

# LINGUISTIC ANALYSIS OF ENGINEERING REQUIREMENTS

Carl Lamar

# Contents

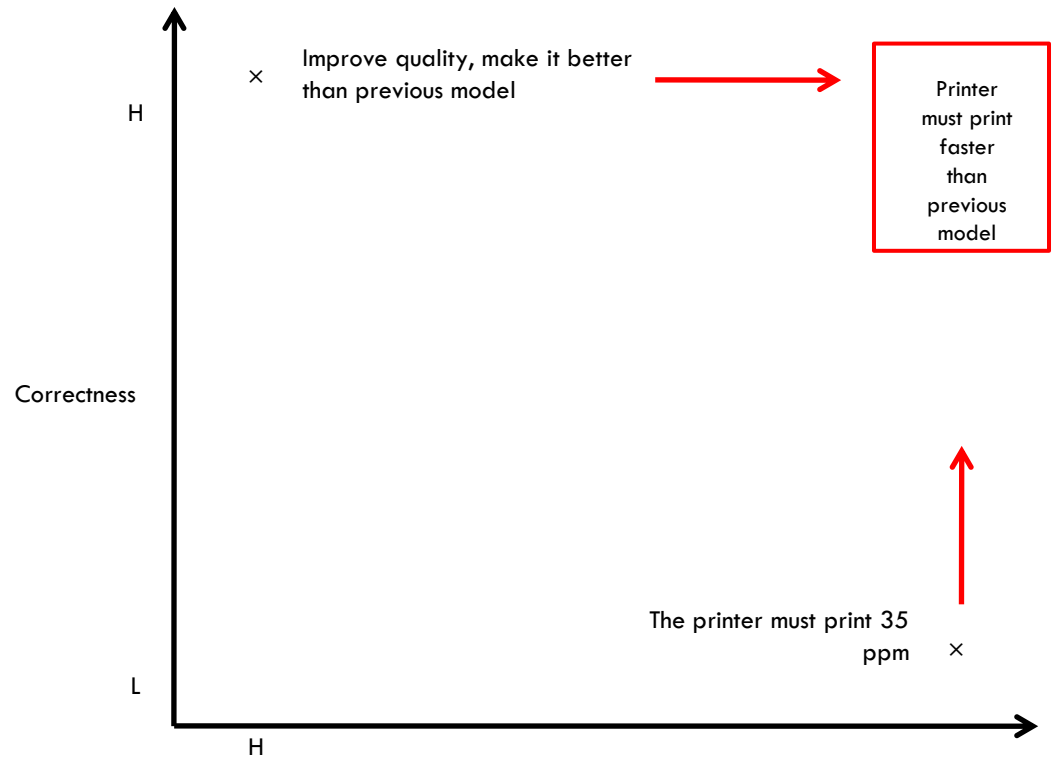


- Background
- Grammar rules
- How they apply to engineering requirements
- Rules for refining requirements
- Process for using rules
- Requirement refinement tool
- Future work

# Background

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- Figure shows a “bad” requirement being changed to a “good” requirement
- A formalized syntax to describe what a good requirement looks like
- A process to transform bad requirements into good requirements



# Background

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- The correctness of a requirement is difficult to define.
  - ▣ Ambiguity, Syntax, Solution Neutrality, Semantics
  
- Currently correctness is a subjective measure.
  - ▣ What if it can become an objective measure?
  
- Before correctness can become an objective measure requirements need to be formalized.

# Grammar Rules

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- Transitive Verbs
- Intransitive Verbs
- Linking Verbs

# Grammar Rules

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- Transitive Verbs – verbs that always has a noun that receives the action of the verb

□ Example: *Dr. Mocko rides his bike*

Subject      Verb      Direct Object

- Requirement Example:

*The seat must prevent injury*


Subject      Verb      Direct Object

# Grammar Rules

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- Intransitive Verbs – verbs that never has a direct or indirect object, but it can be followed by an adverb or adverbial phrase.

□ Example: *Dr. Summers falls.*

  
A green bracket underlines "Dr. Summers" with the label "Subject" below it. A red bracket underlines "falls" with the label "Verb" below it.

