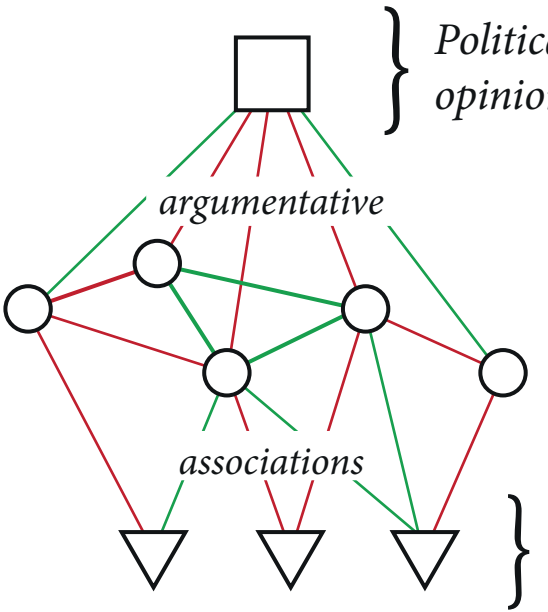
argument-based opinion dynamics

more complex & realistic representations of opinions

Multi-level Structure of Opinions/Attitudes



Political topic (issue) on which an opinion is formed

Concepts used in the argumentation about different positions on the issue

- *natural language processing*

Basic (latent) evaluative dimensions:

- *valence dimensions of adjectives*
- *basic values (Schwartz)*
- *moral foundations theory (Haidt)*

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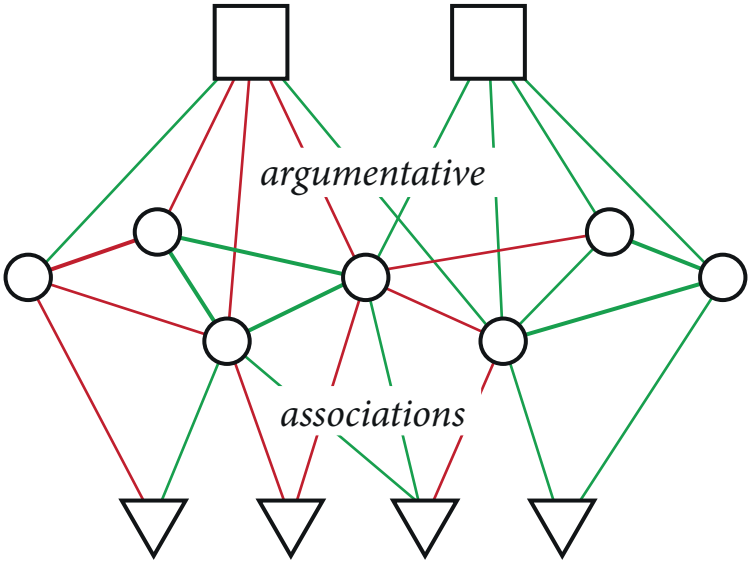
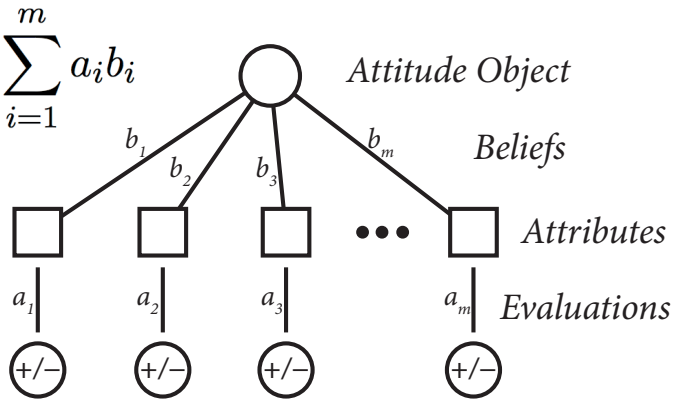


- *This framework is easily extended to multiple political issues*
- *Multiple issues are related by the concepts evoked when talking about them*
- *Future: Text analysis will be used to identify this conceptual overlap*

Basic Ideas from Attitude Theory

- *Attitudes: »a psychological tendency (e.g. behavioral disposition) that is expressed by evaluating a particular entity (attitude object) with some degree of favor or disfavor« (Eagly/Chaiken 1998)*
  - *If the attitude object is a political issue we deal with political attitudes and if the attitude is expressed we can observe it as a political opinion*

