Requirements Validation

Lectures 7, DAT230, Requirements Engineering
Robert Feldt, 2011-09-20

Customer Interview #1

Thursday 22/9, Jupiter320

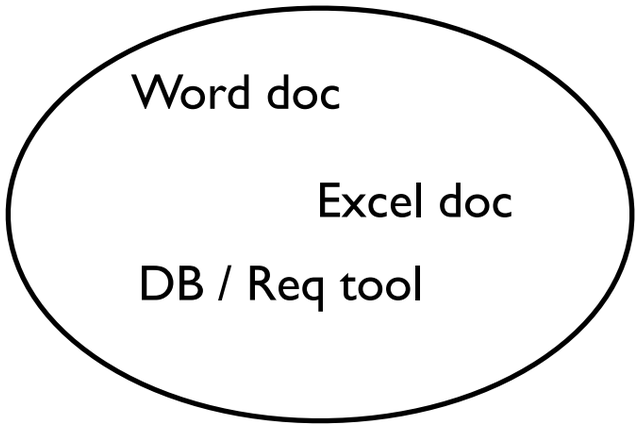
Time	Groups
13:15-14:10	1, 2, 3
14:15-15:10	4, 5, 6
15:15-16:10	7, 8, 9
16:15-17:15	10, 11, 12

Recap from last lecture

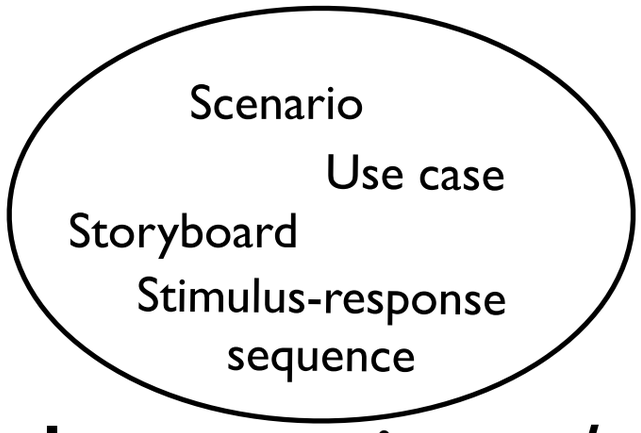
Recap

- Specification to refine/specify reqs and reduce risks
- SRS is primarily a communication device
  - Also drives development and is baseline for releases
- Modeling for specific situations and reqs
- Many different specification techniques
  - Text, Sequence- and state-based models are key
  - Use cases, scenarios also quite common
  - Formal approaches less used; user communication harder
- IEEE 830 gives basic and common structure

