# Difficult Testing Questions and How To Answer Them

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# Updates

- This presentation is ALWAYS under construction
- Updated slides at http://www.developsense.com/past.html

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## Themes

- It's a complex world
- There are lots of possible right answers
- There are lots of factors in any given right answer
- Many of the things that we think are *absolutes* are really *relationships*
- Many of the things that we treat as *objects* are *constructs*, not tangible, countable things
- Many of the things that we see as *objects* are *models* or *representations*
- Testing is a social science

## The Big Theme of This Workshop

**A tester is someone who knows that things can be different.**

- Jerry Weinberg

## A Martial Art

- Learning to answering the tough questions is like learning self-defense
- In order to defend ourselves from tough questions that can hurt, we have to learn
  - not everything is an *attack*, but many things are potential *traps*
  - the patterns of traps and attacks
  - premises (often false) that can be questioned
  - how to keep centered in our responses

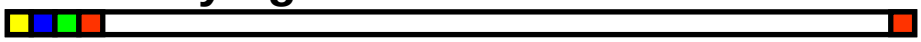
## Patterns of Difficult Questions

- Pressure to answer quickly
- Differences in models
- Invalid assumptions or biases in the question
- Insufficient data for an answer
- *Too much* data for an answer
- Fear from one or more parties

## Some Tools for Dealing with Difficult Questions

- Critical thinking
- General systems thinking
- Psychology and personal interactions
- Factoring
- Heuristics
- Collaboration
- Treating testing as a soft science, not a hard one

## Factoring: Identifying the Elements that Matter



- A factor is an element that you can identify, control, or vary about something.
- What factors form our models of something?
- To whom do they matter?
- How do we describe the factors?
- What factors are consistent with
  - the thing itself?
  - things like it?
- What are the elements that differ
  - from one thing to another?
  - in the same thing over time?

## Exercise

Factoring

# Critical Thinking Meta-thoughts

- Many of the tough questions are based on mistaken assumptions and critical thinking errors.
- Refine your answers by recognizing common errors and digging up buried assumptions

**See Levy, "Tools of Critical Thinking"**

# Some Common Thinking Errors

- Reification Error
  - giving a name to a concept, and then believing it has an objective existence in the world
  - ascribing material attributes to mental constructs—"that product has quality"
  - mistaking relationships for things—"its purpose **is**…"
  - purpose and quality are *relationships*, not attributes; they depend on the person
  - how can we count ideas? how can we quantify relationships?

MY NOMINEE FOR TESTING'S BIGGEST PROBLEM!

## Some Common Thinking Errors

- Fundamental Attribution Error
  - “it always works that way”; “he’s a jerk”
  - failure to recognize that circumstance and context play a part in behaviour and effects
- The Similarity-Uniqueness Paradox
  - “all companies are like ours”; “no companies are like ours”
  - failure to consider that *everything* incorporates similarities *and* differences
- Missing multiple paths of causation
  - “A causes B” (even though C and D are also required)

## Some Common Thinking Errors

- Assuming that effects are linear with causes
  - “If we have 20% more traffic, throughput will slow by 20%”
  - this kind of error ignores non-linearity and feedback loops—c.f. general systems
- Reactivity Bias
  - the act of observing affects the observed
  - a.k.a. “Heisenbugs”, the Hawthorne Effect
- The Probabilistic Fallacy
  - confusing unpredictability and randomness
  - after the third hurricane hits Florida, is it time to relax?

## Some Common Thinking Errors

- Binary Thinking Error / False Dilemmas
  - “all manual tests are bad”; “that idea never works”
  - failure to consider gray areas; belief that something is either entirely something or entirely not
- Unidirectional Thinking
  - expresses itself in testing as a belief that “the application works”
  - failure to consider the opposite: what if the application *fails*?
  - to find problems, we need to be able to imagine that they *might* exist

## Some Common Thinking Errors

- Availability Bias
  - the tendency to favor prominent or vivid instances in making a decision or evaluation
  - example:  people are afraid to fly, yet automobiles are far more dangerous per passenger mile
  - to a tech support person (or to some testers), the product always seems completely broken
  - spectacular failures often get more attention than grinding little bugs
- Confusing concurrence with correlation
  - “A and B happen at the same time; they must be related”

