EVALUATION OF ADAPTIVE HYPERMEDIA AUTHORING PATTERNS DURING A SOCRATES PROGRAMME CLASS

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Abstract
In this paper we present the second experiment in combining teaching and research: the testing of MOT and its new adaptive patterns. MOT is an adaptive hypermedia authoring tool based on the LAOS adaptive hypermedia authoring framework. The patterns are implemented via an adaptive language that uses a low granularity domain model, LAOS, to extract the adaptation alternatives. The tests were performed in a class of over thirty students enrolled in the fourth year of the University "Politehnica" of Bucharest, taking a two week intensive course in Adaptive Hypermedia. The focus of this paper is on the experiment itself, and its parameters: the setting and initial planning, the implementation and the results. Finally, we will comment on the results and interpret them.

Key Words
Adaptive Educational Hypermedia (AEH), Authoring of Adaptive Educational Hypermedia, Adaptive Patterns

1. Introduction

Adaptive Hypermedia (AH) [4] appeared in response to the need for personalized views and guidance systems especially within *educational* hypermedia. Adaptive hypermedia aims to provide customized, appropriate information for each student. This can only be of benefit to the two actors in the learning process, the *teacher* and, most importantly, the *student*.
However, in spite of its successes and novel implementations, adaptive hypermedia is still largely unknown within the e-learning community, its most important target. This may be due to some of its disadvantages: the authoring task is complex; good authoring tools are lacking; reuse of authored materials is difficult; the structural overview is lacking; the adaptation is hidden in the implementation; authoring cooperation is almost impossible; and, finally, there is no standardized approach to adaptive techniques and behaviours.
As a response to these problems, we have endeavoured to extract patterns of adaptive hypermedia authoring, which can be reused. A pattern is described in [4] as the pairing of a problem and it's (repetitive) solution(s). Therefore, we have extracted typical AH problems, and defined the elements of the solutions [11]. Based on this theoretical background, as well as on a previous framework for authoring of adaptive hypermedia systems, called LAOS [9], we have implemented MOT (My Online Teacher [11])[1]. MOT is gradually implementing LAOS and the extracted AH authoring patterns. This paper presents an experiment using MOT with a class of undergraduate fourth year students that had to transform themselves into authors of educational adaptive hypermedia material. To test an authoring system, two types of experiment are required. The first step is to test the system with the authors of educational material, to see what type of products can be produced, what kind of flexibility can be achieved and how the authoring efficiency has been affected. The second step is to test the resulting educational material with (student) users, to see how the learning efficiency has been affected. In this paper we report on the second set of tests of the MOT prototype, belonging to the first category of possible experiments. Previous tests were described, based on user requirements and an earlier version of the system in [7].
The remainder of this paper is organized as follows. First, we undertake a short review of MOT and its components. Then, we present and discuss some student output samples. Following that we present the statistical analysis of the results of the course and student assignments. Finally, we discuss these results and conclude.

2. MOT

MOT [10] is an AEH web-authoring environment, constructed based on LAOS and LAG - the three-layer model for authoring adaptation, as introduced in [8]. MOT implements LAOS and the AH authoring pattern dimensions [11]: it contains a *domain model* in the form of a conceptual hierarchical layer (of atomic and composite concepts, built from a variable umber of

[1] pronounced 'moh', like the French word for 'word'

attributes). This is the part of the implementation that contains the learning resources, annotated with the respective metadata. The second part, also implemented from LAOS, is the *goal and constraints model*, in the form of a *lesson layer*, dealing with alternative presentation of contents at attribute level or above. This part of the implementation contains instructional material and instructional metadata. This structure conforms with the requirements of the W3C towards the third generation Web, called the Semantic Web. MOT now also implements a version of the LAG model, by having a newly added *adaptation model* with three possible levels for adaptation functionality. This means that the adaptation itself follows a three-layer granularity structure: direct *adaptation techniques* and rules; an *adaptation language;* and, *adaptation strategies*. Moreover, adaptation strategies can be saved as *adaptation procedures* and reused within other adaptation strategies, in the same way the adaptation language is used. In this way, the adaptation language can be extended and refined. The adaptation language and the adaptation strategies aim to reflect recurrent patterns in adaptive hypermedia authoring, so that the authors are spared the repetitive call to low level adaptation techniques.

This means that authors can create the static element of their courseware (i.e., the educational resources) and/or the dynamic element (i.e., the adaptation and personalization behaviour requirements) - in other words, author by using static or dynamic patterns. They don't have to author everything, because emphasis is on reuse, both for static as well as for dynamic material. This gives authors the freedom to make their own choices, according to their experience and preferences.

For our experiment, we allowed the students some reuse, especially of static material, but as the experiment's focus was on adaptive patterns and the authoring of the dynamic part, they had to create the dynamic material as well.

3. Experimental Goals and Procedure

By testing MOT in a classroom environment, we sought feedback on: the extent to which our

- *goals* were fulfilled with this system
    - LAOS pattern dimensions;
    - separation of domain;
    - goal and constraints models;
    - automatic authoring and automatic linking; LAG representation;
    - adaptive patterns representation;
    - and adaptive strategies representation; and the
- *usability* of the whole system.

