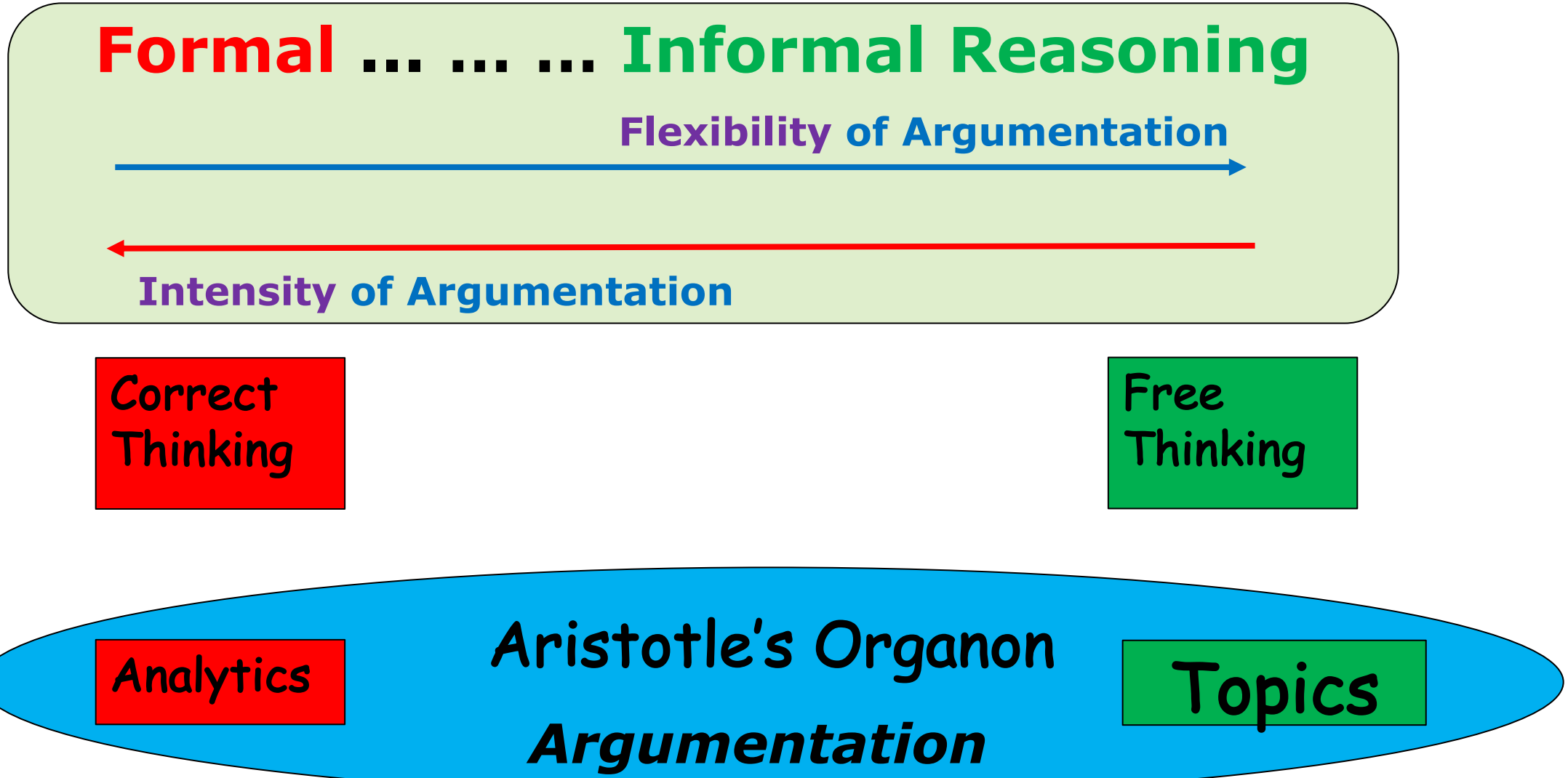
# Argumentation: Reasoning Universalis

**Antonis Kakas**
**University of Cyprus**

## 13th Panhellenic Logic Symposium

**Volos, Greece**
**6-10 July, 2022**

# Argumentation: Reasoning Universalis



# Acceptability of Arguments
# <Args, ATT>

***Acc(Δ,Δ′)*: Set *Δ* is acceptable relative to a set *Δ′***

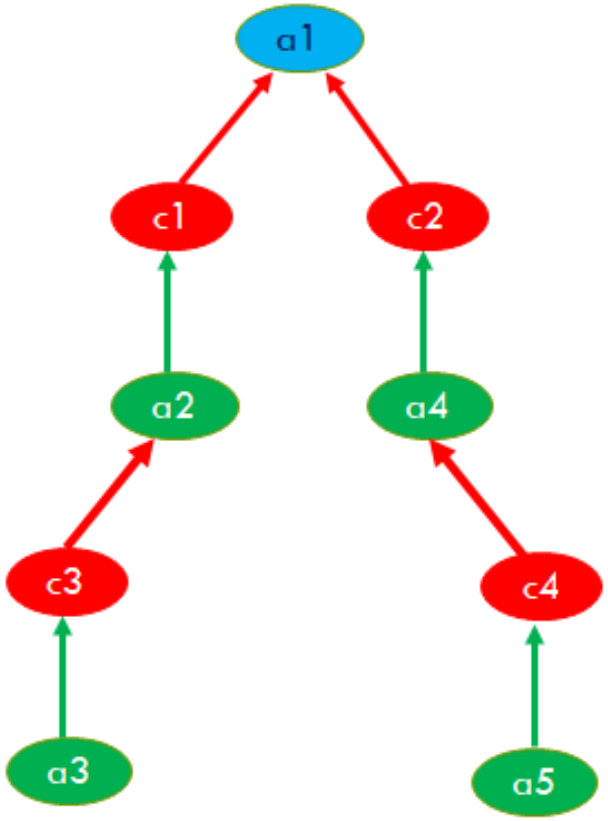
- ***Acc(Δ,Δ′)*** iff $\Delta \subseteq \Delta'$, or
  for any *A* that **attacks** *Δ*: $\neg Acc(A, \Delta' \cup \Delta)$.
- ***Acc(Δ,Δ′)*** iff $\Delta \subseteq \Delta'$, or
  for any **A** that **attacks** *Δ*: **A** $\notin \Delta' \cup \Delta$