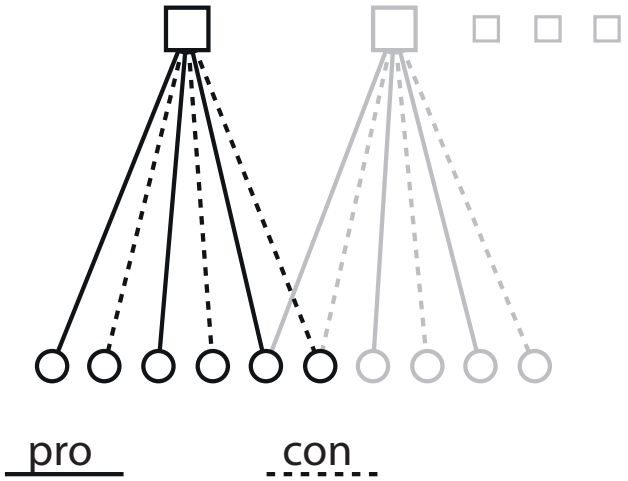
- *Expectancy-value models:* $A(o) = \sum_{i=1}^{m} a_i b_i$



»different beliefs about any given object, i.e. many different characteristics attributes, goals, and objects are positively or negatively associated with a given object« (Fishbein 1963)

Multi-Level Structure of Opinions

- *Attitudes about a series of issues and the argumentative discourses about them make reference to underlying factual dimensions*
- *Some beliefs are (cognitively or logically) related to several issues*



attitudes on political issues
(say 2 to simplify matters)

cognitive-evaluative map
(collectively shared structures of evaluative meaning determine how facts are interpreted with respect to the issues)

factual dimensions
(beliefs about the truth (1) or untruth (0) of facts modeled as binary variables are exchanged in social interaction)

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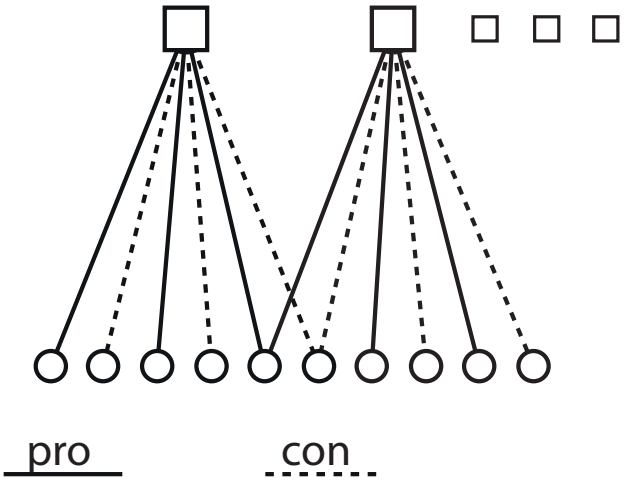

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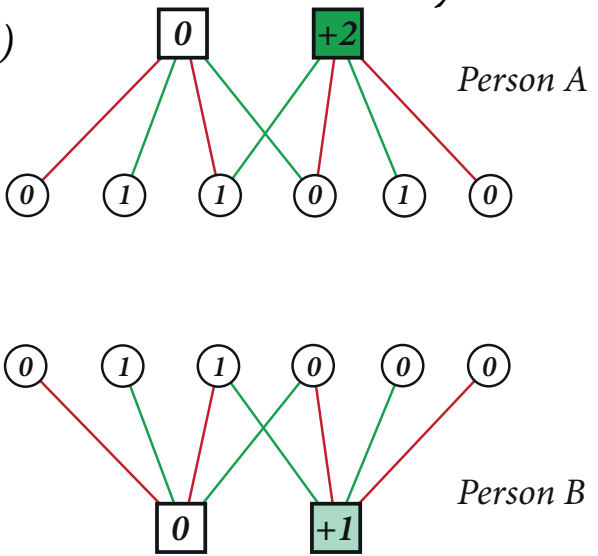
An Abstract Model of Argument Exchange

- *Models are abstractions (caricatures) of reality that allow to identify and study potentially relevant mechanisms*
- *Agent-based model: individuals interact with each other by exchanging arguments (Mäs/Flache 2013)*
- *Homophily at the attitude level: Arguments adopted if attitudes are not too different*
- *Model explains correlations between attitudes with overlapping conceptual dimensions and polarization along these lines*



