IEEE Project 2247.1

Conceptual Modeling
of
Adaptive Instructional Systems
(AISs)
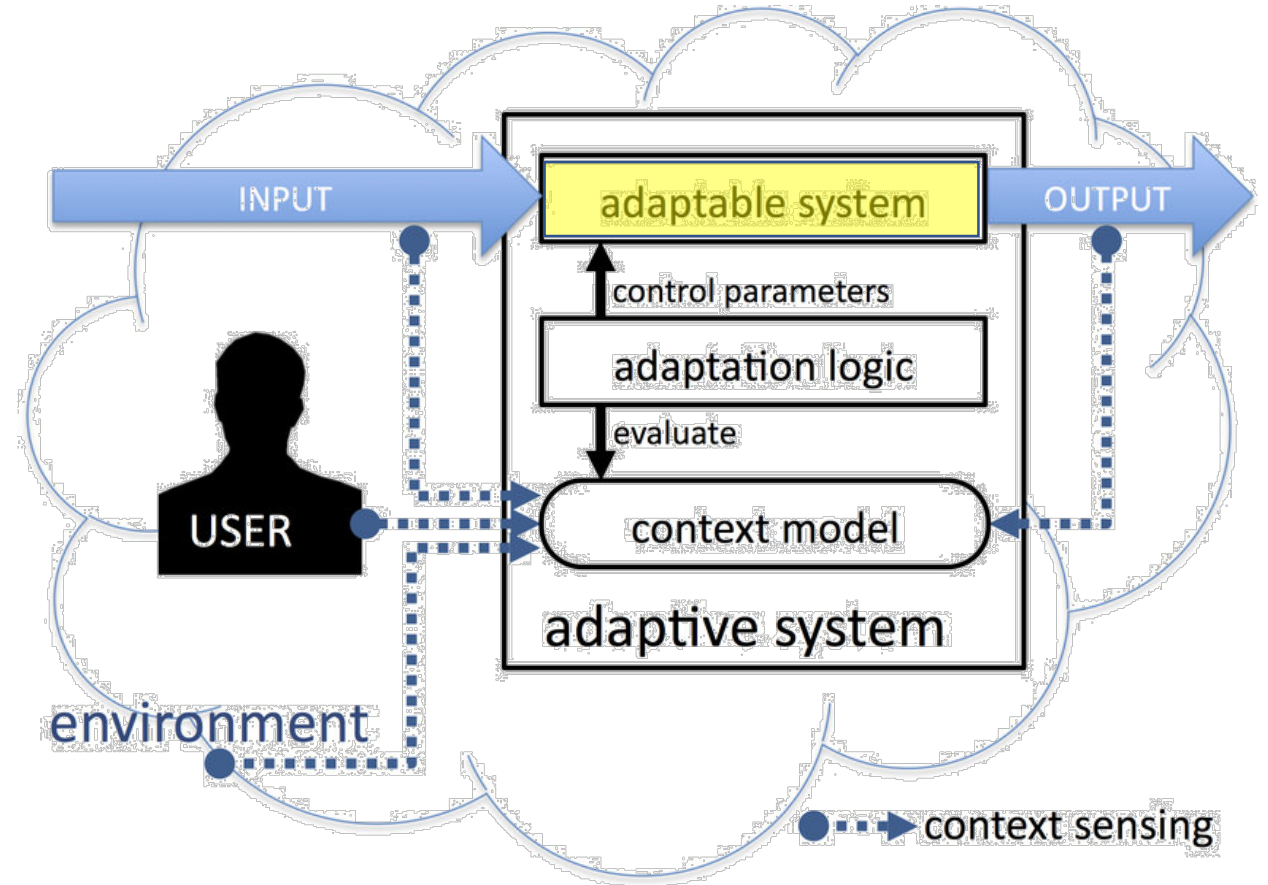
Robert Sottilare, Ph.D.

Event Moderator

Comparing adaptive and adaptable systems...

