



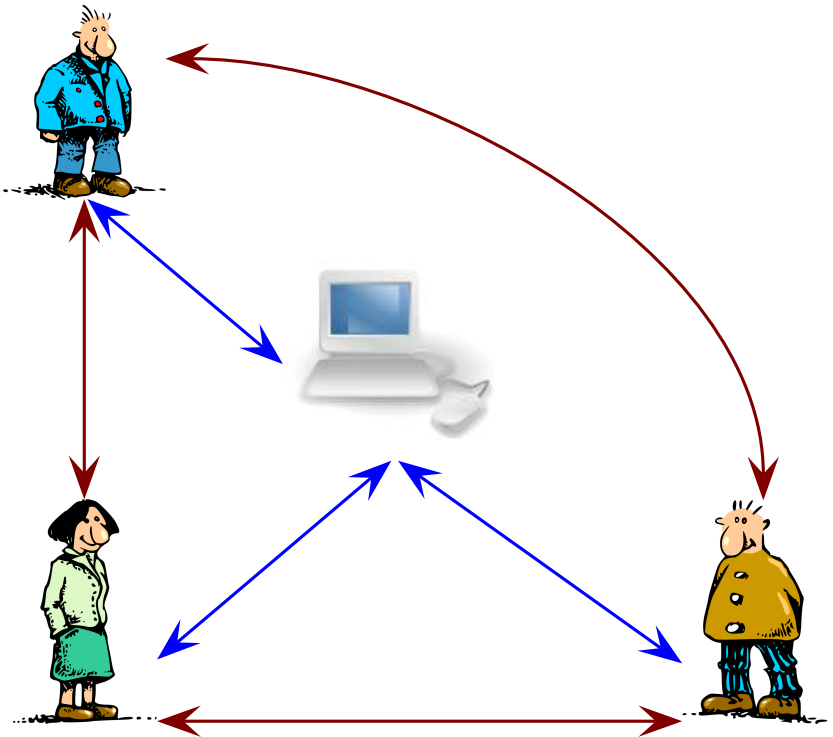
# Collective decision-making process to compose divergent interests and perspectives

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## Motivation : a collective and arguable decision-making

- **Social software**= computer tools for collaboration in a group.
- **Problem**= support a collective decision-making.
- **Requirement**= a fair effect process :
  - not to aggregate individual preferences (vote);
  - to compose divergent interests and perspectives (debate).

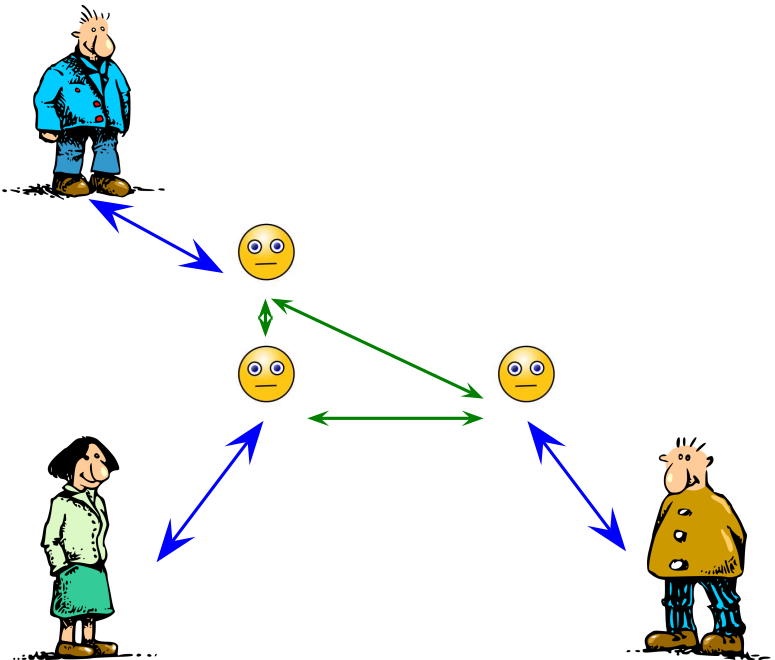


Collective decision=

- multi-actors process
- complex reasoning of actors
- collaborative process
- outcome of individual actions

