Uniwersytet Wrocławski

Estimation Techniques

Presented by: Fady Yacoub
M.Sc. Data Science Student, University of Wrocław

Instructor: Prof. Kamil Matuszewski
University of Wrocław

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Agenda

1. Introduction
2. Core Concepts
3. Agile Estimation Techniques
4. From Estimation to Forecasting
5. Common Pitfalls and Biases
6. Best Practices
7. Summary

Introduction

- Purpose of Estimation in Agile
- Challenges of Traditional Estimation
- Agile Perspective on Estimation
- Key Principles

Purpose of Estimation in Agile

- Helps the team and stakeholders **forecast delivery timelines and plan releases.**
- Supports Sprint Planning by **estimating how much work can fit into a sprint**.
- Provides **a basis for roadmaps**.
- Helps **balance scope, time, and resources** for optimal outcomes.
- **Tracking actual effort vs. estimates helps improve team predictability.**

Purpose of Estimation in Agile

- **Reveals process inefficiencies.**
- Reveals areas where **understanding or accuracy can improve over time.**
- Provides **transparency to stakeholders** on how long features may take.
- Sets **realistic goals** to avoid overpromising and under-delivering.

Challenges of Traditional Estimation

- Estimates are often made **before full requirements are known**.
- **Changes in scope** make early estimates quickly **outdated**.
  - **Leads to unrealistic deadlines** and rigid commitments.
- Traditional methods (like hours or Gantt charts) **assume predictability**.
- Focus on exact numbers **creates a false sense of accuracy.**
- **Deviations from estimates are seen as failures instead of learning opportunities.**

Challenges of Traditional Estimation

- Poor adaptability to change as it **assumes stable scope** and requirements.
- Struggles with **changing priorities** common in Agile environments.
- Leads to delays and **rework when plans must be updated.**
- Hidden Costs and Waste:
  - **Time-consuming estimation meetings** and detailed documentation.
  - **Delays starting actual development** and feedback loops.

Agile Perspective on Estimation

- Estimation is **team-driven**, not management-imposed.
- Builds a **shared understanding** of the user story and its complexity.
- Agile favors **task-relative estimation** rather than trying to predict exact durations.
- Prioritize **high-value, low-effort stories**.
- Team works on **what delivers maximum customer impact first.**
- Retrospectives help compare estimates to outcomes for future improvement.
- A **feedback and learning loop,** not a rigid contract.

Key Principles Behind Agile Estimation

- Relative Estimation:
  - Compare tasks **against one another** instead of assigning exact hours.
- Estimation ≠ Commitment:
  - Estimates are forecasts, **not promises**.
  - Teams commit to **delivering value within a sprint**, not to perfect predictions.
  - **Encourages flexibility** and realistic expectation-setting.

Key Principles Behind Agile Estimation

- Progressive Elaboration
  - **Estimations are refined over time** as more information becomes available.
  - Early estimates are rough, details **increases closer to implementation.**
- Simplicity and Transparency
  - Keep estimation **lightweight and easy to explain.**
  - **Avoid complex formulas.**
- Estimates should consider **business value and technical risk**, not just size.

Core Concepts

- What is Effort Estimation?
- Relative vs. Absolute Estimation
- Story Points
- Ideal Time vs. Actual Time
- Velocity

What is Effort Estimation?

- The process of **predicting how much work is required to complete** a specific task.
- It’s about understanding the **relative effort compared to other tasks.**
- Helps the team plan and **prioritize work realistically.**
- Agile estimation uses **relative sizing.**
- Focuses on **complexity, uncertainty, and risk, rather than just time.**
- **Done collaboratively** by the whole development team to ensure shared understanding.

Relative vs. Absolute Estimation

Absolute Estimation	Relative Estimation
• Estimating **exact time or effort** needed to complete a task (8 hours, 3 days). • Common in **traditional project management**. • Focuses on **precision**. • Assumes **stable scope** and predictable conditions.	• Compares tasks **to one another** instead of predicting exact durations. • Uses scales like **Story Points, Fibonacci or T-shirt sizes**. [Discussed later] • Focuses on **complexity, effort, and uncertainty** rather than hours.
• **Hard to predict early** in the project. • **Encourages overconfidence and micromanagement.** • **Doesn't handle uncertainty or change well.** • Asks **"How long will it take?"**	• Easier for teams to agree on relative sizes. • Adapts well to evolving understanding and scope changes. • Asks **"How big is it compared to what we've done before?"**