  there exists **D** that **attacks A**
  such that $Acc(D, \Delta' \cup \Delta \cup A)$.
- ***Acc(-,-)*** is the **least fixed point of the *Acc operator***.

*Δ* is **acceptable** iff **Acc(Δ,{})** holds

# Acceptability of Arguments

## <Args, ATT>

Computational Argumentation (AI)




**Terminating cases for acceptability:**

1) A **defence** belongs to earlier **defences**, e.g. **a3= a2 (or a1)**

2) A **defence** belongs to earlier **attacks**, e.g. **a3= c1 (or c3 )** **i.e. c1 is self-defeating**

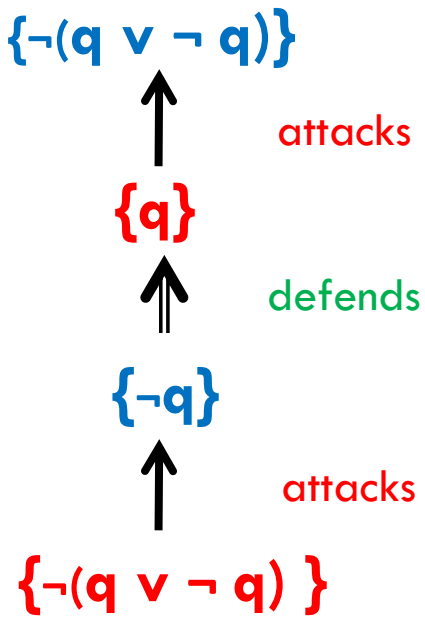
**Non-acceptability:** **an attack belongs to earlier branch, attack or defence.**