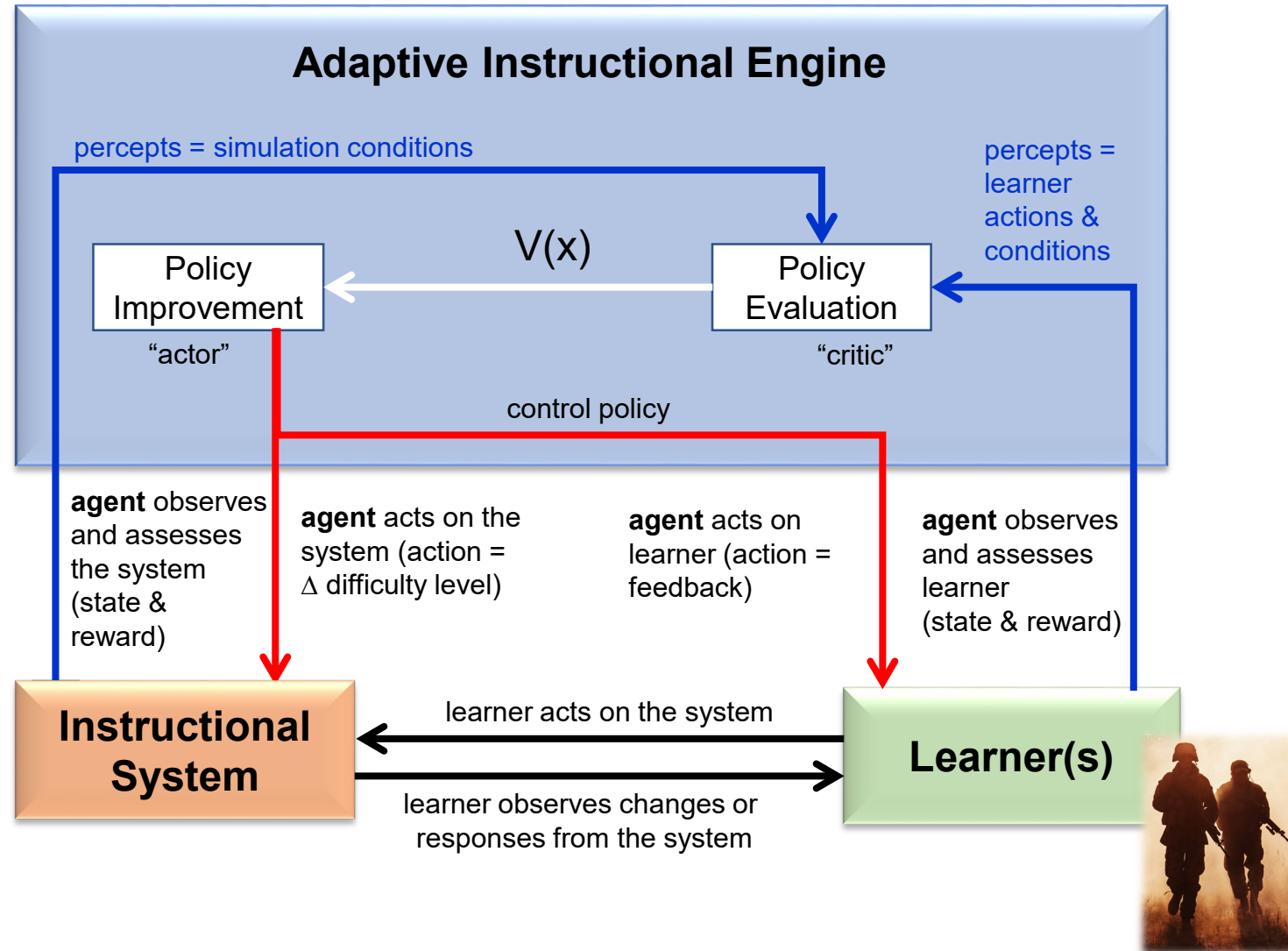**Adaptable Systems** – may be changed by the user

- *flexible control of information or system performance automation resides in the hands of the user (Oppermann, 1984)*

