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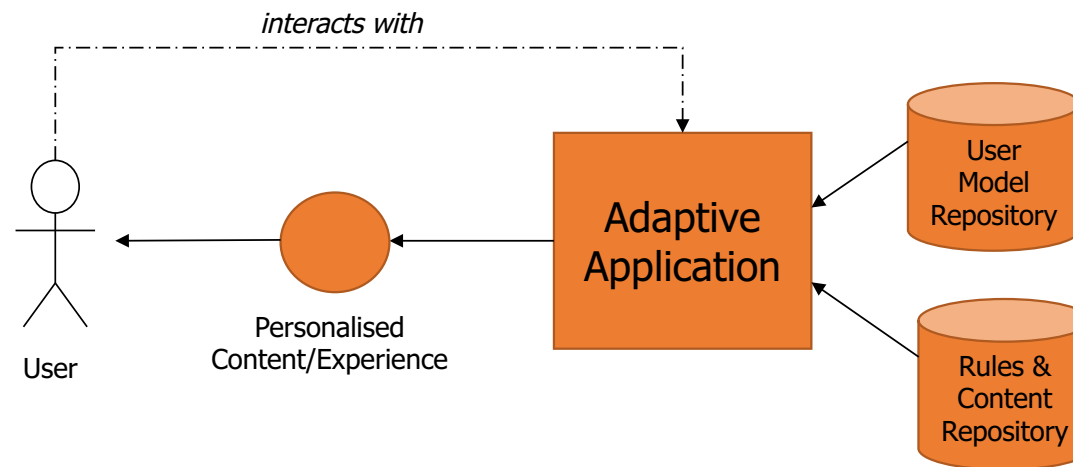
# User Modelling: The Basics

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# What is an Adaptive Application?

- Let's consider a (very) basic one



- We'll revisit this again later...

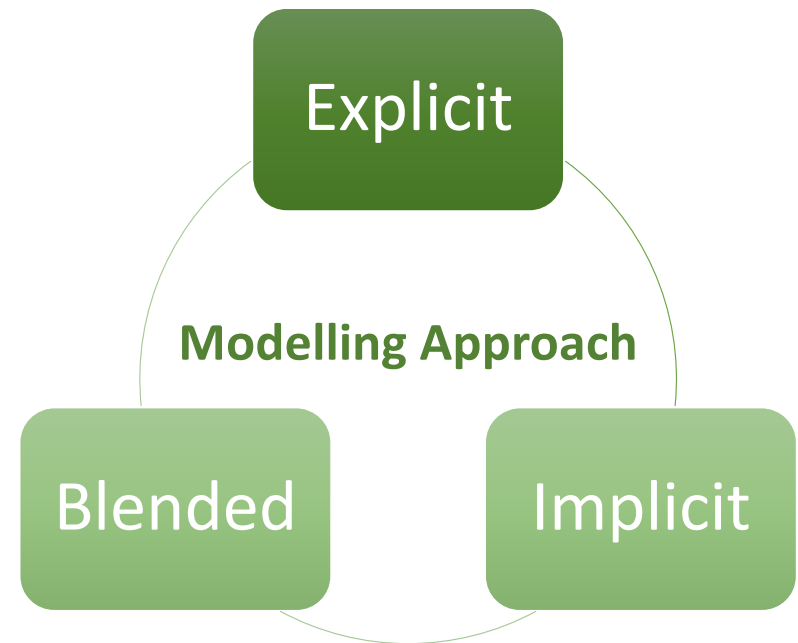
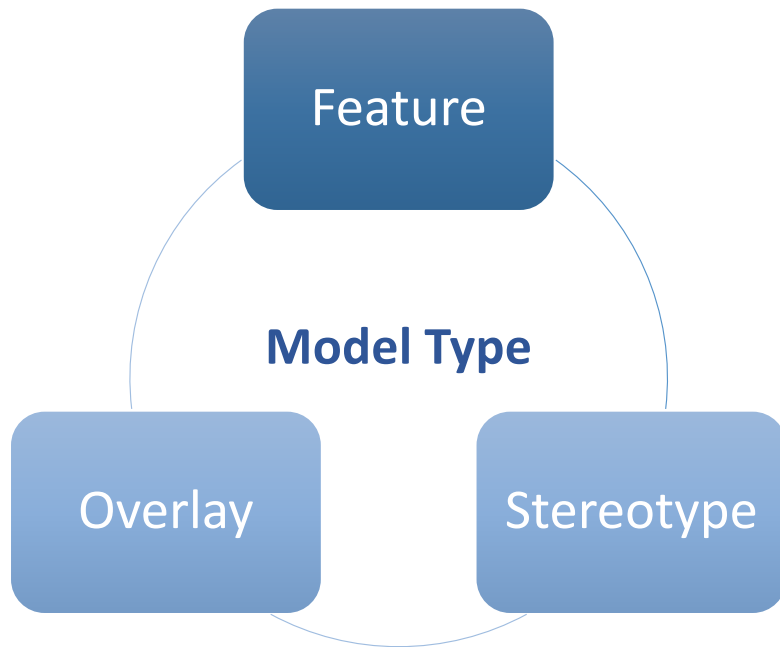


