# Test Framing

Michael Bolton
http://www.developsense.com

## Acknowledgements

- Ideas about test framing have been developed in collaboration with James Bach
- Some material in this presentation is from Rapid Software Testing, a course by James Bach and Michael Bolton.
  - http://www.satisfice.com/rst.pdf
  - http://www.satisfice.com/rst-appendices.pdf

## Question

What are the elements of a test?

## Important Questions

Why run that test?

- Variations:
  - Why are you planning to run that test?
  - Why are you running that test *right now*?
  - Why did you run that test?
  - Why perform that step?
  - Why make that observation?

## Important Questions

Why NOT run THAT test?

- Variations:
  - Why aren't you planning to run that test?
  - Why aren't you running that test *right now*?
  - Why didn't you run that test?
  - Why not perform this step?
  - Why not make that observation?

## Important Questions

Why didn't you find that bug?

- Variations:
  - Why didn't you find that bug earlier?
  - Why did you apparently ignore that requirement?
  - Why did you miss that symptom?
  - Why did you misinterpret that symptom?

## Important Questions

Why do you think that's a bug?

- Variations:
  - Why do you say that this isn't working properly?
  - What requirement is being left unfulfilled here?
  - Why do you think that's a requirement?
  - For whom might this be a problem?
  - Do you think a user would ever do that?

## Even more generally…

Why are you doing this?

- Variations:
  - Why are you not doing that?
  - How does this test relate to a requirement?
  - How does this test relate to a risk?
  - How does this test relate to your mission?

# What is testing?

*Getting Answers*

"Try it and see if it works."

| Procedures | Coverage | Oracles |
|---|---|---|
| • Get different versions | • Where to look? | ▪ Read the spec |
| • Set them up | • How to look? | ▪ (There's no spec? Oh.) |
| • Try simple things | • What's there? | ▪ (There IS a spec! Oh, it's old and wrong.) |
| • Try complex things | • What's not there? | ▪ Find inconsistencies |
| • Try sequences | • What's invisible? | ▪ Find "obvious" problems |
| • Try combinations | • Did it change? | ▪ Find obscure problems |
| • Try weird things | • Will it change? | ▪ Find BAD problems |
| • Try them again | • How 'bout now? | |

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# What is testing?

*Getting answers…*

"Try it and see if it works."


"**Try it to learn,**
sufficiently, everything that matters
about whether it can work and
**how it might not work**."

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# What is testing?

*Serving Your Client*

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*If you don't have an understanding and an agreement on what is the mission of your testing, then doing it "rapidly" would be pointless.*

**Know your mission.**

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# What is Testing?

"Try it to learn…how it might not work."

1. Model the test space.
2. Determine coverage.
3. Determine oracles.
4. Determine test procedures.
5. Configure the test system.
6. Operate the test system.
7. Observe the test system.
8. Evaluate the test results.
9. Apply a stopping heuristic.
10. Report test results.

Risk!

**Most testing is driven by questions about risk…**

**…So, it helps to relate test results back to risk.**

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## To test is to compose, edit, narrate, and justify *three* parallel stories.

1. You must tell a story about the product…
   …about how it failed, and how it *might* fail…
   …in ways that matter to your various clients.
2. But also tell a story about how you tested it…
   …how you configured, operated and observed it…
   …about what you haven't tested yet…
   …or won't test at all…
3. And also tell a story that explains how good your testing was…
   …why your testing has been good enough…
   …why what you haven't done (so far) doesn't matter…
   …what the risks and costs of testing are…
   …how testable (or not) the product is…
   …what you need and what you recommend.

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## What is test framing?

Test framing is *the chain of logical connections that structure and inform a test,* from the mission to the test result

**Given this…**


**If *these premises and facts* are true…**
**…and if we observe *this specific behaviour*…**
**…and we apply *this relevant oracle*…**
**…then we can make *these conclusions* about the…**

## Framing ~= Traceability

- Framing is, in essence, traceability…
- …but typically we hear people talk of traceability in an impoverished way: between *tests* and requirements *documents*
- *Can you demonstrate traceability between tests and implicit requirements?*

## Much More Traceability

1. Product traces to specifications.
2. Specifications trace to standards.
3. Test sessions trace to product versions.
4. Test sessions trace to specifications.
5. Test sessions trace to logs which trace to product, playbook and specifications.
6. Tests trace to claims.
7. Test sessions trace to charters and charters to playbook.
7. Playbook traces to standards.
8. Playbook traces to specifications.
9. Playbook traces to risks which trace to specifications…
10. Tests trace to risk…
11. Tests trace to implicit requirements…
12. Tests trace to other tests…

# Vocabulary

- system
  - a set of things in meaningful relationship
- structure
  - that which forms the unchanging parts and relationships of a system; a consistent pattern for the system; "that which remains"
- narration
  - telling a story that fits in time
- framing
  - via logic and narrative, placing the test in logical relationship with the structures that inform it

# Vocabulary

- logic
  - a formal means of convincing or proving facts via valid arguments
  - …using a set of propositions linked by connectives or operators
- proposition
  - a simple statement of fact or inference
- connectives
  - formal logic: if, and, or, and not, else, if and only if, therefore
  - less formally: because, unless, otherwise…

Framing provides traceability, but testers often limit traceability as being between *tests* and requirements *documents*—explicit requirements.

