Adaptive Learning Systems

Introduction

- Adaptive learning systems with particular focus on cognitive skills.
- Accommodation of both the ‘instuction’ and ‘construction’ of knowledge.
- Design based on informed educational methodologies.

What exactly we mean by

Adaptivity

in

Adaptive Learning Systems?

"Intelligence"/adaptivity

Increased user efficiency, effectiveness and satisfaction

by

Improved correspondence between learner, goal and system characteristics

Need of Intelligence/adaptivity

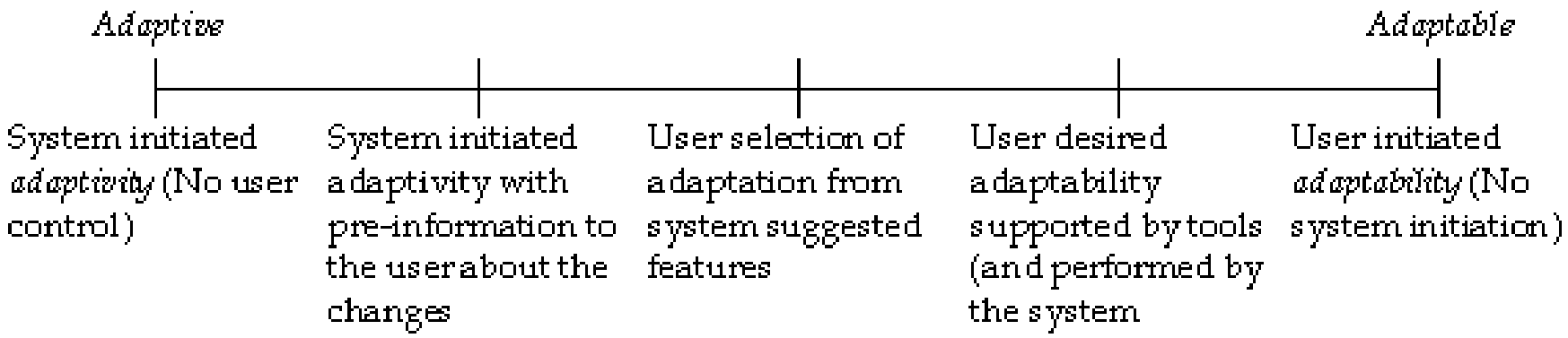
- Users generally work on their own without external support.
- System is used by variety of users from all over the world.
- Customised system behaviour reduces meta-learning overhead for the user and allows focus on completion of actual task.

Adaptable Systems

Systems that allow the user to change certain system parameters and adapt the system behaviour accordingly.

Adaptive Systems

Systems that adapt to the users automatically based on system's assumptions about user needs.


Adaptive
Adaptable
System initiated adaptivity (No user control)
System initiated adaptivity with pre-information to the user about the changes
User selection of adaptation from system suggested features
User desired adaptability supported by tools (and performed by the system
User initiated adaptability (No system initiation)

How does adaptivity work?

- System monitors user's action patterns with various components of system's interface.
- Some systems support the user in the learning phase by introducing them to system operation.
- Some systems draw user's attention to unfamiliar tools.
- User errors are primary candidates for automatic adaptation.

Levels of adaptation

- **Simple:** "hard-wired"
- **Self-regulating:** monitors the effects of adaptation and changes behaviour accordingly.
- **Self-mediating:** Monitors the effects of adaptation on model before putting into practice.
- **Self-modifying:** Capable of changing representations by reasoning about the interactions.

Problems in adaptation

- User is observed by the system, actions are recorded, giving rise to data and privacy protection issues.
- Social monitoring becomes possibility.
- User feels being controlled by the system.
- User is exposed to adaptation concept favoured by the designer of the system.
- User may be distracted from the task by sudden automatic modifications.

