

Cognitive Systems

Argument & Cognition

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- **Realization of Argumentation in Practice**
- **Preference-based argumentation suitable for cognition?**
- **Aim: Argue the case for (preference-based) argumentation for Cognitive Reasoning**
 - **Case for dialectical acceptability semantics**

AL-Dialectic Argumentation in Practice

- **Reasoning about Actions and Change**
 - ▣ Frame, Ramification and Qualification problems
 - ▣ Narrative Text Comprehension
 - STAR System: <http://cognition.ouc.ac.cy/star>
- **Non-monotonic learning (from 1995)**
 - ▣ Learning **argumentation theories of** defeasible concepts – associations
 - Knowledge from Data Analytics
 - Commonsense Knowledge from associations in text.
 - ▣ **Induction produces arguments (not strict rules)**

AL Dialectic Argumentation

Reasoning about Actions and Change

Comprehension: “The power cut had turned the house into darkness. Bob came home and turned on the light switch. ...”

- {power_cut@T⁰, darkness@T⁰, turn_on_switch@T}

- **Arguments** {a1,a2,a3}

- a1={turn_on_switch \rightsquigarrow light_on ; light_on \rightsquigarrow \neg darkness}

- a2={power_cut \rightsquigarrow \neg electricity ; \neg electricity \rightarrow \neg light_on}

- a3={darkness@T \rightsquigarrow darkness@T⁺}

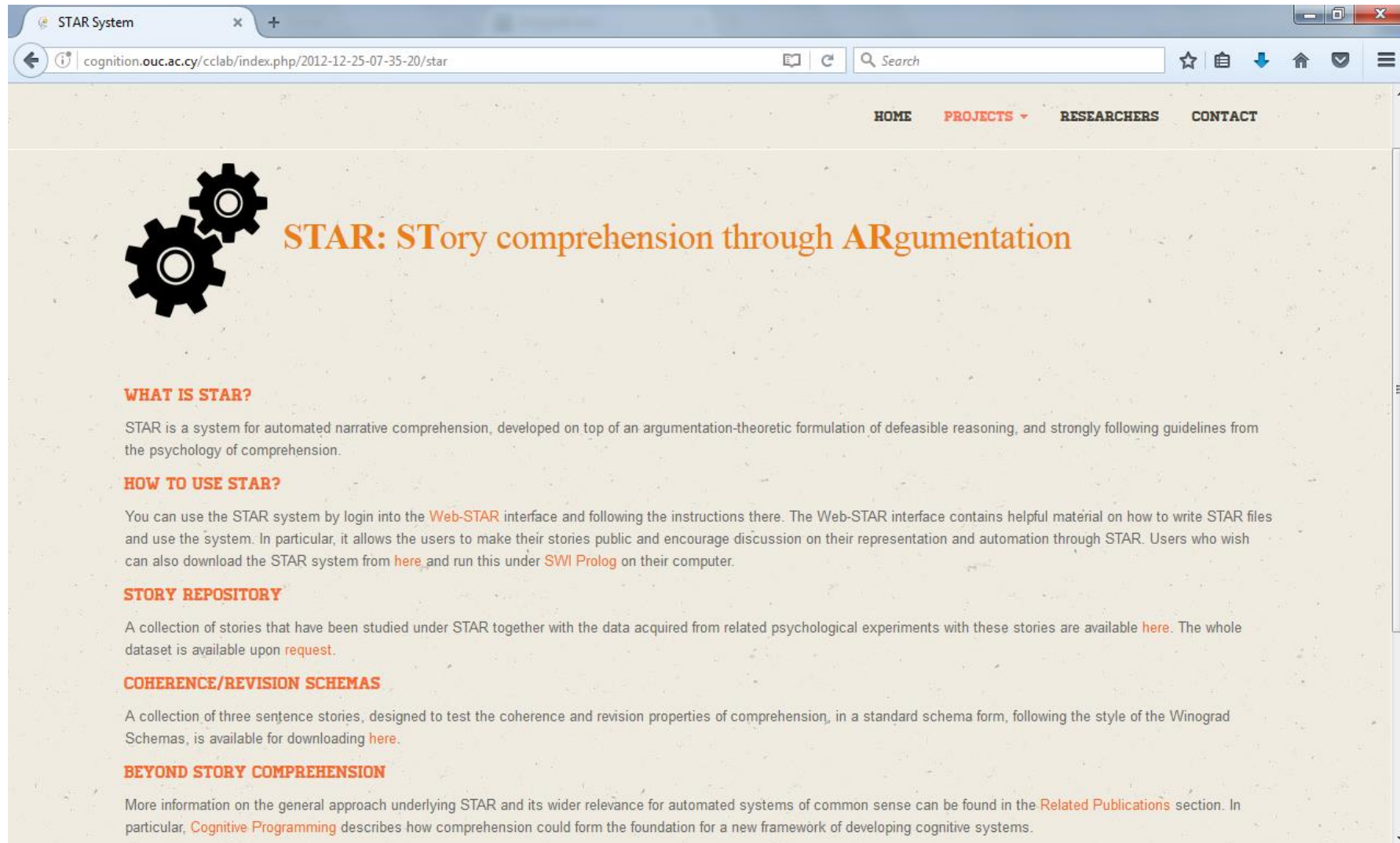
- a1 **supports** \neg darkness@T⁺ ; a3 **supports** darkness@T⁺