The students were over thirty Romanian nationality students studying with the Faculty of Engineering in Foreign Languages at the "Politehnica" University of Bucharest. They were exposed to an intensive two-week course from 5th to 17th of January 2004, consisting of a set of lectures about adaptive hypermedia, and a hands-on testing time combined with tutoring during their progress. Specifically, the students were exposed to the following procedure [1]:

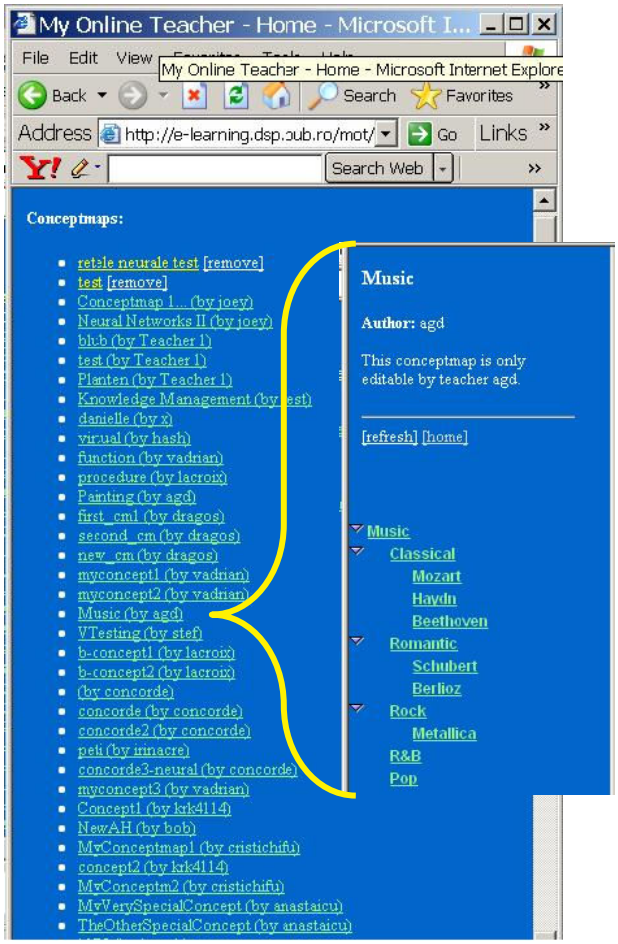
1. Pre-test on adaptive hypermedia
2. Pre-questionnaire on adaptive systems
3. Lecture on adaptive hypermedia
4. Lecture on LAOS [9]
5. Lecture on LAG [8]
6. Lecture on MOT [10]
7. Creating a presentation with MOT (domain and goal & constraints model) -individually [11]
8. Creating adaptation strategies and adaptation language constructs with MOT (adaptation, user and presentation model) - individually [11]
9. Post-test on adaptive hypermedia, LAOS, LAG and MOT (exam)
10. Post-questionnaire on MOT
11. Evaluation of assignments and student grading.

All of the students had to individually go through all the assignments. Group work was allowed, however, the output had to be individual. Here we need to mention that the students were told from the beginning that their negative evaluation of the system would not affect their grades, but that the thoroughness and constructiveness of their answers would. The questionnaires and the tests were kept apart, in order to separate their opinions about their experience from their actual results and work. In this paper we focus mainly on the results of the students' work, and what we can learn from it. The questions of all the questionnaires were mapped on a Likert scale between 0-10. There was plenty of space provided for free evaluations and opinions. The students' MOT system evaluation results were analyzed for: mean, standard deviation, and correlation [14]. Finally, the student course, adaptive procedures and strategies creation results were analyzed, in order to reflect on the: time necessary to become familiar with MOT; perceived flexibility of MOT; perceived freedom of expression in MOT; time necessary to create some courseware using MOT, etc. Their concept maps and respective lessons (corresponding to the goal & constraints model) can be seen on the online (Unix) MOT version [11].

4. Student Output

In the following, some of the student results are shown, then analysed.

Figure 1a shows a part of the list of concept maps created by the students of the Adaptive Hypermedia course in Romania, and Figure 1b shows an instance of a concept map created by the student with username 'agd'. Figure 1b shows also the hierarchy of concepts. When selected, concepts display their component attributes, which are either the actual learning resources, or pointers to them.



a) b)

Figure 1: a) A MOT domain concept map list created by the Romanian students. b) A MOT domain concept map instance on 'Music' created by one of the Romanian students.

Figure 3 shows a small part of the list of lesson maps created by the students. Figure 4 shows an instance of a lesson created by a student with username 'mariuszah'.

In Figure 4 we can see that lesson components are ordered (they are numbered). This order can be changed by the author. On the right of the learning item group titles, the flag 'AND' marks the request to consider all lesson components mandatory. The flag 'OR' would mark the free choice of any of the items in the group.

The adaptive strategy in Figure 2 checks if the exercises are solved for a general concept 'Concept' and, if not, displays the explanation attribute (hints helping to solve the exercises, it is to be presumed). Either way, it goes on by displaying the mark or evaluation of the student.

```
if * UM.Concept.exercise == not solved then
  ( [add statement]
  * UM.Concept.explanation = show
  [add statement]
  )
* UM.Concept.mark = show
```

Figure 2: A MOT short adaptive strategy created by one of the Romanian students with some small mistakes, showing also lacks of the adaptive strategy programming environment.

Figure 3: A MOT lesson concept map list created by the Romanian students, based on the domain concept maps.

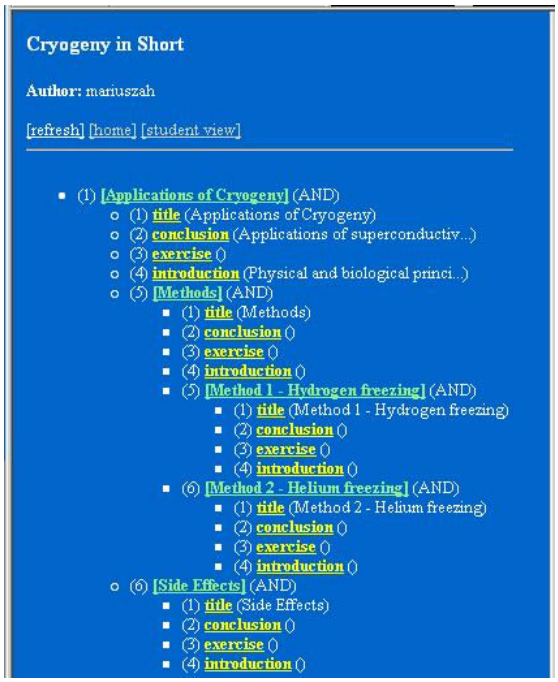


Figure 4: A MOT lesson concept map instance on 'Cryogeny' created by one of the Romanian students.