Recommendation for adaptive systems

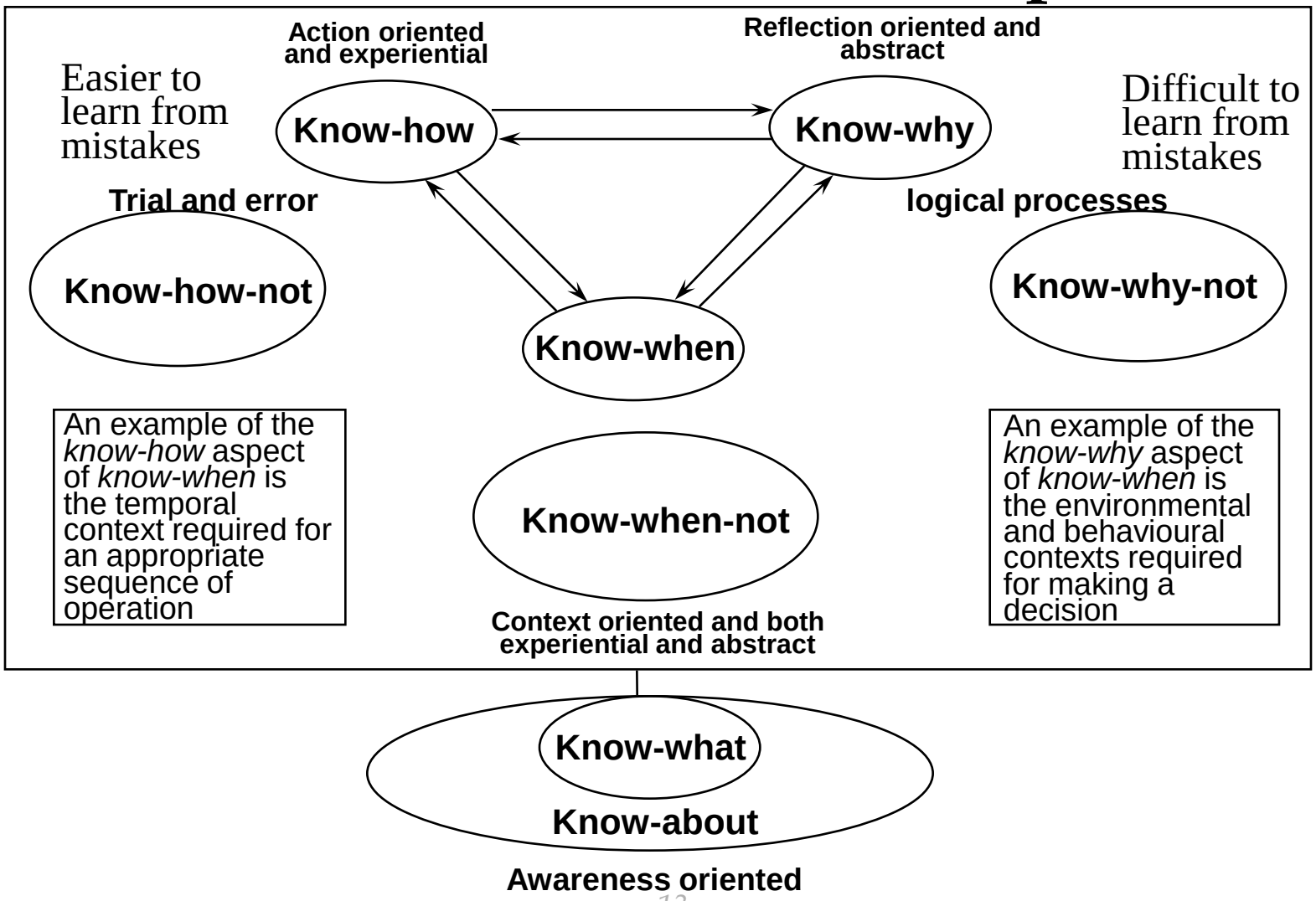
- Means for user to (de)activate or limit adaptation procedure
- Offering adaptation in the form of proposal
- User may define specific parameters used in adaptation
- Giving user information about effects of adaptation hence preventing surprises
- Editable user model

Domain competence

And

computers

Constituents of Domain Competence



Constituents of Domain Competence

Know-how

- It has an operational orientation.
- It is mainly action-driven and hence pre-dominantly experiential.
- It is difficult to inherit it from someone else's experience.

Know-how-not

- Learning by mistakes.

  Examples : Computer simulation and virtual reality

Constituents of Domain Competence

Know-why

- It has a causal orientation.
- It is mainly reflection-driven and therefore based on abstraction.
- It can be inherited from someone else's line of reasoning.