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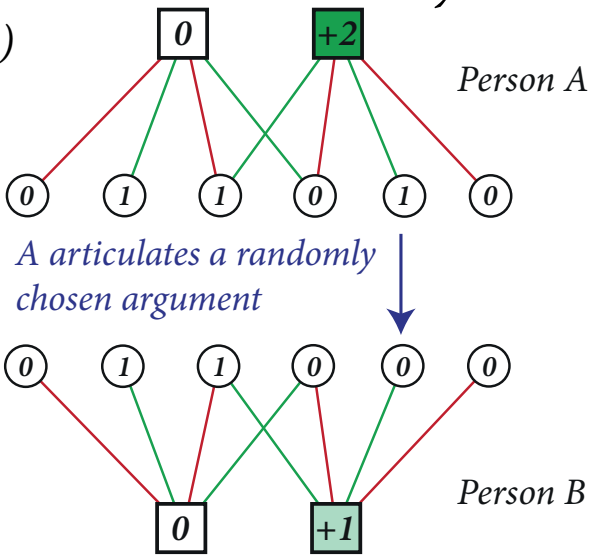

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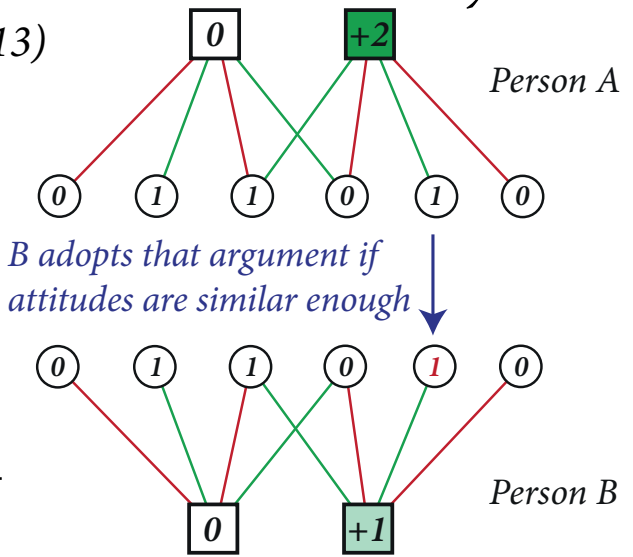

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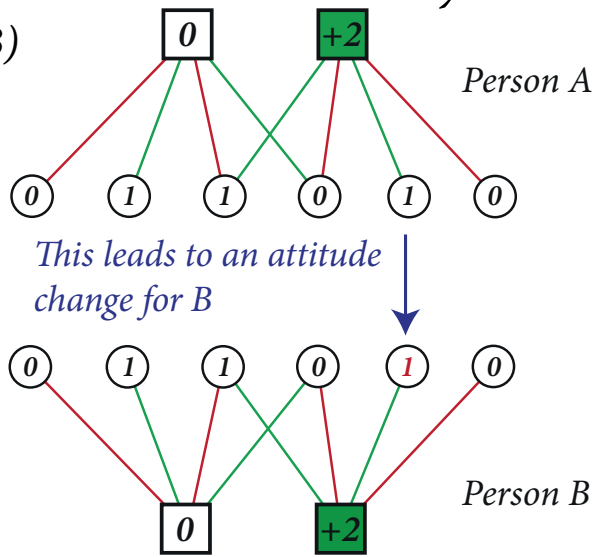
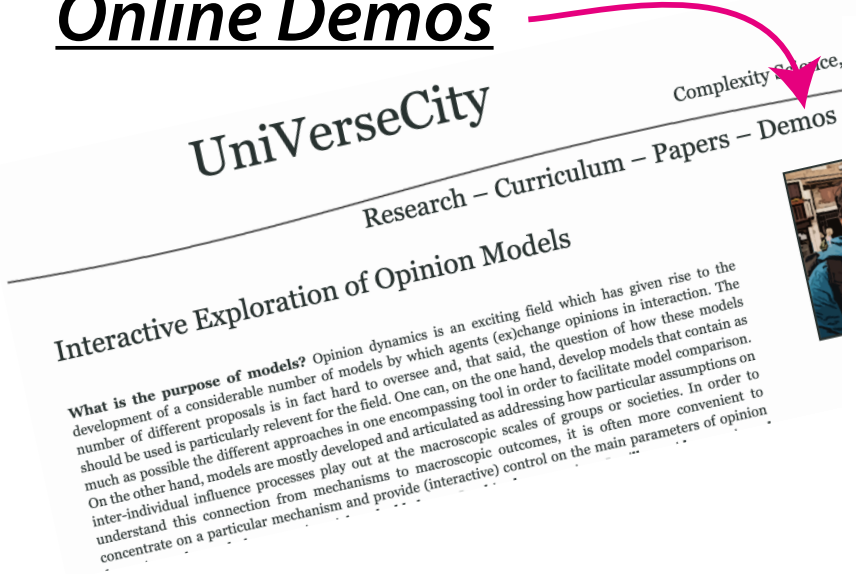