# Argumentation Logic ≈ Propositional Logic

- **Technically, this result rests on the recognition of structurally inherent (context-independent) fallacious arguments as self-defeating arguments:**
  - **Δ self-defeating iff has a counter-argument, A:**
    - **non-Acc(A,{})**
    - **Acc(A, Δ)**
- **Identification with Reduction ad Absurdum:**
  - **[ φ … ⊥ ] ↔ hyp(φ) is self-defeating**

# Deduction via (Relativistic) Argumentation

**Excluded Middle Law:** $q \vee \neg q$




**Posited Argument is given temporary preference.**

# Argumentation Logic
# Beyond Classical Logic

- **Argumentation Logic applies unchanged when premises in T are classically inconsistent**
  - **Models -→ Cases (Sets of acceptable arguments)**
  - **No explosion or trivialization.**
  - **No paradoxes – Agnostic.**
- **Just extend Preferences e.g.**
  - **Directly conflicting subsets of T defend each other**
  - **Domain Preferences on the premises T**
  - **Domain Relative Strength on arguments/proofs**

# Argumentation for Human Reasoning

## Through Preference-based argumentation

- **Where are the preferences?**
  - Policy Requirements
  - Expert Knowledge
  - Common Sense Knowledge
  - Human Personal Biases

Legal Reasoning
Medical Diagnosis
Comprehension
Debate

Strictness of reasoning

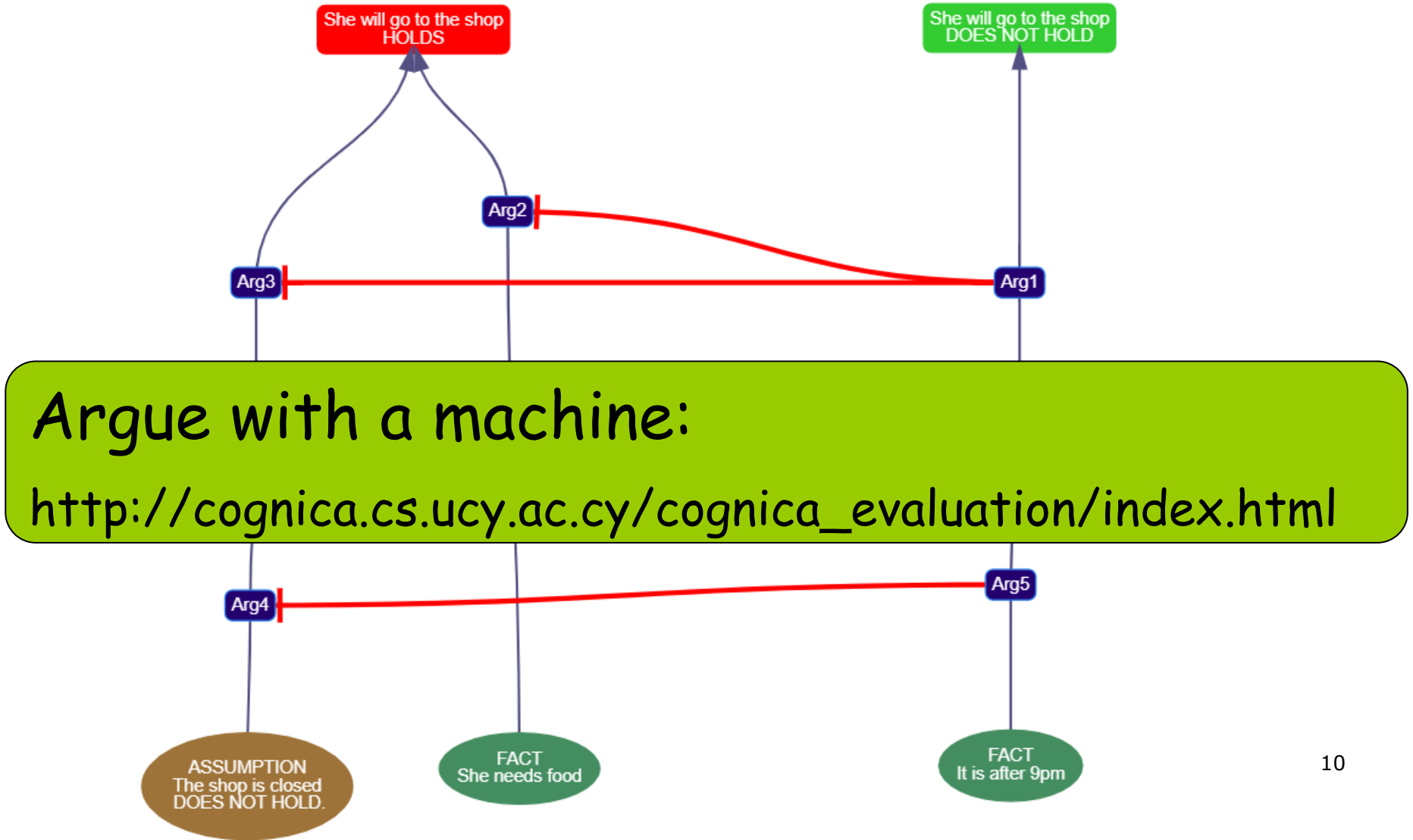
- **How do we program preferences?**
  - We don't. We capture/learn preferences.