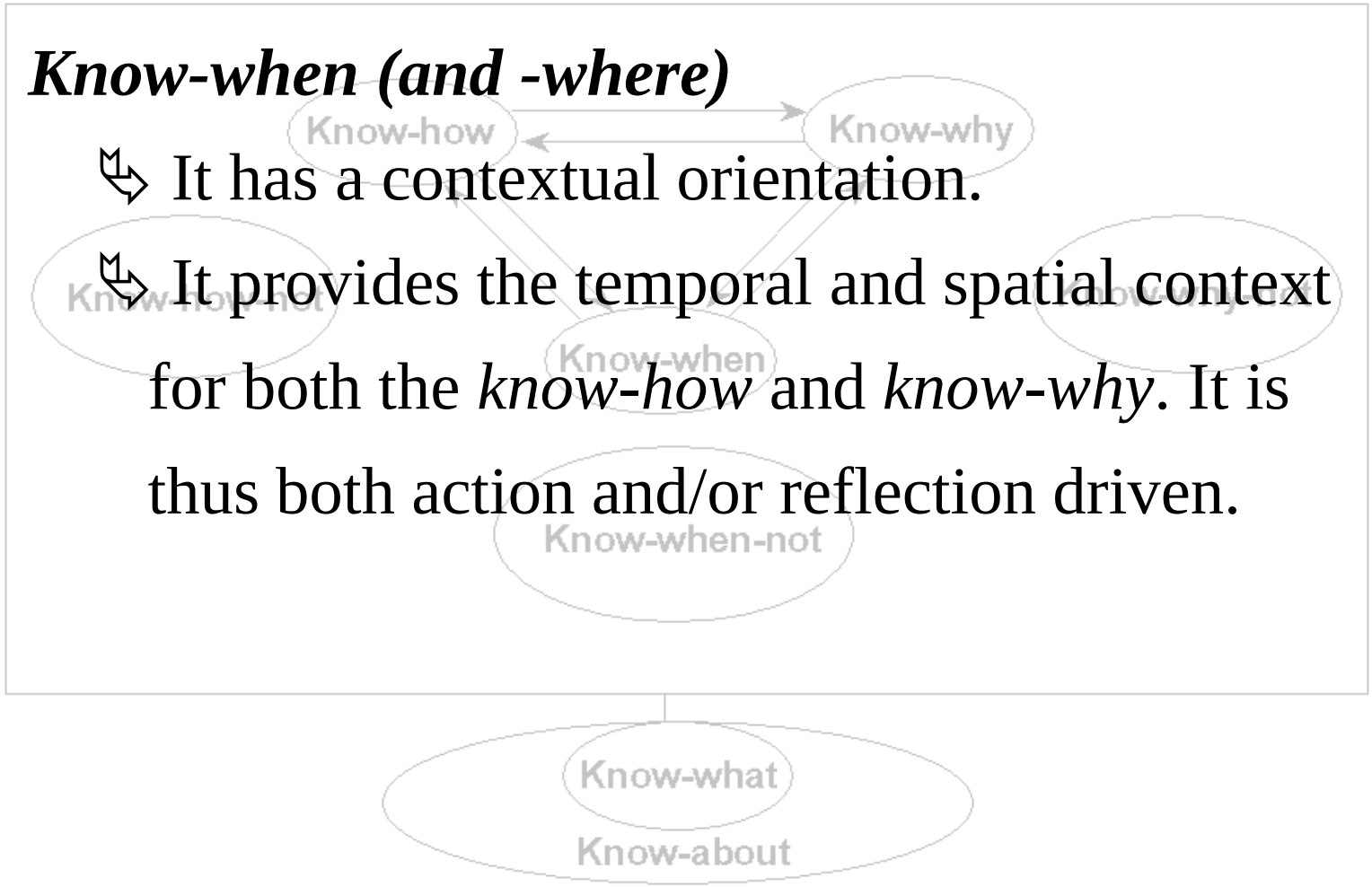
Know-why-not

- Logical processes.
- Needs deeper reflection.

Constituents of Domain Competence

Know-when (and -where)