## Motivation : a collective and arguable decision-making

- **Social software**= computer tools for collaboration in a group.
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Collective decision=

- multi-actors process  
⇒ *autonomous agent*
- complex reasoning of actors  
⇒ *cognitive agent*
- collaborative process  
⇒ *social agent*
- outcome of individual actions  
⇒ *framework for interaction*

**Goal : multi-agents formalization of such a decision**

## Approach : dialectics

Dialectics = design the formal area in which the argumentation process take place.

- A dialectics system [Hamblin70] =
  - a set of **participants** who assert arguable hypothesis.
  - the **commitment stores** of participants, *i.e.* data types to record commitment during dialogue.
  - a **convention**, *i.e.* a collaborative structure to communicate.

● A dialogue [Walton95] =  
**initial situation** → sequence of moves → **goal of dialogue**

## DIAL: a framework for inter-agents dialogue

Dialectics = design the formal area in which the argumentation process take place.

↪ *Framework for inter-agents dialogue*

- A dialectics multi-agents system =
  - a set of **participants** who assert arguable hypothesis.
    - ↪ *Manage conflicts*
  - the **commitment stores** of participants, *i.e.* data types to record commitment during dialogue.
    - ↪ *Reason together*
  - a **convention**, *i.e.* a collaborative structure to communicate.
    - ↪ *flexible and refined process*
  
- A dialogue =  
**initial situation** → sequence of moves → **goal of dialogue**
  - ↪ *Warrant to reach an agreement*



= Argumentative theory

$V$	$\mathcal{T}$
$v_1$	$r_{11} : \text{pres}(\text{bush}) \leftarrow \neg \text{pres}(\text{kerry})$ $r_{21} : \text{pres}(\text{kerry}) \leftarrow \neg \text{pres}(\text{bush})$
$v_2$	$r_{12}(x) : \text{weak}(x) \leftarrow \text{silly}(x)$ $r_{22}(x) : \neg \text{pres}(x) \leftarrow \text{weak}(x)$
$v_6$	$r_6 : \text{current\_pres}(\text{bush}) \leftarrow$
$v_5$	$r_5 : \text{weak}(\text{kerry}) \leftarrow$
$v_4$	$r_4 : \text{silly}(\text{bush}) \leftarrow$
$v_3$	$r_3(x) : \text{pres}(x) \leftarrow \text{current\_pres}(x)$



1 = Argumentative theory of the agent #1

$\ll_1$	$V$	$\mathcal{T}$
↑	$v_1$	$r_{11} : \text{pres}(\text{bush}) \leftarrow \neg \text{pres}(\text{kerry})$ $r_{21} : \text{pres}(\text{kerry}) \leftarrow \neg \text{pres}(\text{bush})$
	$v_2$	$r_{12}(x) : \text{weak}(x) \leftarrow \text{silly}(x)$ $r_{22}(x) : \neg \text{pres}(x) \leftarrow \text{weak}(x)$
	$v_6$	$r_6 : \text{current\_pres}(\text{bush}) \leftarrow$
	$v_5$	$r_5 : \text{weak}(\text{kerry}) \leftarrow$
	$v_4$	$r_4 : \text{silly}(\text{bush}) \leftarrow$
	$v_3$	$r_3(x) : \text{pres}(x) \leftarrow \text{current\_pres}(x)$



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	$v_5$	$r_5 : \text{weak}(\text{kerry}) \leftarrow$
	$v_4$	$r_4 : \text{silly}(\text{bush}) \leftarrow$
	$v_3$	$r_3(x) : \text{pres}(x) \leftarrow \text{current\_pres}(x)$

