

APLIC Report

This interim progress report describes work performed within the APLIC project during the time period 1st of November 2010 – 30th of April 2011. It involves the development, extension and usage with Warwick students and beyond of three systems: ADE, an adaptive course delivery environment, MOT and PEAL, two authoring environments for the former tool (and other tools). So far, the expenses involve only the travel of Joshua Scotton to Romania, for the second lot of experiments.

The Adaptive Display Environment

The *Adaptive Display Environment* (ADE) is an adaptation delivery engine using the LAOS framework for authoring & delivery of adaptive hypermedia (AH). It builds on existing delivery engines by extending the adaptation behaviours that can be used in AH systems as well as increasing the reusability of adaptation specifications and content.

ADE is designed to be a modular adaptive hypermedia system which supports multiple types of content formats and adaptation languages. It is based on the LAOS framework for AH systems which enforces a strict separation between the content and adaptation specifications. In the experiments described below we were using the CAF content format and the LAG adaptation language.

The CAF format stores adaptive content in a two-layered content structure. The first layer, the Domain model, contains a conceptual hierarchy and the actual content of the course. The second layer, the Goal and constraints model, stores pedagogical information about the course contents and groups the concepts from the Domain model in “lessons” which correspond to pages in an adaptive system.

At the start of the project ADE was a proof-of-concept prototype and work was needed in the following areas:

Functionality

Not all of LAG was properly supported in the initial prototype of ADE.

Bugs

Stability was an issue, especially when working when parsing imported LAG adaptation strategies

Speed

Speed, especially when scaling, was an issue.

Design

The initial user interface of ADE was very basic and needed some work to make it easier to use.

Work on all of these areas was completed before the experiment during the CS411 course started. A brief evaluation comparing ADE with one of the more well-known delivery engines, AHA! was conducted

to ensure that ADE was on a similar standard to current systems. ADE compared favourably in the evaluation and was preferred in areas such as Navigation, Layout and Overall Design. Speed was still an issue in this evaluation and so more work was carried out to optimise this area before the first experiment started with the CS411 course.

CS411: Dynamic Web-Based Systems

ADE was used as an example of adaptation delivery engines and also as part of the coursework for the CS411 module on Dynamic Web-Based Systems at the University of Warwick, in the 2010-11 Autumn term (term 1).

This module is a key part of the newly introduced MSc in Cognitive Systems, a joint degree between the Departments of Computer Science and Psychology. 37 students took this module.

Demonstration

As part of the course, ADE was used as an example of an adaptive delivery engine. Various examples of adaptive courses on ADE were shown, demonstrating many different types of adaptation.

Coursework

Additionally to learning with the help of the ADE tool, students were given the task of authoring three adaptive courses using the content authoring tool, MOT3.0, and an adaptation strategy editor, PEAL. The students produced content files in the CAF format and created the adaptation strategies in the LAG adaptation language. These files were then imported into ADE, which was then used to display and test the courses.

Feedback

A number of suggestions and comments were made by the students as a result of the coursework. The most important issue raised was the speed of the system under intense usage. Work was carried out to solve this issue during the coursework period which went some way to solving the problem.

Most of the other issues that students raised or commented on were related to the LAG strategy language and not the actual ADE system. Students wanted more control over the adaptation in the system and to track more information about the user. This included adaptation of the navigational elements independent of the content adaptation and easily calculating information about groups of user model concepts.

Web Application Development at Bucharest University

After the initial feedback from the CS411 students, it was decided to work on improving the scalability of ADE and extending the LAG language to support more advanced adaptations. These extensions ranged from small modifications in the syntax to adding more adaptation possibilities.

The information stored in the user model was increased and made accessible to the adaptation model. This included information about time spent on the page and whether the user was actively using the system.

The capability to dynamically adapt the layout and presentation of courses based on the adaptation strategy of the course was added. Also a complete test module was created which used multiple choice tests to update the user model. This information could then be used by adaptation strategies within ADE.

After this work was completed, a further evaluation of ADE was undertaken by students from the Web Application Development course at the Engineering faculty within the Politechnica University of Bucharest, Romania, with around 70-80 students.

Three revision courses, delivered via ADE, were run alongside the tutorials in the course. The courses covered MySQL, Perl and PHP.

Experiment 1

The addition of the *presentation adaptation functionality* to ADE enabled an experiment on whether different layouts can influence the learning outcomes of learners in a hypermedia course.

Recent research into cultural influences on user interface preferences was used to create two versions of a course on PHP and another course on Perl. One was based on a Romanian stereotype and the other on a British stereotype.

The students were separated into two groups and were given access to one course at a time, completing a test before and after taking the course. Each group accessed one of the courses using the Romanian stereotype interface and accessed the other using the British stereotype.

Preliminary results show a significant difference ($p < 0.1$) between Romanian students studying with a Romanian versus British interface template (this result was obtained by giving half of the students a Romanian interface to their course material, and the rest an English interface). Students with matching interface had greater learning efficiency gains than students with nonmatching interface.

Experiment 2

The second experiment was to compare the learning results between two groups accessing the same course material on MySQL, but with/without adaptation.

The first group accessed information on MySQL as per a normal website, using a navigational menu and links within the content pages. The second group was given a progress bar, recommended links and used an adaptation strategy called Beginner – Intermediate – Advanced. This is where content is labeled with 'beg', 'int' or 'adv' and then only beginner concepts are shown at first until they have been learnt, then the intermediate content and finally the advanced content.

Students completed a test prior to starting the course and complete a final test to measure improvement after completing the course. The course has run from the end of February 2011 to the end of April 2011, hence this experiment is still in progress.

Students will be completing a questionnaire on ADE, answering questions covering the following areas:

Navigation

- Were students able to access content easily?
- Did the students find the different navigational controls useful?
- Did students feel in control or did they need more guidance?

Student's movement through the course has been tracked so we hope to be able to link the actual movement to the answers from the students and find some correlations. This includes tracking which navigational elements were used to navigate the course.

Layout

- Was the interface easy to understand?
- Would modifying the layout make it easier to use the system?

Speed

- Was the page loading time fast enough for the students?

The page generation speed for each part of the interface has been logged throughout the experiment so we can compare actual data to perceived results.

Evaluation Area: Learning

- Did students feel that they learnt a lot using the system?
- How confident did students feel about their knowledge of the subject area before and after the course?

We are tracking the amount of time spent in the system and can compare this information to the answers as well as seeing if there are any statistically significant links between the pre/post test results and the amount of time spent in the system.

Further Work

As a result of discussions throughout 2010/11 and student feedback from the experiments described about, there have been a number of modifications proposed to the LAG adaptation language. This includes changes implemented in ADE relating to user interface adaptation for the experiments at Bucharest University as well as unimplemented proposals to allow independent adaptation of the navigation and content in LAG.

Further work on ADE will include work on fixing bugs in the user interface adaptation, and implementing the independent adaptation of navigation and content. This will be done in time for the next CS411 course in October 2011.