Relative vs. Absolute Estimation: Example

Task	Absolute Estimation	Relative Estimation
Simple Login Page	6 hours	3 Points
Login + Social Media Integration	12 Hours	6 Points
Login + MFA + Role-based Access	24 Hours	12 Points

Story Points

- A way for teams to **compare one story's difficulty to another.**
- Capture three dimensions of effort:
  - **Complexity**: how difficult the work is.
  - **Risk/Uncertainty**: how much is unknown or likely to change.
  - **Effort**: how much work is required (coding, testing, reviewing, etc.).
- Common Scales Used
  - Fibonacci sequence (1, 2, 3, 5, 8, 13, 21...).
  - Modified Fibonacci (1, 2, 3, 5, 8, 13, 20, 40, 100).
  - T-shirt sizes (XS, S, M, L, XL)

Story Points: Example

Task	Story Points	Reason
Simple Login Page	3 Points	Simple feature Low risk
Login + Social Media Integration	6 Points	Moderate complexity API Integration
Login + MFA + Role-based Access	12 Points	High complexity Multiple Flows

Ideal Time vs. Actual Time

- Ideal Time: Represent the amount of **uninterrupted time it would take to complete a task** if nothing else interfered (meetings, context switching, or delays).
- Actual Time: **Real-world time** including meetings, breaks, interruptions, and context switching.
- **Easy to understand for teams used to traditional estimation.**
- Limitations:
  - Can **reintroduce time pressure** if misunderstood as commitments.
  - **Reduces focus on complexity and uncertainty**.

Velocity

- **The amount of work** (usually in story points) **a team completes in a single sprint.**
- Predicts **how much work can be delivered next sprint** (planning).
- Tracks **progress and stability over time.**
- Helps identify trends such as overcommitment.
- Velocity is team-specific and **should not be compared between teams.**
- **It’s not a performance metric but a planning tool.**

Velocity: Example

- Sprint 1: 30 story points completed
- Sprint 2: 28 story points completed
- Sprint 3: 32 story points completed

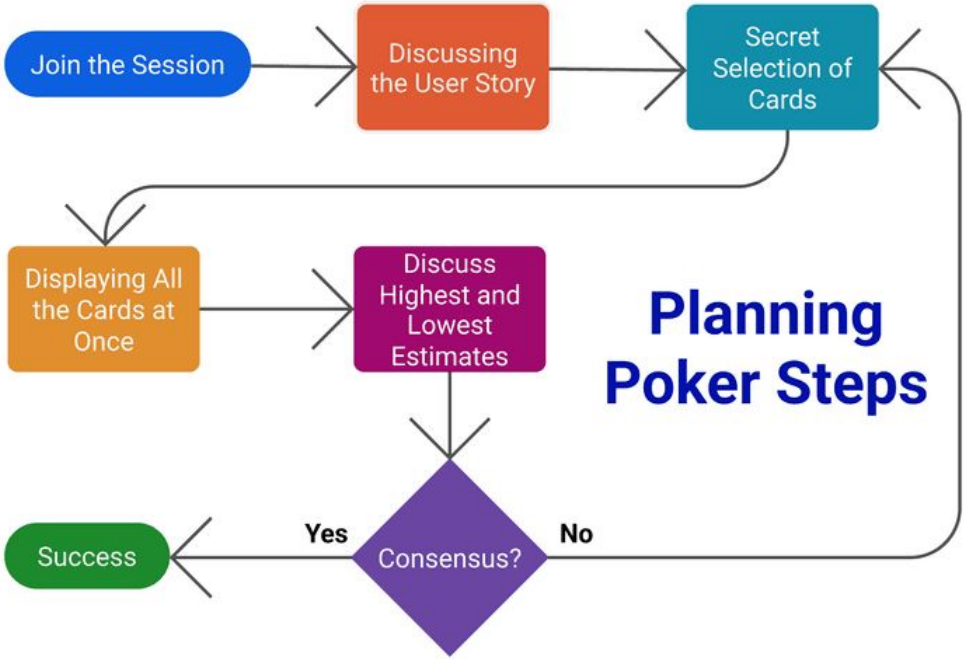
- **Average velocity = 30 story points per sprint**

Agile Estimation Techniques

- Planning Poker
- T-Shirt Sizing
- Bucket System
- Affinity Estimation
- Dot Voting
- Three-Point Estimation

Planning Poker

- **A consensus-based estimation technique**.
- **Discussion between highest and lowest estimate.**
- Used during s**print planning** or backlog refinement.
- Best suited for small-to-medium stories.



