Harmonization of Usability Measurements

In ISO/IEC 9126

Software Engineering Standards

Cheikhi, Abran & Suryn
Agenda

- Motivations and Objectives
- ISO/IEC 9126 Standards
- Analysis of the Usability in ISO 9126
- Recommendations to ISO 9126
- Conclusions
Motivations

- In Software Engineering, producing a usable product receives often attention only when a nonusable one is a failure.

- Usability is not a luxury, but a fundamental quality characteristic.

- To assess software usability, many models have been proposed by individual researchers and standards.
Motivations

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Effectiveness</td>
<td>Effectiveness</td>
<td>Effectiveness</td>
<td>Understandability</td>
<td>Effectiveness</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Efficiency</td>
<td>Efficiency</td>
<td>Learnability</td>
<td>Efficiency</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Satisfaction</td>
<td>Satisfaction</td>
<td>Operability</td>
<td>Satisfaction</td>
</tr>
<tr>
<td>Learnability</td>
<td></td>
<td></td>
<td>Attractiveness</td>
<td>Learnability</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Usability</td>
<td>Security</td>
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<td></td>
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<td></td>
<td>Compliance</td>
<td></td>
</tr>
</tbody>
</table>

Different models with a variety of characteristics and their corresponding purposes

None of which has yet include the concept of quality in use of ISO 9126
Motivations

- In ISO 9126 – Software Product Quality
  - Two ways to assess usability of the software product before its delivery:
    - Internal
    - External
  - How to assess the usability of the software product after its delivery?
Objectives

- Review of the external usability characteristic of ISO 9126 standards: definitions and proposed measures

- Investigate the two harmonization issues:
  - Does external usability characteristic really belong to the external quality view of ISO TR 9126-2?
  - Can this usability characteristic be harmonized with the quality in use view of ISO 9126-1 and ISO TR 9126-4?

- Propose some additions to the ISO 9126 “Quality In Use” Model
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ISO/IEC 9126 – *Software Product Quality*

1 International Standard:
   - ISO/IEC 9126-1: Quality Model
     - Internal & External Quality Model
     - Quality In Use Model

3 Technical Reports:
   - ISO/IEC 9126-2: External measures
   - ISO/IEC 9126-3: Internal measures
   - ISO/IEC 9126-4: Quality In Use measures
   - More than 200 measures
   - Same structure of documentation
ISO/IEC 9126 – Software Product Quality

Internal quality:
- Internal view of quality
- Quality of the software product without its execution
- Measure the static properties of the software itself

External quality:
- External view of quality
- Quality of the software product during its execution
- Measure the behaviour of the computer-based system that includes the software
Quality in use

Quality from the end-users viewpoint
Is the combined effect of internal quality and external quality
Measure:
- The effect of using the software in a specific context of use
- To which extent users can achieve their goals
ISO/IEC 9126 – *Usability & Quality in use*

<table>
<thead>
<tr>
<th>Usability</th>
<th>Quality in Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early phases of software development process</td>
<td>Operation and maintenances phases</td>
</tr>
<tr>
<td>During the execution</td>
<td>During the execution</td>
</tr>
<tr>
<td>Before delivery</td>
<td>After delivery</td>
</tr>
<tr>
<td>Limited development constraints: short test</td>
<td>Not so constrained: a long period of time for testing, real end-users and a</td>
</tr>
<tr>
<td>period, a limited number of users and a</td>
<td>real environment.</td>
</tr>
<tr>
<td>temporary environment</td>
<td></td>
</tr>
<tr>
<td>“capability of the software product to be</td>
<td>“the capability of the software product to enable specified users to achieve</td>
</tr>
<tr>
<td>understood, learned, used and attractive to</td>
<td>specified goals with <em>effectiveness, productivity, safety</em> and <em>satisfaction</em></td>
</tr>
<tr>
<td>the user, when used under specified conditions”</td>
<td>in specified contexts of use”</td>
</tr>
</tbody>
</table>
Agenda