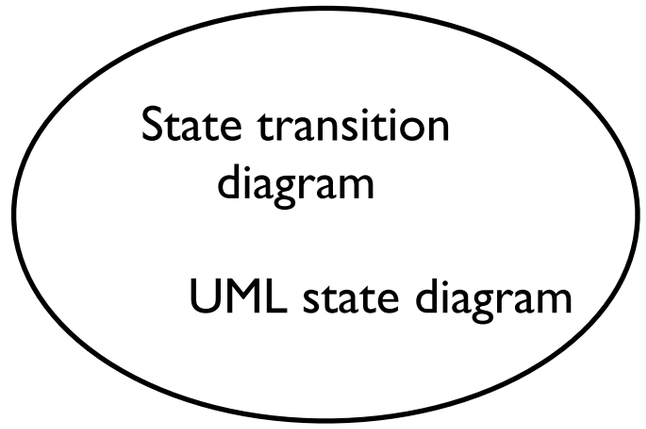
Specification Techniques



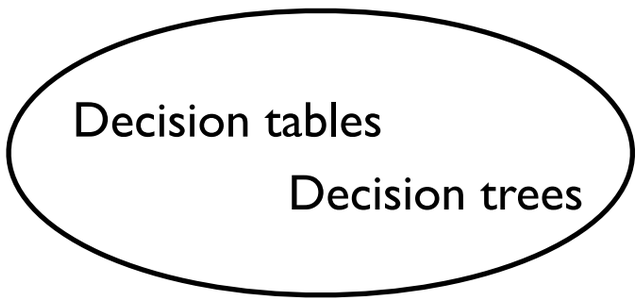
Text



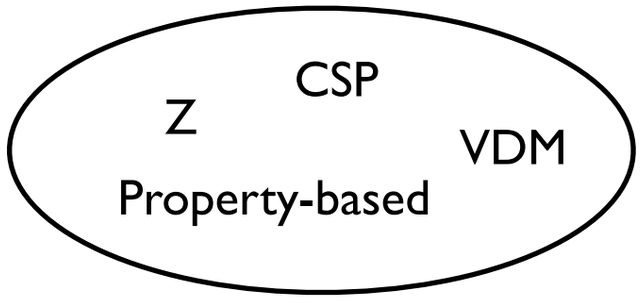
Interaction- / Sequence-based



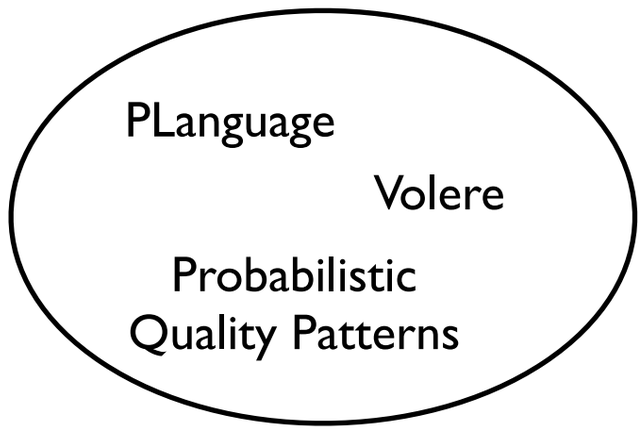
State-based



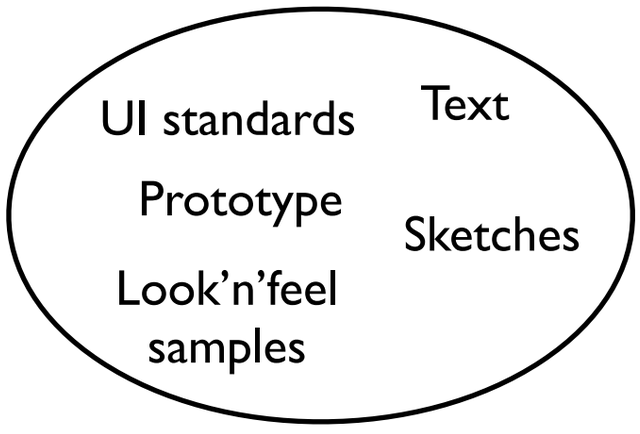
Decision-based



Formal



Quality Requirements



User Interfaces

Why validation?

"If temperature is higher than 70 and less than 100, then output should be 3000 watts"

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- What if <70?

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- What if >100
- 70 and 100 are in C or F?

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- What if <70?
- What if >100
- 70 and 100 are in C or F?
- How does this fit with rest? Conflicts?

Why validation?

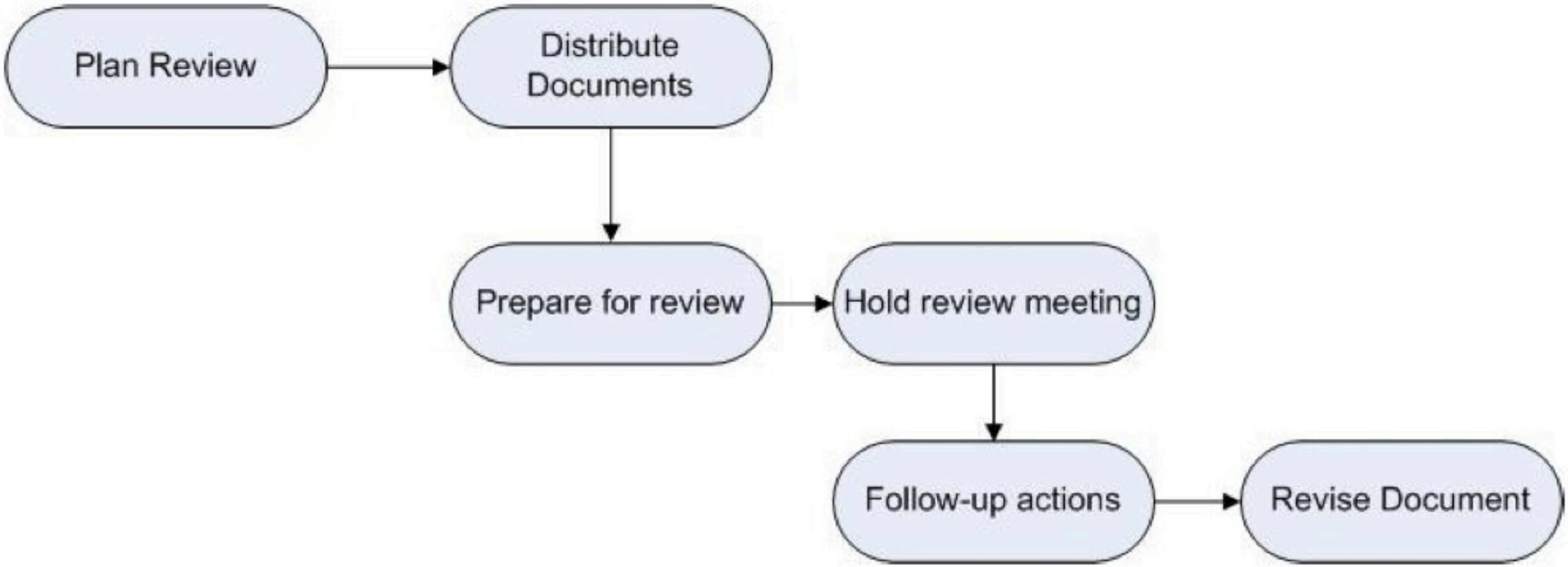
"If temperature is higher than 70 and less than 100, then output should be 3000 watts"

- What if <70?
- What if >100
- 70 and 100 are in C or F?
- How does this fit with rest? Conflicts?
- What is missing?