If *general* concepts are used, this means that the same strategy can be applied to any concept map that has the attributes that are used in it, so reuse is straightforward.

MOT also allows *specific* concept use, e.g.:

Music.Mozart.compositionnumber > 25

Students have also been using this latter type of referencing. In Figure 2 'UM.Concept.mark' should actually be replaced by 'PM.(UM).Concept.mark', referring to the presentation (PM [9]) of the user model (UM [4]) concept (Concept) mark being displayed. However, the current implementation of MOT doesn't allow for the latter more precise expression version.
Figure 5 shows another short strategy that also uses a call to a new adaptive procedure, 'proc_next', previously created by one of the students. This was required by one of their exercises in order to show that they knew how to reuse the dynamic part of the AEH system, and not only the static part.
It should also be noted that students used domain and lesson map overlay user variables frequently, for example to check if some particular resource was read, or accessed, or understood.

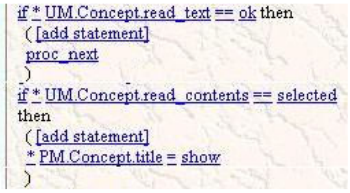


Figure 5: A correct MOT adaptive strategy with procedure call.

Finally, Figure 6 displays a longer, more elaborate strategy written by one of the students. It displays the usage of stereotypes, such as beginner ('incepator'), advanced ('avansat'), checking student marks ('Nota'), checking of pages read, etc.

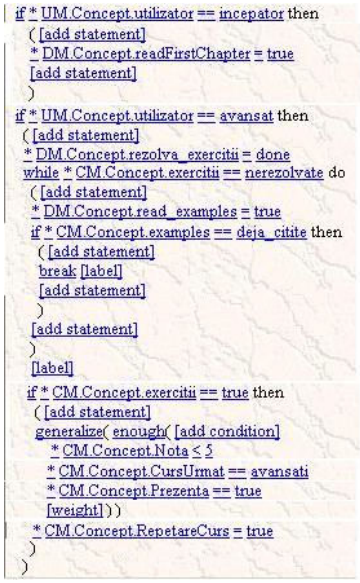


Figure 6: A longer MOT adaptive strategy created by the students.

5. Results

Some of the student results according to the evaluation at various stages are presented in the following. We will present some detailed hypotheses we made and the actual results confirming or refuting them.

Hypothesis 1: The performance on the MOT experiment and on the exam is similar (depends on the students' mental abilities).
Hypothesis 2: The performance on the three parts of the MOT experiment is similar (the creation of static material is similar in complexity to that of dynamic material.

First let's have a look at the individual trajectories of the students performance with respect to the four major tests: the exam (post-test), and the three hands-on experience evaluations of work with MOT.
The three parts of MOT testing were concerned with domain concept map editing; the lesson map editing; and the adaptive strategies editing, as exemplified in section 4. For more information on the tests see [1] and Annex 3.
Figure 7 shows that most students performed better with the system than in the written examination. This is probably also due to the fact that they had constant guidance during the work with the system, as well as peer help, whereas in the exam they did not. Also it can be seen that the spread of marks is greater for the exam and the third MOT experiment. This shows they were of greater difficulty then the first two experiments. The exam questions covered the whole study material, and therefore probably the difficulty. The third MOT experiment was on creating the dynamic part of the system, which was more difficult. This *refutes* the 2nd hypothesis.
In more detail, the pair-wise correlation between the results of the MOT experiment is high (first and second part, 97.8%; second and third part, 94.5%; first and third part is 94.1%). So even if the results were different in average and spread, they are highly related. The refutation of hypothesis 2 means that dynamic material creation is more complicated than static material creation, and would probably require some specialist or trained personnel.
To investigate hypothesis 1, we look at how much does the knowledge of the theory influence the good performance in the practical element, and vice versa. Note that the exam took place after the theoretical element of the course, when the practical work with MOT had only just started.