## Some Common Thinking Errors

- Nominal Fallacies
  - believing that we know something well because we can name it
    - "equivalence classes"
  - believing that we don't know something because we don't have a name for it at our fingertips
    - "the principle of concomitant variation"; "inattentional blindness"
- Evaluative Bias of Language
  - failure to recognize the spin of word choices
  - …or an attempt to game it
  - "our product is full-featured; theirs is bloated"

## Some Common Thinking Errors

- Selectivity Bias
  - choosing data (beforehand) that fits your preconceptions or mission
  - ignoring data that doesn't fit
- Assimilation Bias
  - modifying the data or observation (afterwards) to fit the model
  - grouping distinct things under one conceptual umbrella
  - Jerry Weinberg refers to this as "lumping"
  - for testers, the risk is in identifying setup, pinpointing, investigating, reporting, and fixing as "testing"

## Some Common Thinking Errors

- Narrative Bias
  - a.k.a “post hoc, ergo propter hoc”
  - explaining causation after the facts are in
- The Ludic Fallacy
  - confusing complex human activities with random, roll-of-the-dice games
  - “Our project has a two-in-three chance of success”
- Confusing correlation with causation
  - “When I change A, B changes; therefore A must be causing B”

## Some Common Thinking Errors

- Automation bias
  - people have a tendency to believe in results from an automated process out of all proportion to validity
- Survivorship bias
  - we record and remember results from projects (or people) who survived
  - the survivors prayed to Neptune, but so did the sailors who died
  - What was the bug rate for projects that were cancelled?

# Exercise

Group the thinking errors on the preceding pages into five named categories

## Some Common Beliefs About Testing

- Every test must have an expected, predicted result.
- Effective testing requires complete, clear, consistent, and unambiguous specifications.
- Bugs found earlier cost less to fix than bugs found later.
- Testers are the quality gatekeepers for a product.
- Repeated tests are fundamentally more valuable.
- You can’t manage what you can’t measure.
- Testing at boundary values is the best way to find bugs.

## Some Common Beliefs About Testing

- Test documentation is needed to deflect legal liability.
- The more bugs testers find before release, the better the testing effort.
- Rigorous planning is essential for good testing.
- Exploratory testing is unstructured testing, and is therefore unreliable.
- Adopting best practices will guarantee that we do a good job of testing.
- Step by step instructions are necessary to make testing a repeatable process.

## Exercise

Associate each testing belief with at least one critical thinking error.

There are no right or wrong answers, but be prepared to defend yours.

# General Systems Thinking

- General systems thinking is a way of observing and determining the way things (tend to (tend to)) work
- A means of analyzing, mastering, and learning to live with complexity
- A means of simplifying hard problems in useful ways
- Any view of a system is necessarily a model
  - "All models are wrong; some are useful."
    - George Box
  - "The map is not the territory."
  - "When the map and the territory disagree, believe the territory."
    - Jerry Weinberg, quoting the Swedish Army
- "Compared to what?" is a key modeling question

# General Systems

- systems are made up of parts comprising a whole, with dynamic connections and relationships between them
- input, output, control, and feedback influence the behaviour of systems
- system behaviour may be linear or non-linear
- system behaviour may tend towards equilibrium or chaos
- no part of a system can change without some other part of the system changing
- systems can be decomposed into parts or subsystems, which are themselves systems
- notions of systems depend on our models

## General Systems Thinking: The Science of Simplification

- …and the simplification of science.
- "*X* is the study of those systems for which the approximations of *X* work successfully."
- Concerned with general observations and patterns in identifying systems, their components, and their relationships
- Saying things concisely, while recognizing the potential for hidden or dangerous assumptions
- General systems laws must have at least two specific applications—and at least two specific exceptions

## Models Link Observation and Inference

- **A model is an idea, activity, or object…**

  such as an *idea in your mind*, a *diagram*, a *list of words*, a *spreadsheet*, a *person*, a *toy*, an *equation*, a *demonstration*, or a *program*

