

THESIS / THÈSE

DOCTOR OF SCIENCES

Methodology for automating web usability and accessibility evaluation by guideline

Beirekdar, Abdo

Award date:
2004

Awarding institution:
University of Namur

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.



Facultés Universitaires
Notre-Dame de la Paix

A Methodology for Automating Guideline Review of Web Sites

Abdo Beirekdar

Thesis submitted in fulfillment of the requirements for the degree of Doctor of Sciences
(Computer Science Option)

- August 30th, 2004 -

Director: Professor M. Noirhomme-Fraiture
Co-director: Professor J. Vanderdonckt, Université Catholique de Louvain, Belgium
Jury: Professor F. Bodart
Professor J.-L. Hainaut (President)
Professor Ch. Kolski, Université de Valenciennes, France
Professor Ph. Palanque, Université Paul Sabatier - Toulouse III, France

Institut d'Informatique
NAMUR

Table of Contents

Chapter 1. Introduction

1.1	The Situation	1
1.1.1	Usability	2
1.1.2	Accessibility	4
1.1.3	Relationship between Accessibility and Usability.....	5
1.2	The Problem	7
1.2.1	Reasons	7
1.2.2	Solution1: User testing.....	8
1.2.3	Solution2: U&A Guidelines.....	8
1.3	Our Approach to Automating Web U&A Evaluation....	10
1.4	Context of the proposed work.....	11
1.5	Aim of the research	11
1.6	Thesis content	12

Chapter 2. State of the Art of Automated Web Evaluation

2.1	Introduction.....	13
2.2	Usability evaluation: Basic Concepts	14
2.2.1	Usability and Web Site Design Process.....	14
2.2.2	Usability Evaluation.....	16
2.2.3	Empirical and analytical approaches	17
2.2.4	Evaluation phases.....	17
2.2.5	Black-testing and White-testing.....	17
2.3	Usability evaluation taxonomies	19
2.3.1	Balbo [1995]	19
2.3.2	Brajnik [2000].....	19
2.3.3	Ivory and Hearst [2001].....	20
2.3.4	Methods for Web ergonomic evaluation.....	21
2.3.5	Supported analyses.....	22
2.3.6	Our Focus: UE by Guideline Review	26
2.4	Overview of automated tools for evaluation by Guideline Review.....	29
2.4.1	Tools for traditional UI.....	29
2.4.2	Web tools	31
2.4.3	Characterization of user abilities	32
2.4.4	Evaluating whether Web sites support diverse user abilities.....	32
2.4.5	Comparison of tools Assessments	36

2.5	Expanding existing approaches to automating evaluation by guideline review	42
2.5.1	Anatomy of existing evaluation tools	43
2.5.2	A new approach for automated Web UE	46

Chapter 3. A Methodology for Automating Web Evaluation

3.1	Introduction	47
3.2	Evaluation scenarios	47
3.2.1	Web site evaluation	47
3.2.2	Web page design	48
3.3	The Methodology	49
3.3.1	Guideline Structuring	49
3.3.2	Web page parsing	50
3.3.3	Guideline evaluation	51
3.4	Evaluation Improvement	51
3.4.1	Guideline Structuring	51
3.4.2	Web page Parsing	52
3.4.3	Guideline evaluation	52
3.5	Evaluation activity based on the proposed methodology	53
3.5.1	Tasks	53
3.5.2	Quality factors	54
3.5.3	Automation Limits	54
3.6	Development of automated Web evaluation tool	56
3.6.1	Developing a Tool Based on Guidelines	56
3.6.2	Our Tools	57
3.7	Summary	58

Chapter 4. A Framework for Evaluation-Oriented Structuring of Web Guidelines

4.1	Introduction	59
4.1.1	Requirements	60
4.1.2	Related works	60
4.1.3	Our framework	64
4.2	The Framework	65
4.2.1	Step 1: Interpret the guideline	66
4.2.2	Step 2: Specify HTML elements useful for the evaluation	71
4.2.3	Step 3: Structure selected elements into evaluation sets	72
4.2.4	Step 4: Specify the evaluation logic	77
4.2.5	The formal Guideline	82
4.3	Framework Advantages	83