- Requirement Example:

*The airplane seat must float.*

  
A green bracket underlines "The airplane seat" with the label "Subject" below it. A red bracket underlines "must float" with the label "Verb" below it.

# Grammar Rules

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- Linking verb – verb that connects the subject of a sentence to a noun or adjective that renames or describes it.

□ Example: *Dr. Fadel is a professor.*

Subject      Verb      Subject Compliment

- Requirement Example:

*The seat must be easy to adjust.*

Subject      Verb      Subject Compliment

# How do these grammar rules apply to engineering requirements

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- Transitive and intransitive verbs relate to functional requirements

Action verbs = function

- Linking verbs relate to form requirements

Linking verbs = state of being

# Solution Dependency and Verb types

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- In addition to the type of requirement, verb types along with the subject and object can determine whether a requirement is solution neutral or not

□ Example: *The engine must accelerate the vehicle.*



*The vehicle must accelerate*



*The vehicle must tow a boat*

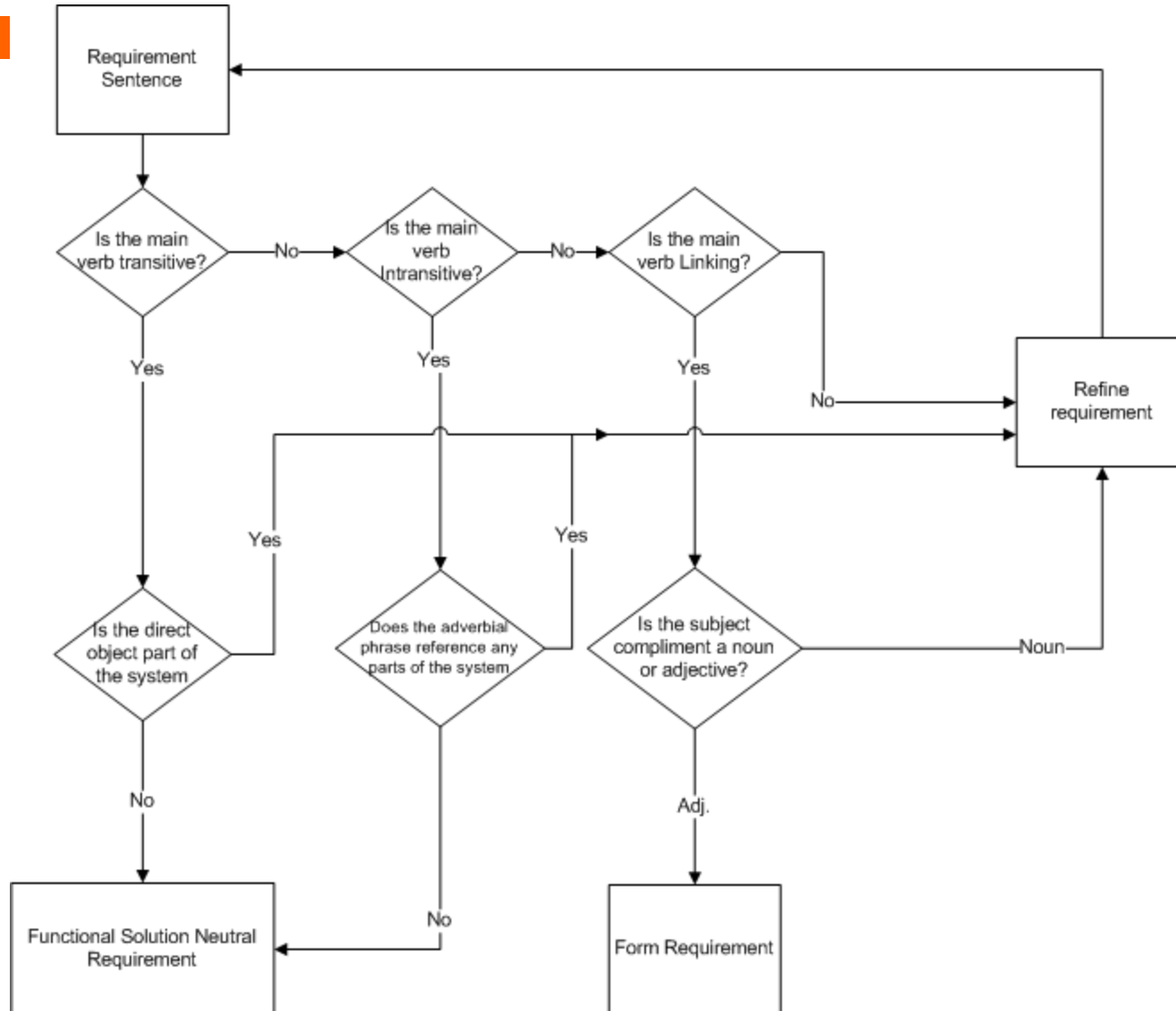


# Linguistic Rules for Engineering Requirements

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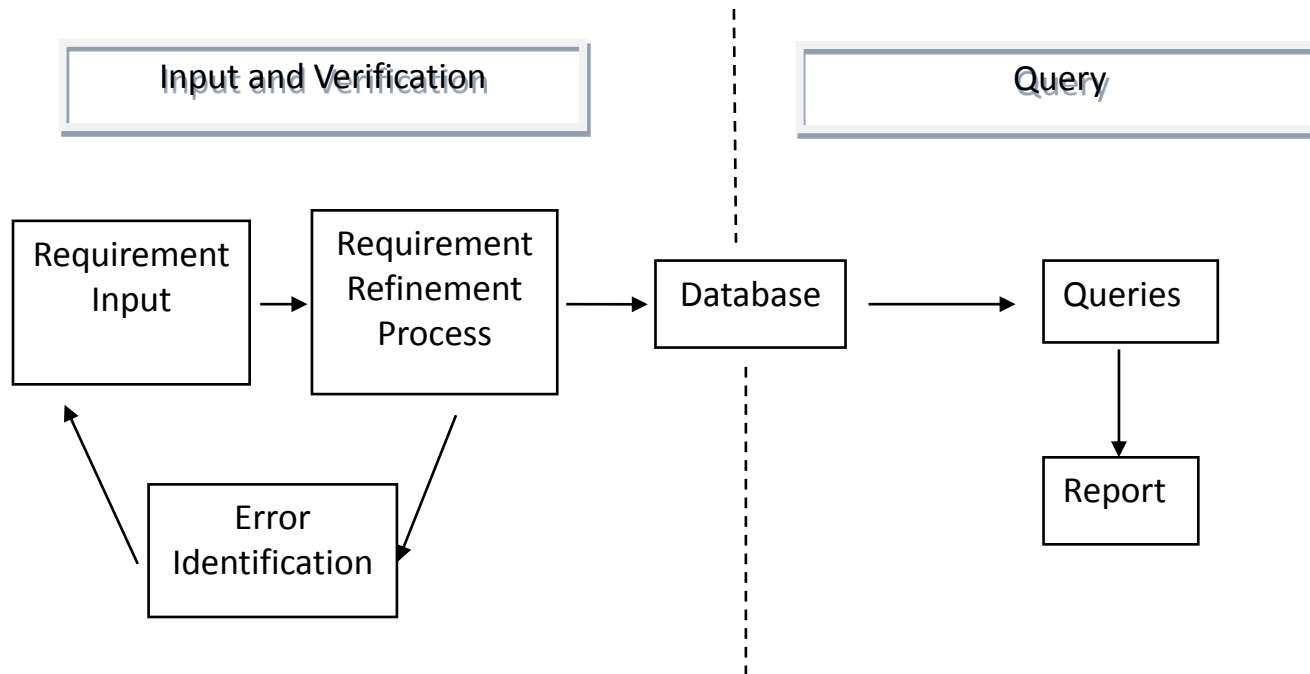
- All functional requirements should be expressed as either transitive or intransitive verb sentences.
- All form requirements should be expressed as a linking verb with an adjective as the subject complement not a noun.
- In a functional requirement the subject should be the system of interest.
- In a transitive verb sentence the direct object should never be the system or any part of the system.
- In an intransitive verb sentence the adverbial phrase (constraint) should not contain any part of the system or the system itself

# Process for checking requirements



# Tool for Processing Requirements

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# Future Work

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- Include a limited vocabulary
- Parse more requirements to ensure rules are valid
- Create a database