **setup** **go** **On Reporters?**

Global reporters

number_of_individuals 4

Number_of_affiliated_organisations 4

Knowledge network setting

number_of_topics 4

information_items_per_topic 10

number_of_connected_items 2

relevant_topics_per_affiliation 4

private_information_items_per_individual 2

Relevance range settings

min_value_relevant_topics_and_items -1.0

max_value_relevant_topics_and_items 1.0

Choice_relevance_distr_rel Uniform

min_value_non_relevant_topics_and_items -1.0

max_value_non_relevant_topics_and_items 1.0

Choice_relevance_distr_norm Uniform

min_attitude 0.2

max_attitude 1.0

Attitude_multiplier 1

Multiplier increases influence of attitude on processing info from certain people

Choice_item_distribution Same number

Choice_nr_connected_items_distr Same number

Choice_relevant_top_distr Uniform

percentage_private_ite... 48 %

Min_values set lower bounds for distributions. Max is either the input for an exponential function or the maximum range for uniform functions. On same number the min value is used

On Reporters?

Turns on reporters in functions for debugging

go once

percentage_of_normal_topics_known 65 %

Choice_normal_known_distr Same number

percentage_of_relevant_topics_known 65 %

Choice_relevant_known_distr Same number

min_sharing_energy 50

max_sharing_energy 182

Choice_sharing_energy_distr Uniform

min_processing_energy 63

max_processing_energy 164

Choice_processing_energy_distr Uniform

Delays the chance for breaks to happen by this amount of ticks(rounds). Allows for guaranteed information sharing beforehand.

min_delay_breaktime 23

chance_that_round_is_break 20 %

break_modifier 2

topic_frequency_modifier 0.05

learning_frequency_modifier 0.1

Weighted chances for staring to share a specific thing. The same values will lead to equal chances as long as they are higher than 0.

chance_sharing_topic 48

chance_sharing_link 48

chance_sharing_information_item 49

With relation to sharing items and links this is the chance someone starts sharing one of the two. If there is enough energy left someone may share up to two items and a single link.

sharing_cost_topic 20 **sharing_cost_item** 22 **processing_cost_item** 12

sharing_cost_link 17 **processing_cost_link** 12

energy_decay 2

The amount of energy for processing lost after each round/tick

These are not chances, but percentages that are rounded up. 33 percent of 3 information items is around 1 item that is known. Similarly 33% of 2 is 0.66, which is rounded up to 1 known information item. For distributions the value is the mean for an exponential distribution and the max for a uniform distribution.

Min_values set lower bounds for distributions. Max is either the input for an exponential function or the maximum range for uniform functions. On same number the min value is used

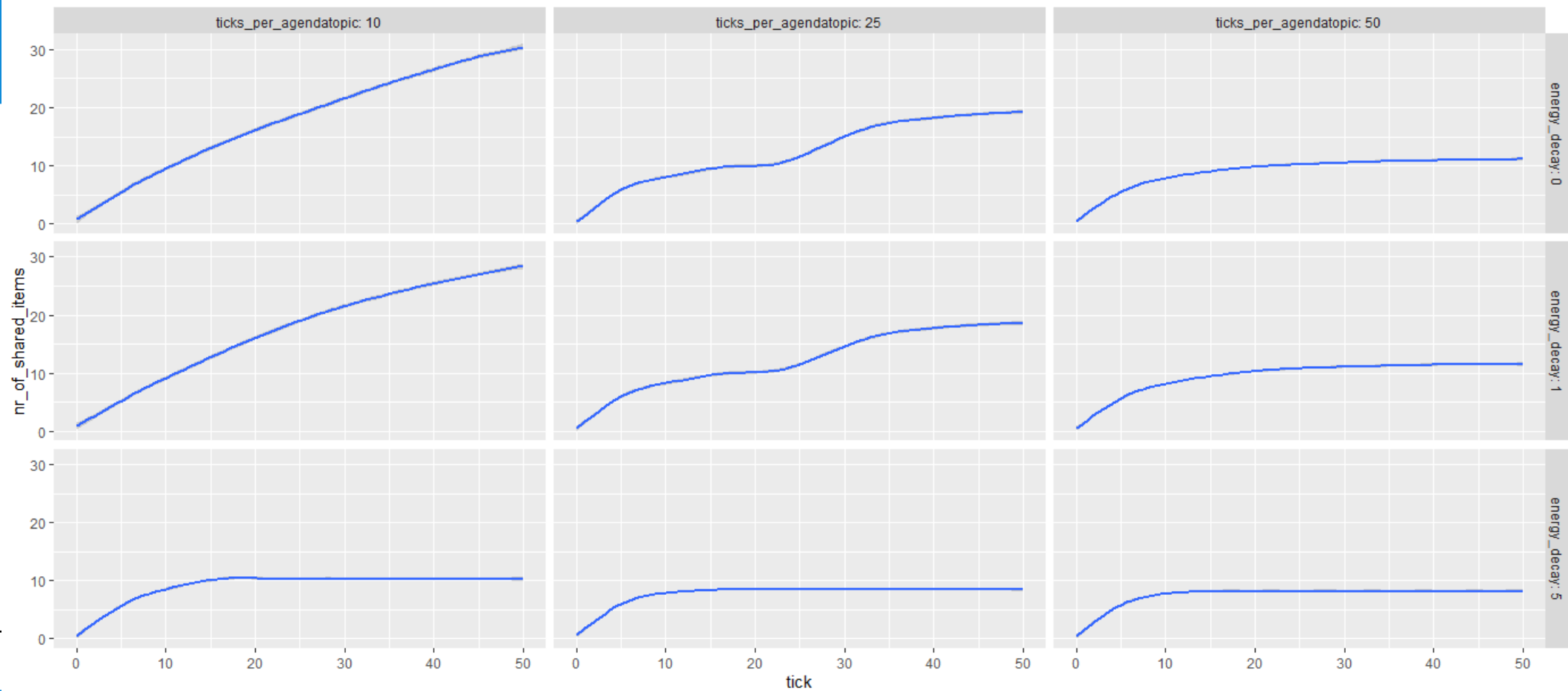
Frequency_modifiers determine the degree to which one will deem something more relevant based on it being discussed more. The break modifier determines how much energy someone has to process earlier shared information

