

Is Simple Sequencing Simple Adaptive Hypermedia?

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ABSTRACT

In this paper, we explore the differences between the Adaptive Hypermedia and IMS Simple Sequencing approaches. Both approaches provide learning material tailored for the learner's current context. Understanding the difference between the approaches enables us to identify the best features of each, and thus to identify research agendas for improvement of adaptive hypermedia and of Web-based Learning Management Systems.

Categories and Subject Descriptors

H.5.4 [Information Interfaces and Presentation]:
Hypertext/Hypermedia – navigation, user issues.

General Terms

Human Factors

Keywords

Adaptive Hypermedia, Learning Objects, Simple Sequencing.

1. INTRODUCTION

Adaptive Hypermedia (AH) [1] and IMS Simple Sequencing (SS) [6] are two distinct pedagogical approaches for selecting what materials will be presented to learners.

An Adaptive Hypermedia System (AHS) employs a user model and a model of the concepts in the learning domain in order to decide what content and navigational features to display, and how to present that content. The user model may be instantiated by some prior understanding of the user (e.g. obtained by a pre-test) and will then be dynamically updated as the system monitors the user's behaviour.

IMS Simple Sequencing, which is the specification adopted by the learning objects community in ADL SCORM 1.3, provides a learner with a sequence of learning activities to guide them through a learning space in order to achieve a specific learning objective. The sequencing is based on instructional design strategies selected by the course's instructor and are expressed in XML in the "manifest file". The Learning Management System (LMS) maintains a simple user model based on the learning objects the user has visited and on intermediate test results. Based on this information the LMS will decide what learning object should be next in the sequence.

On the face of it these two approaches appear similar; both aim to

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deliver the appropriate material to enable the user to achieve their learning objective as quickly as possible. This paper explores the differences and concludes by considering what each community might learn from the other.

2. THE DIFFERENCES

2.1 The Objective of the Approach

In general the objective of IMS SS is to ensure that a learner completes all the activities that an instructor deems important, while avoiding those that may be unnecessary, as demonstrated by prior knowledge or by swift grasp of the material; the objective is instructor centred. In contrast the objective of an adaptive hypermedia system is to assist the learner in navigating a complex information space in order to achieve whatever goal they choose; AH is user centred.

2.2 Constituent Components

According to the AHAM reference model [5], an AHS should consist of a Domain Model (DM), a User Model (UM), an Adaptation Model (AM), also known as Pedagogical Model, and an Adaptive Engine (AE). The DM describes how the information is structured and linked together using concept relationships. The UM describes a set of user's characteristics and preferences in browsing the hypermedia space and the AM consists of pedagogical rules which define how the DM relates to UM to specify adaptation. The AE is then responsible for generating the actual adaptation outcomes by manipulating link anchors or fragments of the pages' content before sending the adapted pages to a browser.

On the other hand, IMS SS does not have either an explicit Domain Model or an explicit User Model. Instead the IMS SS Specification [6] describes three data models: the Sequencing Definition Model states the rules for progressing through the learning objects, the Tracking Model holds the results of the learners' interactions with the content, and the Activity State Model records the current activity or activity to return to if the learner has temporarily quit. Clearly there is a User Model implicit in the tracking model, but it is simplistic when compared to the models employed by AHSs, recording only progress and having no interest in user preferences or learning styles. Instead of a Domain Model we have Sequencing Rules, which express the pedagogical strategy of the instructor/author, rather than any generalised concept map of the subject domain.

2.3 Conceptual Structures

In AHSs each node represents a page which corresponds to a concept. Attribute-value pairs in the user model provide information about each concept in the domain model. Attributes

might be, for example, knowledge, interest, time spent reading, etc. Since the concepts are represented in a concept hierarchy, values attributed to sub-concepts may contribute to the same attribute value in their parent concept via propagation rules. E.g. interest in Heineken may suggest an interest in beer. For each page requirement rules decide, based on the information in the user model, whether links to a page should be shown as desirable.

In IMS SS, learning activities are managed and arranged in the form of an activity tree and each node represents a learning activity. The root of the tree is the main activity, while the branches represent the sub-activities. Navigation through the activity space is based on a pre-order traversal method. The sequencing rules will decide whether a particular node will be traversed or skipped in the learning process based on the status or values obtained from the Tracking and Activity State models.

2.4 Techniques Employed

AHSs use several adaptation techniques to provide adaptation. Currently, there are three major adaptation technologies: adaptive navigation support, adaptive content presentation and adaptive content selection [1]. Adaptive link sorting, adaptive link hiding, adaptive link annotation, map adaptation and direct guidance are among the adaptive techniques found in adaptive navigation support. In adaptive content presentation, adaptive techniques like adaptive text presentation and adaptive multimedia presentation are used. Techniques like conditional-inclusion of fragments are employed by AHA to minimize comprehension problems by providing additional explanation when requested [2].

IMS SS controls the sequencing processes by using sequencing and rollup rules. Sequencing rules provide a means to describe conditional sequencing behaviour for an individual activity in the activity tree; rollup rules specify how the values of a child's activities influence the objective of the parent.

2.5 Tracking Mechanisms

In AHSs, learners' browsing behaviour is continuously tracked by the AE in a form of log entries in the user model [4]. For each user page access a log entry is created which records the fact that the page has been visited and for how long. The AE will also monitor which concept's attributes are updated by rule actions, and will trigger the execution of their associated rules [3].

On the other hand, the tracking mechanism in IMS SS is controlled by its Tracking Model and Activity State Model. Results of learner's interactions with the learning activity are tracked, kept and updated in the Tracking Model in order to control the selection and sequencing of other activities. The sequencing and delivery process use the tracking data to determine which activity should be sequenced next and which associated contents need to be delivered to the learner

2.6 Re-usability

There are two main factors involved in ensuring reusability and interoperability of content across any Web-based LMSs: first, adaptive-related rules and functions must be separated from their contents; secondly, content should be represented by learning objects that conform to agreed specifications. However, many AHSs have adaptive rule definitions and links embedded within the learning content, hindering re-usability.

With IMS SS instructional designers can specify meaningful sequencing behaviour externally from the learning resources. The sequencing behaviour is encoded using XML in a manifest file, which references the learning resources.

3. CONCLUSION

This paper has demonstrated that although AHSs and IMS SS are superficially similar, there are some fundamental and important differences. Adaptive Hypermedia aims to use intelligence and knowledge of each individual user to assist the learner in achieving their chosen learning objective, whereas Simple Sequencing has no intelligence and makes no distinction between users, but simply applies a set of rules decided by an author to sequence a learner towards a pre-determined learning objective. Of course, dynamic course generation techniques have been used in ITSs to generate appropriate course sequences from an understanding of users and the subject domain [7], and IMS SS might use such techniques.

Although the goals of Adaptive Hypermedia appear laudable, the concept has yet to catch on in either industry or education partly due to the lack of standards and the difficulty in reusing and authoring materials. SCORM 1.3 with Simple Sequencing can provide us with some useful tips on working in the mainstream: it makes use of re-usable content, it has a specified language for expressing its sequencing rules, the sequencing rules are held independently from the content and there is a standard API for communicating the tracking information with the LMS. Although the Simple Sequencing specification has only been public for a few months there are already multiple implementations becoming available.

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