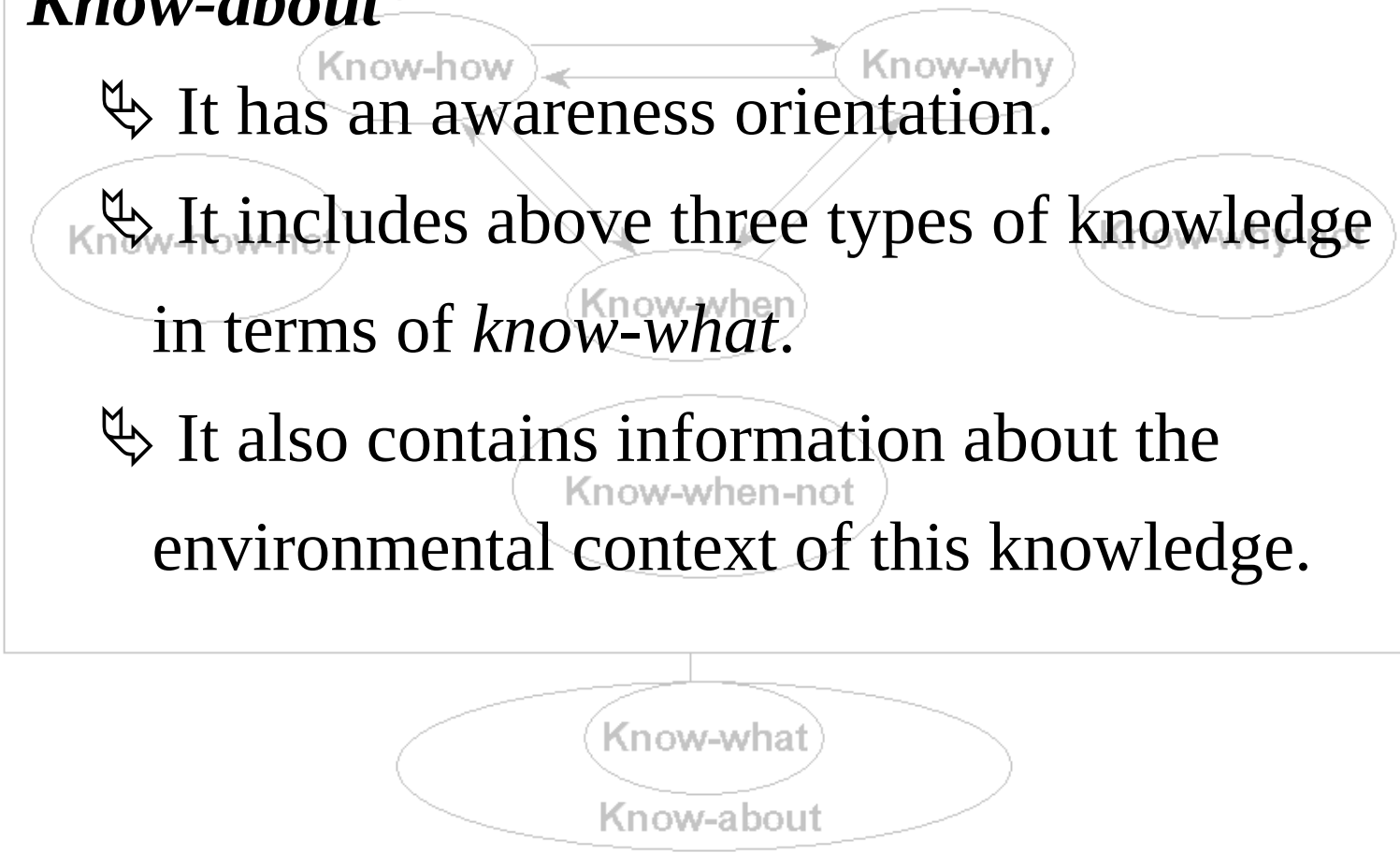
- It has a contextual orientation.
- It provides the temporal and spatial context for both the *know-how* and *know-why*. It is thus both action and/or reflection driven.



Constituents of Domain Competence

Know-about

- It has an awareness orientation.
- It includes above three types of knowledge in terms of *know-what*.
- It also contains information about the environmental context of this knowledge.



Instruction in knowledge context

Ideally, an instructional system, designed for novice users, teach all knowledge constituents.

But, *know-why* is difficult to handle mainly for two reasons:

1. It needs natural language interaction.
2. It needs use of metaphors, which are difficult to understand for a novice user.

Know-how, on the other hand, is operational, and can be conveyed to the user more easily, even with symbolic representations.

Instruction in knowledge context

Traditional hypermedia based ITSs approach, in general, has been to teach the *know-why* aspect of knowledge with the help of explanations.

The links provide stimulus to the user to know more about a particular topic.

System works more as a friendly librarian and learning depends on the initiative of a student.

Theoretical framework best suitable for facilitation of cognitive skills?

Cognitive Apprentice Framework

Cognitive apprenticeship framework

- **Modelling**: Learners study the task pattern of experts to develop own cognitive model
- **Coaching**: Learners solve tasks by consulting a tutorial component of the environment
- **Fading**: Tutorial activity is gradually reduced in line with learners' improving performance and problem solving competence

Phases of Cognitive apprenticeship

1. World knowledge (initial requirement)
2. Observation of interactions among masters and peers
3. Assisting in completion of tasks done by master
4. Trying out on own by imitating

Phases of Cognitive apprenticeship

5. Getting feedback from master
6. Getting advise for new things on the basis of results of imitation, comparing given solution with alternatives
7. Reflection by student, resulting from master's advice

Phases of Cognitive apprenticeship

8. Repetition of process from 2 to 7
   - Fading out guidance and feedback
   - Active participation, exploration and innovation come in
9. Assessment of generalisation of the tasks and concepts learnt during repetition process

SUMMARY