$A_1$

conclusion( $A_1$ ) = pres(bush)





1 = Argumentative theory of the agent #1

$\ll_1$	$V$	$\mathcal{J}$
↑	$v_1$	$r_{11} : \text{pres}(\text{bush}) \leftarrow \neg \text{pres}(\text{kerry})$ $r_{21} : \text{pres}(\text{kerry}) \leftarrow \neg \text{pres}(\text{bush})$
	$v_2$	$r_{12}(x) : \text{weak}(x) \leftarrow \text{silly}(x)$ $r_{22}(x) : \neg \text{pres}(x) \leftarrow \text{weak}(x)$
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	$v_5$	$r_5 : \text{weak}(\text{kerry}) \leftarrow$
	$v_4$	$r_4 : \text{silly}(\text{bush}) \leftarrow$
	$v_3$	$r_3(x) : \text{pres}(x) \leftarrow \text{current\_pres}(x)$

$A_2$

$A_1$

$\text{conclusion}(A_2) = \text{pres}(\text{bush})$



1 = Argumentative theory of the agent #1

$\ll_1$	$V$	$\mathcal{J}$
↑	$v_1$	$r_{11} : \text{pres}(\text{bush}) \leftarrow \neg \text{pres}(\text{kerry})$ $r_{21} : \text{pres}(\text{kerry}) \leftarrow \neg \text{pres}(\text{bush})$
	$v_2$	$r_{12}(x) : \text{weak}(x) \leftarrow \text{silly}(x)$ $r_{22}(x) : \neg \text{pres}(x) \leftarrow \text{weak}(x)$
	$v_6$	$r_6 : \text{current\_pres}(\text{bush}) \leftarrow$
	$v_5$	$r_5 : \text{weak}(\text{kerry}) \leftarrow$
	$v_4$	$r_4 : \text{silly}(\text{bush}) \leftarrow$
	$v_3$	$r_3(x) : \text{pres}(x) \leftarrow \text{current\_pres}(x)$

$A_2$

$B$

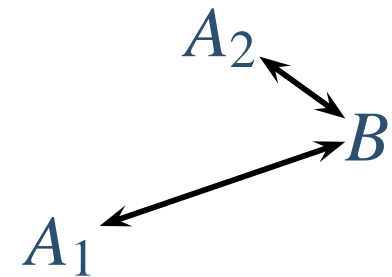
$A_1$

$\text{conclusion}(A_3) = \text{pres}(\text{kerry})$



1 = Argumentative theory of the agent #1

$\ll_1$	$V$	$\mathcal{J}$
↑	$v_1$	$r_{11} : \text{pres}(\text{bush}) \leftarrow \neg \text{pres}(\text{kerry})$ $r_{21} : \text{pres}(\text{kerry}) \leftarrow \neg \text{pres}(\text{bush})$
	$v_2$	$r_{12}(x) : \text{weak}(x) \leftarrow \text{silly}(x)$ $r_{22}(x) : \neg \text{pres}(x) \leftarrow \text{weak}(x)$
	$v_6$	$r_6 : \text{current\_pres}(\text{bush}) \leftarrow$
	$v_5$	$r_5 : \text{weak}(\text{kerry}) \leftarrow$
	$v_4$	$r_4 : \text{silly}(\text{bush}) \leftarrow$
	$v_3$	$r_3(x) : \text{pres}(x) \leftarrow \text{current\_pres}(x)$