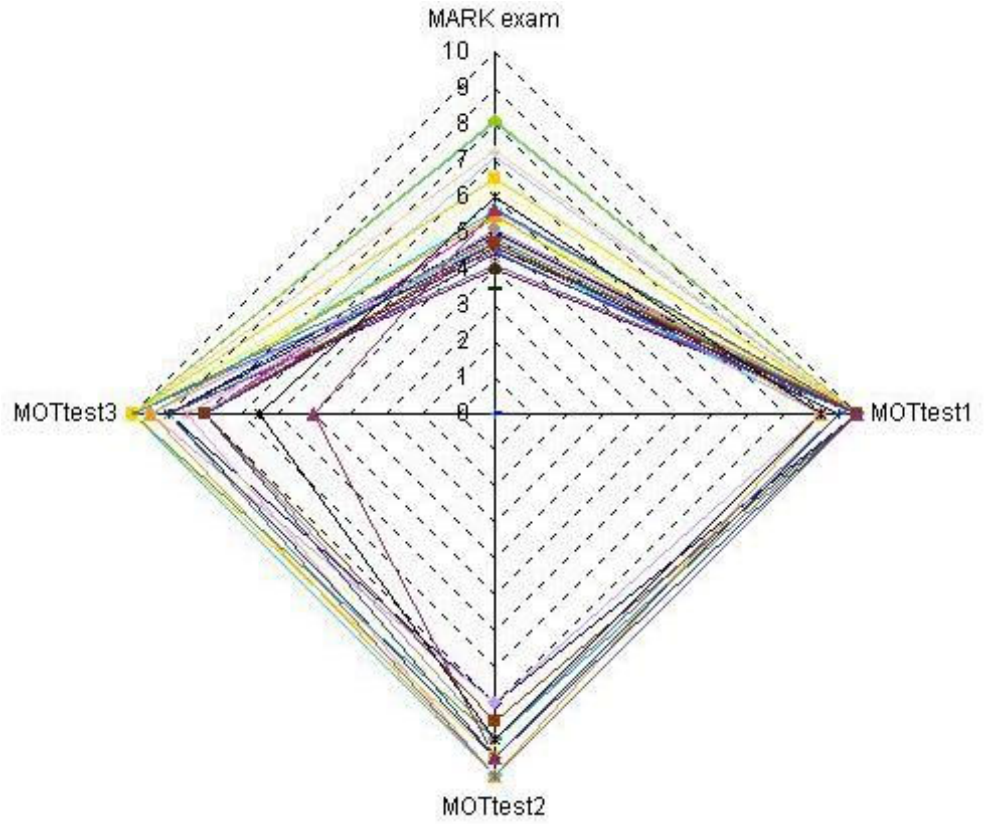


Figure 7. The distribution of exam marks and project work.

Mean X	4.625000
Mean Y	7.468750
Variance X	2.984375
Variance Y	10.624023
Covariance X and Y	3.863281
Correlation X and Y	0.686096
Regression Y on X	1.294503
Regression X on Y	0.363636

Figure 8: The comparison of the exam results and the average results of performance with the MOT system.

Figure 8 shows a high correlation (68.6%) between the performance with the MOT system and the exam. This would lead to the conclusion that the knowledge of the theoretical and practical elements are correlated. This *confirms* the 1st hypothesis. This also means that teachers and authors will need appropriate training to understand the purpose and meaning of what they are doing, at least for the part (e.g., static or dynamic) that they are authoring with the system.

Hypothesis 3: The students' results with the MOT experiments are dependent on their prior knowledge.

To check whether the students' results are dependent on their previous background knowledge, we compare the pre-test and the post-test (exam) results (Figure 9).

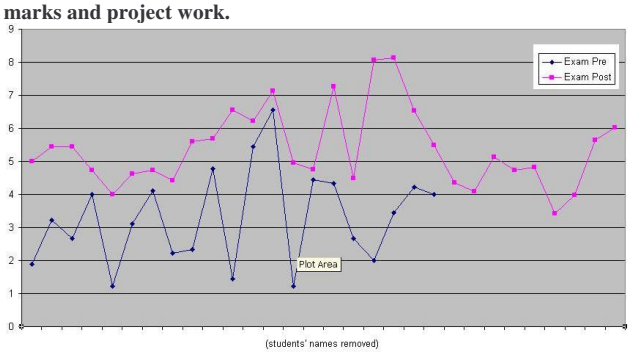


Figure 9. Comparison of Pre and Post test results.

Are the pre- and post-test results correlated? Seemingly yes, but let's look at the exact data. We compared only the students who performed both tests (Figure 9); the others, who took only the post-test, are not be included.

Mean X	2.952381
Mean Y	5.238095
Variance X	1.950113
Variance Y	1.705215
Covariance X and Y	0.439909
Correlation X and Y	0.241237
Regression Y on X	0.225581
Regression X on Y	0.257979

Figure 10. The comparison of the pre-test & post-test (exam) results.

The results of this comparison can be seen in Figure 10. Surprisingly enough, the correlation between pre-test and post-test is low (24%). Similarly, comparing the

performance on the MOT experiment with the prior test, we obtain a low correlation (-39.7%). This seems to point at the fact that their prior knowledge had little to do with their later performance, *refuting* hypothesis 3. Indeed, examining the results of the pre-test, one can see that their prior knowledge was quite low (average of 29.5%). However, the variations in the prior knowledge, together with the fact that it doesn't influence the final results too much, leads to the conclusion that, with short, proper training, anybody would be able to create adaptive educational hypermedia courseware.

Hypothesis 4: The MOT system is easy to use.

As Figure 11 shows, the hypothesis 4 is supported by the questionnaire on system usage (Annex 3), as follows. Supporting questions are question 3 on *ease of use* (mean 3.69, variance 0.75), question 2 on *complexity* (mean 3.08, variance 0.92) and partially question 9 on *self confidence in using* (mean 3.08; the variance of 1.23 is relatively high, showing different confidence values for different students). Another indirectly supporting question is the question 1 on *liking to use the system frequently* (mean 3.2, variance 0.77).

The same figure also shows a high preference towards the need of *technical support*, although, as question 7 shows, the system is considered *easy to learn* by the majority (mean 3.15, but with high variance 1.36).

The questionnaire also shows that the system is considered to be well integrated, even if inconsistencies are still found. For the latter, the students spotted for instance a bug at saving the strategies again without name change, which can sometimes result in loosing the information and having to type it again.

Hypothesis 5: The MOT system is flexible (many different alternative views can be created easily).

For the testing of this hypothesis, we had to look first during a qualitative evaluation at the different products the students delivered. Many students created also their own concept attribute types, for instance, to express information of a nature other than that in the standard attributes provided by MOT. The variety and flexibility of their created material can be seen on the MOT site for the experiment [1].
For a quantitative, statistical evaluation, we performed a different questionnaire on MOT usage. Here we are going to present only the part of it directly related to reuse, as shown in Figures 12, 13 as we consider, as already stated in the introduction, that reuse is in itself a measure of flexibility. MOT is supposed to provide authors with AH pattern-based solutions for authoring, allowing as much reuse as possible.