Argument Communication Theory

Online Demos



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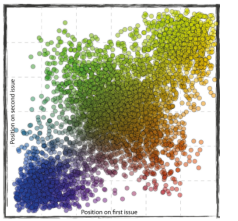
/index.php?site=demos

From Attitude Structure to Political Spaces. Arguments in a discussion often address different aspects of the issue at stake. But, some of these aspects are also relevant for other issues, which induces correlations between opinions on different issues. Those correlations could originate from factual interdependencies between the considered processes in the world, but they give also rise to ideologies and group identities which can induce further dependencies on their part. Many of the classical models of opinion dynamics studied in sociophysics are not able to address these issues. Drawing upon expectancy-value models in attitude research and the theory of conceptual spaces we developed a multi-level representation of opinions which allows to study of opinion dynamics on multiple interrelated issues. The model is based on three different ingredients: (1) interacting agents align their views regarding the significance of different argumentative domains; (2) different (partially overlapping) sets of these domains are associated with different political issues and an agent's attitude is a function of the importance assigned to the argument domains and their evaluative relevance for the issues; and (3) agents preferentially interact with other agents that hold similar attitudes. Under some conditions these combined processes give rise to polarization and reinforce correlations between attitudes towards multiple political issues. (See arxiv)



1. Argument Communication Model with 1000 agents (run it) (This version accompanies a paper that will appear in *JASSS*. See the brief guide to the model for how to use the demo.)

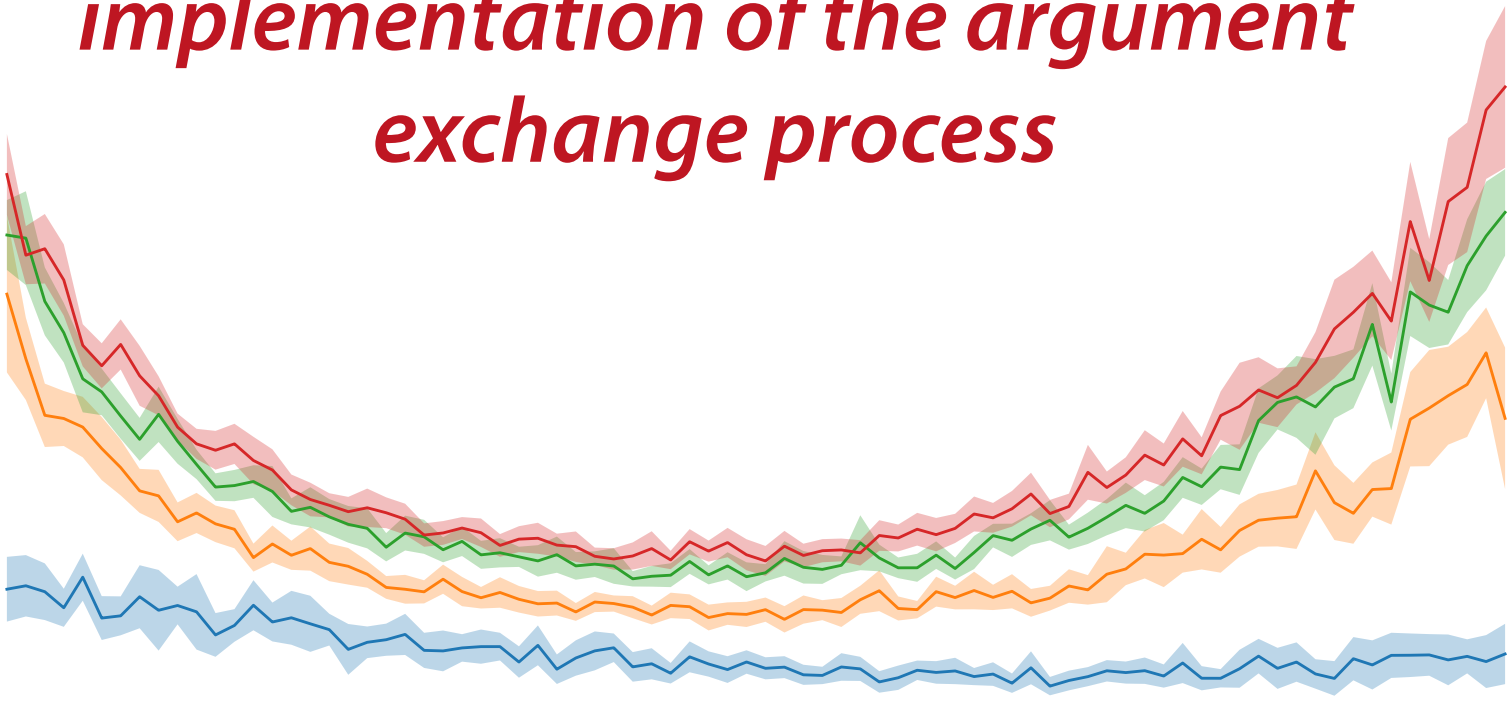
2. Argument Communication Model with 5000 agents (run it - time is ok)