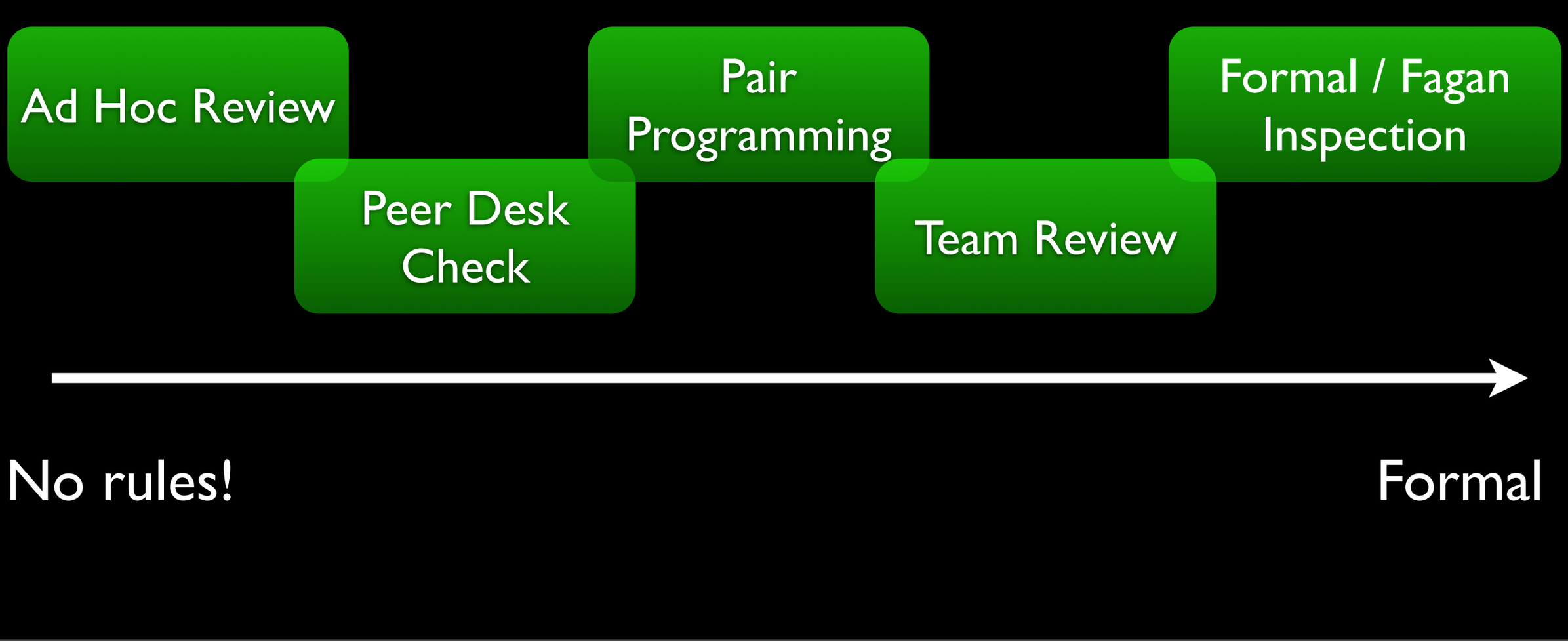
Validation Techniques

1. Requirements Pre-Reviews
2. Requirements Reviews
   - 2.1 Requirements Inspections
     - 2.1.1 Test-Case Driven Inspection
   - 2.2 Reading Techniques
     - 2.2.1 Ad-hoc based Reading
     - 2.2.2 Check-list based Reading
     - 2.2.3 Perspective based Reading
3. Requirements Prototyping
   - 3.1 Throwaway Prototyping
   - 3.2 Evolutionary Prototyping
4. Model-based requirements validation
   - 4.1 Data-flow Models
   - 4.2 Compositional Models
   - 4.3 Classification Models
   - 4.4 Stimulus Response Models
   - 4.5 Process Models
   - 4.6 Simulation Models
5. Testing-based requirements validation
6. Viewpoint-oriented requirements validation