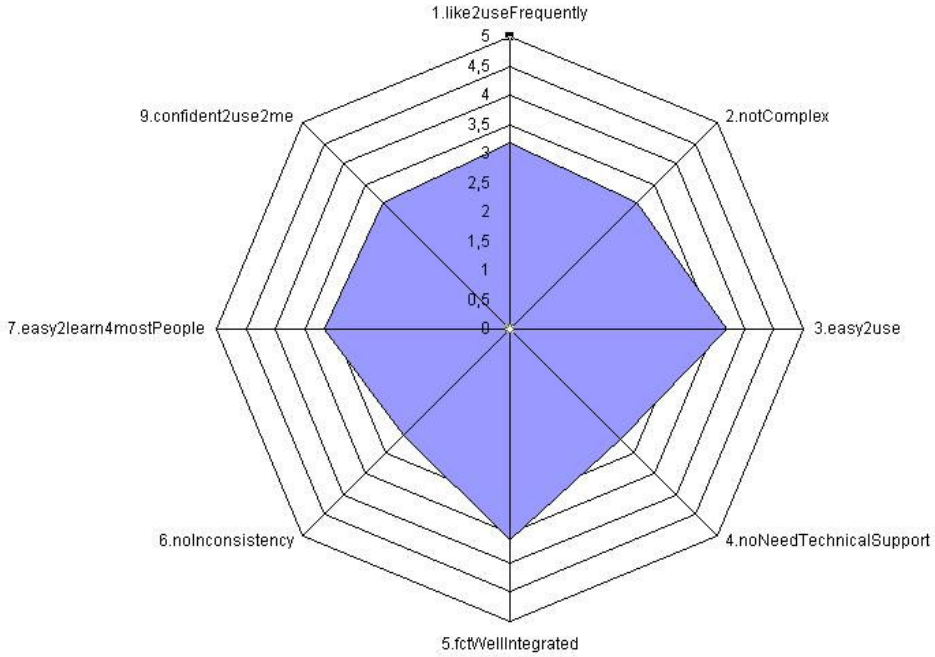


Figure 11. MOT System Usage Questionnaire Results on a scale from 1 (totally disagree) to 5 (totally agree).

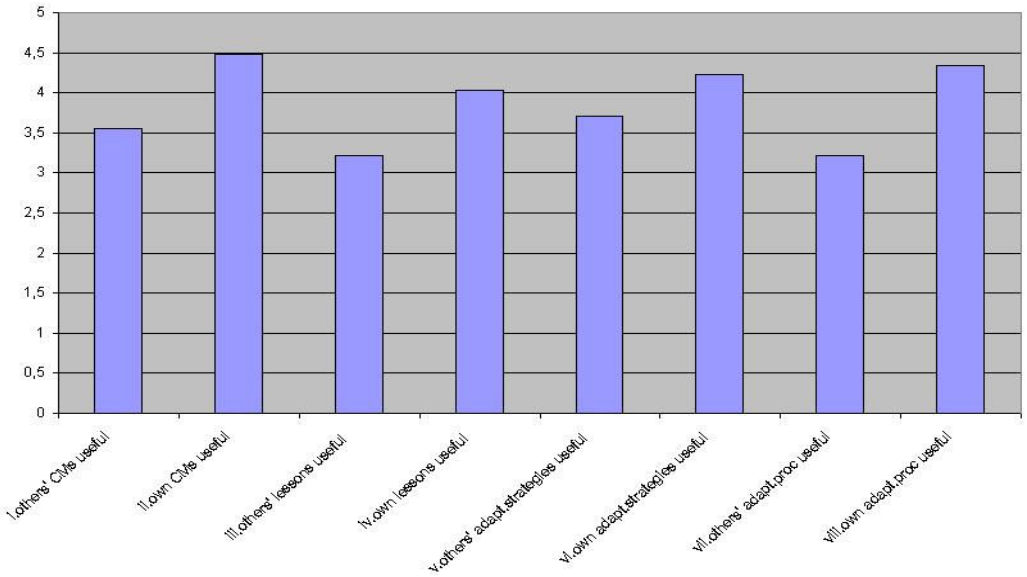


Figure 12. Opinion of students on the Usefulness of Reuse within MOT. The scale is from 1-not useful at all; to 5 – extremely useful.

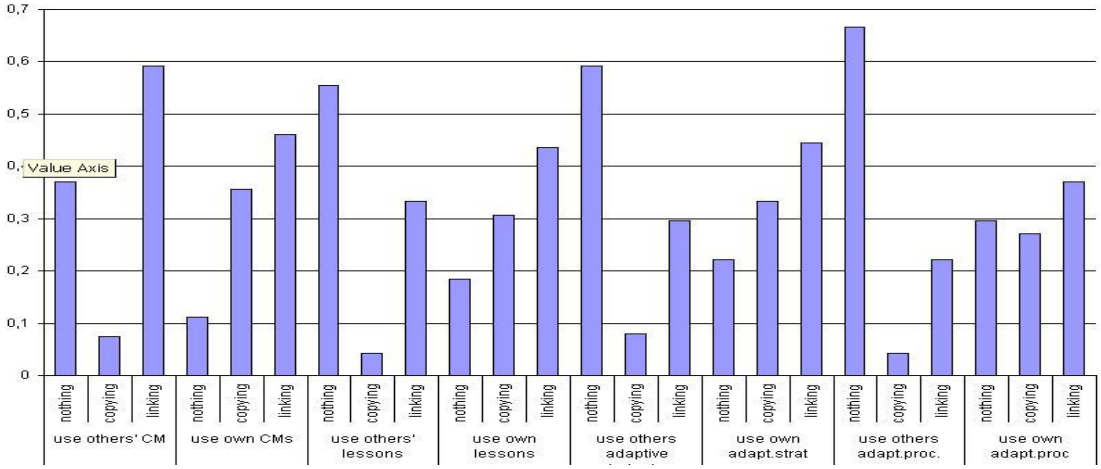


Figure 13. Actual Reuse of MOT ADAPT Pattern Components by the students. The scale is in percentage from 0 to 1, expressing the relative number of students selecting that answer. The sum of answers of *nothing*, *copying* and *linking* is normalized to 1 for each separate answer.

