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### Assessing Maturity of User Interaction Designs in Software Applications

by

Rajiv B Deo

Patni Computer Systems Ltd, Mumbai

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## Introduction

Business complexities are ever increasing. Improvement in the end user productivity is a must. At the same time, software consumer is becoming aware and more demanding. It is not just enough to deliver the products or software systems that are merely functional or useful. User Interaction (UI) of the product / solution needs to be more appealing and desirable. UI should be delivering a significantly higher level of user experience altogether.

Even though User-Centric Design is followed properly while developing the systems, it is natural that different systems will be at different level of Usability Maturity. So, how do we measure and verify that the system is really usable? If so, to what extent?

This paper describes a framework for quantitative assessment of the Usability Maturity Level of the software system in the form of an index with a case study.

## Scope of this paper

This paper does not address proposition of the UCD-HCI process and design aspects for desired level of Usability Maturity.

It also does not address the predictability of efforts and cost associated with desired level of Usability Maturity.

## Need for such a framework

Research shows that, a comprehensive framework is not available to quantitatively assess the usability. There was a need felt for standardizing such a evaluation framework. We started work on building an evaluation framework with following objectives in mind:

- To quantitatively assess the usability Maturity Index of the existing product. It would help us in making comparative analysis between competing products. One can use it to take right decisions while purchasing a product amongst multiple choices.
- To provide a common ground and a baseline where all the concerned stake holders (i.e. customer, developer, purchaser, supplier, etc.) can talk in the same language.
- To be able to predict the usability of the end product before actually starting the development.
- To be able to plan and estimate for the desired level of productivity in terms of efforts, cost, schedule, etc.
- To be able to commit to customer what level of usable product we can deliver at the time of making a contract.

The current paper covers the framework developed for meeting the first part of our set objectives i.e. to assess quantitatively the usability maturity level of the software system in the form of an index. The proposed framework needs further

research, piloting on sufficient number of systems and refinement for perfection by optimization.

### Benefits realized out of this framework

- We could compare two or more diverse or similar products for Usability
- Help in understanding the usability problem areas in software systems
- We also discovered that as a by-product of the assessment exercise, one can give concrete inputs for Product Enhancement Roadmap
- Help in doing SWOT analysis of the product
- Significant improvement in employee moral within the product team

### Business Perspective of the framework

- Company can assess where the products stand with respect to competitor's products
- By doing SWOT analysis, enhancement roadmap can be defined
- Comparative strengths can be taken for competitive advantage
- Helps in developing better products resulting into increased sales & market share, satisfied customers, improved end user productivity, lesser warranty and support cost, less end to end cost in product life cycle
- With the standardized framework, a central agency can offer the service of assessing the usability maturity of software system and endorse the level at which the software stands. This can be treated as authentic credential of the software like hallmarking of gold and everybody interested in the product need not repeat the assessment saving on the efforts and cost.

### Broad features of the framework

- Comprehensive Assessment & Quick Assessment Methods
- Flexible and extensible framework
- Granularity of evaluation can be increased or decreased and weights can be adjusted accordingly depending on the need, type of product, complexity of the product, business impact of the product, etc.
- Quantification helps reduce the impact of subjectivity

### What is Usability Maturity of Software System?

Usability Maturity of a software system can be defined as -

*'The extent to which the particular Software System meets the Usability Requirements in terms of Efficiency, Effectiveness and Satisfaction enabling specified users achieve their goals in a particular environment.'*

### Expected Audience

- Users of this framework
  - Usability Experts

- Beneficiaries
  - Organizations desiring to evaluate their products for usability
  - Purchasers desiring to select products amongst competing ones
  - Suppliers of the products who can project competitive advantages of their products with respect to other competing products
  - Development teams - To validate that their product meets the usability requirement
  - Third party consulting firms / persons who work in advisory capacity

### Pre-requisites for using this framework

- Knowledge of User-Centric Design Processes
- Knowledge of Heuristic Evaluation & User Testing processes

### Inputs required for Usability Maturity Assessment

#### *Requirements Phase*

- Business Objectives from the system
- Users' objectives from the system
- Any strategy guidelines / compliance requirements for the system
- Context information
  - Physical Environment
  - Ergonomic Conditions / Requirements
  - Role, Designation and Position of the user in the organization
  - Demographic information of the user
  - Criticality of the business process executed by the user
  - Psychological aspects of the user
  - Level of expertise of user
  - The frequency of execution of the task
  - Interrelationship between tasks executed by the user
  - Interdependence of tasks - tasks executed by user and tasks executed by others
  - External help required to execute the task
- Find execution patterns
  - People - who are they?
  - Activities - what do people do?
  - Places - where do they do it?
  - Time - when or how often do they do it?
  - Tools - what helps them do it?
  - Interactions - how do they do it?
- Gain insights behind the activities
  - Goals - why do they do it?
  - Motivations - what makes them do it?
  - Problems - what problems are there?
  - Difficulties - what do they have to deal with?
  - Met / Unmet needs - what do they need?
  - Desires - what do they really want?