# What is a User Model?

- A digitised representation of certain features of a user
  - The Adaptive Application will use this representation to change how the application functions
  
- It is the source of our first problem in creating Adaptive Applications!



# How do we build a User model?





# Feature-based User Model

- Very popular approach to modelling users





# Feature-based User Model

- Discrete features that represent the user are encoded in the user model
  - This encoding may take many forms
- Boolean and tuple encodings are quite common
  - Boolean simply adds features names to the user model as they apply
    - e.g. User1 → Professor, Runner, Driver:Car, Cyclist:MTB, Mathematics:Algebra
  - Tuple encodings have name=value pairs
    - e.g. User1 → Professor=0.7, Runner=0.6, Driver:Car=0.3, Cyclist:MTB=0.9, Mathematics:Algebra=0.8
- Does the lack of a feature imply it is a) not modelled, b) not known, or c) both?
- Where do the vocabulary and values come from?



# Advantages of Feature-based User Models

- Can facilitate very fine-grained modelling of a user
- Enables different feature subsets to be grouped
  - Different parts of the Adaptive Application may work with one or more groupings



# Disadvantages of Feature-based User Models

- Can lead to proliferation of features and highly complex Adaptive Applications
- Can be very difficult to test the Adaptive Application for all permutations of User Model





# Overlay User Model

the idea of overlay knowledge modeling is to represent an individual user's knowledge as a subset of the domain model that resembles expert knowledge of the subject. Overlay models of user knowledge were introduced and developed in the field of ITS where overlay models were used mainly by systems with task sequencing, curriculum sequencing, and instructional planning functionalities. The popularity of this approach among early AES and AHS systems can be explained by their strong connection with ITS systems. In fact, a number of early AHS were developed in an attempt to extend an ITS system with hypertext functionality [8; 26; 75; 155]. The overlay knowledge models proved to be a good match for the core function of AHS: providing personalized access to information. As a result, within just a few years these models were accepted as de-facto standard by almost all educational and many non-educational adaptive hypermedia systems.

Source: User Models for Adaptive Hypermedia and Adaptive Educational, Adaptive Web, Brusilovsky and Millán, 2007, p3-53



# Advantages of Overlay User Models

- Can facilitate very fine-grained modelling of a user
- Enables different feature subsets to be grouped
  - Different parts of the Adaptive Application may work with one or more groupings
- Clear connection between the User Model and the Domain Model



# Disadvantages of Overlay User Models

- Can lead to proliferation of features and highly complex Adaptive Applications
- Can be very difficult to test the Adaptive Application for all permutations of User Model
- Constrained by the Domain Model



# Stereotype User Model

Stereotype user modeling is one of the oldest approaches to user modeling. It was developed in the works of Elaine Rich [163; 164] over a quarter of century ago and elaborated in a number of user modeling projects. Stereotype user models attempt to cluster all possible users of an adaptive system into several groups, called stereotypes. All users belonging to the same stereotype are treated in the same way by the adaptation mechanisms. A user in a classical stereotype-based system is represented simply as her current stereotype (i.e., a group she currently belongs to). Naturally, each stereotype groups together users with specific mixture of features. However, stereotype modeling ignores the features and uses the stereotype as a whole. More exactly, the goal of stereotype modeling is to provide mapping from a specific combination of user features to one of the stereotypes. After that, only the user current stereotype is used for adaptation. Any changes in the user's features are responded to by simply re-assigning a user, if necessary, to a different stereotype. Elaine Rich discusses extensively when would be the right moment for this [164].