First we started by asking the students' opinion about the usefulness of reuse within MOT. Please note that this was done after they had performed all the tasks in Annex 1 on MOT, so they generally speaking had a good grasp of what type of reuse is achievable in MOT. We therefore limited the question to those items that can be reused, such as other authors' concept maps, ones own concept map, others' lessons, etc. The results are shown in Figure 12. Students found most useful the reuse of elements from their *own concept maps* (mean 4.48, variance 0.62), as well as the reuse of the *adaptive procedures* (mean 4.33, variance 0.89) and the reuse of their own *adaptive strategies* (mean 3.7, with a higher variance, however 1.76). It is interesting to note that the reuse of their own material in different presentations was considered generally speaking the most useful (probably because the author knows the contents and its goal the best use). However, all reuse questions scored above average.

Next, we looked at what the students really reused, and in what proportion, as shown by Figure 13. Most reuse takes place, as can be seen in the Figure 13, in the form of reuse of ones own *concept maps*, *lessons* and *adaptive strategies*.

Please note that the actually reused were adaptive strategies and not procedures, as were selected previously as being useful to reuse. *Adaptive procedures* themselves are also reused, but to a lesser degree. *Linking* seems the slightly preferred way of reuse, as opposed to *copying*, even for the reuse of ones own material.

The reuse of others' materials is on a much smaller scale, as can be seen in the Figure 13. Moreover, in the reuse of others' materials, linking is highly preferred to copying.

These results support hypothesis 5.

6. Conclusion

This paper reports on the results of the second set of 'in class' experiments for the MOT system, and adaptive hypermedia authoring system with application in education. At the time of the experiment, MOT only implemented three of the five layers of the LAOS framework, so the testing was able to give us useful

insight about the next implementation steps necessary to fulfil the LAOS requirements. The results shown here are only a partial analysis of the data, and further correlation analysis (for instance, between the different answers) is necessary to extract the significance of these results with higher confidence.

Moreover, have examined the data of the questionnaires concerning system use, in order to relate these to the students' results and determine possible improvements of the current implementation of the MOT system, in addition to generating more feedback of a theoretical nature.

We have shown (section 4) what type of products the students can produce with the MOT system based on patterns of adaptive hypermedia authoring. The examples covered both major aspects of the system: static and dynamic data creation. For a larger statistical view, we have shown the individual grading results of the whole class for the project work (Figure 7).

In order to determine the efficiency and flexibility of the proposed pattern dimensions, we have looked at the problem we tried to tackle: reuse. The questionnaires give answers with respect to the degree of perceived reuse and actual reuse in MOT (Figures 12, 13).

Moreover we have performed evaluations for the specific case of adaptive patterns, expressed at the different levels with the help of adaptation language and adaptation procedures and strategies. We have questioned the students about their understanding and usage of these components, about superfluous elements and about what they found lacking.

Other information resulted from our evaluations. We have learned, for instance, that theory of adaptive hypermedia must be related to the praxis, showing that there is some minimal training required in order to produce viable AEH. To localize the training needed for creating static or dynamic elements of the AEH, more specialized tests would be necessary. However, from the preliminary results, as expected, it seems that creators of the dynamic material would need most of the training. This can be seen in Figure 7, where for the third phase of testing (dynamic rule authoring) most students had lower scores. These results may however be influenced by the fact that students have a general tendency to score less in the last part of a hands-on test, when they consider to have already scored more than enough to pass in the previous sections.

Concluding we would like to remark that, as there are no benchmarks for adaptive educational hypermedia or AEH authoring, testing in these domains is vital. Here we have shown some results of this important process in the development of an authoring system for general AEH.

7. Acknowledgements

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References:

[1] Adaptive Hypermedia course site, http://wwwis.win.tue.nl/~acristea/HTML/PUB04/

[2] AHA!. http://aha.win.tue.nl.

[3] ADAPT project web site http://wwwis.win.tue.nl/ ~acristea/ HTML/Minerva/index.html

[4] Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I. & Angel, S. (1997). *A Pattern Language*. Oxford University Press, New York.

[5] P. Brusilovsky, Adaptive hypermedia, *User Modeling and User Adapted Interaction,* Ten Year Anniversary Issue (Alfred Kobsa, ed.) *11*(1/2), 2002, 87-110.

[6] L. Curry, Integrating Concepts of Cognitive or Learning Styles: A Review with Attention to Psychometric Standards, *Canadian College of Health Services Executives*, Ottawa, Ontario, Canada, 1987.

[7] A.I. Cristea, Evaluating Adaptive Hypermedia Authoring while Teaching Adaptive Systems. *SAC*, Track ELS'04, ACM.

[8] A.I. Cristea, & L. Calvi, The three Layers of Adaptation Granularity. Proc UM'03, Springer.

[9] A. Cristea, & A. De Mooij, LAOS: Layered WWW AHS Authoring Model and its corresponding Algebraic Operators. *Proc 14th Intl. World Wide WebConference*, Budapest, ACM, Hungary 20-24 May 2003.

[10] A.I. Cristea & A. De Mooij, Designer Adaptation in Adaptive Hypermedia Authoring, *Proc. ITCC'03*, Las Vegas, US, IEEE Computer Science, 444-448, 2003.