Req Review

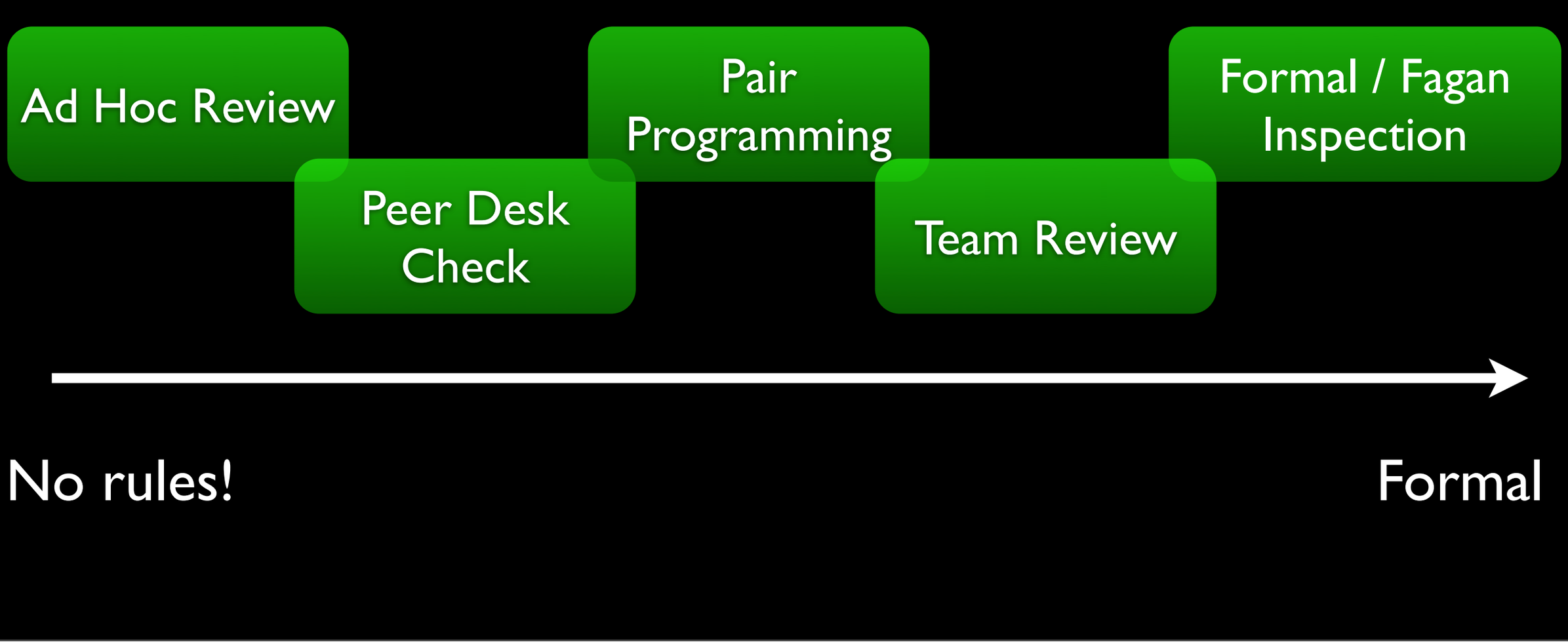

Plan Review
Distribute Documents
Prepare for review
Hold review meeting
Follow-up actions
Revise Document

The Review Formality Spectrum



The Review Formality Spectrum

7 Stages
Roles
Preparation
Recorder
Approval/Not



Fagan Inspection Process

IBM: 80-90% of defects found & 25% resource savings

In a typical Fagan inspection the inspection process consists of the following operations[1]:

- Planning
  - Preparation of materials
  - Arranging of participants
  - Arranging of meeting place
- Overview
  - Group education of participants on the materials under review
  - Assignment of roles
- Preparation
  - The participants review the item to be inspected and supporting material to prepare for the meeting noting any questions or possible defects
  - The participants prepare their roles
- Inspection meeting
  - Actual finding of defect
- Rework
  - Rework is the step in software inspection in which the defects found during the inspection meeting are resolved by the author, designer or programmer. On the basis of the list of defects the low-level document is corrected until the requirements in the high-level document are met.
- Follow-up
  - In the follow-up phase of software inspections all defects found in the inspection meeting should be corrected (as they have been fixed in the rework phase). The moderator is responsible for verifying that this is indeed the case. He should verify if all defects are fixed and no new defects are inserted while trying to fix the initial defects. It is crucial that all defects are corrected as the costs of fixing them in a later phase of the project will be 10 to 100 times higher compared to the current costs.