Source: User Models for Adaptive Hypermedia and Adaptive Educational, Adaptive Web, Brusilovsky and Millán, 2007, p3-53



# Advantages of Stereotype User Models

- Simplifies the development of the Adaptive Application
  - Limited number of permutations to consider
  - Constrains the overall bounds in which the application is designed to function
- Can ease scrutability (more on this later)

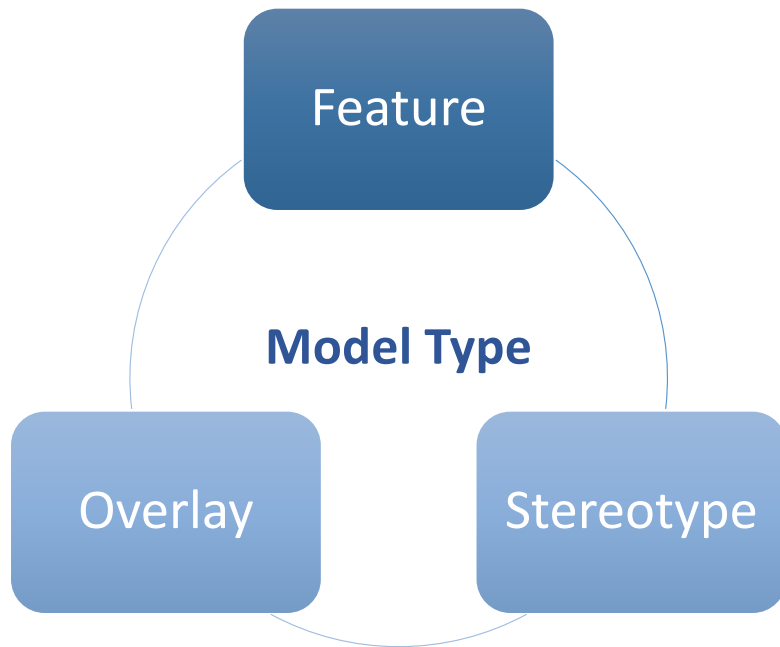


# Disadvantages of Stereotype User Models

- Assigning Users to a Stereotype can be inexact
- Moving Users between Stereotypes can be tricky



# Model Type

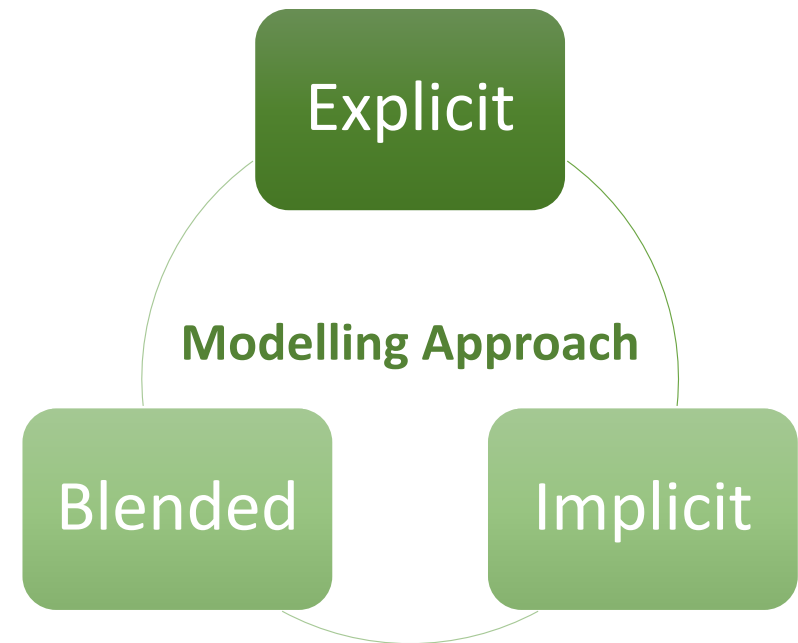


- Model Type covers the high-level *Form* in which the user information is stored
- We'll talk about the details of *What* is stored later on



# Modelling Approach

- The Modelling Approach is *How* the user model is constructed
- i.e. How we populate the features, assemble the overlay or select a stereotype.