Argument Communication with Biased Processing. We look at data from an experiment on biased argument processing from the perspective of the cognitive architecture employed in argument communication models of collective opinion formation. The empirical experiment realized in the context of attitudes toward energy reveals a strong tendency to consider arguments aligned with the current attitude more persuasive and to downgrade those speaking against the current attitude. This is integrated into a theoretical model of cognitive agents by assuming that the coherence of an argument with the current attitude controls the probability to adopt it and to change the attitude accordingly. The strength of this bias is included as a free parameter which can be estimated from experimental data. We find a clear signature of moderate biased processing. This tool allows to explore simulations with interacting cognitive agents that exchange arguments. It relates the opinion distributions emerging in the model to surveyed attitude distributions (coal, gas, wind, photovoltaic, biomass). A good match is found transitory periods of the model and with unbiased external information.

1. Argument Communication Model with 1078 agents (run it)

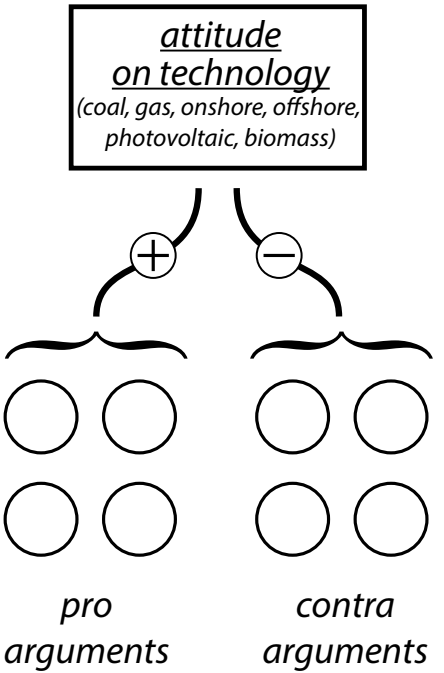
Joint Task

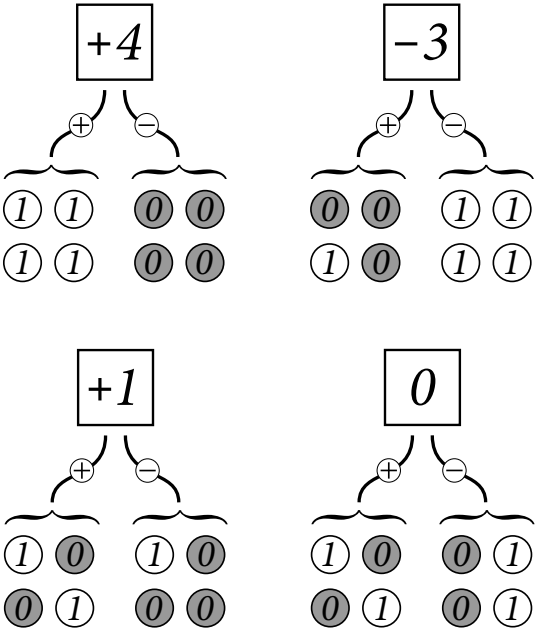
implementation of the argument exchange process



