Building Confidence Incrementally

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Document Markings

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Building Confidence in an Interface Device

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How might assurance be developed incrementally as the design and implementation evolve?

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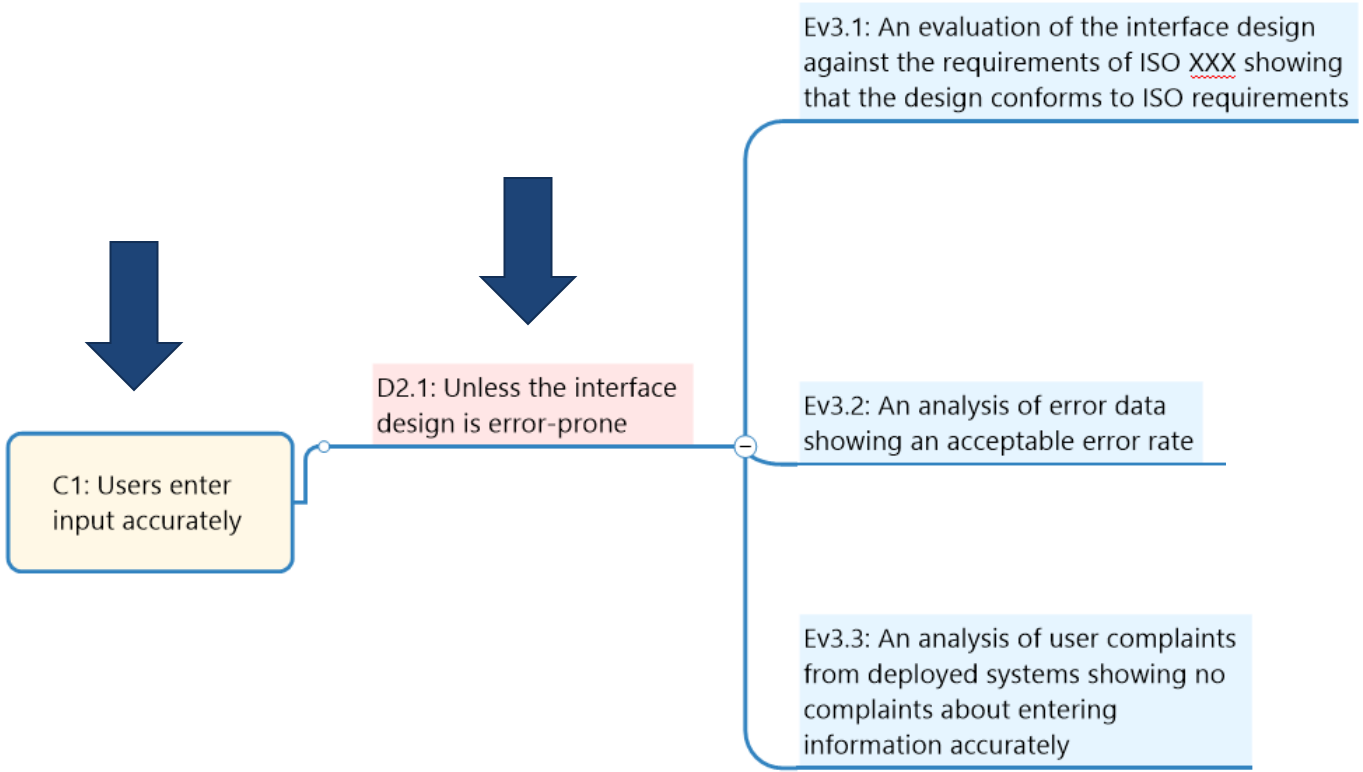