# Modelling Approach

There are a number of implicit approaches that may be used in acquiring and refining the learner model. These include –

- The observation of the learner's direct-manipulative interaction with the software system.
- The analysis of the information which the learner retrieves from a database or repository [Kass and Stadnyk, 92].

The system can also explicitly ask the learner for information [Kobsa, 93] employing mechanisms such as questionnaires and tests.

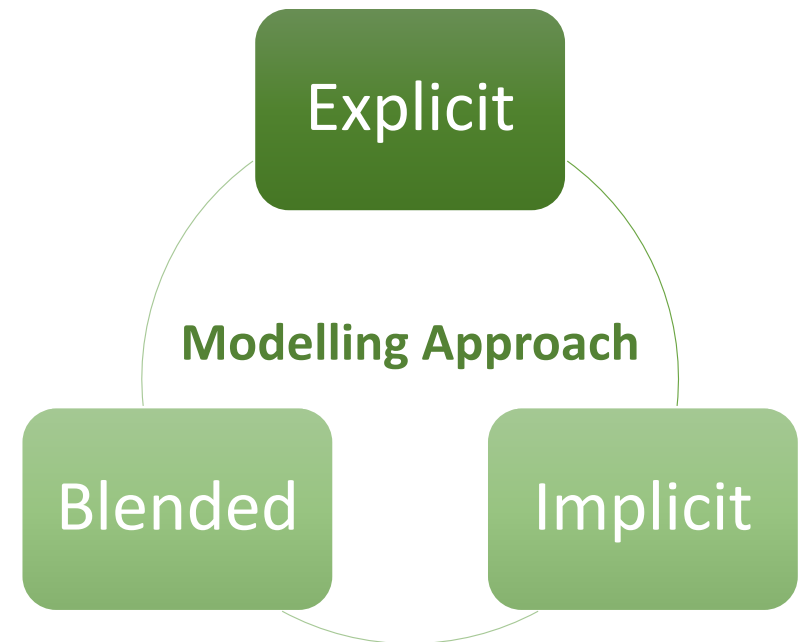
There are a number of sources of information which may be used to construct a learner model. The system acquires data about the learner and infers user characteristics from this data. The validity of the assumptions depends on the technique used to acquire the information. Automatic modelling by the system may be unreliable.

Source: The Multi-Model, Metadata Driven Approach to Personalised eLearning Services, Conlan, 2005, p26



# Explicit versus Implicit Modelling

- **Explicit: ask the user directly**
  - What are the problems with this?
    - User doesn't always know what they want
    - Disrupts the flow of the experience
    - Granularity of enquiry
- **Implicit: infer from interactions/ other data**
  - What are the problems with this?
    - Inexact inferences
    - Partial evidence
    - Often requires expert knowledge