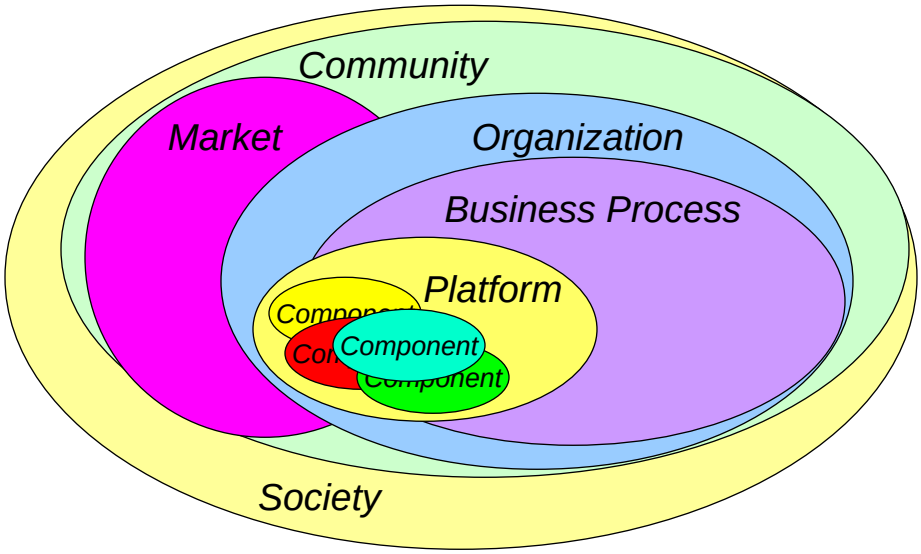
- **…that represents (literally *re-presents*) another idea, activity, or object…**

  such as something complex that you need to work with or to study

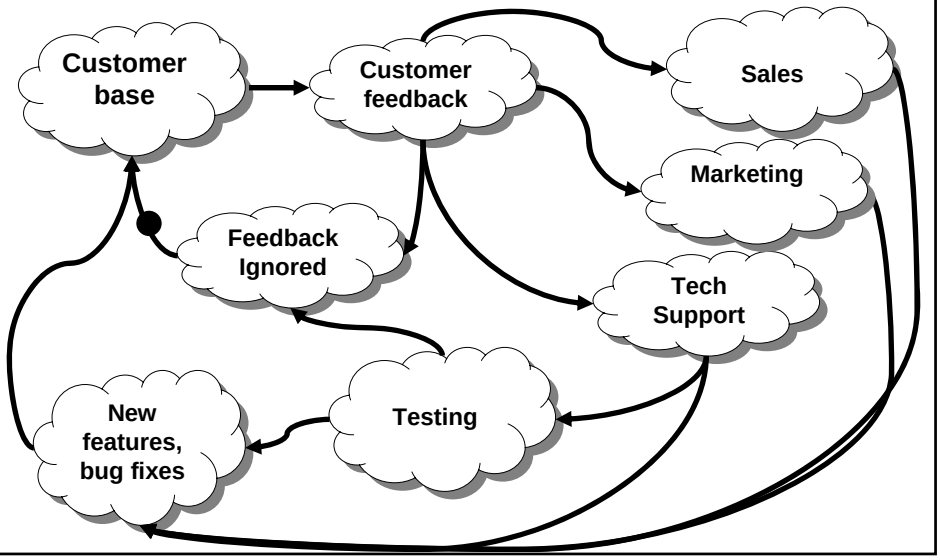
- **…whereby understanding the model may help you to understand or manipulate what it represents.**

  - A *map* helps navigate across a terrain.
  - *2+2=4* is a model for adding two apples to a basket that already has two apples.
  - *Atmospheric models* help predict where hurricanes will go.
  - A *fashion model* helps understand how clothing would look on actual humans.
  - *Your beliefs about what you test are a model of what you test.*