AL Dialectic Argumentation

Reasoning about Actions and Change

- **Arguments** = $\{a1, a2, a3\}$
- **Attacks** = $\{(a1, a3), (a2, a1)\} \cup \{(a3, a1), (a1, a2)\}$
- **Defense** = $\{(a1, a3), (a2, a1)\}$
 - **Causality Arguments** \supset **Persistence Arguments**
 - **Precondition Arguments** \supset **Causality Arguments**
- $\{a3\}$ (and $\{a2\}$) are **acceptable** arguments
 - **Comprehension**: “**House remains in darkness**” via $a3$

STAR: STory Comprehension via ARgumentation



The screenshot shows a web browser window with the address bar displaying 'cognition.ouc.ac.cy/cclab/index.php/2012-12-25-07-35-20/star'. The website has a navigation menu with links for HOME, PROJECTS, RESEARCHERS, and CONTACT. The main content area features a logo of two interlocking gears and the title 'STAR: STory comprehension through ARgumentation'. Below the title, there are five sections: 'WHAT IS STAR?', 'HOW TO USE STAR?', 'STORY REPOSITORY', 'COHERENCE/REVISION SCHEMAS', and 'BEYOND STORY COMPREHENSION'. Each section contains a brief description of the system or resources available.

STAR: STory comprehension through ARgumentation

WHAT IS STAR?

STAR is a system for automated narrative comprehension, developed on top of an argumentation-theoretic formulation of defeasible reasoning, and strongly following guidelines from the psychology of comprehension.

HOW TO USE STAR?

You can use the STAR system by login into the [Web-STAR](#) interface and following the instructions there. The Web-STAR interface contains helpful material on how to write STAR files and use the system. In particular, it allows the users to make their stories public and encourage discussion on their representation and automation through STAR. Users who wish can also download the STAR system from [here](#) and run this under [SWI Prolog](#) on their computer.

STORY REPOSITORY

A collection of stories that have been studied under STAR together with the data acquired from related psychological experiments with these stories are available [here](#). The whole dataset is available upon [request](#).

COHERENCE/REVISION SCHEMAS

A collection of three sentence stories, designed to test the coherence and revision properties of comprehension, in a standard schema form, following the style of the Winograd Schemas, is available for downloading [here](#).

BEYOND STORY COMPREHENSION

More information on the general approach underlying STAR and its wider relevance for automated systems of common sense can be found in the [Related Publications](#) section. In particular, [Cognitive Programming](#) describes how comprehension could form the foundation for a new framework of developing cognitive systems.

HR from Cognitive Psychology

- Features of human reasoning **compatible** with **argumentation**:
 - Handles **conflicts** / no absolute knowledge.
 - **Tentative** conclusions / revises when surprised.
 - Human **biases** influence the reasoning.
 - **Justification** of conclusion / decision matters.
 - Human reasoning is “**on demand**” / **dialectical**.
- Argument is **native** to human reasoning.
 - Argumentation offers **unified** perspective of empirical psychological evidence on nature of human reasoning (Mercier & Sperber).

Argument and Cognition

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- **Cognition** via **Preference-based** Argumentation
 - **Preferences** come from **human biases**
 - **Generic biases** e.g. as seen in **Comprehension**
 - **Personal interests/motivations**
 - **Cognitive** Decision Making
 - **Personal preferences** in **argumentation**
 - **Personalized** and **adaptive** decision making
 - **Cognitive Systems** put all these **preference –based argumentation** elements together
- Cognitive Programming**