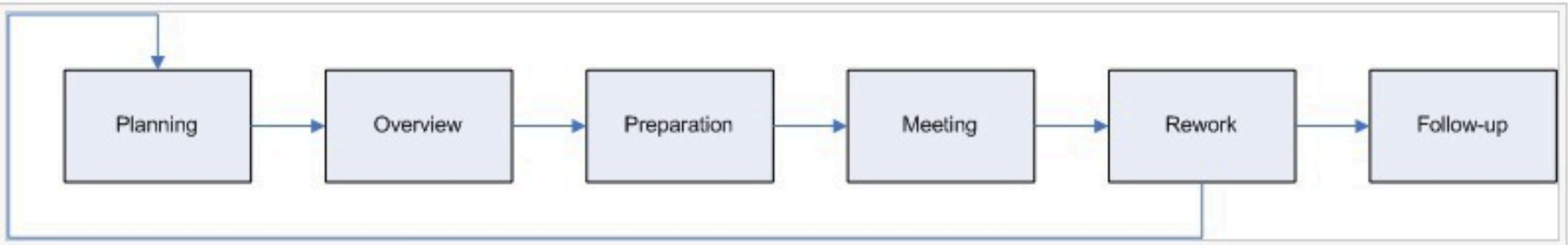


Figure 1: Fagan inspection basic model

[Wikipedia2011]

Review/Reading Styles

- Test-Case Driven Review
  - Tester does review to find reqs that are not testable
- Reading techniques
  - Ad hoc (most common, focused on experience)
  - Check-list based
  - Perspective-based (different stakeholders or user types)

Checklist example

Checklist Questions	Quality Attribute
Is each requirements is easily Identified?	Traceability, conformance to the standard
Are specified terms are defined in the glossary	Understandability
Do individual requirements use the same term in different ways?	Ambiguity
If a requirement makes references to some other facilities; are these described elsewhere in the document?	Completeness
Are related requirements group together?	Organization
Are there any contradictions in the requirement?	Redundancy
Do you have to examine other requirements to understand what it means?	Completeness

Selective Homeworkless Review

- Challenges when re-introducing Fagan inspections at IBM:
  - Managers: High up-front cost (20-30% of dev time), since everything reviewed => **Selective reviewing**
  - Individuals: Preparations seldom happen, since tight schedules => **Homeworkless reviews**
- Team meets once a week, fixed day&time, 1-1.5 hours
- Artifact selected just before or at meeting
- Roles: Moderator, Reader, Scribe/Recorder
- Hybrid: No preparation => informal, Roles => formal
- Moderator selects specific review technique

[Farchi2008]

Selective Homeworkless Review

Characteristic	Inspection	Team Review	Walkthrough	Selective Homeworkless
Leader	Moderator	Moderator or Author	Author	Moderator
Material presenter	Reader	Moderator	Author	Reader or Author
Requires preparation	Yes	Yes	No	No
Granularity of material	Small chunks	Pages or sections	Author discretion	Usually small chunks
Recorder used	Yes	Yes	Maybe	Yes
Documented procedure followed	Yes	Maybe	Maybe	Yes
Specific participant roles	Yes	Yes	No	Yes
Defect checklist used	Yes	Yes	No	Depends on review method chosen
Data collected and analyzed	Yes	Maybe	No	Yes
Product appraisal determined	Yes	Yes	No	Maybe