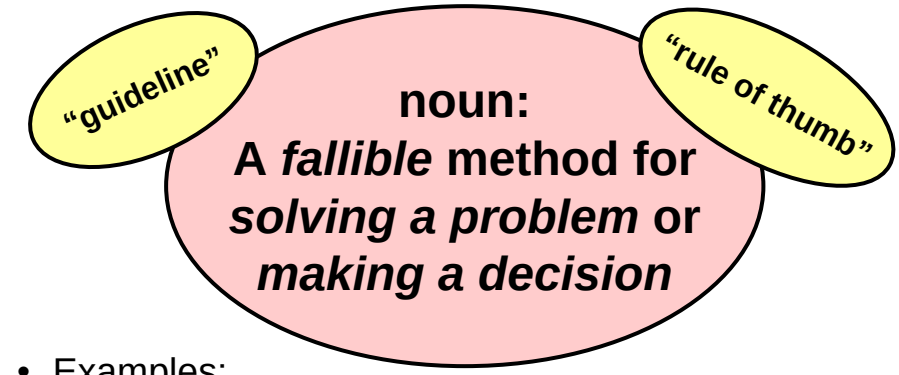
# General Systems in Testing




# Diagram of Effects to Identify Risk: The Customer Feedback Loop

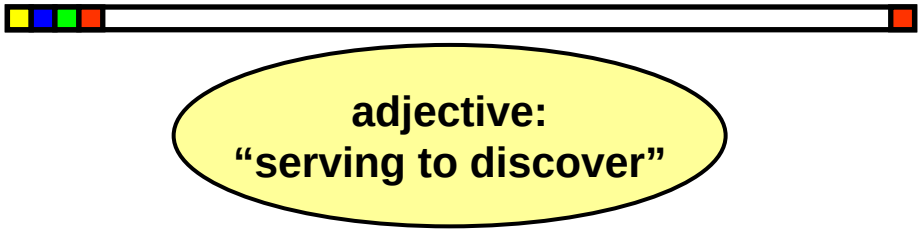


# Heuristic




- Examples:
  - "Plant your corn early!"
  - Pull on the handle, push on the plate.
  - Problems are cheaper to fix the earlier they're found.

# Heuristic




- Examples:
  - a heuristic *approach*
  - heuristic *guidewords*
  - heuristic *models*
  - heuristic *tools*

# Heuristics

- Fallible, “fast and frugal” methods of solving problems, making decisions, accomplishing a task…

*“The engineering method is* ***the use of heuristics*** *to cause the* ***best change*** *in a* ***poorly understood situation*** *within the* ***available resources***.”

Billy Vaughan Koen
*Discussion of the Method*

**All is heuristic!**

# Heuristics Are Fallible

- Heuristics use guidance and control of skilled practitioners.
- They’re heavily context-dependent.
- They may be useful even when they contradict each other—especially when they do!
- They can substitute for complete and rigorous analysis.
- Because they are *reasonable, low-cost* shortcuts, heuristics can present *more valuable* solutions for the present circumstances *because* they’re less complete.

“Heuristic reasoning is not regarded as final and strict but as provisional and plausible only, whose purpose is to discover the solution to the present problem.”
- George Polya, *How to Solve It*

## Heuristic: A vs. THE

**When trying to explain something, prefer "a" to "the".**

- Example: “A problem…” instead of “THE problem…”
- Using “A” instead of “THE” helps us to avoid several kinds of critical thinking errors
  - single path of causation
  - confusing correlation and causation
  - single level of explanation

## Heuristic: Unless…

**Try adding "unless..."**

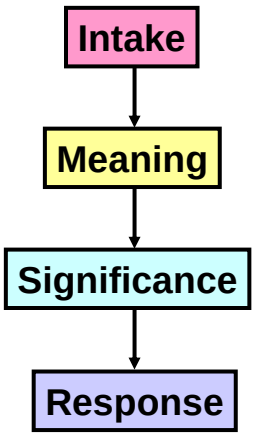
- When someone asks a question based on a false or incomplete premise, try adding “unless…” to the premise
- When someone offers a Grand Truth about testing, append “unless…”

## Heuristic: The Helpful Rule

**No matter how much it looks otherwise, everyone is trying to help.**

- Take responsibility for the communication
- Make it clear that you too are trying to help

## The Satir Interaction Model




- Developed by Virginia Satir and explained by Jerry Weinberg
- Useful to identify the phases in conversation and communication