- Values - what does it mean to them? What is meaningful to them?
- Business process descriptions
- Specific usability requirements and usability aspects of Performance, safety, and security stated by the user of the product

### *Analysis Phase*

- Personas
- Scenario
- Task hierarchy & relationship, Task dependencies
- User Workflows
- Conceptual model of the system
- User models - Stages of execution

### **Assumptions**

- User-Centric Design processes are followed to develop the software system. The inputs required for assessment are available from Requirements Gathering and Analysis phases as defined earlier.
- Weights to various elements in this framework are based on past experience and do not have any support from the factual data. The rationale for these weights is defined at appropriate place in the paper. After conducting sufficient number of pilot assessment projects, the rationale behind the weights can be improved and these weights can be refined.

### **Limitations**

- Many times it is possible, that the inputs required for assessment may not be available. In this situation, domain experts and usability experts will create these documents by understanding the product and domain. These will be validated for correctness by the appropriate person nominated by sponsor of the assessment activity. These documents will not be as authentic as if execution of proper UCD processes would have generated them. These artifacts are very important in the assessment process. However, this may not assure correct assessment.
- This framework is purely based on User-Centric Design. Does not consider the HCI aspects.
- User testing is one of the main activities in the assessment. If the actual end users are not available for testing, the domain experts' help will be taken to execute the business processes. This will not give true results.
- Many times, it may not be possible to conduct user testing in the context of use. In such cases, it will be conducted either at the usability testing lab or just in conference room by setting up necessary infrastructure. The impact of contextual aspects will not be assessed.

### **Resources required for Usability Maturity Assessment**

- Usability Experts - 3 to 5

- End users - 3 to 5 for user testing
- Domain Expert
- Product Owner or anybody else who can give the required information related to requirements and analysis activities for conducting assessment
- If the input information related to requirements and analysis activities is not available, then domain expert and usability expert will develop those documents. Appropriate person required to validate these documents.

### Rationale behind the framework

The rationale behind the assessment model is that if we conform to the User-Centric Design Process while developing the software, then we are likely to get the highly usable software systems. Hence, the framework lays importance to the core processes like Requirements Gathering, Analysis, and Designing. The method to check for the compliance is through various checklists and user testing.

The framework also assumes that the criticality of different processes / checkpoints is different. Hence different weights are given to them and weighted average is used to calculate the index.

The weights are based on assumptions and past experience. These need to be refined after conducting sufficient number of pilot assessments. By observing user behavior and through interactions with users, these weights can be refined.

Following list gives various areas to which, product compliance should be checked to arrive at the index -

- Evaluation against the outputs from Requirements and Analysis phases
- Evaluation based on the following
  - Nielsen's 10 Heuristics
  - Interaction Design
  - Information Design
  - Information Architecture
  - Interface Design
    - Visual Design
    - Graphics Design

### Broad level steps / description of the framework

At top level, the assessment involves -

- Gather inputs
- If inputs are not available, then develop the input documents through domain and usability experts. Get them validated through the appropriate person nominated by the sponsor of the assessment activity. Omit those inputs that are not required for current assessment.
- Create / Tailor the various checklists based on -
  - Domain
  - Technology
  - Applicability to the current software system under assessment
  - Based on the input documents received

- Assign weights to various check points
- Conduct Heuristic evaluation of the product and evaluation using various checklists, give rating for compliance level
- Conduct User Testing, give rating for compliance level
- Consolidate and summarize the findings
- Arrive at the single figure Usability Maturity Index

### Usability Maturity Assessment Framework

- The evaluation points are classified into two levels called 'Main Area' and 'Sub Area'.
- There are 9 Main Areas. Within each main area, there are further sub areas.
- The main areas are given weights totaling to 1.
- The sub areas are also given weights totaling to 1 within the main area.
- The software system is evaluated against each of the sub area and assigned a rating on 0 to 5 scale. The meaning of the scale is given below -
  - 5 - Implemented all the times
  - 4 - Implemented most of the times
  - 3 - Implemented some times
  - 2 - Implemented but not effective
  - 1 - Not implemented & not required
  - 0 - Not implemented but required
- The weighted rating for each sub area is calculated and consolidated at main area.
- The weighted rating for each main area is calculated and consolidated at the system level to give the Usability Maturity Index on scale of 0 to 5.
- The details of the main areas, sub areas and weights are given in the embedded excel sheet below. Sample rating and calculation of final index is also demonstrated for better explanation.