Planning Poker

Pros	Drawbacks/Limitations
Encourages **team discussion and knowledge sharing.**	Time-consuming for large backlogs.
Fast and simple to facilitate (requires only cards or a digital tool).	May lead to pressure for consensus instead of honest agreement.
	Quality depends on team maturity and story clarity. **i.e. too ideal!**

T-Shirt Sizes

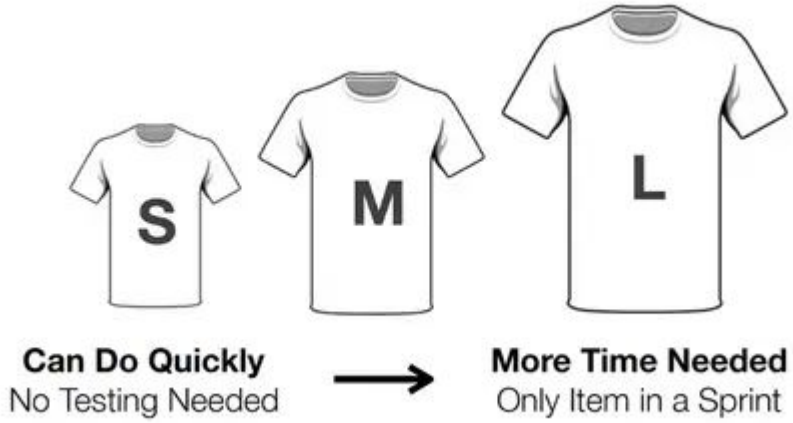
- A simple **relative estimation technique** used to express the size or effort of a user story without assigning numbers.
- **Each story is assigned a size label instead of numeric values.**
- Teams compare new stories with known examples
  - This feels like an M, similar to the login page feature.
- Can later be mapped to Story Points (S = 3 pts, M = 5 pts…).

T-Shirt Sizing

Pros	Drawbacks/Limitations
Fast and intuitive	Too coarse for sprint-level planning or velocity tracking.
Useful for non-technical stakeholders (managers, product owners).	**Inconsistent across teams** unless calibration stories are defined.
Can be easily converted into Story Points later.	**Must later be converted to numerical values for forecasting.**

T-Shirt Sizing: Example

- XS: Fixing a typo
- S: Adding a validation rule
- M: Implementing a new form
- L: Integrating third-party API
- XL: Refactoring an entire module

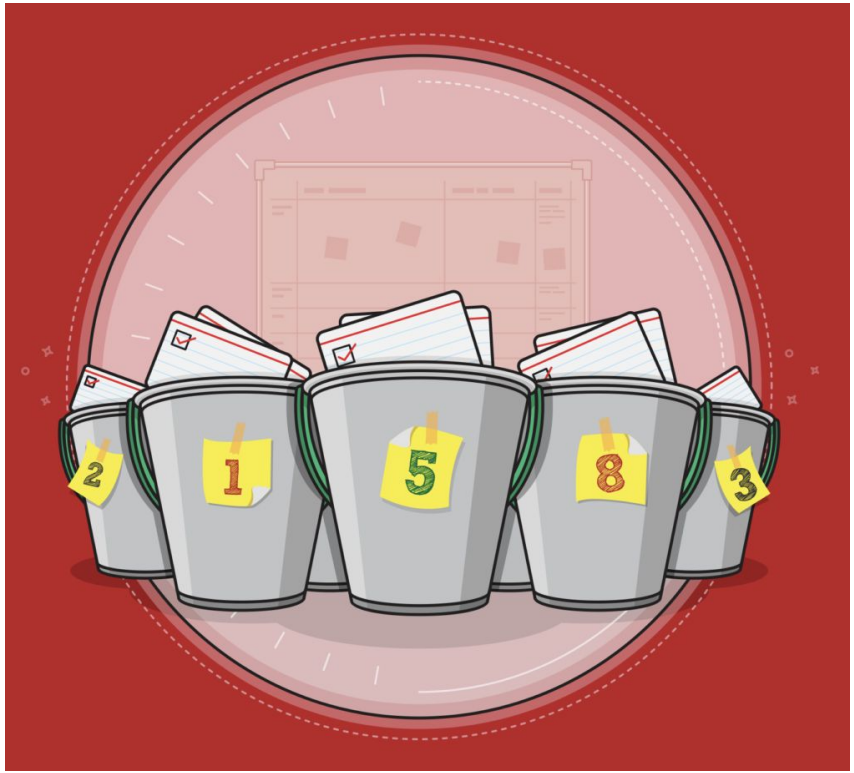


Bucket System

- A **group-based estimation technique** designed for rapid estimation of large backlogs.
- User stories are sorted into predefined “buckets” representing relative effort or complexity.
- **Achieve fast consensus across many items (50–200+) without individual discussion for each.**
- Used when relative comparison matters more than numeric precision.