# Intake

- distinct from in*put*
- you have considerable control over what you choose to sense
- listen carefully to the words, but…
- listen to the music and watch the players, too
- beware of selective listening, both in yourself and in the other

# Meaning

- Words are inherently slippery and fundamentally ambiguous
- A given sentence or question may have a large number of possible interpretations
- Words don't have meaning until some person *assigns* a meaning
- People may differ in their meanings
- Keep your sense of possibilities open
- Feed back into Intake
- Hint:  try applying the Rule of Three

## Significance

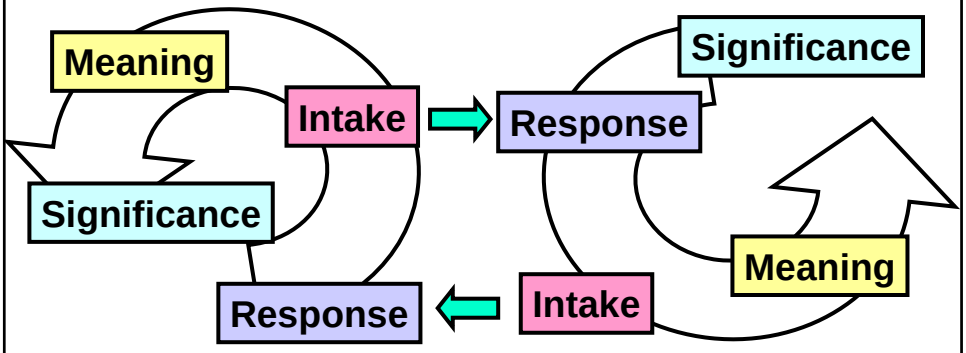
- Gives priority *for some person* to meaning *for some person*
- Feeds back into Intake and Meaning
- Strongly conditioned by emotion
- Hint:  apply the Rule of Three here, too

## Response

- Don't feel obliged to respond
  - right away, or
  - under pressure
- Do watch, listen, and assign priorities to observations
- Do anticipate to go with the response, "seek more data"

## …and remember…

- …the process is continuous and interactive.




## Heuristic: The Data Question

**What did you see or hear (smell, taste, touch) that made you believe…?**

# Heuristic: The Subtitle

- Reframe an idea so you can see alternatives and bring out assumptions in a conversation.


What users haven't you thought of?

What users don't you like?

What might a user that you *do* like do by accident?

# Heuristic: The Rule of Three

- Special case of the Rule Of At Least Three:

**If you can't think of at least three explanations for something, you probably haven't thought about it enough.**

## Heuristic: The Turnaround

- Identify the factors in the sentence.
  - Note that pronouns are especially ripe for alternative interpretations.
- Vary or invert one or more of the factors.
- Repeat at least three times.

## The Turnaround: Exercise

Your manager asks…

**Are You On Top Of It?**

## The Turnaround: Example

- My boss doesn't understand me!
- I don't understand my client.
- My client does understand me.
- I don't understand me.
- My client doesn't understand himself.
- My client doesn't understand my work.
- My client doesn't understand his work.

## Testing as a Social Science

- This is a very compelling notion from Kaner
- Social sciences investigate effects on *people*
- Include qualitative *and* quantitative research methods.
- Diversity of values and interpretations is normal.
- Observer bias is an accepted fact of life and is managed explicitly in well-designed research.

**Partial answers that might be useful!**

# Readings

- Exploring Requirements (Weinberg)
- Tools of Critical Thinking (Levy)
- Perfect Software and Other Illusions About Testing (Weinberg)
- Lessons Learned in Software Testing (Kaner, Bach, and Pettichord)
- Quality Software Management, Vol. 1:  Systems Thinking (Weinberg)
- Quality Software Management, Vol. :  First-Order Measurement (Weinberg)

# Readings

- How To Lie With Statistics (Huff)
- The Black Swan (Taleb)
- An Introduction To General Systems Thinking (Weinberg)
- Measuring and Managing Performance in Organizations (Austin)
- Software Testing as a Social Science (Kaner)
  - http://www.kaner.com/pdfs/KanerSocialScienceSTEP.pdf
- How To Solve It (Polya)
- Politics and the English Language (Orwell)