*Can you demonstrate traceability between tests and implicit requirements?*

## Thinking Like A Tester: *Seeing the Words that Aren't There*

- Among other things, *testers question premises.*
- A *suppressed premise* is an unstated premise that an argument needs in order to be logical.
- A suppressed premise is something that should be there, but isn't…
- (…or *is* there, but it's *invisible* or *implicit*.)
- Among other things, *testers bring suppressed premises to light and then question them.*
- A diverse set of models can help us to see the things that "aren't there."

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## Thinking Like A Tester: *Spot the missing words!*

- "I performed the tests. All my tests passed. Therefore, the product works."
- "The programmer said he fixed the bug. I can't reproduce it anymore. Therefore it must be fixed."
- "Microsoft Word frequently crashes while I am using it. Therefore it's a bad product."
- "Step 1. Boot the test system."
- "Step 2. Start the application."

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# Testing against requirements is all about modeling.

*How do you test this?*

*"The system shall operate at an input voltage range of nominal 100 - 250 VAC."*

*Poor answer:*

*"Try it with an input voltage in the range of 100-250."*

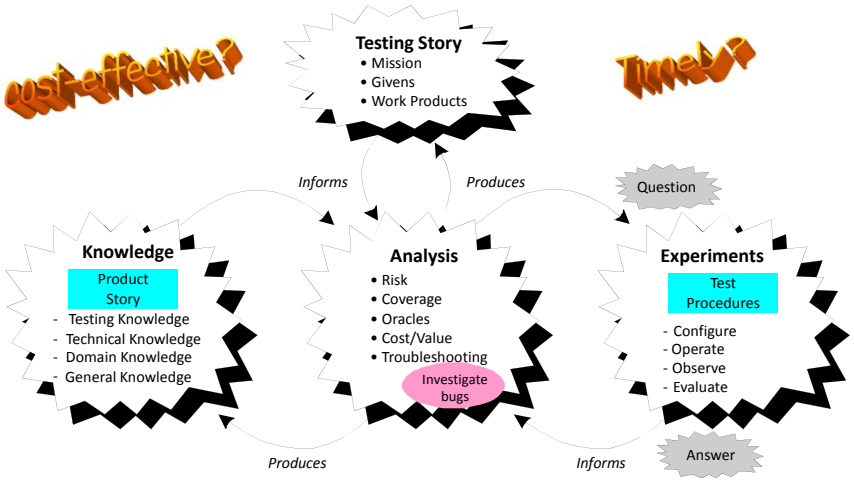
# How Do We Know What "Is"?

*We see the signs!*

"If I see X, then probably Y, because *probably* A, B, C, D, etc."

- THIS CAN FAIL:
  - Getting into a car
    - Ooops, not my car.
  - Drunk driving
    - People with diabetes can seem drunk
  - Irrational decisions
    - rational from a different set of values
  - I can never find the sugar
    - I have a preset model for sugar—and it's always the other one
  - Hotel offers two clean beds
    - That's not exactly what they said

# One View of Testing Structure

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# Project Environment
## *Aspects of Our Context*

"CIDTESTD -- Mother Approved"

- Customers
  - *Anyone who is a client of the test project.*
- Information
  - *Information about the product or project that is needed for testing.*
- Developer relations
  - *How you get along with the programmers.*
- Team
  - *Anyone who will perform or support testing.*
- Equipment & tools
  - *Hardware, software, or documents required to administer testing.*
- Schedule
  - *The sequence, duration, and synchronization of project events.*
- Test Items
  - *The product to be tested.*
- Deliverables
  - *The observable products of the test project.*

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# Quality Criteria
## *Identifying Value and Threats To It*

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- Capability
- Reliability
- Usability
- Security
- Scalability
- Performance
- Installability
- Compatibility
- Supportability
- Testability
- Maintainability
- Portability
- Localizability

*Many test approaches focus on Capability (functionality) and underemphasize the other criteria*

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# Product Elements
## *Ways to Model and Cover The Product*

"SFDPOT – San Francisco DePOT"

- Structure
  - *What are the pieces and how do they fit together?*
- Function
  - *What does the product do?*
- Data
  - *What does the product do things to?*
- Platform
  - *What does the product depend upon?*
- Operations
  - *How do people actually use the program?*
- Time
  - *How does the product interact with time?*