Gorgias-B: Cognitive Preferences

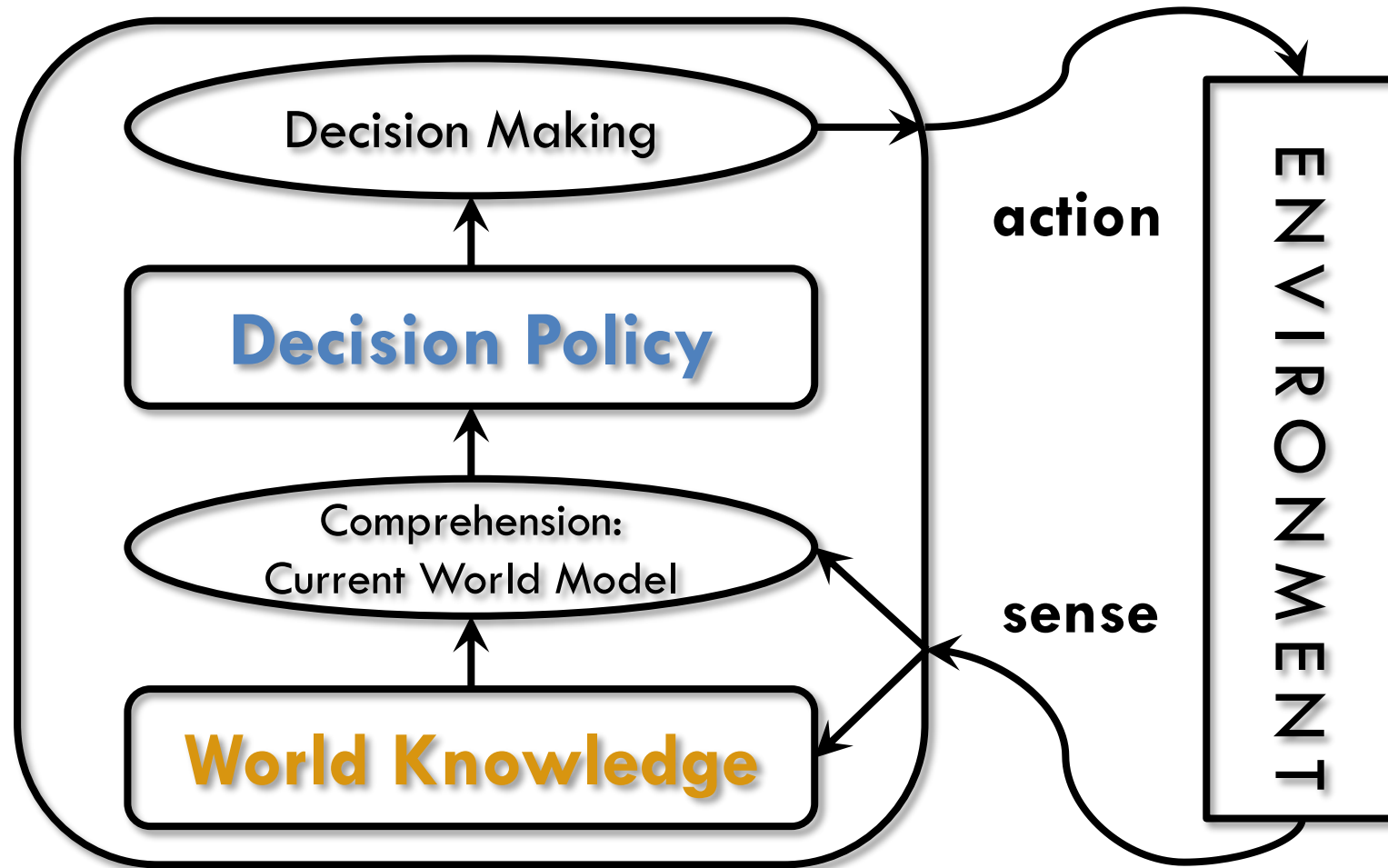
- **Example: Call Assistant**

- Generally, when working (prefer to) allow family calls
- When busy prefer to hold calls
 - Except when there is an emergency at home.