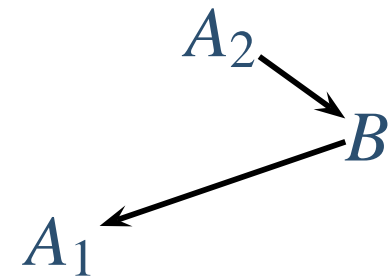


relation of attack



1 = Argumentative theory of the agent #1

$\ll_1$	$V$	$\mathcal{J}$
↑	$v_1$	$r_{11} : \text{pres}(\text{bush}) \leftarrow \neg \text{pres}(\text{kerry})$ $r_{21} : \text{pres}(\text{kerry}) \leftarrow \neg \text{pres}(\text{bush})$
	$v_2$	$r_{12}(x) : \text{weak}(x) \leftarrow \text{silly}(x)$ $r_{22}(x) : \neg \text{pres}(x) \leftarrow \text{weak}(x)$
	$v_6$	$r_6 : \text{current\_pres}(\text{bush}) \leftarrow$
	$v_5$	$r_5 : \text{weak}(\text{kerry}) \leftarrow$
	$v_4$	$r_4 : \text{silly}(\text{bush}) \leftarrow$
	$v_3$	$r_3(x) : \text{pres}(x) \leftarrow \text{current\_pres}(x)$

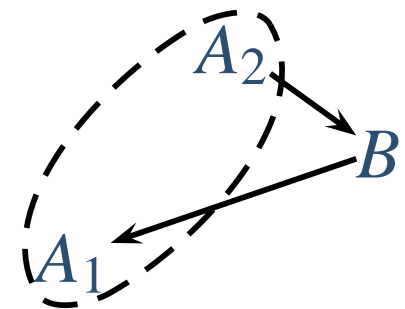


relation of defeat



$\mathcal{T}_1$  = Argumentative theory of the agent #1

$\llcorner_1$	$V$	$\mathcal{T}$
↑	$v_1$	$r_{11} : \text{pres}(\text{bush}) \leftarrow \neg \text{pres}(\text{kerry})$ $r_{21} : \text{pres}(\text{kerry}) \leftarrow \neg \text{pres}(\text{bush})$
	$v_2$	$r_{12}(x) : \text{weak}(x) \leftarrow \text{silly}(x)$ $r_{22}(x) : \neg \text{pres}(x) \leftarrow \text{weak}(x)$
	$v_6$	$r_6 : \text{current\_pres}(\text{bush}) \leftarrow$
	$v_5$	$r_5 : \text{weak}(\text{kerry}) \leftarrow$
	$v_4$	$r_4 : \text{silly}(\text{bush}) \leftarrow$
	$v_3$	$r_3(x) : \text{pres}(x) \leftarrow \text{current\_pres}(x)$

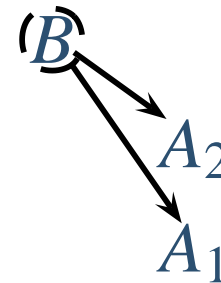


acceptability



$\mathcal{A}_2$  = Argumentative theory of the agent #2

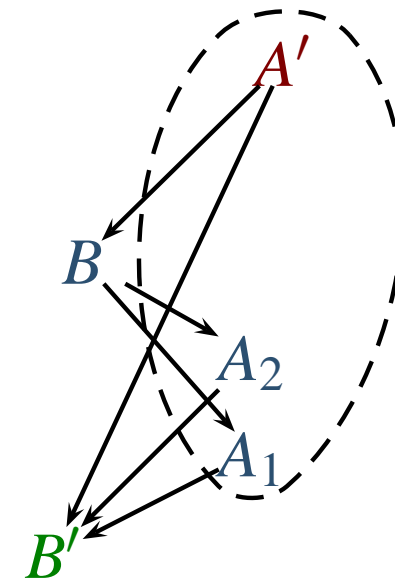
$\llcorner_2$	$V$	$\mathcal{J}$
↑	$v_1$	$r_{11} : \text{pres}(\text{bush}) \leftarrow \neg \text{pres}(\text{kerry})$ $r_{21} : \text{pres}(\text{kerry}) \leftarrow \neg \text{pres}(\text{bush})$
	$v_2$	$r_{12}(x) : \text{weak}(x) \leftarrow \text{silly}(x)$ $r_{22}(x) : \neg \text{pres}(x) \leftarrow \text{weak}(x)$
	$v_3$	$r_3(x) : \text{pres}(x) \leftarrow \text{current\_pres}(x)$
	$v_4$	$r_4 : \text{silly}(\text{bush}) \leftarrow$
	$v_5$	$r_5 : \text{weak}(\text{kerry}) \leftarrow$
	$v_6$	$r_6 : \text{current\_pres}(\text{bush}) \leftarrow$