Adaptive Systems – change to optimize desired outcomes

- *possess the intellect to change themselves and act on their environment in response to changing conditions and goals*
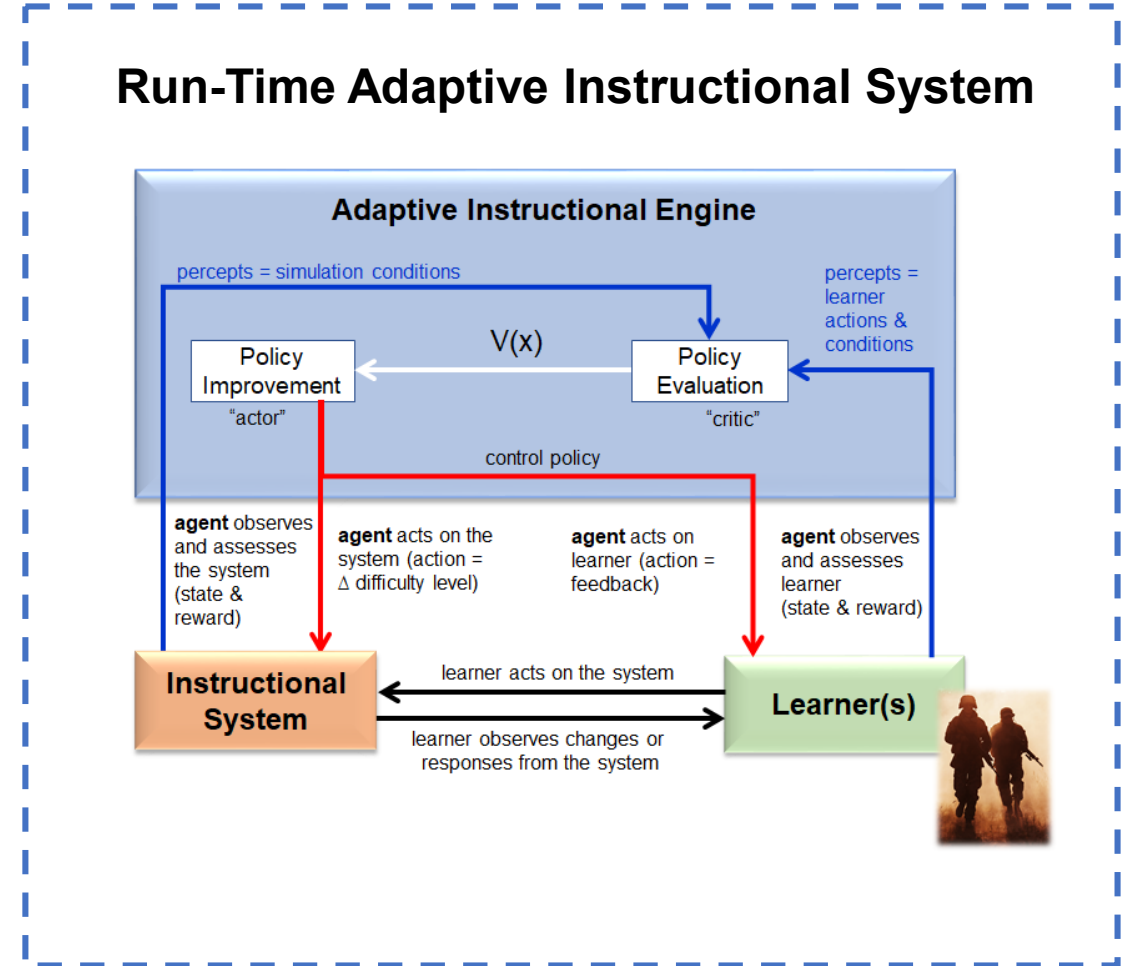
Stober S, Nürnberger A. Adaptive music retrieval–a state of the art. Multimedia Tools and Applications. 2013 Aug 1;65(3):467-94.