4.3.1	Control of the evaluation process	83
4.3.2	Support for multiple guidelines sources and interpretations.....	83
4.3.3	Semantic similarities and differences among guidelines	85
4.4	Approach Extensibility	88
4.4.1	Level Extension	88
4.4.2	Technology Extension	90
4.5	Summary	92

Chapter 5. A Formal Evaluation-Oriented Guideline Definition Language (GDL)

5.1	Introduction	95
5.1.1	The syntax	95
5.1.2	The semantics.....	97
5.1.3	Aims of the GDL	98
5.1.4	Models of a GDL specification.....	98
5.2	Semantics of the GDL	99
5.2.1	GUIDELINE	99
5.2.2	INTERPRETED_GL	99
5.2.3	INTER_CONTEXT	100
5.2.4	FORMAL_GL.....	100
5.2.5	HTML_ELEMENT.....	101
5.2.6	EVALUATION_SET	101
5.2.7	USER_VALUE.....	102
5.2.8	EVALUATION_CONDITION	103
5.2.9	META_VARIABLE	103
5.2.10	OPERATION.....	104
5.2.11	ARGUMENT	104
5.2.12	ACTION	105
5.3	XML in a nutshell	105
5.3.1	XML Documents	106
5.3.2	GDL restrictions caused by XML.....	110
5.4	Specification of GDL-compliant structure for a Web guideline	110
5.4.1	Scope of the specification	110
5.4.2	Organization of the specification	111
5.4.3	Abstract and concrete syntaxes	112
5.4.4	GDL specification.....	112
5.4.5	Guideline	113
5.4.6	Interpretation.....	113
5.4.7	Formal Guideline	114
5.4.8	Evaluation Structure.....	114
5.4.9	HTML Element.....	114
5.4.10	Evaluation Set	114
5.4.11	Set Exclusion	115

5.4.12	Evaluation Logic	115
5.4.13	User values	116
5.4.14	Predefined Simple Data Types and Operations	116
5.4.15	Predefined Constructed Data Types and Operations	117
5.4.16	Evaluation Conditions	119
5.4.17	Meta evaluation Condition	119
5.4.18	Operations in evaluation conditions	119
5.4.19	Direct Evaluation Condition	120
5.4.20	Mapped Evaluation Condition	121
5.5	Evaluation function	121
5.5.1	"Respected" Guideline	123
5.5.2	"Violated" Guideline	123
5.5.3	A Quality Model for the evaluation result	124
5.6	Feasibility of Automatic Evaluation	125
5.6.1	ERGOVAL	125
5.6.2	WAI guidelines	127
5.6.3	ISO 9241 - 12	127
5.6.4	Automation limits of our approach	129
5.7	Summary	131

Chapter 6. Tools for Automated Web Evaluation

6.1	Introduction	133
6.2	Requirements and Architecture	133
6.3	Implementation and Application	137
6.3.1	GDL editor (Not implemented)	137
6.3.2	GDL Viewer (Implemented and Functional)	140
6.3.3	Configuration module (Not implemented)	141
6.3.4	Page locator (Implemented and Functional)	142
6.3.5	The GDL parser (Implemented and Functional)	142
6.3.6	The GDL evaluator (Implemented and Functional)	143
6.3.7	The report viewer (Implemented and Functional)	143
6.4	Case Study	143
6.4.1	Guideline Structuring	143
6.4.2	Structure visualization	144
6.4.3	Page evaluation	144
6.5	Summary	146

Chapter 7. Cost-Benefit Analysis

7.1	Usability of the GDL	149
7.2	KWARESMI tool	149
7.2.1	Utility	149

7.2.2	Cost and Benefits	149
7.2.3	Exploitation.....	151
7.2.4	Actors.....	152

Chapter 8. Conclusions and Perspectives

8.1	Contributions of the work	153
8.2	Limits of the work.....	154
8.3	Perspectives.....	154
8.4	The DESTINE project	155

Bibliography

Annex A: GDL Abstract and Concrete Syntaxes

Annex B: Some Application Examples

Annex C: Web Guidelines Integrated by Major Existing Evaluation Tools