Example experiment :

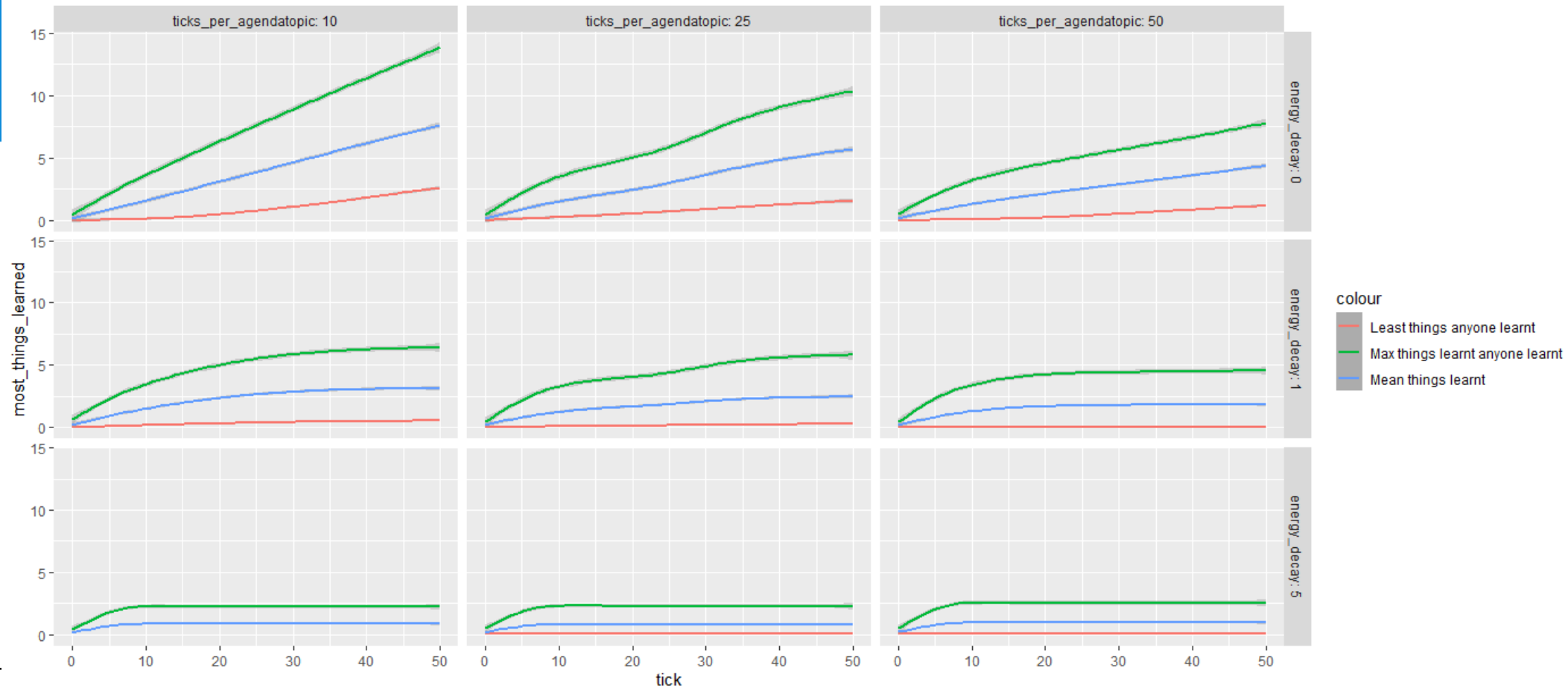
influence the process agenda

- Experiment Setup
 - 4 people , 5 topics, 15 information items,
 - 2 items of each topic have a link to another topic
 - Agenda determined which topic is discussed during round
 - Preference for sharing items and links
 - rather than discussing a whole topic
 - 50 rounds , no breaks
 - Only positive attitudes towards others
 - People are specialized in 1 topic
- We vary :
 - 5, 2 and 0 agenda changes during process
 - How tiring is the process (not, average, very)

Example outcome : Things shared at least once



Example outcome : Number of things learned



(very) Preliminary findings

- Specific:
 - Model seems to be “sane” and provide broadly intuitive outcomes
 - Agenda has clear effect on how much is shared, available energy behaves as expected
 - Systematic exploration of model behavior has just started
- General
 - Model concept is promising, and already allows fairly elaborate participatory process description
 - Sensible parametrisation will be “interesting”

Future plans

- Continue refining the theoretical framework
 - (much) more explicit modeling mechanism, loss of information due to abstraction / simplification, effect of modeling paradigm, etc
 - Diversify interaction to be dependent on form of session
- Develop sensible parametrisation
 - Case data for behavioral elements
 - Quantitative data for parametrisation
- Start thinking about a process design tool
- Expected publication of code and detailed model description ~ 2 months from now

Thank you !

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[@ComplexEvo](#)

Also on
pmcop-workspace.slack.com
and
participatorymodeling.org