Learner Interactions in Adaptive Instructional Systems (AISs)

Adaptive Instructional Engine

percepts = simulation conditions

percepts = learner actions & conditions

$V(x)$

Policy Improvement

"actor"

Policy Evaluation

"critic"

control policy

agent observes and assesses the system (state & reward)

agent acts on the system (action = Δ difficulty level)

agent acts on learner (action = feedback)

agent observes and assesses learner (state & reward)

Instructional System

Learner(s)

learner acts on the system

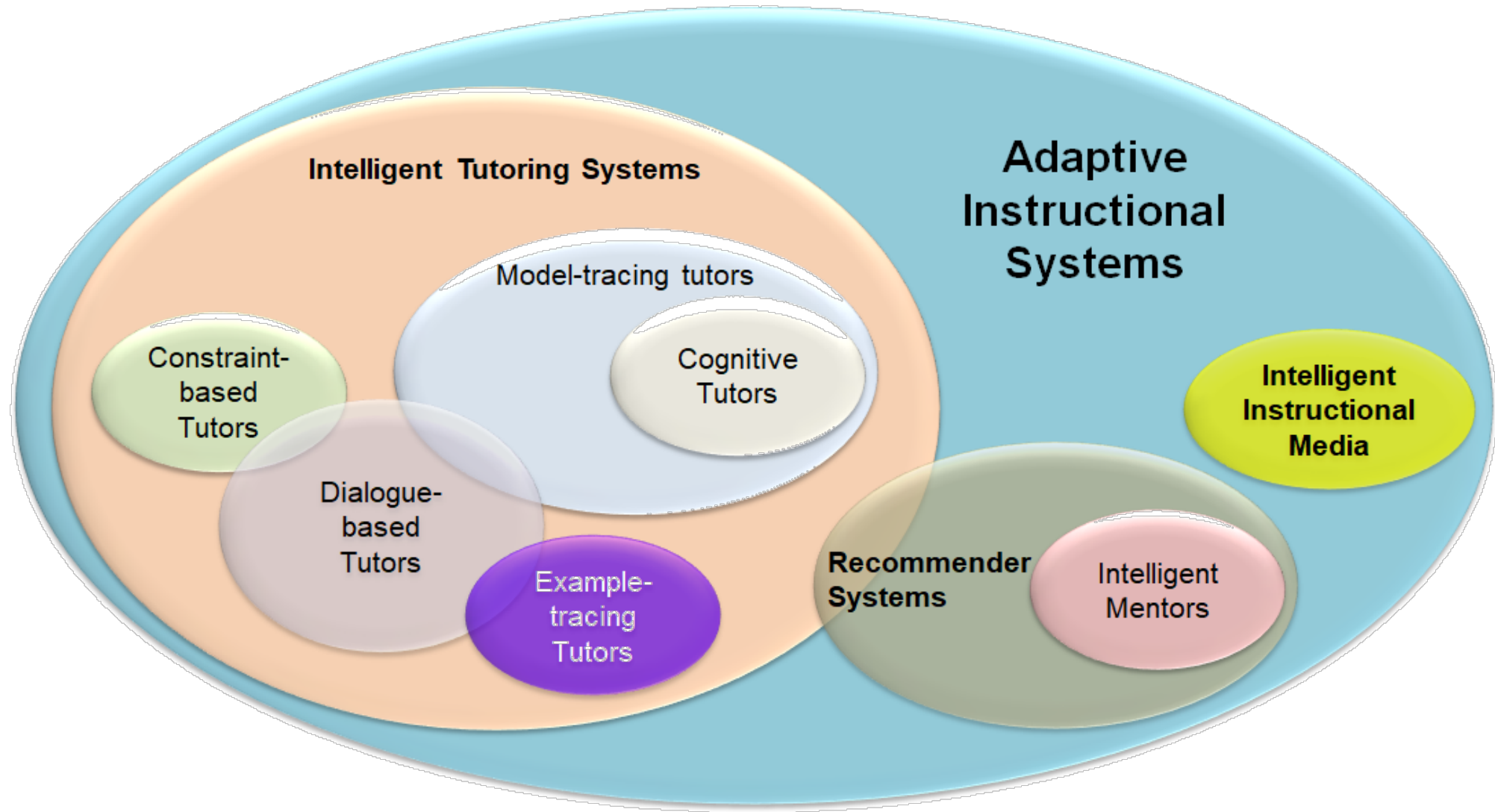learner observes changes or responses from the system