Table 1. Comparing characteristics of review and inspection techniques

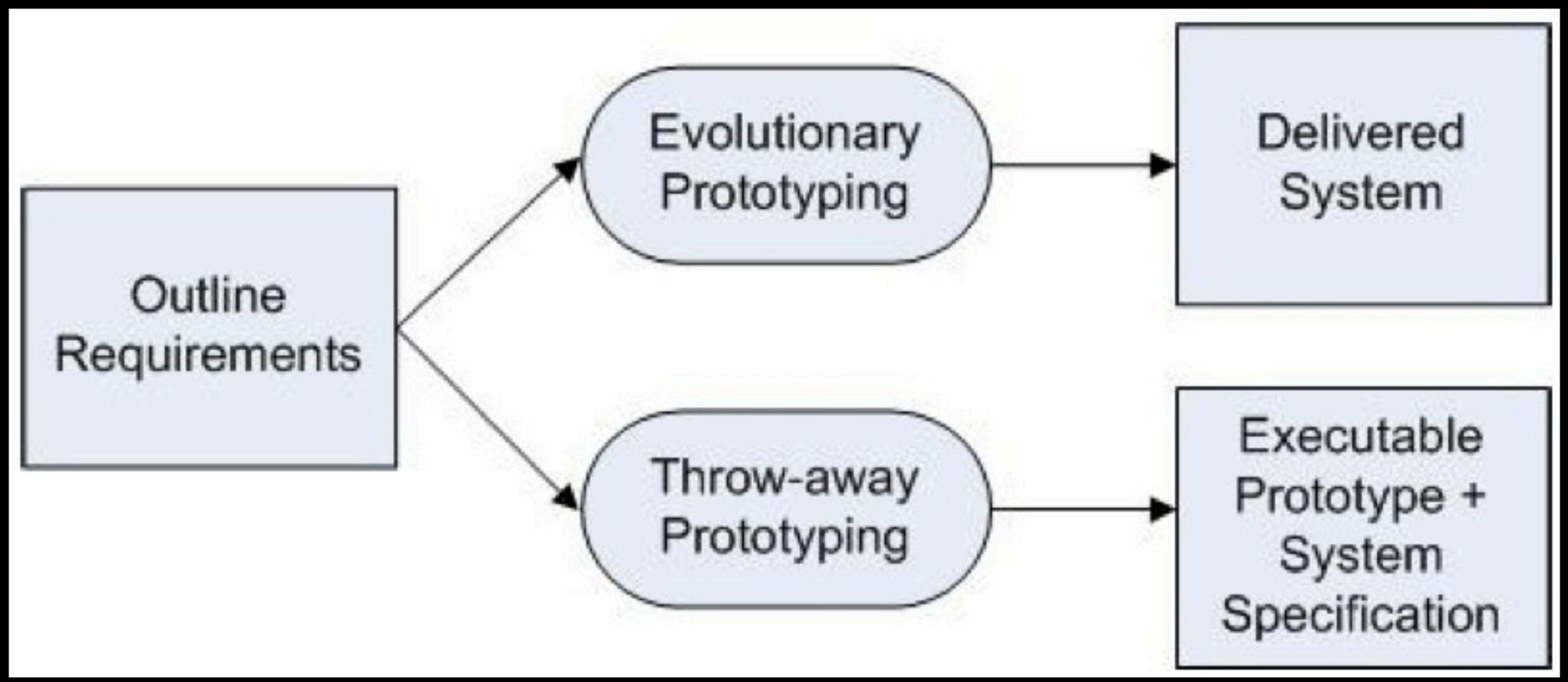
Selective Homeworkless Review

- Moderator monitors metrics:
  - Issues found per reviewer per hour
  - If below 2, then stop meeting or use other technique
- Does it work?

- 2.17 +/- 0.34 issues/hour/reviewer (90% confidence level)
- *"When compared to other review methodologies that in- clude preparation, our method finds fewer issues overall but more major issues per hour. Our opinion is that people working on their own are more effective in finding low-level syntactic problems, as more eyes are watching more places, but less effective in finding real bugs as the understanding is shallower."*

[Farchi2008]

Prototyping



Prototyping

	Throw-away	Evolutionary
Development Approach	Quick	Precisely developed (takes time)
What to build first	Difficult parts	Build understood part first
Goal	Throw it away	Evolve it

What do industry use?

Country	Sweden			Pakistan		
Companies RVTs…	Company X	Company Y	Company Z	Company A	Company B	Company C
Reviews	*	*	*	*	*	*
Prototyping	*	*	*	*	*	*
Testing Based RVTs		*			*	*
Model Based RVTs	*					*

4 companies used checklist-based and 2 ad hoc review reading

6 used throwaway prototypes, 2 also evolutionary

Who do industry involve in reviews?

Companies	Personnel Involved in Review Activities
Company X	System Manager, Design Coordinator (Representative of defected designs), Quality Assurance Person, and System Expert.
Company Y	Project Manager, Technical Architect, Software Engineer, and Quality Assurance Person
Company Z	Software Architect, Requirements coordinator, developers, System Engineer, Functional Group leader, and Quality Assurance Person
Company A	Customer, Quality Assurance person, Developer, and Project Manager
Company B	Project Manager, team leader, and Customer
Company C	Project Manager, Senior Architect and Team Lead