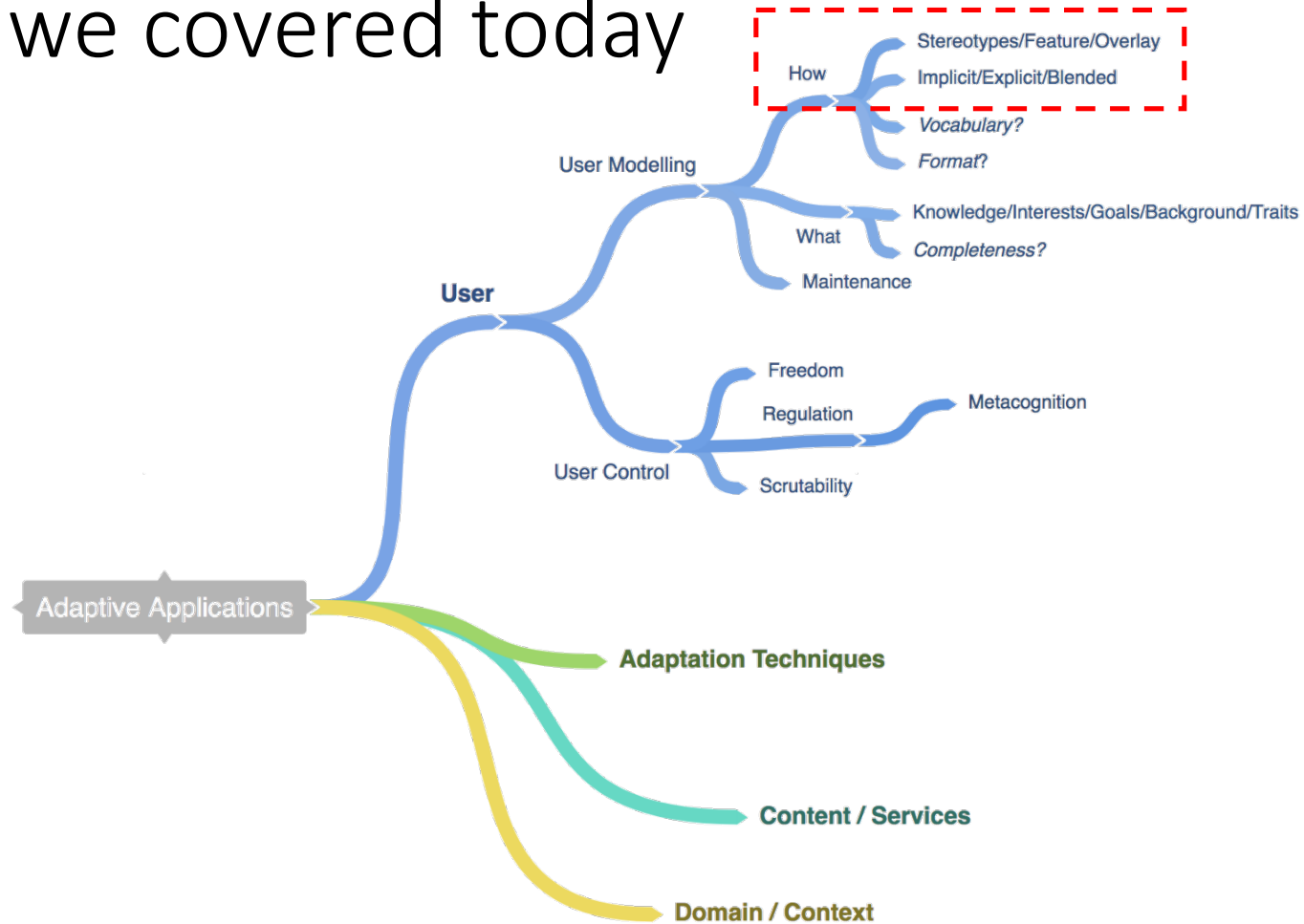


# Blended Approach

- Combine explicit and implicit approaches
  - Sometimes use explicit questioning to overcome the cold-start issue
    - What is this?
- When use explicit or implicit?
  - Probably need to model certainty in the modelling process...
  - ... or have clearly defined approaches for different features



# What we covered today





# What we didn't discuss today

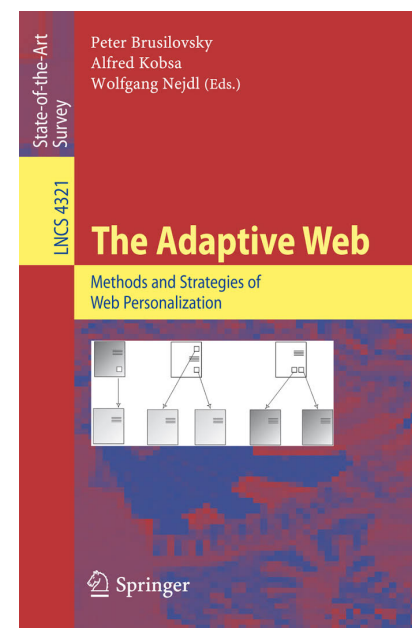
- Dynamism and Maintenance
  - The user model is not a static thing
- What exactly we might want/need to model
- Completeness
- Vocabulary and Format of the model
- User Control!



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# Reading for next the lecture

- Chapter: *User Models for Adaptive Hypermedia and Adaptive Educational*, by Brusilovsky and Millán,
- From this book: *Adaptive Web*, LNCS 4321, Brusilovsky, Kobsa and Nejdl, 2007
- Pages: 3 – 24 (i.e. not the full chapter; just *1.2 What Is Being Modeled* and *1.3 The Overlay Approach to User Modeling*)





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# Questions?

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