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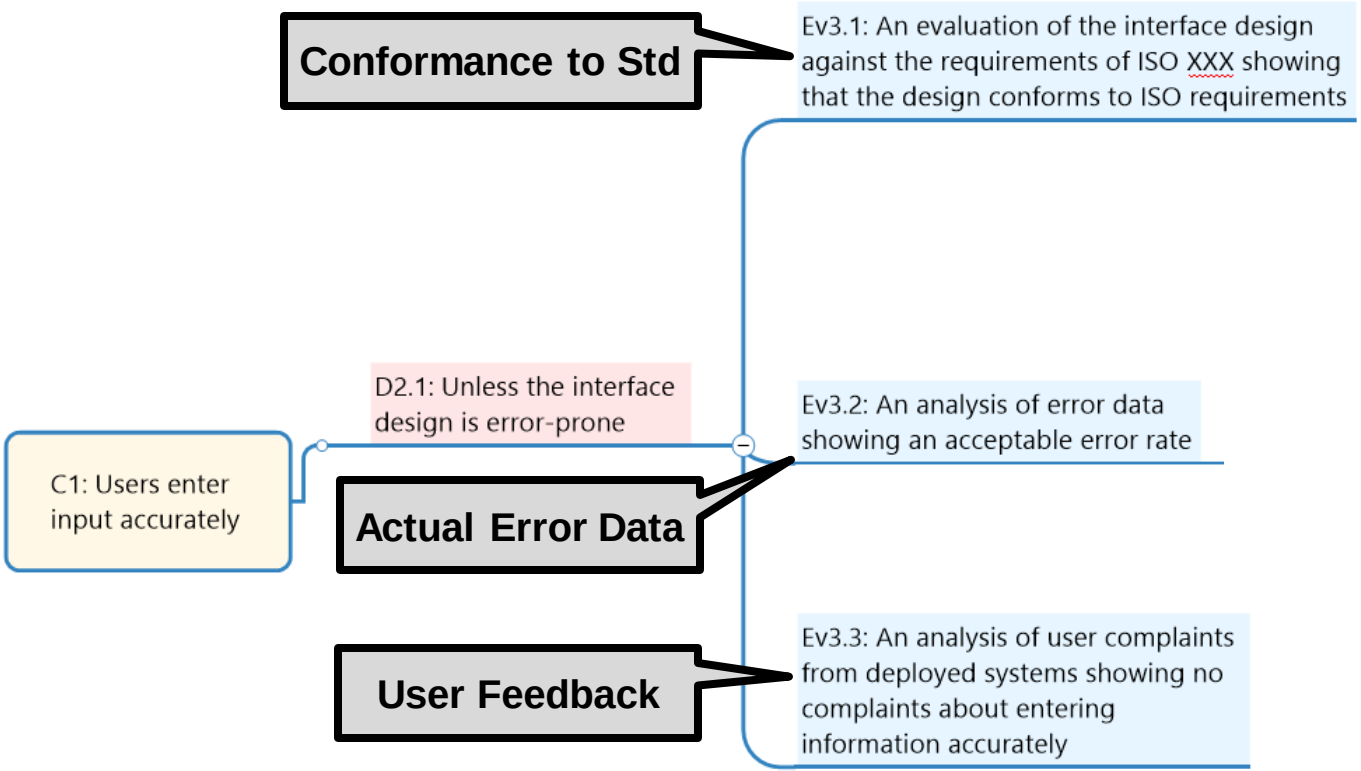