[11] F. Garzotto & A. Cristea, ADAPT Major Design Dimensions for Educational Adaptive Hypermedia, ED-MEDIA'04, Lugano, Switzerland.

[12] MOT, http://e-learning.dsp.pub.ro/mot/ & /motadapt/

[13] N. Stach, A. Cristea & P. De Bra, Authoring of Learning Styles in Adaptive Hypermedia: Problems and Solutions. *Proc. 13th Intl. World Wide WebConference*, New York, May 2004.

[14] Statistical tools online: http://calculators.stat.ucla.edu/

[15] WHURLE, http://whurle.sourceforge.net/

[16] H. Wu, A Reference Architecture for Adaptive Hypermedia Applications, doctoral thesis, *Eindhoven University of Technology*, The Netherlands, ISBN 90-386-0572-2.

ANNEX 1: Tests of MOT within the course 'Adaptive Hypermedia' at PUB, January 2004: http://wwwis.win.tue.nl/~acristea/HTML/PUB04/

MOT ('moh') Testing Part 1

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1. create your own, personal teacher account at: http://e-learning.dsp.pub.ro/mot/
   (or http://wwwis.win.tue.nl/MOT03/TeachersSite-html/enter.html)
2. create a new concept map of the domain model with concepts with all standard attributes
3. create a new concept map of the domain model with a different name with concepts with only three standard attributes
4. change the name of the root concept for each concept map in the domain model that you created
5. create three children for each root concept of the concept maps above
6. add more children to the concept maps, so that the depth becomes 3
7. change the default number of standard attributes to three (different from the ones chosen for the second CM) for the concepts of the first concept map, by editing it (edit concept map)
8. add two concepts to the first concept map, to check that the change works;
9. select one concept and add extra attributes different from the standard attributes to it

10. add some keywords for at least two concepts (separate them with ';'); make sure that the concepts have at least one concept in common
11. calculate the relatedness relations and for at least one of the concepts, and check that the other concept with at least one keyword in common is found; add it to the relatedness relations

MOT ('moh') Testing Part 2
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12. create a new concept map; copy the Neural Network course into it
13. transform the last concept map into a new lesson, by keeping all standard attributes;
14. look at the student view of the lesson, to check what you copied;
15. create another two lessons with fewer attributes, considering some teaching goals;
16. view the newly created lessons;
17. change the order of the attributes in the lessons created which need to be re-ordered. Perform this change for at least one lesson.
18. think of possible alternative views for at least one of the lessons and use the OR relationships to create alternative views;
19. add weights representing either difficulty or importance to your OR connections; label each of these alternatives correspondingly
20. create two very short new lessons, by adding directly the concept attributes from the domain model (concept map) into the lessons
21. create a third lesson by copying one of the last new lessons into the other one
22. view the result in the student view

MOT ('moh') Testing Part 3
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23. enter the adaptive strategy and procedure interface (the adaptation model, for adaptation language and adaptive strategies) – (http://e-learning.dsp.pub.ro/motadapt/)
24. select the creation of a new strategy; give it a name, and a description;
25. create a strategy using at least once each adaptation language construct, without instantiating it
26. instantiate all the constructs above; use at least one generic concept reference and one specific concept reference;
27. use the construct 'break';
28. use the construct 'enough', by inserting three conditions of which only two must be satisfied to trigger the loop (or 'if')
29. create a new strategy of a small size (at most two constructs) and with generic concept usage; transform this strategy into a procedure
30. create another new strategy, and include some adaptation language constructs and the new procedure
31. create two realistic strategies of teaching NN, based on the concept map and lessons that you have created previously

(you can use for inspiration for part 3 the two ITCC papers in the course directory, at: http://wwwis.win.tue.nl/~acristea/HTML/PUB04/)

ANNEX 2: **Questionnaire UPB Adaptive Hypermedia course – post course: System (& partially, framework) tested**
Date: 12.01.2004 Study direction: Teacher: Dr. Alexandra Cristea
Name of course preceding project: Adaptive Hypermedia
Please circle what appropriate (sometimes you might want to circle two items) or fill-in:

I. MOT

a. General (this refers to both interfaces, for Concept Map and Lesson creation, as well as Adaptive Strategies creation)

1. Did you understand how the system works?
(no/not really/somewhat/mostly/yes)
2. Did you prefer the standalone version of MOT or the version on the web?
standalone; web version;
3. Do you consider MOT to be a useful system towards adaptive hypermedia creation?
(no/not really/somewhat/mostly/yes)

b. Collaboration and re-usage

1. Do you consider it useful to be able to look at other people's concept maps during your own presentation creation?
(no/not really/somewhat/mostly/yes)
1. Did you use other people's concept maps (copying or linking)?
nothing; copying; linking;
2. Do you consider it useful to be able to use part of your own concept maps?
(no/not really/somewhat/mostly/yes)
1. Did you re-use parts of your own concept maps (copying or linking)?
nothing; copying; linking;

Do you consider it useful to be able to look at other people's lessons during your own presentation creation?
(no/not really/somewhat/mostly/yes)
2. Did you use other people's lessons (copying or linking)?
nothing; copying; linking;

Do you consider it useful to be able to use part of your own lessons?
(no/not really/somewhat/mostly/yes)
3. Did you re-use parts of your own lessons (copying or linking)?
nothing; copying; linking;

Do you consider it useful to be able to look at other people's adaptive strategies during your own presentation creation?
(no/not really/somewhat/mostly/yes)
4. Did you use other people's adaptive strategies (creating different versions)?
nothing; copying; linking;

Do you consider it useful to be able to use part of your own adaptive strategies?
(no/not really/somewhat/mostly/yes)
5. Did you re-use parts of your own adaptive strategies (creating different versions)?
nothing; copying; linking;

Do you consider it useful to be able to look at other people's adaptive procedures during your own presentation creation?
(no/not really/somewhat/mostly/yes)
6. Did you use other people's adaptive procedures (including them in your own strategy/ procedure)?
nothing; copying; linking;

Do you consider it useful to be able to use part of your own adaptive procedures?
(no/not really/somewhat/mostly/yes)
7. Did you re-use parts of your own adaptive procedures (including them in your own strategy/ procedure)?
nothing; copying; linking;

c. User interaction

1. Did you consider the user interface of MOT sufficient?
(no/not really/somewhat/mostly/yes)
1. If not, name a maximum of three things that you missed or that should be improved (for each interface).