Cognitive Model of Attitudes/Opinions

► *Attitude defined as the number of pro versus con arguments*





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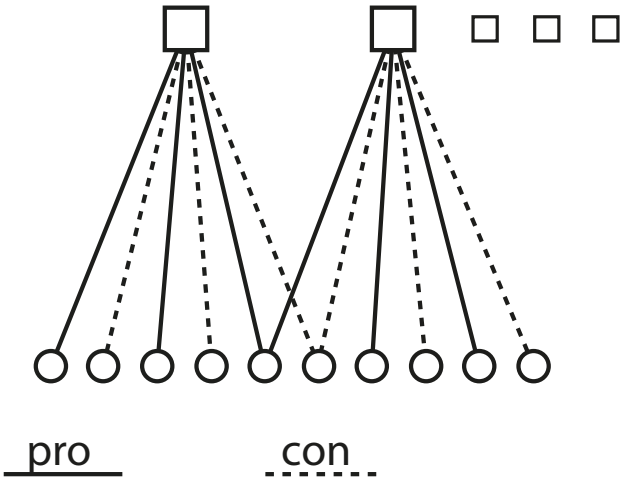

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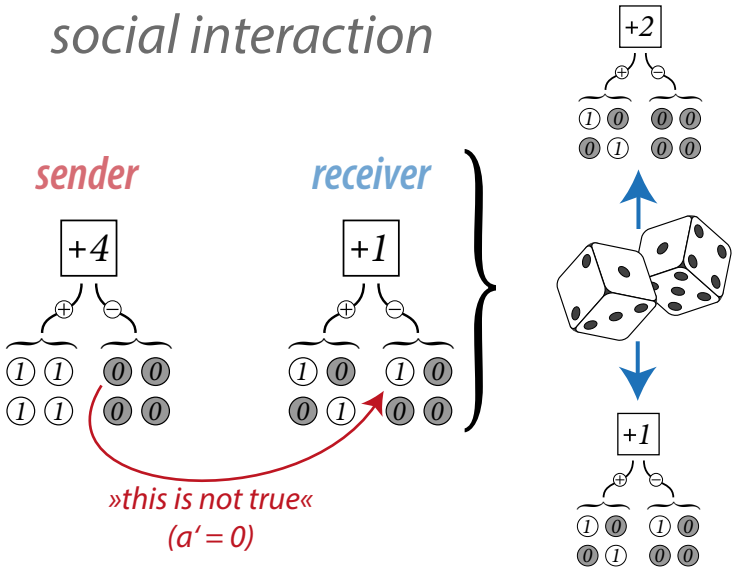
Update Process

social interaction

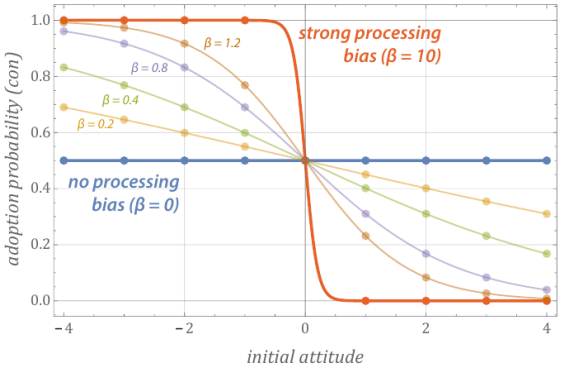


cognitive processing

1. *A number (N) of cognitive agents is paired at random.*
2. *The sender articulates a random argument to a receiver.*
3. *The receiver adopts this argument with probability 1/2 and updates its attitude accordingly.*