# COGNICA (Reasoning Pathways)

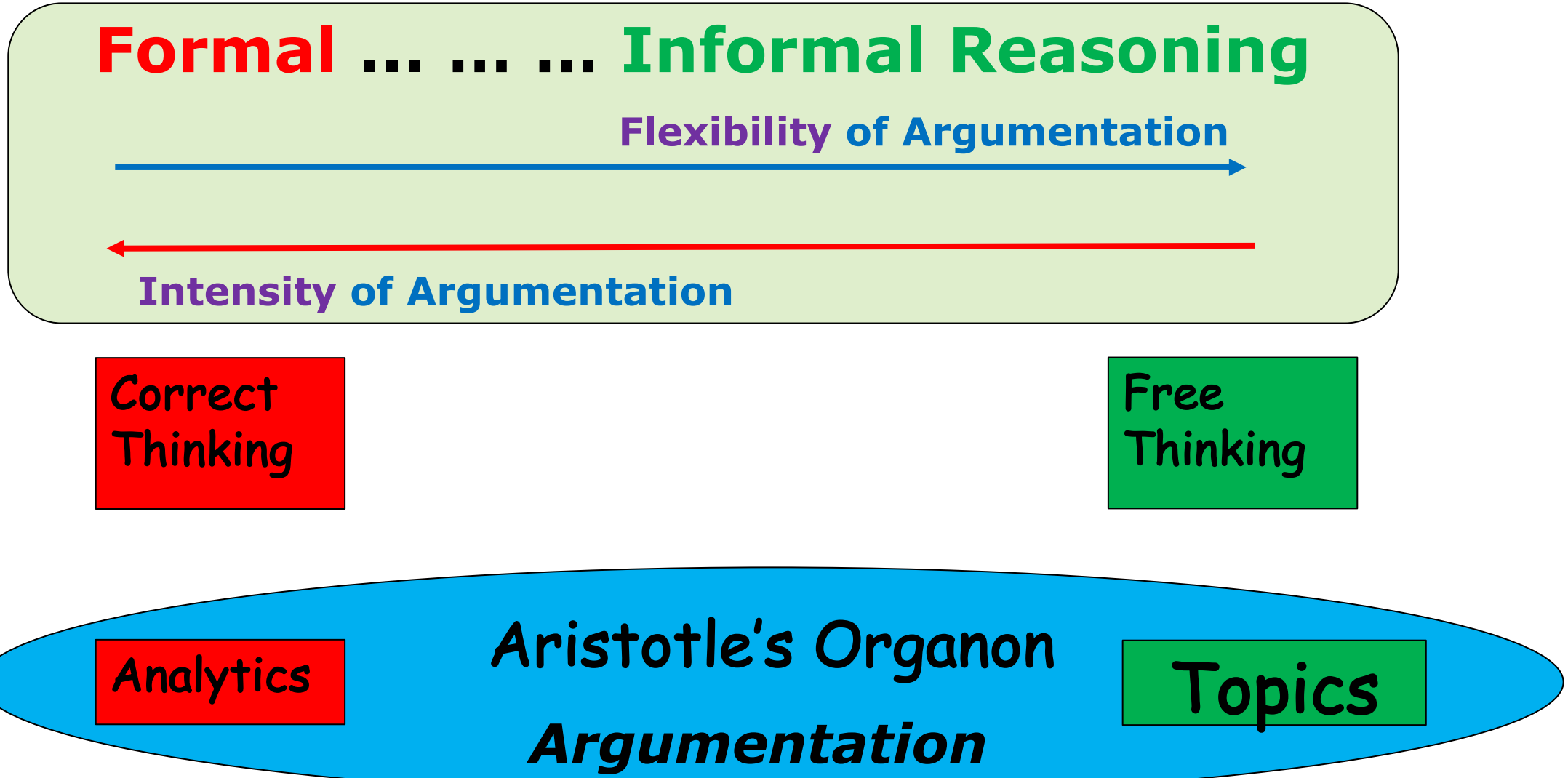
**1. If she needs food then she will go to the shop**
**2. If it is after 9pm then the shop is closed.**