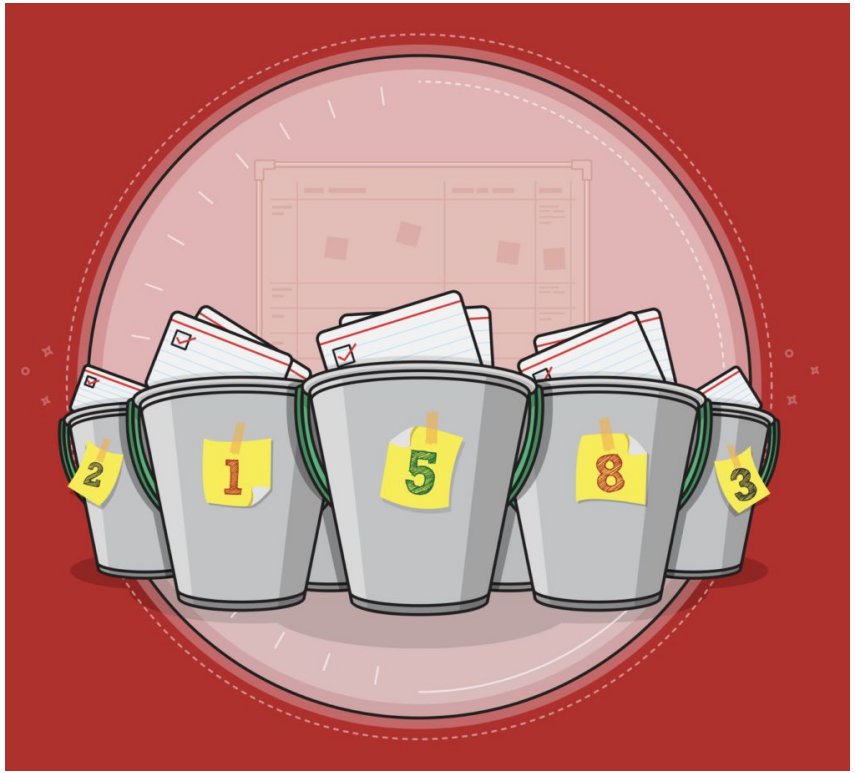
Bucket System

- Create buckets (1, 2, 3, 5, 8 Fibonacci-like).
- **Select a few reference stories and assign them to appropriate buckets.**
- Place remaining stories into **buckets based on similarity in effort/complexity**.
- **Team reviews outliers** and reassigns if necessary.
- We could convert buckets to story points later.



Bucket System: Example

- Bucket 1: Very small (typo fix)
- Bucket 5: Moderate feature (CRUD form)
- Bucket 13: Large story (new module or screen)
- Bucket 40: Epic-level (requires refactoring)



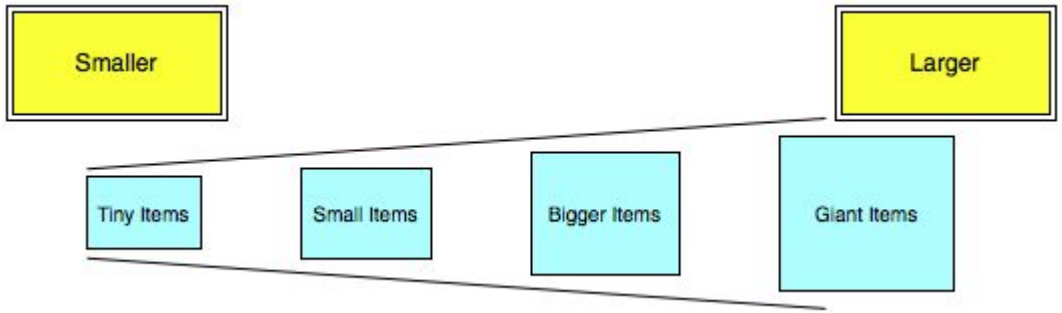
Bucket System

Pros	Drawbacks/Limitations
Very fast.	Less precise than Planning Poker.
Encourages collaboration and broad perspective.	**May overlook dependencies.**
Suitable for large-scale planning sessions.	Requires strong facilitator to maintain pace and focus.