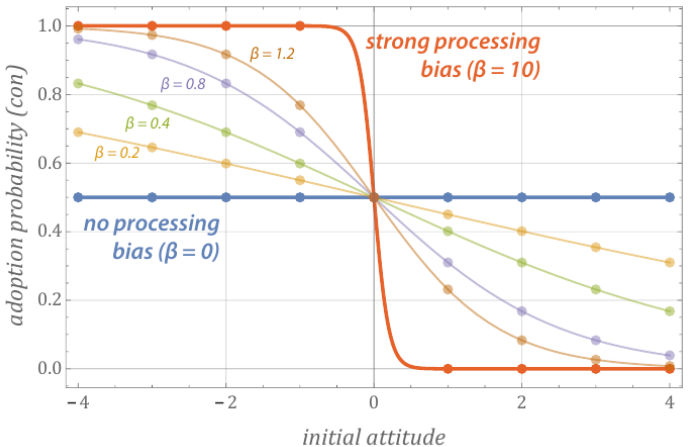
Joint Task

integration of biased processing



First Extension: Biased Argument Processing

- *Humans process information in a biased way:* ***attitude-congruent arguments are favoured over challenging ones!***
  - *Argument adoption is assumed to depend on the evaluation V(a) and the strength of biased processing β by*

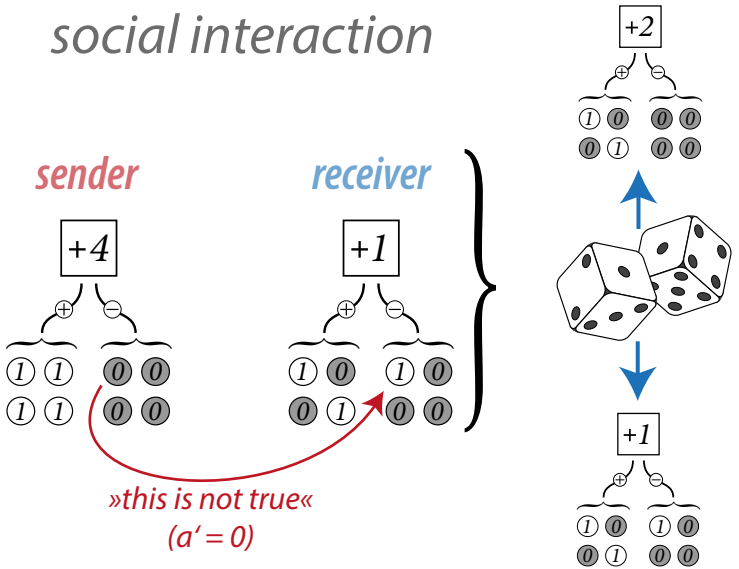


$$p_\beta(V(a_i')) = \frac{1}{1 + e^{-\beta V(a_i')}}$$

- *The free parameter* ***β*** *accounts for* ***the strength of biased processing***
- *β = 0 means unbiased adoption and if β is large only coherent arguments are adopted*

Update Process

social interaction



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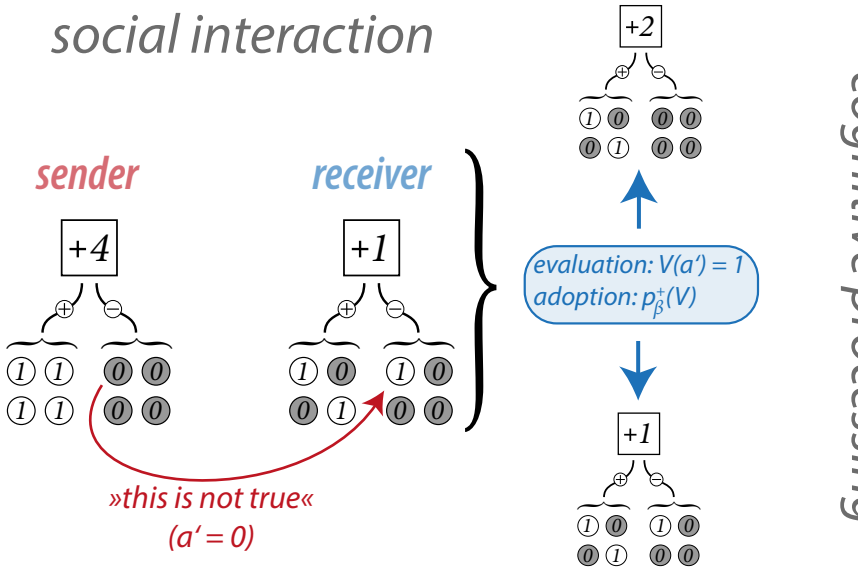

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3. *The receiver adopts this argument with probability p_β and updates its attitude accordingly.*

- *Consistent information/congruent arguments are adopted with higher probability* (Banisch/Shamon, 2022)