**BK** Only if the shop is not close she go to the shop.

**Grice's Maxim:** Before 9pm then the shop is not closed.



# Aristotle: Argumentation



# Aristotle's Argumentation: Topics

- **Background Comments:**
  - **Precedes Analytics?**
  - **First Study of a System of Human Reasoning.**

- **Main elements of study are the TOPOI:**
  - **"Recipes" for Pragmatically Effective Argumentation**
    - **Four categories of Position- "Predicables"**
    - **Prescription and Strategy to Dialectically support each**
    - **Today: Argument Schemes & Cognitive Heuristics**

# Aristotle's Argumentation: Topics

## Uniform Abstract Structure of all Topoi

- **Scene: Dialectic Argumentation Process**
- **Actors: Pro & Con – Questioner & Answerer**
  - **Avoid Self-Refutation OR Bring Self-refutation**
- **Process:**
  - **Opening – set the Position**
  - **Interrogation – collect agreed premises**
  - **Conclusion – Reveal the self-refutation**
    - **As a (syllogistic) counter-argument to the position whose premises have been agreed.**

# Aristotle's Argumentation Logic

**Questioner - Answerer**

**Stage A - Openning**
Thebes is a thread?
Wage war on Thebes?

**Stage B - Interrogation**
Sparta will be threatened?
Sparta will wage war us?

Need allies to defend (or prevent) Sparta attack?
Only ally is Thebes?

Cannot have an ally that we are attacking!

**Stage C - Conclusion**
Waging war on Thebes is **not** reasonable.

**Dialectic Argumentation**

**Position:** "War on Thebes"
a1 = Athens should wage war on Thebes as it poses a thread.

c1= Sparta will consider us a thread and will wage war on us.

d1= Defend against Sparta with Thebes an ally.

a1′ = War on Thebes prevents us it as an ally!

**Position cannot** be defended against its counter-argument.

**Computational Argumentation**


**a1** is **self-defeating** so **not** acceptable

# Aristotle's: Topics TODAY

**Topoi: "Algorithms" for valid and effective argumentation**

**Argumentation in AI**

**- See Conclusions of Paper: Reenact the study of Topoi**

**- See following video narrated by Stephen Fry:**

- **Why Argument Technology?**