Defining adaptive instructional systems (AISs)

- **computer-based** systems, tools & methods

- use **AI methods**

- **guide** learning experiences for **individual learners and teams**

- **tailor** instruction and recommendations

- consider learner **goals, learning gaps, preferences and interests**

- consider the **context** of domain learning objectives

- include easy-to-use methods for **authoring lessons** and **curating content**

Run-Time Adaptive Instructional System

Adaptive Instructional Engine

percepts = simulation conditions

percepts = learner actions & conditions

$V(x)$

Policy Improvement "actor"

Policy Evaluation "critic"

control policy

agent observes and assesses the system (state & reward)

agent acts on the system (action = Δ difficulty level)

agent acts on learner (action = feedback)

agent observes and assesses learner (state & reward)

Instructional System

learner acts on the system

learner observes changes or responses from the system

Learner(s)

R. Sottilare and K. Brawner. "Component Interaction within the Generalized Intelligent Framework for Tutoring (GIFT) as a Model for Adaptive Instructional System Standards." the Adaptive Instructional System (AIS) Standards Workshop of the 14th International Conference of the Intelligent Tutoring Systems (ITS) Conference, Montreal, Quebec, Canada. 2018.

Categories of Adaptive Instructional Systems (AISs)

AISs are artificially-intelligent, computer-based systems that guide learning experiences by tailoring instruction and recommendations based on the goals, needs, and preferences [and interests] of each individual learner or team in the context of domain learning objectives (Sottilare & Brawner, 2018)

Adaptive Instructional System (AIS) Architectures

Generalized Intelligent Framework for Tutoring (GIFT, US Army)

AutoTutor (University of Memphis, USA)

Tutor-Expert System (TexSys, University of Split, Croatia)

Cognitive Tutor (Carnegie Mellon University, USA)

Authoring Software Platform for Intelligent Resources in Education (ASPIRE, University of Canterbury, NZ

AISs are artificially-intelligent, computer-based systems that guide learning experiences by tailoring instruction and recommendations based on the goals, needs, and preferences of each individual learner or team in the context of domain learning objectives (Sottilare & Brawner, 2018)

Developing Practical Solutions

We should also be considering how we promote:

- reuse and interoperability (think standards)
- jump start development (think recommended practices)
- bring new entities and solutions into the market... **think IEEE**

IEEE Learning Technology Events at IITSEC...

opportunities to get involved

Conceptual Modeling of Adaptive Instructional Systems
(IEEE Project 2247.1) TUESDAY, 3 DECEMBER • 1400 – 1530 • ROOM S329 • COI1

Adaptive Instructional System Interoperability Standards
(IEEE Project 2247.2) WEDNESDAY, 4 DECEMBER • 0830 – 1000 • ROOM S329 • COI3