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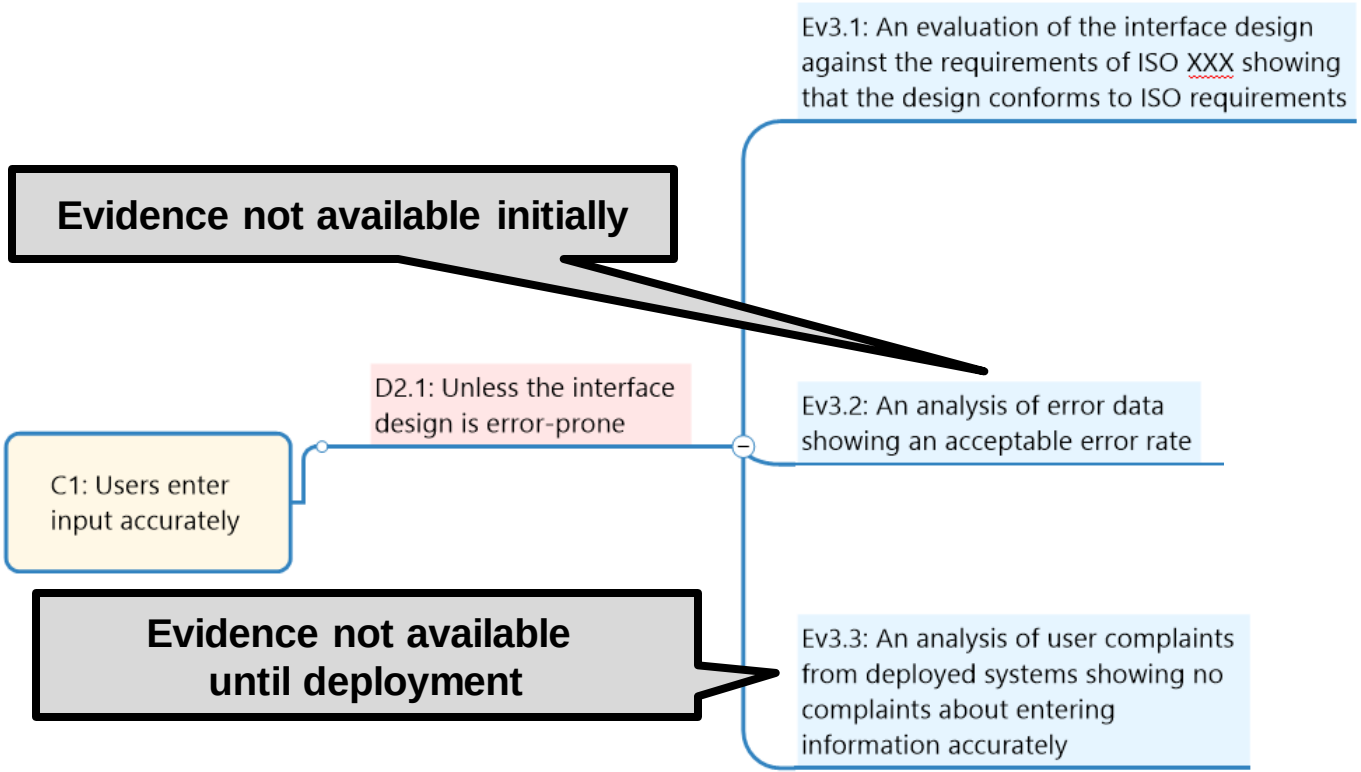