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# Test Techniques
## *General Ways to Test*
FDSFSCURA

- Function testing
  - *Test what it does*
- Domain testing
  - *Divide and conquer the data*
- Stress testing
  - *Overwhelm or starve the product*
- Flow testing
  - *Do one thing after another after another*
- Scenario testing
  - *Test to a compelling story*

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# Test Techniques
## *General Ways to Test*
FDSFSCURA

- Claims testing
  - *Test everything that people say it should do*
- User testing
  - *Involve the users (or systematically simulate them)*
- Risk testing
  - *Imagine a problem, and then look for it*
- Automatic testing
  - *Perform zillions of tests, aided by machines*

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## Thirty-Six Test Strategy Heuristics


**C**ustomers
**I**nformation
**D**eveloper relations
**T**eam
**E**quipment & tools
**S**chedule
**T**est Items
**D**eliverables

*Project Environment*

**S**tructures
**F**unctions
**D**ata
**P**latforms
**O**perations
**T**ime

*Product Elements*

**C**apability
**R**eliability
**U**sability
**S**ecurity
**S**calability
**P**erformance
**I**nstallability
**C**ompatibility
**S**upportability
**T**estability
**M**aintainability
**P**ortability
**L**ocalizability

*Quality Criteria*

**F**unction testing
**D**omain testing
**S**tress testing
**F**low testing
**S**cenario testing
**C**laims testing
**U**ser testing
**R**isk testing
**A**utomatic testing

*Test Techniques*

## Consistency **("this agrees with that")**
## *an important theme in oracles*

- **History:** The present version of the system *is consistent* with past versions of it.
- **Image:** The system *is consistent* with an image that the organization wants to project.
- **Comparable Products:** The system *is consistent* with comparable systems.
- **Claims:** The system *is consistent* with what important people say it's supposed to be.
- **Users' Expectations:** The system *is consistent* with what users want.
- **Product:** Each element of the system is *consistent* with comparable elements in the same system.
- **Purpose:** The system *is consistent* with its purposes, both explicit and implicit.
- **Statutes:** The system *is consistent* with applicable laws.
- **Familiarity:** The system ***is not consistent*** with the pattern of any familiar problem.

***Consistency heuristics rely on the quality of your models of the product and its context.***

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## What if you have an unframed test?

Try framing it!

But if you can't do it perfectly, or right away, that might be okay. Why?

To test a *very simple* product meticulously,
*part* of a complex product meticulously,
or to maximize test *integrity*…


1. Start the test from a *known* (clean) state.
2. Prefer *simple, deterministic* actions.
3. Trace test steps to a *specified model*.
4. Follow *established and consistent* lab procedures.
5. Make *specific* predictions, observations and records.
6. Make it *easy to reproduce* (automation helps).

## How can you justify an unframed test?

All of the hidden frames!

Focus in testing is valuable, but we must also practice
de-focusing to expose new problems
and to trigger new ideas about risk.

To find *unexpected problems*,
*elusive problems* that may occur in the field,
or more problems *quickly* in a complex product…


1. Start from *different states* (not necessarily clean).
2. Prefer *complex, challenging* actions.
3. Generate tests from a *variety* of models.
4. *Question* your lab procedures and tools.
5. Try to *see everything* with open expectations.
6. Make the test *hard to pass*, instead of easy to reproduce.

# Galumphing

*A Defocusing Heuristic to Exploit Variability*

- doing things in a deliberately over-elaborate way
- adding lots of unnecessary but inert actions that are inexpensive and shouldn't (in theory) affect the test outcome
  - bring up a dialog and dismiss it
  - modify an option and rescind it
  - perform an action and reverse it
  - re-selecting default options
  - inserting an expression where a single value would do
  - over-filling an input field, then fixing it

# Exploiting Variation To Find More Bugs

- **Micro-behaviors**
  - Unreliable and distractible humans make each test a little bit new each time through.
- **Randomness**
  - Can protect you from unconscious bias (but be careful; humans almost always act non-randomly)
- **Data Substitution**
  - The same actions may have dramatically different results when tried on a different database, or with different input.
- **Timing/Concurrency Variations**
  - The same actions may have different results depending on the time frame in which they occur and other concurrent events.
- **Platform Substitution**
  - Supposedly equivalent platforms may not be.

# Exploiting Variation To Find More Bugs

- **Scenario Variation**
  - The same functions may operate differently when employed in a different flow or context.
- **State Pollution**
  - Hidden variables of all kinds frequently exert influence in a complex system. By varying the order, magnitude, and types of actions, we may accelerate state pollution, and discover otherwise rare bugs.
- **Sensitivities and Expectations**
  - Different testers may be sensitive to different factors, or make different observations. The same tester may see different things at different times or when intentionally shifting focus to different things.