



Requirements Analysis - Ambiguity

Reduce Ambiguity from Start to Finish

Ambiguity – **uncertainty** because of **obscurity or indistinctness**; capable of being **understood in two or more possible senses or ways**

- **Ambiguity is a leading cause of requirements defects**
 - Via *unconscious disambiguation* – reader uses the **first meaning** that comes to mind **as the only meaning**
- **Recognizing and minimizing requirements ambiguity is a fundamental challenge for requirements engineering**

Ambiguities?

Example #1: "The product shall switch between displaying and hiding non-printing characters instantaneously."

Example #2: "The HTML Parser shall produce an HTML markup error report which allows quick resolution of errors when used by HTML novices."

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Wieggers, "Writing Quality Requirements"

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Ambiguity in Stating Requirements

- **There are no unambiguous software requirements specifications**
 - ***Always*** someone who understands a SRS differently
 - **Want majority agreement** to be useful

Example:

Create a means for protecting a small group of human beings from the hostile elements of their environment ...

Sources of Ambiguity

- **Missing information**
 - From the example: building materials; shape, size, longevity; functions performed inside the structure; the external physical environment; social and cultural environments; etc.
- **Introduced elements**
 - Where did a “structure” as a solution come from?
 - Other means of protecting:
 - Protect against weather by moving away
 - Protect against political critics through a legal framework
 - Protect against criminals by a fence
- **Ambiguous words** – inherent in the use of natural language
 - From the example: “small,” “group” (→ interaction?); “hostile”?
- **Communication errors** - diverse interpretations (or misinterpretations) of the same requirement

Linguistic Ambiguity in Natural Language

Lexical	Words can have multiple meanings	“green”, “bank”
Syntactic	A sentence or phrase can be parsed in multiple ways	“the Tibetan history teacher” “My dog chases anyone he sees on a bike.”
Semantic	Scope ambiguity - quantifier operators (words such as “every, each, all, some, several, a, not, etc.”) have different scoping relations with other sentence constituents	“All linguists prefer a theory” “No one has seen a pig with wings”
Pragmatic Pronoun references	A sentence can have several meanings in context . Meaning requires domain and contextual knowledge	“The trucks shall treat the roads before they freeze” “I only saw one movie today” (hear it?)
Generality or vagueness	Lack of quantifiable measurement unit	“maximize”, “sufficient”, “adequate”, “fast”, “robust”, “valid”
Language errors	Grammatical, punctuation error	

Sources of Ambiguity

- An exercise
 - Separate slide set

Sources of Ambiguity

- **Observational errors:** No two humans will see things identically
 - Geometry of star
- **Recall errors:** No two humans will recall things identically
 - Often, the same person will recall differently at different times
- **Interpretation errors:** Questions or statements can be interpreted differently – natural language traps
 - Meaning of point – tip, dot, line as an infinite series of points
- **Effects of human interaction**
 - Follow up discussion changes interpretation

Memory Heuristics

- Take away the written requirements document
 - Recall - ask each participant to write down what it said
 - Memorization - ask individuals to recall a specific problem statement precisely from memory
 - Differences indicate ambiguous, error-prone parts of the document
- **Few people will refer to the written requirements document as they work**
 - They will prefer to work from memory
 - A document that is easy to remember is less likely to lead to design errors

Names

- We name everything
- **Names are created formally or casually**
- **Once established names are hard to change**
- **The name is often the first impression** to what it names
- **Names are significant sources of ambiguity**
 - **Acronyms and logos** can also be a **source of ambiguity**
- Naming heuristic
 - Propose a name
 - Find three reasons it is a bad name
 - Pick a new name to eliminate them
 - Repeat (to a point)

The “Mary had a little lamb” Heuristic

Dealing with Syntactical and Semantic Ambiguity

- Nursery rhymes are infamous examples of ambiguity
 - The original meaning and cultural context is lost or transformed
 - “Pop (to pawn) goes the weasel (a shoemaker anvil)”
 - Shoe maker pawns the anvil for needed cash
 - “Ring around the rosy”
 - The bubonic plague (black death) had a symptom of a ring of rash around a rosy-colored bump. Posies or other scents in your pocket were a hope for avoidance. (It also helped with the scent of death)
 - “Mary had a little lamb”
- Heuristic: **emphasize each of the words in the line, one by one, and then in combinations, to identify possible meanings**

“Mary had a little lamb”

- Mary had a little lamb
 - It was Mary’s, not Tom’s or Harry’s
- Mary had a little lamb
 - She no longer has the lamb
- Mary had a little lamb
 - She had only one lamb, not several
- Mary had a little lamb
 - It really was surprisingly small
- Mary had a little lamb
 - She didn’t have a dog, cat, cow, goat or parakeet
- Mary had a little lamb
 - John still has his little lamb
- Mary had a little lamb
 - As contrasted with Sally, who still has four large turtles
- Mary had a little lamb
 - Why are you telling us this?
 - Did she have it for dinner?

“Mary conned the trader” Heuristic Variation

- Heuristic: **substitute synonyms** for each of the key words taken out of context
 - Why? The client may be producing the problem statement in another context, which would be a major source of ambiguity

Example: “had” and “lamb”

had past of have

have to hold in possession as property

beget, bear (have a baby)

partake (have dinner)

bribe, suborn (can be had for a price)

lamb young sheep

a person as gentle or weak as a lamb

a person easily cheated or deceived, especially in trading securities

So Mary bribed a small person trading in securities who was easily cheated

Example: “fleece” and “snow”

fleece to strip of money or property by fraud or extortion

snow *slang*: to deceive, persuade, or charm glibly

The poem is about a charmingly glib but fraudulent person named Mary who tricked a small, helpless, gullible stock trader and stripped him of all worldly goods through deceit and extortion.

Is it any wonder that

Everywhere that Mary went

The Lamb was sure to go.

What else could the poor lamb do after she fleeced him?

References

- Gause, D.C. and Weinberg, G.M., *Exploring Requirements: Quality Before Design*, Dorset House, New York, NY (1989)
- Daniel Barry, “From Contract Drafting to Software Specification: Linguistic Sources of Ambiguity - A Handbook”, 2003