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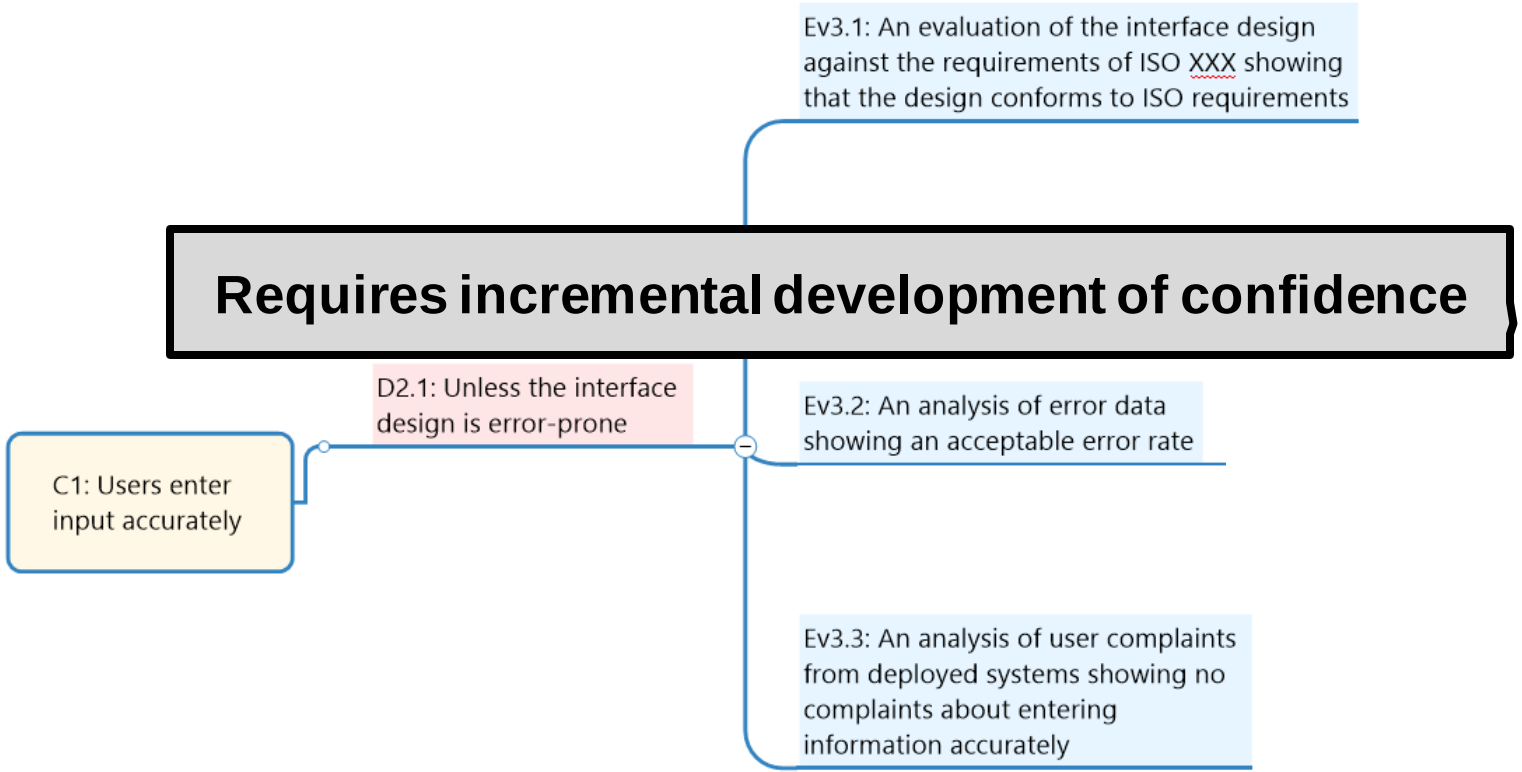