$\mathcal{T}_2 =$  Extended argumentative theory of the agent #2

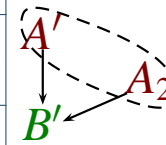
$\ll_2^*$	$V_2^*$	$\mathcal{T}_2^*$
↑	$v_1$	$r_{11} : \text{pres}(\text{bush}) \leftarrow \neg \text{pres}(\text{kerry})$ $r_{21} : \text{pres}(\text{kerry}) \leftarrow \neg \text{pres}(\text{bush})$
	$v_2$	$r_{12}(x) : \text{weak}(x) \leftarrow \text{silly}(x)$ $r_{22}(x) : \neg \text{pres}(x) \leftarrow \text{weak}(x)$
	$v_1^2$	$\{\text{pres}(\text{bush}) \leftarrow\} = \text{CS}_1^2$
	$v_3$	$r_3(x) : \text{pres}(x) \leftarrow \text{current\_pres}(x)$
	$v_4$	$r_4 : \text{silly}(\text{bush}) \leftarrow$
	$v_5$	$r_5 : \text{weak}(\text{kerry}) \leftarrow$
	$v_6$	$r_6 : \text{current\_pres}(\text{bush}) \leftarrow$
	$v_3^2$	$\{\text{pres}(\text{kerry}) \leftarrow\} = \text{CS}_3^2$



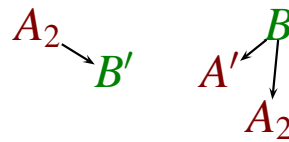
# Dialectics system: warrant to reach an agreement



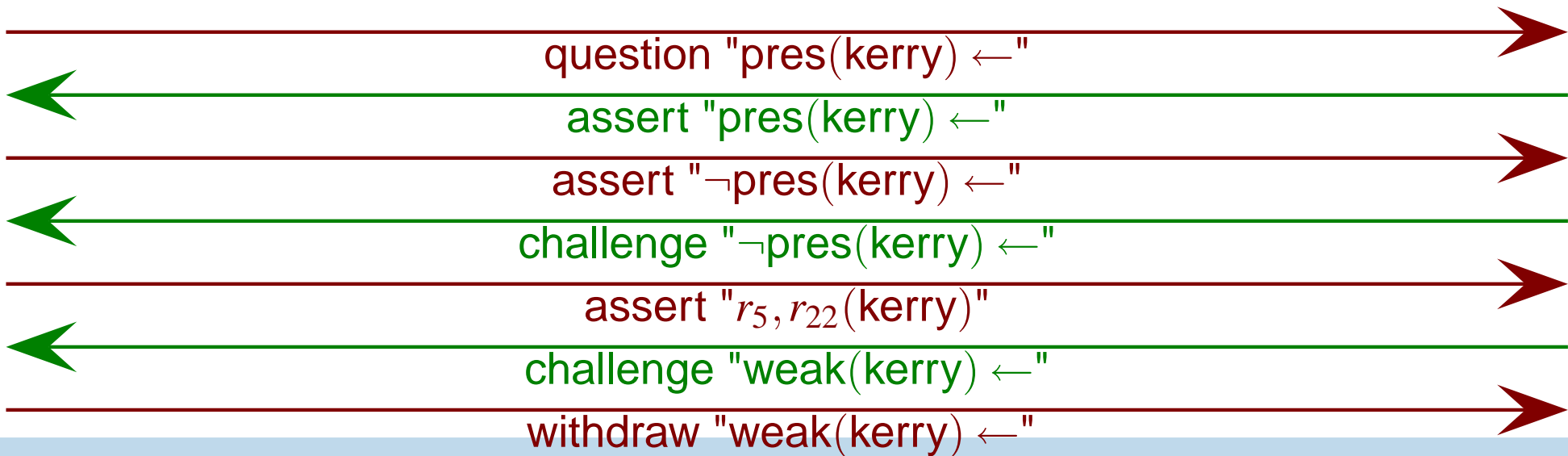
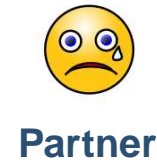
$\ll^*_{wit}$	$V^*_{wit}$	$\mathcal{T}^*_{wit}$
↑	$v_1$	$r_{11} : \text{pres}(\text{bush}) \leftarrow \neg\text{pres}(\text{kerry})$ $r_{21} : \text{pres}(\text{kerry}) \leftarrow \neg\text{pres}(\text{bush})$
	$v_2$	$r_{12}(x) : \text{weak}(x) \leftarrow \text{silly}(x)$ $r_{22}(x) : \neg\text{pres}(x) \leftarrow \text{weak}(x)$
	$v^{\text{wit}}_{\text{init}}$	$\neg\text{pres}(\text{kerry}) \leftarrow$ $\text{weak}(\text{kerry}) \leftarrow$
	$v^{\text{wit}}_{\text{part}}$	$\text{pres}(\text{kerry}) \leftarrow$