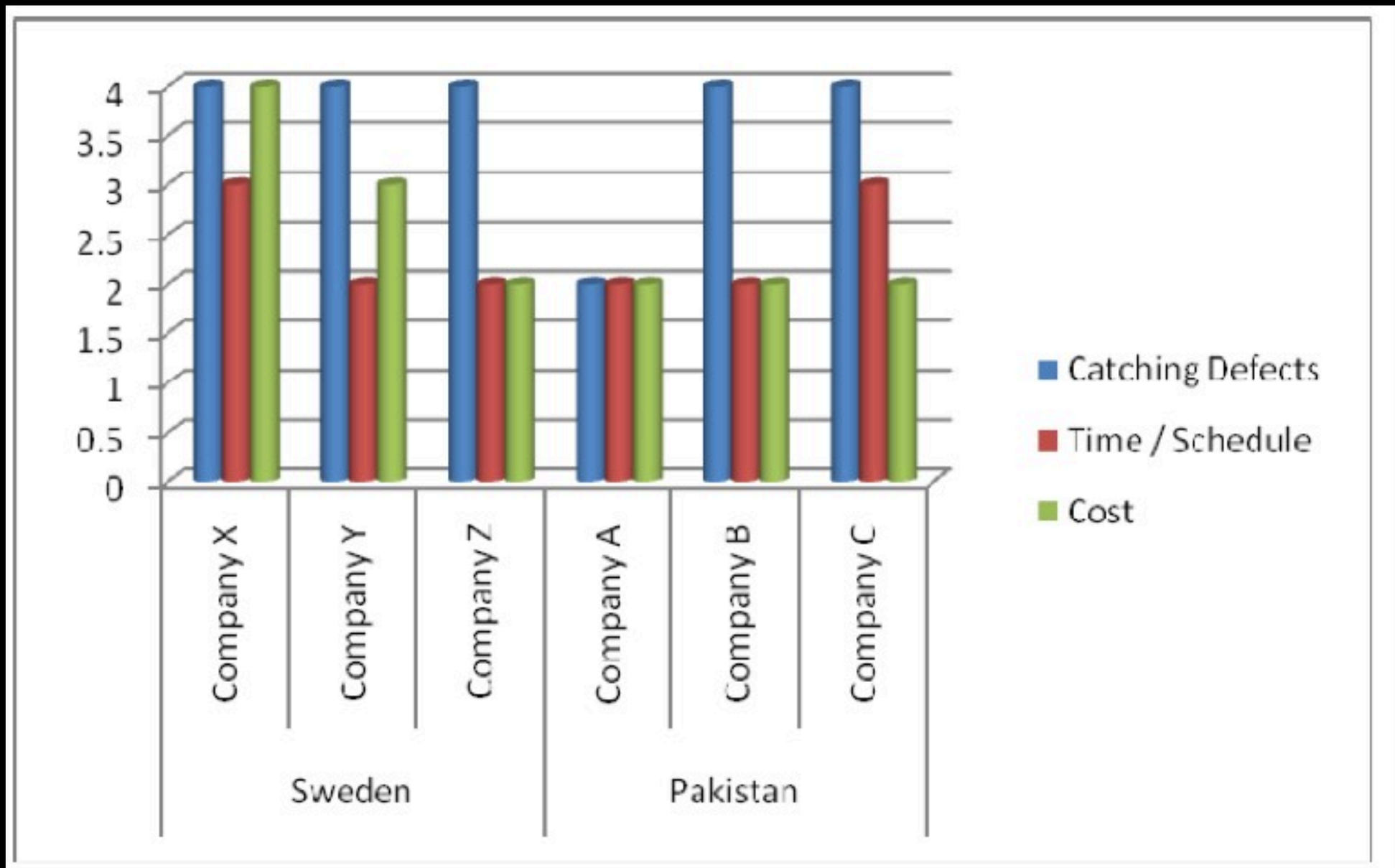
Pros/Cons of Reviews?

Companies	Pros of Reviews as RVTs	Cons of Reviews as RVTs
Company X	Reviews helps to Remove Defects, and also Remove Ambiguity in the requirements	Time Required for preparation, requirements written only in text without diagrams/maps is negative, resource unavailability
Company Y	Easy to Remove defects, Educational	Resource unavailability (Time to time put overload and strain), Risks with Reviews,
Company Z	Consistency, Better Quality Estimates, Detailed Time Schedule , requirements clarity people from different backgrounds together, give clear view of the requirements and have different perspective	Time Consuming, resource unavailability, checklist, Too much required for preparation and lengthy process. difficult to prioritize the exact activities
Company A	Removes assumptions , and Reduce Rework	Time Consuming, lengthy process, resources unavailability
Company B	Completeness, and Reduce Rework,	Lengthy process and time consuming, client do not take ownership. Too much documentation kills the effectiveness of reviews.
Company C	Real Requirements from customers, resolve conflicts and removes assumptions	Time Consuming, Resource usage

Improvements to Reviews?

