

# The Influence of Cognitive Styles on the Design of Adaptive Web-based Learning Materials

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# ABSTRACT

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This research addresses the issues of adaptation and personalisation of the computer interface for Web-based learning materials taking into consideration key characteristics of learners and particularly their cognitive style.

The thesis examines main concerns driving learning towards individualisation. Different approaches to adaptation and personalisation are analysed, as are a range of adaptive systems. The need for further research regarding individual differences is identified; it is argued that cognitive styles should be allowed for in designing adaptive learning materials.

A comprehensive review of cognitive style classifications is presented, from which key defining attributes and advantageous instructional conditions are identified and a number of adaptive variables derived.

LEARNINT, a prototype based on these variables was developed and used in two experimental studies. Results show a relationship between Interface Affect and learning outcomes and also between the variables underpinning the interface style used and variation in user reactions and performance; however, little interaction is observed between these variables and cognitive style.

It is suggested that for most learners using Web-based learning materials performance may improve if they experience positive affect towards the interface; also, that the proposed variables stand as good candidates for providing adaptivity. A methodological approach is presented that extends the functionality of LEARNINT. The generic aspects of the research are further elaborated offering guidance on future directions for the design of adaptive Web-based learning materials.

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*“Gratitude is the memory of the heart”*

(Jean Baptise Massieu)

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# LIST OF ABBREVIATIONS

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<b>AH</b>	<b>Adaptive Hypermedia</b>
<b>AJAX</b>	<b>Asynchronous JavaScript and XML</b>
<b>CAA</b>	<b>Computer Aided Assessment, Computer-Assisted Assessment</b>
<b>CAI</b>	<b>Computer Aided Instruction</b>
<b>CAL</b>	<b>Computer Aided Learning</b>
<b>CAT</b>	<b>Computer Adaptive Tests</b>
<b>CSA</b>	<b>Cognitive Styles Analysis test</b>
<b>CBL</b>	<b>Computer Based Learning</b>
<b>CBT</b>	<b>Computer-Based Test</b>
<b>CD ROM</b>	<b>Compact Disc-Read Only Memory</b>
<b>CMC</b>	<b>Computer Mediated Communications</b>
<b>DVD</b>	<b>Digital Versatile Disc</b>
<b>HE</b>	<b>Higher Education</b>
<b>HTML</b>	<b>HyperText Markup Language</b>
<b>ICT</b>	<b>Information and Communication Technologies</b>
<b>IMS</b>	<b>IMS Global Learning Consortium</b>
<b>ITS</b>	<b>Intelligent Tutoring System</b>
<b>IRT</b>	<b>Item Response Theory</b>
<b>LCMS</b>	<b>Learning Content Management Systems</b>
<b>LIPS</b>	<b>List Processor (programming language)</b>
<b>LO</b>	<b>Learning Object</b>
<b>LOM</b>	<b>Learning Object Metadata</b>
<b>LT</b>	<b>Learning Technology</b>
<b>MLE</b>	<b>Managed Learning Environments</b>
<b>SUS</b>	<b>System Usability Scale</b>
<b>URL</b>	<b>Uniform Resource Locator</b>
<b>VICS &amp; E-CSA-WA</b>	<b>Verbal-Imager Cognitive Style &amp; Extended Cognitive Style Analysis Wholist-Analytic test</b>
<b>VLE</b>	<b>Virtual Learning Environments</b>
<b>WWW</b>	<b>World Wide Web</b>
<b>Web</b>	<b>World Wide Web</b>
<b>XHTML</b>	<b>EXtensible HyperText Markup Language</b>
<b>XML</b>	<b>EXtensible Markup Language</b>
<b>XSP</b>	<b>EXtensible Server Pages</b>

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# LIST OF PUBLICATIONS

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The following articles were published during my period of research. Certain material and concepts from these publications will necessarily be presented within the body of this work.

- Uruchurtu, E., Rist, R., MacKinnon, L. (2006) Interface Affect and Familiarity: Some Implications for Designing the Interaction. In Bryan-Kinns, N., Blandford, A., Curzon, P. & Nigay, L.(Eds.) *People and Computers XX – Engage*, proceedings of Proceedings of the *20th British HCI Group Annual Conference*. Queen Mary University of London, 11-15 September. London: Springer-Verlag, pp. 73-82.
  
- Uruchurtu E., MacKinnon L., Rist R. (2005) Designing the Learning Interface using Cognitive Styles. Proceedings of the *19th British HCI Group Annual Conference*, Vol. 2. Edinburgh, Scotland, 5-9 September.
  
- Uruchurtu E., MacKinnon L., Rist R. (2005) User Cognitive Style and Interface Design for Personal, Adaptive Learning. What to Model?. In Ardissono L., Brna P. and Mitrovic A. (Eds.) Proceedings of the *10th International Conference on User Modeling*. Edinburgh, Scotland, 24-29 July. Lecture Notes in Artificial Intelligence 3538. London: Springer-Verlag, pp. 154-163.
  
- Uruchurtu E., MacKinnon L., Rist R. (2004) Interface Design for Adaptive, Personal Learning Systems. Doctoral Consortium at the *18th British HCI Conference*. Leeds Metropolitan University, 6-10 September.