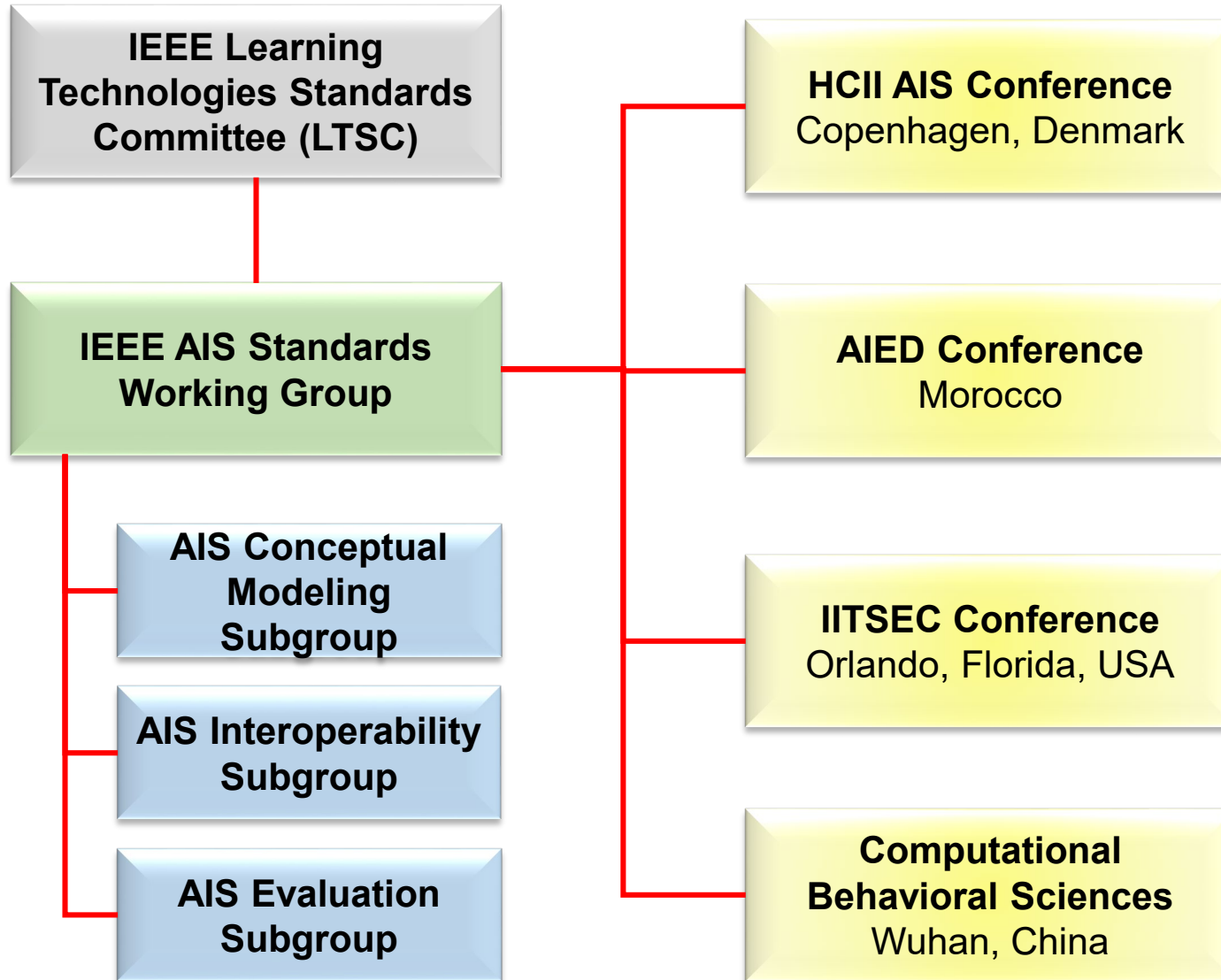**Learning Engineering: A New Academic Discipline and Engineering Profession** WEDNESDAY, 4 DECEMBER • 1030 – 1200 • ROOM S329 • COI4

Best Practices for the Evaluation of Adaptive Instructional Systems (IEEE Project 2247.3) WEDNESDAY, 4 DECEMBER • 1600 – 1730 • ROOM S329 • COI5

IEEE

Want to know more…

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Learning Sciences and AIS Landscape...

opportunities to get involved

IEEE Learning Technologies Standards Committee (LTSC)

IEEE AIS Standards Working Group

AIS Conceptual Modeling Subgroup

AIS Interoperability Subgroup

AIS Evaluation Subgroup

HCII AIS Conference Copenhagen, Denmark

AIED Conference Morocco

IITSEC Conference Orlando, Florida, USA

Computational Behavioral Sciences Wuhan, China

◆IEEE

Eager to help…

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Our Panel of Experts

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