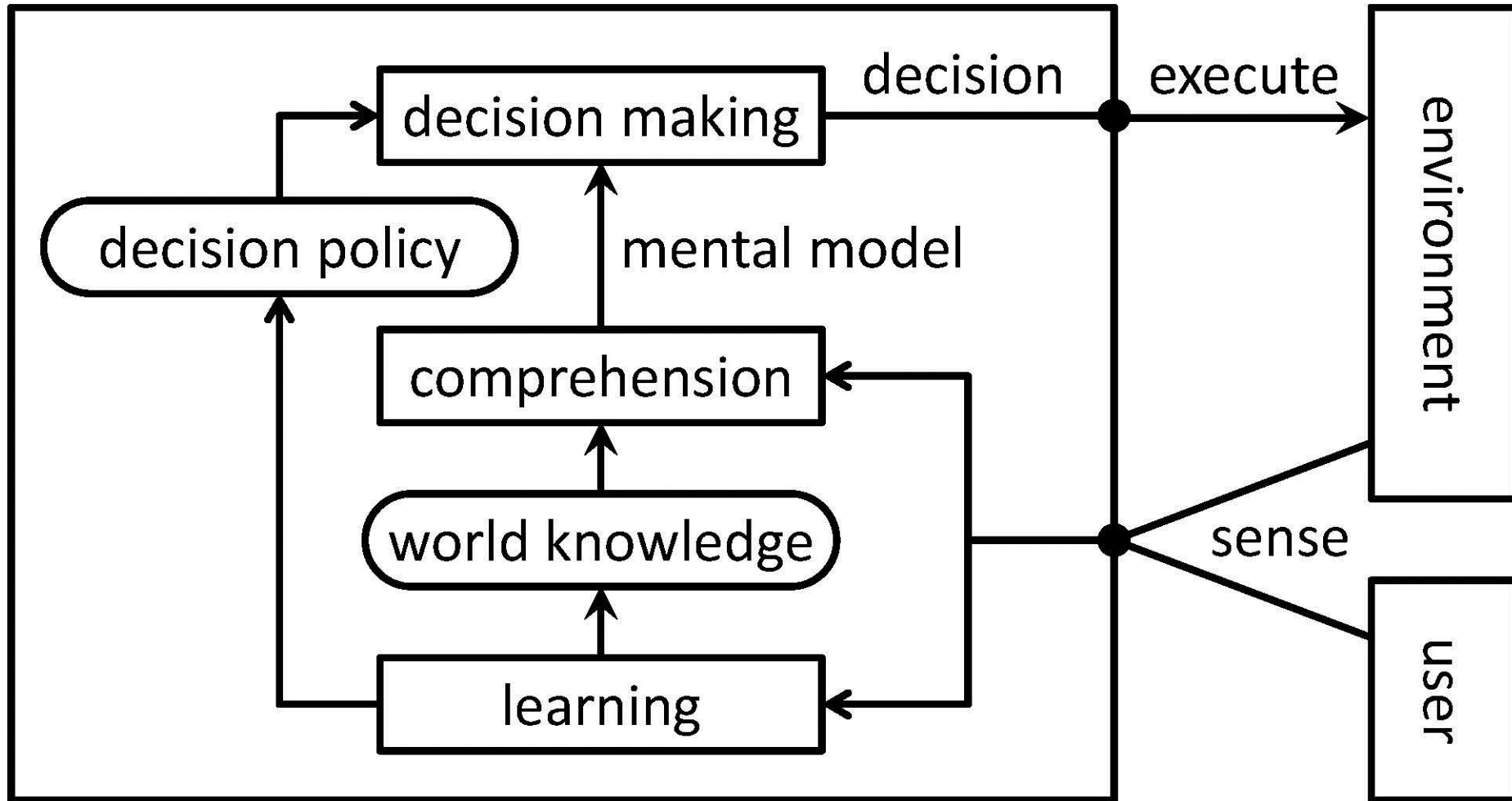
- **Gorgias-B:**User considers successive scenario refinements

- In SCENARIO are there OPTIONS generally PREFERRED?
 - Are there special CONTEXTS where ANOTHER OPTION is PREFERRED?

Cognitive Assistant Bird-Eye View



Cognitive Assistant Bird-Eye View



Cognitive Programming Challenges

- Cognitive elicitation of user preferences.
(How can the system help the user?)
 - ▣ More natural elicitation in natural language?
 - ▣ System proposes revised scenarios / contexts?
 - ▣ Elicitation without active user involvement?
- Acquisition through machine learning of relevant background world knowledge.
(How can the user help the system?)
 - ▣ User proposes vocabulary / hypothesis bias?
 - ▣ User curation of the data or the knowledge?

Why is **Cognition** Effective?

Hints for **Argumentation**

- Cognition is based on **default** inferences:
 - Acquired through **experience**. Good “bet” in **stable** environments. **Recovery mechanism** for surprises.
- Default Experience is **extensionalized**:
 - **Cognitive Knowledge** compiled into knowledge that can be **grounded** directly to external information typically coming from environment. E.g., conforming to our Language Vocabulary.
- Cognition is **effectively cautious**:
 - **Lazily** waits for information to **ground** default knowledge to past experience.

Cognition & Argumentation: Summary

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- **Cognition through preference-based argumentation**
 - **Preferences** come from **human biases**
 - **Generic biases** or **Personal interests/motivations**
- **Cognitive Programming Challenges**
- **Visit Website of:**
 - **Argument & Cognition:**
<http://cognition.ouc.ac.cy/argument/>