$\ll^*_{\text{init}}$	$V^*_{\text{init}}$	$\mathcal{T}^*_{\text{init}}$
↑	$v_1$	$r_{11} : \text{pres}(\text{bush}) \leftarrow \neg\text{pres}(\text{kerry})$ $r_{21} : \text{pres}(\text{kerry}) \leftarrow \neg\text{pres}(\text{bush})$
	$v_2$	$r_{12}(x) : \text{weak}(x) \leftarrow \text{silly}(x)$ $r_{22}(x) : \neg\text{pres}(x) \leftarrow \text{weak}(x)$
	$v_5$	$r_5(x) : \text{weak}(\text{kerry}) \leftarrow$
	$v^{\text{init}}_{\text{part}}$	$\text{pres}(\text{kerry}) \leftarrow$



$\mathcal{T}^*_{\text{part}}$	$V^*_{\text{part}}$	$\ll^*_{\text{part}}$
$r_{11} : \text{pres}(\text{bush}) \leftarrow \neg\text{pres}(\text{kerry})$ $r_{21} : \text{pres}(\text{kerry}) \leftarrow \neg\text{pres}(\text{bush})$	$v_1$	↑
$r_{12}(x) : \text{weak}(x) \leftarrow \text{silly}(x)$ $r_{22}(x) : \neg\text{pres}(x) \leftarrow \text{weak}(x)$	$v_2$	
$r_4 : \text{silly}(\text{bush}) \leftarrow$	$v_4$	
$\neg\text{pres}(\text{kerry}) \leftarrow$ $\text{weak}(\text{kerry}) \leftarrow$	$v^{\text{part}}_{\text{init}}$	





## Conclusions

- **DIAL** : *A formal framework for inter-agents dialogue*
  - ↳ *Formalization of an arguable and collective decision-making*
- *Model of reasoning, i.e.*
  - value-based argumentation logic**
  - ↳ *Manage conflicts*
- *Model of argumentative agents, i.e.*
  - a model of social agents**
  - ↳ *Reason together*
- *Dialectics multi-agents system, i.e.*
  - a formal area to arbitrate**
  - ↳ *Warrant to reach an agreement*

# References

- Title
- Motivation
- Dialectics
- Argumentation
- Agents
- Dialectics system
- Conclusion
- References

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