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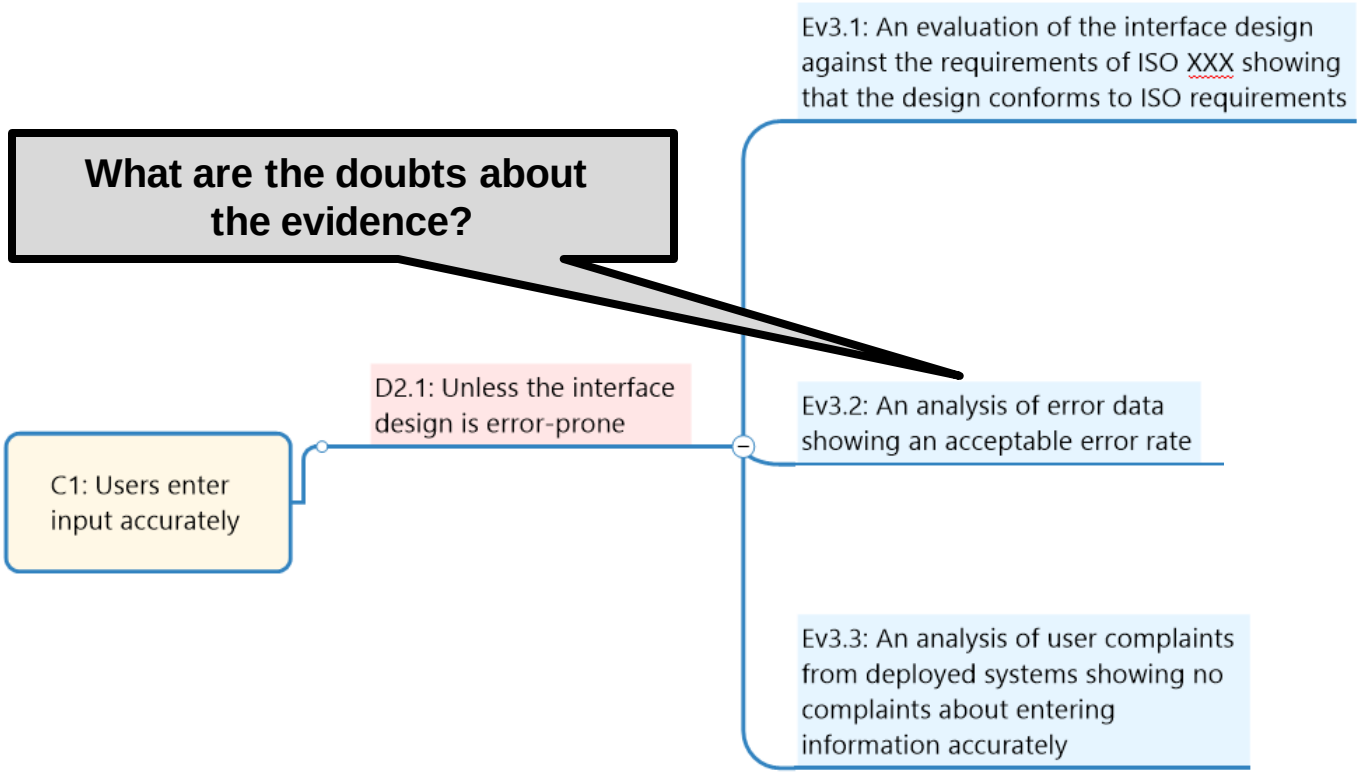

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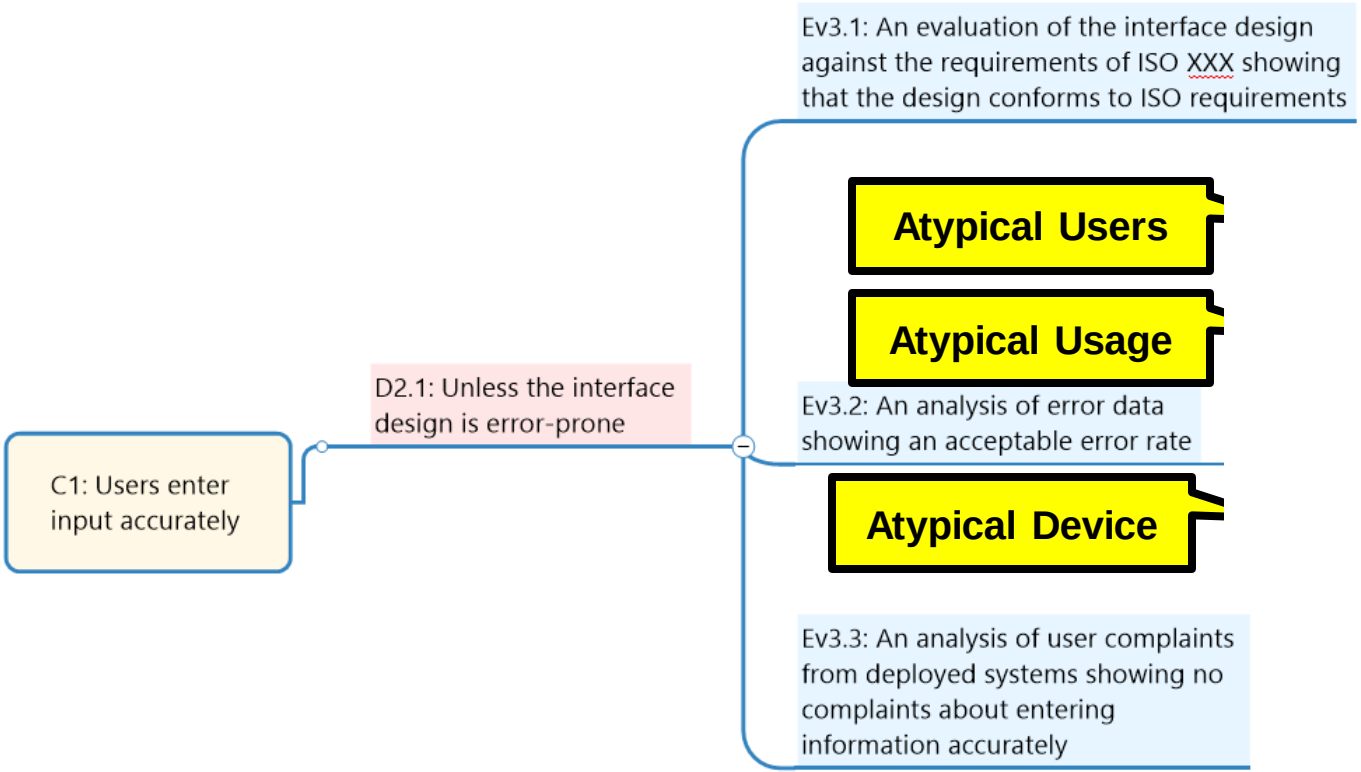