- Motivations and Objectives
- ISO/IEC 9126 Standards
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1st Analysis

Usability Concepts and Related Definitions

Criteria for the 1st analysis:
- ISO 9126-1: definitions of the usability subcharacteristics
- ISO 9126-2: external measures of usability subcharacteristics

Two distinct context of analysis:
- 1st context: Link between the name of each subcharacteristic and its corresponding definition (objective)
- 2nd context: Methods of application of external measures
### Usability Concepts and Related Definitions

#### Observations:

<table>
<thead>
<tr>
<th>Usability Subcharacteristics</th>
<th>Objectives</th>
<th>Methods of Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understandability</td>
<td>To understand</td>
<td>Test conducted by the user</td>
</tr>
<tr>
<td></td>
<td>To be used for particular task</td>
<td>Test of the product in use</td>
</tr>
<tr>
<td>Learnability</td>
<td>To learn</td>
<td>Test conducted by the user</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Test of the product in use</td>
</tr>
<tr>
<td>Operability</td>
<td>To operate</td>
<td>Test conducted by the user</td>
</tr>
<tr>
<td></td>
<td>To control</td>
<td>Test of the product in use</td>
</tr>
<tr>
<td>Attractiveness</td>
<td>To be attractive</td>
<td>Test conducted by the user</td>
</tr>
<tr>
<td>Usability compliance</td>
<td>To adhere</td>
<td>Test conducted by the user</td>
</tr>
</tbody>
</table>
Usability Measures proposed in ISO 9126-2

Criteria for the 2\textsuperscript{nd} analysis:

- Name of the measure
- Method of application

<table>
<thead>
<tr>
<th>Criteria Categories</th>
<th>Name of measure : Ends</th>
<th>Method of application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With “In Use”</td>
<td>Without “In Use”</td>
</tr>
<tr>
<td>1\textsuperscript{st} Category</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2\textsuperscript{nd} Category</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3\textsuperscript{rd} Category</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
### Usability Measures proposed in ISO 9126-2

**Observations:**

<table>
<thead>
<tr>
<th>Usability Subcharacteristics</th>
<th>Number of all external quality measures</th>
<th>Number of measures for Category I</th>
<th>Number of measures for Category II</th>
<th>Number of measures for Category III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understandability</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Learnability</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Operability</td>
<td>12</td>
<td>5</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Attractiveness</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usability compliance</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>28</strong></td>
<td><strong>17</strong></td>
<td><strong>9</strong></td>
<td><strong>2</strong></td>
</tr>
</tbody>
</table>
Analysis of the Usability in ISO 9126 - Summary

Harmonization issues responses : Affirmative

Usability characteristic is an essential part of the external quality view of ISO TR 9126-2.

Usability characteristic can also constitute a part of the quality in use view of ISO 9126-1 and ISO TR 9126-4 through understandability, learnability and operability subcharacteristics.
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Recommendations to ISO 9126-
Enhanced “Quality In Use” Model

ISO9126 Quality In Use

- Effectiveness
- Productivity
- Safety
- Satisfaction

Usability (In Use)
- Understandability (In Use)
- Learnability (In Use)
- Operability (In Use)
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Summary & Conclusions

STATE OF THE ART OF USABILITY:
- Rich body of definitions, models and measures among researchers and standards
- But not homogeneous

USABILITY IN ISO 9126:
- Only the internal and the external usability of the software product, before its delivery, is addressed
- Usability as a part of “quality in use” of the software product, after its delivery, is not considered
Summary & Conclusions

Analysis of usability in ISO TR 9126-2:

- Usability is well positioned within the external quality model of ISO 9126-2 technical report
- Usability can constitute also a characteristic of “quality in use model” (ISO 9126-1 and 4) through understandability, operability and learnability such characteristics

Enhanced model of quality in use (ISO 9126-1):

- Interesting initial work
- But still to be tackled by the ISO 9126 Group
Thank You!

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