Testing to improve requirements – is it mission impossible?

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Testing and Requirements

Contents

Relationship of requirements and testing
Myths and misconceptions
How to improve requirements through testing
V-Model: early test design

Early test design and defects

- test design finds defects
- defects found early are cheaper to fix
- most significant defects found first
- defects prevented, not built in
- no additional effort, re-schedule test design
- changing requirements caused by test design

Early test design helps to build quality, stops defect multiplication
Experience report: Phase 1

Phase 1: Plan

2 mo dev
2 mo test

"has to go in" but didn't work

Actual

fraught, lots of dev overtime

Quality:

Test
150 faults

1st month
50 faults

users not happy

Experience report: Phase 2

Phase 2: Plan

2 mo dev
6 wks test

acc test: full week (vs half day)

Actual

on time

smooth, not much for dev to do

Quality:

Test
50 faults

1st month
no faults

happy users!

Source: Simon Barlow & Alan Veitch, Scottish Widows
Iterative development

Each increment includes
- Requirements analysis
- Design
- Coding
- Testing

Good testing within a lifecycle model

corresponding test activity for every development activity

test objectives for each test level
test analysis and design begins early,
testers review development documentation

Mindsets

- **requirements engineer**
  - what is needed / wanted?
  - what will help the business?
  - want it to be useful

- **designer / developer**
  - how can I make it work?
  - what’s the best way to implement this?
  - want it to be good quality

- **tester**
  - what could go wrong?
  - what exactly does this mean?
  - what if it isn’t?
  - what’s missing?
  - how could I break it?
  - anti-patterns
  - what would a user do?
  - want it to be useful and good quality
  - if you look for bugs, you are more likely to find them!

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Myth 1: Testing starts at the end

- **requirements come first**
  - “We don’t need to think about testing yet – let’s just concentrate on requirements”
  - testing is at the end, we’re at the start

- **what’s wrong with this?**
  - testing can start right at the start
  - thinking about testing early improves requirement specifications early
  - don’t have to wait to get benefits of a tester view

Myth 2: Can’t test till it’s there

- **testing the system needs to have the system**
  - “We can’t do any testing because nothing has been built yet.”
  - “Testers just play with the system and see what happens”
  - “Anyway, you can’t test a piece of paper!”

- **what’s wrong with this?**
  - testing is more than testing, and starts before testing
  - misconception: testing = test execution
Example requirements

- facilities are required to enable the treasurer to update the account information such as when members pay their subscription fees.
- the system will be required to produce reports giving information about who has paid membership fees, etc.
- the system must be fast. Many people must be able to access the website concurrently.

How would you test this spec?

- a computer program plays chess with one user. It displays the board and the pieces on the screen. Moves are made by dragging pieces.
What is testing?

<table>
<thead>
<tr>
<th>Policy and strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test planning</td>
</tr>
<tr>
<td>Identify conditions</td>
</tr>
<tr>
<td>Design test cases</td>
</tr>
<tr>
<td>Build tests</td>
</tr>
<tr>
<td>Execute (run) tests</td>
</tr>
<tr>
<td>Check results</td>
</tr>
<tr>
<td>Test process</td>
</tr>
<tr>
<td>Review test basis docs</td>
</tr>
<tr>
<td>Check exit criteria, Test Report</td>
</tr>
<tr>
<td>Test control</td>
</tr>
<tr>
<td>Test improvement</td>
</tr>
</tbody>
</table>

Test closure activities

Myth 3: Requirements to test is a one-way street

- **testing uses requirements, not vice versa**
  - “You don’t test requirements, you test FROM requirements”

- **what’s wrong with this?**
  - thinking about testing raises questions on the requirements
  - test design can lead to improved requirements
    - boundary value analysis
    - decision tables (example ->)
Example requirement

- Sue has a number of jobs to do on a Saturday but this is dependent on various circumstances.
- if she wakes up early and the weather is sunny she needs to cut the grass. However if she sleeps late and it is sunny then she hangs the washing out.
- if she wakes up early and the weather is not so good and she has some cash in the bank then she will need to go shopping.

what if she sleeps in, it’s raining, and she has cash in the bank?

Clearer requirement

<table>
<thead>
<tr>
<th>Condition/cause</th>
<th>Action/effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up early</td>
<td>Cut the grass</td>
</tr>
<tr>
<td>Sunny weather</td>
<td>Hang washing out</td>
</tr>
<tr>
<td>Cash in the bank</td>
<td>Go shopping</td>
</tr>
</tbody>
</table>

- **Tags:** A, B, C, D, E, F, G, H

"spec" covered only 5 out of 8 combinations!

? = assumption
Myth 4: Tests are for testers only

- **writing good tests is purely a testing concern**
  - “The testers seem to have problems writing tests from our requirements -
  - maybe we should get some better testers!”