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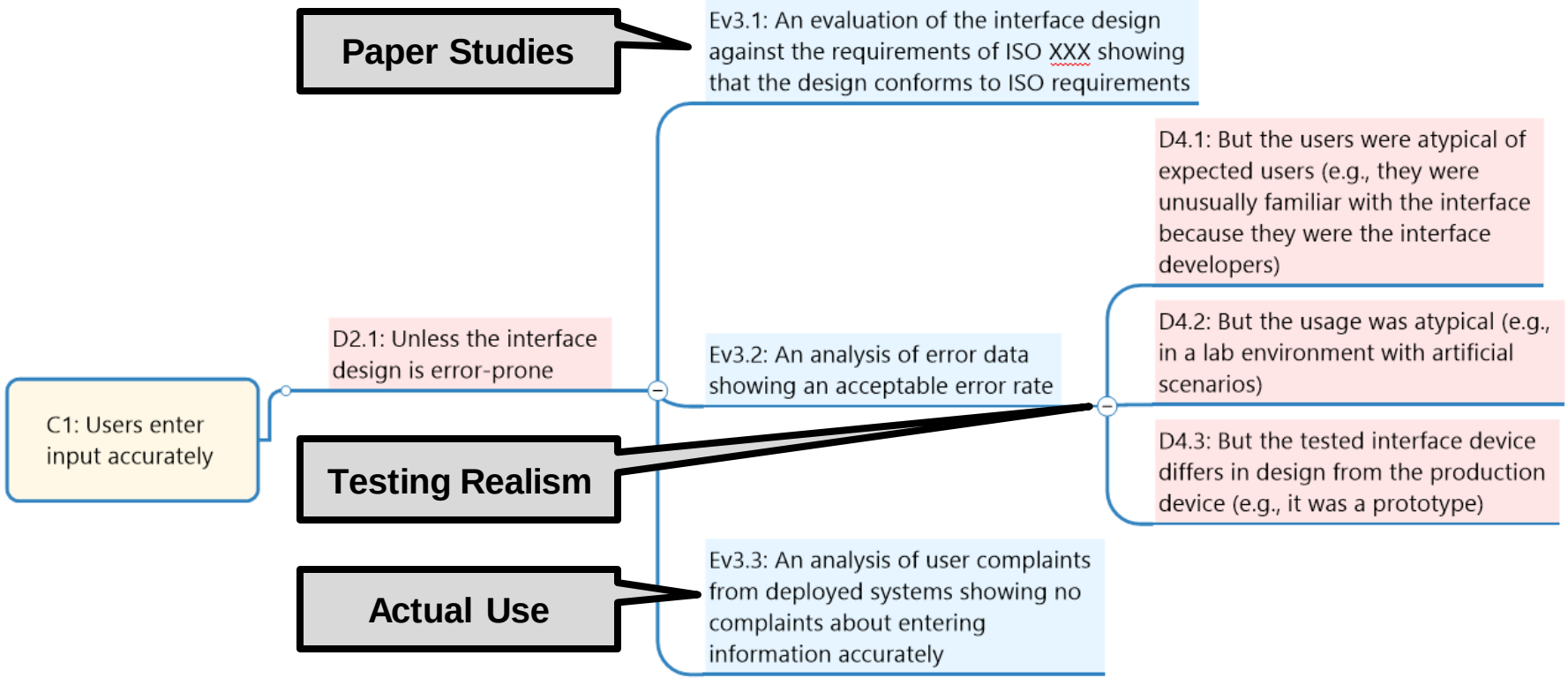

