I-X and <I-N-C-A>

An Architecture and Related Ontology for Mixed-initiative Synthesis Tasks

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What does I-X Stand For?

- **Intelligent** – I-X supports the construction of intelligent systems and intelligent agents.

- **Intelligible** - I-X supports the construction of systems which are intelligible to their users and to other systems and agents.

- **Integrated** – I-X is a systems integration architecture.

- **Issue-based** – I-X is an issue-based and issue handling architecture.
The I-X approach involves the use of shared models for task-directed communication between human and computer agents who are jointly exploring (via some process(es)) a range of alternative options for the synthesis of an artifact such as a design or a plan (termed a product).

I-X system or agent has two cycles:
- Handle Issues
- Manage Domain Constraints

I-X system or agent carries out a (perhaps dynamically determined) process which leads to the production of (one or more alternative options for) a synthesised artifact.

I-X system or agent views the synthesised artifact as being represented by a set of constraints on the space of all possible artifacts in the domain.
Components of I-X Research

1. I-Core, which is the core architecture, the underlying ontology of activity and processes termed <I-N-C-A>, and the terminology used to describe applications, systems or agents built in the I-X framework.

2. I-DE, which is the I-X Domain Editor, which is itself an I-X application but also is used to create and maintain the process models and activity specifications used elsewhere.

3. I-P2, which are I-X Process Panels used to support user tasks and cooperation.

4. I-Plan, which is the I-X Planning System. This is also used within I-P2 and other applications as it provides generic facilities for supporting planning, process refinement, dynamic response to changing needs, etc.

5. I-Views, which are viewers for processes and products, and which are employed in other applications of I-X. I-Views can be for a wide range of modalities and types of user.

6. I-Faces, which are underlying support utilities to allow for the creation of user interfaces (User I-Faces), repository access (Repository I-Faces), and communication with other systems and agents (Communication I-Faces).

7. I-X Applications of the above threads in a variety of areas depending on our current collaborations. These currently include:
   - Coalition Operations (CoAX, CoSAR-TS)
   - Emergency, Unusual Procedure and Help Desk Assistance (I-Help and I-Rescue)
   - Multi-Perspective Knowledge Modelling and Management (I-AKT)
   - Natural Language Presentations of Procedures and Plans (I-Tell)
   - Collaborative meeting and task support (I-Room, CoAKTinG)
Uses of a Shared Model

- Knowledge Acquisition
- Formal Analysis
- Intelligible Representation
- System Manipulation
- User Communication
Issues
Nodes
Constraints

Node Constraints
  Include Node Constraints
  Other Node Constraints

Critical Constraints
  Critical Variable/Object Constraints (e.g. =, ≠)

Auxiliary Constraints
  Auxiliary Variable/Object Constraints
  Other Auxiliary Constraints

Annotations
Activity Ontology

Issues

Nodes (Activities)

Constraints

Node Constraints
- Include Node Constraints
- Other Node Constraints

Critical Constraints
- Critical Ordering Constraints
- Critical Variable/Object Constraints

Auxiliary Constraints
- Auxiliary Ordering Constraints
- Auxiliary Variable/Object Constraints
- World-State Constraints
- Resource Constraints
- Spatial Constraints
- Other Auxiliary Constraints
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Issues or Implied Constraints

Node Constraints

Detailed Constraints

Issues

Nodes

Constraints

Space of Legitimate Product Models

A=Annotations

I=Issues

N=Nodes

C=Constraints

A=Annotations

Product Model
I-X and <I-N-C-A>
Shared Models

**Shared Task Model** - Mixed initiative model of “mutually constraining the space of products”.

**Shared Space of Options** – for the product.

**Shared Model of Agent Capabilities** - handlers for issues, functional capabilities and constraint managers.

**Shared Understanding of Authority** – management of the authority to handle issues and act which may take into account options.

**Shared Product Model** – using constraints on the space of products (<I-N-C-A>).
Current I-X Related Projects

- DARPA CoSAR-TS - with Jeff Bradshaw (UWF/IHMC)
  - Search and Rescue task; DAML-X characterisation of I-X panel services. Follow on to CoAX.
- I-Rescue - http://i-rescue.org
  - NL and CdS PhD projects: responsibility and capability modelling in I-X.
- AKT I-AKT
  - Multi-perspective modelling and collaborative model synthesis.
- AKT I-X/KRAFT TIE – with Aberdeen University
  - Collaborative model synthesis, with specialised capabilities at remote sites.
Further Information

- http://www.aiai.ed.ac.uk/project/ix/
- http://i-x.info