Usability Maturity Scorecard						
<b>Product:</b>	Web based Project Management System		<b>Process:</b>	Resource De-allocation		
Main Area	Sub Area	Weight	Rating	Weighted Rating		
		Main Area		Sub Area	Sub Area	Main Area
<b>Requirements</b>		0.15				
	Business Objectives		0.20	3	0.60	
	Users' objectives from the system		0.35	4	1.40	
	Any strategy guidelines / compliance requirements for the system		0.10	5	0.50	
	Specific Usability Requirements stated		0.35	2	0.70	
					<b>3.20</b>	<b>0.48</b>
<b>Context</b>		0.12				
	Physical Environment		0.12	3	0.36	
	Ergonomic Conditions / Requirements		0.12	5	0.60	
	Demographic attributes of the user - Age, Sex, Economic, Organizational, Social, Cultural, Educational		0.08	4	0.32	
	Criticality of the business process executed by the user		0.12	2	0.24	
	Level of Expertise of user		0.20	5	1.00	
	The frequency of execution of the task		0.08	3	0.24	
	Interrelationship between tasks executed by the user		0.06	1	0.06	
	Interdependence of tasks - Tasks executed by user and tasks executed by others		0.05	4	0.20	
	Execution Patterns		0.09	2	0.18	
	Insights behind the activities		0.08	3	0.24	
					<b>3.44</b>	<b>0.41</b>
<b>System Architecture</b>		0.12				
	Personas		0.10	5	0.50	
	Scenarios		0.15	3	0.45	
	Task hierarchy & relationship, Task dependencies		0.15	3	0.45	
	User Workflows		0.25	3	0.75	
	Conceptual model of the system		0.35	4	1.40	
					<b>3.55</b>	<b>0.43</b>
<b>Heuristics</b>		0.15				
	Visibility of System Status		0.08	3	0.24	
	Match between system and the real world		0.10	4	0.40	
	User control and freedom		0.10	1	0.10	
	Consistency and standards		0.07	2	0.14	
	Error prevention		0.09	3	0.27	
	Recognition rather than recall		0.09	3	0.27	
	Flexibility and efficiency of use		0.11	5	0.55	
	Aesthetic and minimalist design		0.07	3	0.21	
	Help users recognize, diagnose, and recover from errors		0.10	4	0.40	
	Help and documentation		0.07	2	0.14	
	Privacy		0.05	3	0.15	
	Pleasure of Use		0.07	3	0.21	
					<b>3.08</b>	<b>0.46</b>
<b>Information Architecture</b>		0.10				
	Hierarchy of the modules / pages		0.10	3	0.30	
	Taxonomy		0.30	4	1.20	
	Sectioning / Structure of Site		0.20	1	0.20	
	Structure of pages		0.25	5	1.25	
	Information relationship of modules / programs		0.15	2	0.30	
					<b>3.25</b>	<b>0.33</b>
<b>Information Design</b>		0.07				
	Contents & Prominence		0.65	4	2.60	
	Labeling - Content, Navigation, Component		0.35	3	1.05	
					<b>3.65</b>	<b>0.26</b>
<b>Interaction Design</b>		0.09				
	Presentation of information, Prominence		0.45	4	1.80	
	Navigation, Cross-linking		0.20	3	0.60	
	Audio / visual, etc. - medium of communication		0.15	3	0.45	
	User Workflows		0.20	5	1.00	
					<b>3.85</b>	<b>0.35</b>

<b>Interface Design</b>		0.08				
	Visual Design		0.70	4	2.80	
	Graphics Design		0.30	4	1.20	
					<b>4.00</b>	<b>0.32</b>
<b>User Testing</b>		0.12				
	Efficiency of execution		0.20	3	0.60	
	Minimal help required from the system		0.10	3	0.30	
	Minimal help required from outside sources		0.05	4	0.20	
	Ability to locate desired information quickly		0.15	5	0.75	
	Impact on psychological state of user		0.05	2	0.11	
	Considerations to users' expertise - Novice, Advanced Beginner, Competent Performer, Expert		0.25	1	0.25	
	User Satisfaction		0.20	2	0.40	
					<b>2.61</b>	<b>0.31</b>
					<b>Final Weighted Score</b>	<b>3.34</b>