Incremental Confidence

As more information becomes available, confidence can increase

The AC can outline the lifecycle strategy for building (and maintaining) confidence

- Including the increase in doubt as time goes by (is the error rate maintained?)

Confidence in **evidence** plays a significant role in incremental confidence

How much confidence is needed to move to a next development stage?

- Depends on the significance of the remaining doubts
- The ability to gather evidence that eliminates the doubts
- How to measure is unclear (i.e., how much residual doubt is acceptable at some stage
  - Counting uneliminated **significant** doubts is a possibly pragmatic approach

What Information Gives Us SUFFICIENT Confidence?

Significant doubts, if valid, would lead to significant negative outcomes

- When actions are taken based on a belief that a claim is valid

Sufficient confidence is, in part, a function of

- The number, status, and significance of uneliminated doubts
- One has to eliminate a sufficient number of significant doubts
  - But which are significant?
  - How completely are they eliminated?

What is Confidence?

Confidence: the degree of belief that a claim holds

- Possible Measures:
  - Absence of doubt (80% of doubts eliminated)?
  - Probability of operational failure or accident (e.g., P(Failure) < 20%)?
    - On demand – 80% of the time you make a demand, it succeeds?
    - Over some period – a mission of 100 hours is 80% likely to succeed?
  - Some combination of probability of failure and consequence of a failure?
    - Safety integrity levels
    - Residual risk
- Can vary among different holders of the belief
- What does it mean to be more “highly assured”?

What is Confidence?

Confidence changes over time

- As more is known, i.e., as *uncertainty* decreases (more knowledge)
  - While developing a system
  - While investigating a system (building a case)
  - As you discover counterevidence
- Degrades with time
  - As assumptions are invalidated (e.g., system environment or usage changes)
  - As confidence in evidence decays (e.g., will tests still pass?)

What is “Sufficient” Confidence?

“Sufficient” if the consequences of acting as if a claim is true are acceptable

- Release a system
- Approve a design
- Stop perfecting the evidence

The bar is higher if potential consequences are “bad”

Interesting Questions about Confidence

How does a "defense in depth" design strategy impact confidence?

- How do you show that additional confidence created by secondary defense is worthwhile?
  - What doubts does such a strategy eliminate?
  - Why do redundant checks eliminate doubts (that have already been eliminated)?

If we modify a system by adding an electric generator to mitigate the risk of a power outage, do we need to modify the claim to explain what we have increased confidence in?

- E.g., have more confidence in an increased MTF measure?
- Before adding the generator, could have high confidence in a 3 9's claim and hardly any in a 5 9's claim

What about when adding recovery actions to mitigate the damage caused by an intrusion?

- This must increase the confidence in some modified claim about the availability of a system capability. Anything else?

What does it mean to be more "highly assured"

- Fewer uneliminated doubts?
- More doubts identified and eliminated?
- More stringent claim in which to have confidence?

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