2. Was MOT easy to use?
(no/not really/somewhat/mostly/yes)

d. Concept maps

1. Did you use different (extra to standard, or less than standard) attributes for your concepts?
(no/not really/somewhat/mostly/yes)
2. Did you consider the standard attributes useful for expressing your concept map? **(no/not really/somewhat/mostly/yes)**

If no, name the ones that shouldn't have been there, or up to three that you missed.

3. Did you use the concept relatedness connection function?
(no/not really/somewhat/mostly/yes)

4. What size did you in average use for the text attribute of the concept?

50; 100; 300; 500;
1000 or more words;
too various to be relevant
used only existing concepts

e. Lessons

1. Did you understand the difference between a concept and a lesson?
(no/not really/somewhat/mostly/yes)
2. Did you consider the above difference useful?
(no/not really/somewhat/mostly/yes)
3. Did you use automatic transformation from concept map structure to lesson? **(no/not really/somewhat/mostly/yes)**
4. Did you use one-by-one copying from concept attributes to lessons? **(no/not really/somewhat/mostly/yes)**
5. Did you use the AND-OR relations within lessons?
(no/not really/somewhat/mostly/yes)
6. Did you use the weights for the AND-OR relations?
(no/not really/somewhat/mostly/yes)
7. Did you use the priority (order) relation between sub-lessons connected by AND-OR relations?
(no/not really/somewhat/mostly/yes)

f. Adaptation Model

1. Did you understand the difference between adaptive strategies and adaptive procedures?
(no/not really/somewhat/mostly/yes)
2. Which adaptation language construct did you use? Write next to them a number in decreasing order of frequency (i.e., 1 next to the most frequent, a.s.o.). If you have used other procedures as well, write them down.

(IF/WHILE/FOR/GENERALIZE/SPECIALIZE/ACTION/ENOUGH)

3. What adaptation language construct do you consider superfluous?

(IF/WHILE/FOR/GENERALIZE/SPECIALIZE/ACTION/ENOUGH)

4. What adaptation language construct did you miss (should be added, in your opinion)?
5. Do you understand the difference between using general concepts and specific concepts in rules?

(no/not really/somewhat/mostly/yes)

6. What did you use the most?

(general concepts/specific concepts)

II. LAOS (framework of MOT, containing *domain*-, *goal and constraints* (lesson) -, *user* -,*adaptation* -, and *presentation* model) + LAG (*adaptation model*)

g. Do you understand the difference between an adaptive hypermedia authoring system and an adaptive hypermedia system?

(no/not really/somewhat/mostly/yes)

h. Do you understand the difference between an adaptive hypermedia authoring model and an adaptive hypermedia authoring system?

(no/not really/somewhat/mostly/yes)

i. Did you understand the main ideas of the LAOS framework?
(no/not really/somewhat/mostly/yes)
j. Did you understand the main ideas of the LAG framework?
(no/not really/somewhat/mostly/yes)
k. Do you consider that if MOT would implement all LAOS+LAG functionality, it would make adaptive hypermedia creation easier?
(no/not really/somewhat/mostly/yes)
l. After this course is finished, I would be interested to experiment with MOT and its future versions.
(no/not really/somewhat/mostly/yes)

III. Any other comments you wish to make?

ANNEX 3: System Usability

1. I think that I would like to use this system frequently
(**1-strongly disagree … 5-strongly agree**)
2. I found the system unnecessarily complex
(**1-strongly disagree … 5-strongly agree**)
3. I thought the system was easy to use
(**1-strongly disagree … 5-strongly agree**)
4. I think that I would need the support of a technical person to be able to use this system
(**1-strongly disagree … 5-strongly agree**)
5. I found the various functions in this system were well integrated
(**1-strongly disagree … 5-strongly agree**)
6. I thought there was too much inconsistency in this system
(**1-strongly disagree … 5-strongly agree**)
7. I would imagine that most people would learn to use this system very quickly
(**1-strongly disagree … 5-strongly agree**)
8. I found the system very cumbersome to use
(**1-strongly disagree … 5-strongly agree**)
9. I felt very confident using the system
(**1-strongly disagree … 5-strongly agree**)
10. I needed to learn a lot of things before I could get going with this system
(**1-strongly disagree … 5-strongly agree**)

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Paul Cristea graduated the Faculty of Electronics and Telecommunications (PUB -"Politehnica" University of Bucharest, 1962) and the Faculty of Physics (University of Bucharest, 1969). He obtained the Ph.D. in Technical Physics (PUB, 1970). Since then his research and teaching activities covered an extended area of Electrical Engineering and related domains including topics like Digital Signal and Image Processing, Genomic Signals, Neural and Evolutionary Systems, Computerized Medical Equipment, Evolutionary Intelligent Agents, Intelligent e-Learning Environments. He is the author or co-author of more then 125 published papers, 11 patents, and contributed to more then 20 books in these fields. Currently he is director of studies at the Engineering Faculty in Foreign Languages of PUB, general director of the Bio-Medical Engineering Center of PUB and director of the Romanian Bioinformatics Society.