- **what’s wrong with this?**
  - ambiguous specifications – not testable
  - non-functional quality attributes
    - e.g. “user friendly”, “very reliable”
  - if you don’t know how to test it, how can you know how to build it?

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Non-functional testing

- **testing of software product characteristics**
  - “how” the system works
  - quantified on a varying scale (e.g. response time)

- **performed at all test levels**

- **including the following types:**
  - performance - maintainability
  - load - reliability
  - stress - portability
  - interoperability - usability

ISO 9126: Software Engineering: Software Product Quality
Which of the following are testable?

- all help messages are meaningful to the users
- context sensitive help available on all fields
- all users must like all aspects of the system including reports and screens
- the system must be user-friendly
- the system must be intuitive
- navigation must be consistent across all applications
- exit/escape keys must be clearly labelled
- entering a new record must be achieved in less than 20 keystrokes

Tom Gilb, Principles of Software Engineering Management, 1988, or gilb.com

Myth 5: Minor changes are minor

- **minor requirements changes don’t matter (much)**
  - “Just add a couple more spaces to this input field. There’s plenty of room on the screen.”
  - “It’s only a minor change; it won’t need testing”

- **what’s wrong with this?**
  - impact on implementation (e.g. database, checking)
  - impact on testing
    - what unexpected side-effects?
  - size of change NOT = size of testing
Small change ≠ small testing

Confirmation vs. regression testing

Regression tests look for unexpected side-effects (but may not find all of them)

Fix introduces or uncovers new defects

Test finds defect

Confirmation test to check fix
**Myth 6: Testers don’t need requirements**

- **requirements are nice to have but not essential**
  - “We know the requirements aren’t great [there], but just test it anyway as best you can.”
  - “Just see what the system does.”
- **what’s wrong with this?**
  - we still need to test somehow
  - what is the test oracle?
  - test that the system does what the system does?
    - not a test! test against what the system SHOULD do

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**A test**

<table>
<thead>
<tr>
<th>inputs</th>
<th>expected outputs</th>
</tr>
</thead>
</table>

**A Program:**

- Read A
- IF (A = 8) THEN PRINT (“10”) ELSE PRINT (2*A)

Source: Carsten Jorgensen, Delta, Denmark
Myth 7: Can’t test without requirements

- **testers MUST HAVE requirements**
  - “We can’t test until we have decent requirements”
  - the tester’s excuse?
- **what’s wrong with this?**
  - yes, a test oracle is needed
  - not an excuse to avoid testing
  - more responsibility on the tester
  - exploratory testing is designed for severe time pressure and poor or non-existent requirements

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Myth 8: Follow the elephant

- **mainstream is more important**
  - “We need to specify what the users do in their normal work.”
  - “Of course, there will be exceptions, but these don’t happen often, so they’re not important
- **what’s wrong with this?**
  - yes, normal use is important
  - but exceptions must also work correctly
### User Acceptance testing

- 20% of what users do done by 80% of code
- 80% of what users do done by 20% of code

### Acceptance testing is unfair!

<table>
<thead>
<tr>
<th>purchasers / users</th>
<th>suppliers / developers</th>
</tr>
</thead>
<tbody>
<tr>
<td>no requirement changes</td>
<td>changing requirements</td>
</tr>
<tr>
<td>decision pressure</td>
<td>exception details</td>
</tr>
<tr>
<td>business needs</td>
<td>psychic specification</td>
</tr>
<tr>
<td>technical jargon</td>
<td>no technical understanding</td>
</tr>
<tr>
<td>timescales and budgets</td>
<td>delays and overruns</td>
</tr>
<tr>
<td>screens still have errors</td>
<td>screen formats</td>
</tr>
<tr>
<td>-&gt; acceptance to retaliate</td>
<td>-&gt; acceptance nit-picking</td>
</tr>
</tbody>
</table>
Testing motto

If you don't have patience to test the system
the system will surely test your patience

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Improved requirements through testing

- **get testers involved early**
  - start test activities at the beginning
  - invite testers to requirements reviews

- **use the tester perspective / mindset**
  - with every requirement, ask:
    - what could go wrong? what if it isn’t?
  - ask for (and appreciate) feedback from testers

- **technical aspects**
  - include examples, business scenarios, use cases
  - non-functional requirements: measurable & testable

- **communicate with testers: common goals**

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**Testing and Requirements**

**Summary: key points**

Improving requirements through testing is not only “mission possible” – it’s “mission critical”

Good requirements engineering produces better tests; good test analysis produces better requirements

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Shameless commercial plug

IEEE Software article, Sep/Oct 2002:
"Requirements and testing, 7 missing link myths"
from www.grove.co.uk (downloads – “paper on requirements”)