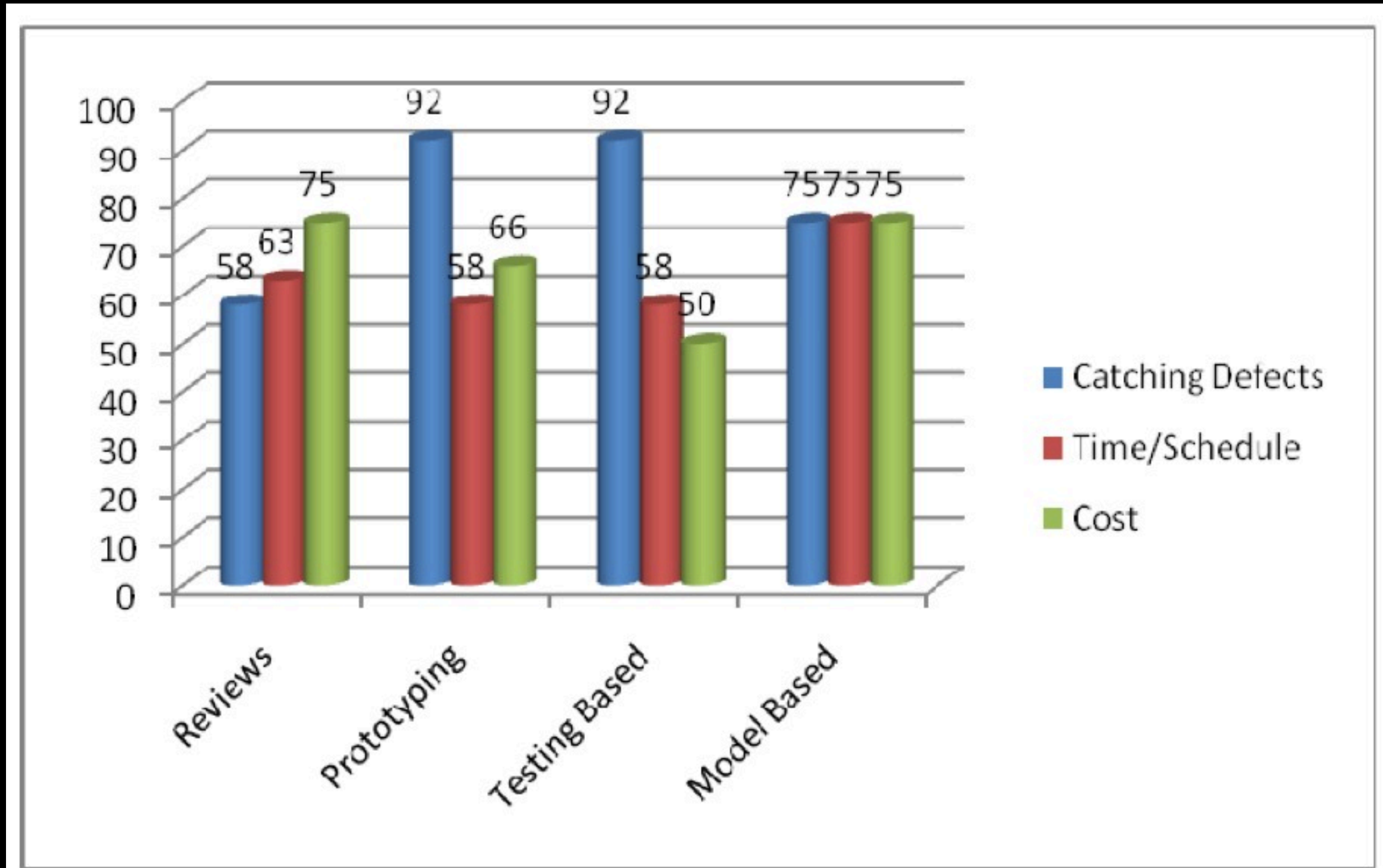
Companies	Suggested Improvements in Reviews as RVT
Company X	Focus should not be set only on functionality because customer needs other things as well, understand the non-functional requirements, and reviews never get to time-plans
Company Y	More time required for requirements reviews and more focus required during reviews
Company Z	Allocation of time to people who are involved in review meetings and it should be spread, checklist should be known, proper preparation of review meeting before actual meetings
Company A	As we have too much generalized checklist, it will be better if we customize check list before review meeting, instant feedback required from the customers.
Company B	More time is required, customer participation is not good because they do not want to take responsibility, and feedback required from the customers.
Company C	Pre-reviews preparation is helpful, participation of stakeholders having different backgrounds is helpful to find different perspectives of the requirements, and feedback on proposed changes from customer is required.

Satisfaction with Prototyping?



Graph 2 - Satisfaction Level of Prototyping

Comparison of Techniques



Graph 5 - Comparison of different RVTs

Standards & Process Reqs

17b. Standards Requirements

Content

A statement specifying applicable standards and referencing detailed standards descriptions. This does not refer to the law of the land—think of it as an internal law imposed by your company.

Motivation

To comply with standards so as to avoid later delays.

Example

The product shall comply with MilSpec standards.

The product shall comply with insurance industry standards.

The product shall be developed according to SSADM standard development steps.

Fit Criterion

The appropriate standard-keeper certifies that the standard has been adhered to.

Considerations

It is not always apparent that there are applicable standards because their existence is often taken for granted. Consider the following:

- Do any industry bodies have applicable standards?
- Does the industry have a code of practice, watchdog, or ombudsman?
- Are there any special development steps for this type of product?

Standards & Process Reqs

4 General system requirements

R4.1	The X System, subsystems included, shall fulfil, where applicable[3], the specified standards and recommendations for use in Y operations: *standarder och rekommendationer enligt Xstyrelsens KNM NNNN:N1.*
R4.2	The X System, subsystems included, shall meet, where applicable[3], the standards and guidelines in ICAO Standards and Recommended Practices (SARP(s)) and Eurocontrol standards as listed in *Xstyrelsens föreskrifter och zzz för X, KNM NNNN:N2 och KNM NNN2:NN3* according to the Y services that will be performed in X.