Affinity Estimation

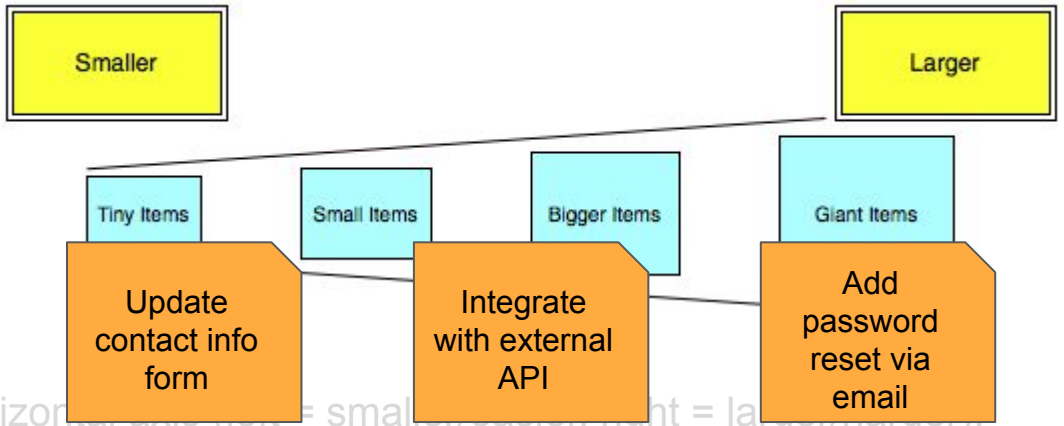
- A collaborative, **visual estimation technique.**
- Teams sort user stories by **relative size** through grouping and comparison.
- **Rather than assigning numeric values immediately.**
- To achieve **quick consensus** on large sets of stories.
- To promote shared understanding and **avoid long estimation debates**.

Affinity Estimation



- Create a horizontal axis (left = smaller/easier, right = larger/harder).
- **Team silently places stories on the scale according to perceived effort.**
- After all items are placed, **team reviews and discusses misplacements**.
- Adjust positions until relative order reflects team agreement.
- We can map positions to numeric story points.

Affinity Estimation: Example



- Create a horizontal axis (left = small, right = large).
- **Team silently places stories on the scale according to perceived effort.**
- After all items are placed, **team reviews and discusses misplacements**.
- Adjust positions until relative order reflects team agreement.
- We can map positions to numeric story points.

Affinity Estimation

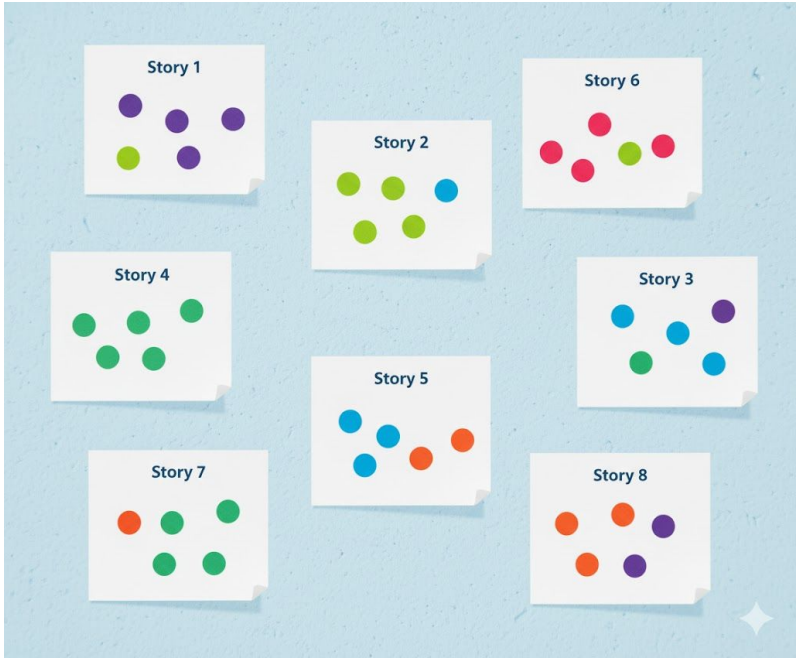
Pros	Drawbacks/Limitations
Fast and democratic	**Less precise** than Planning Poker.
Reduces anchoring bias through silent initial placement. **[revisited later]**	**Can be biased by dominant voices during group adjustments.**
Excellent for cross-functional teams with mixed expertise.	**Not suitable for vague items.**

Dot Voting

- A simple **prioritization and estimation** method.
- Team members **allocate a fixed number of votes (dots)** to items they believe are most significant, complex, or effort-heavy.
- Focus: team perception of value or difficulty, not numeric precision.
- Purpose:
  - To identify **consensus quickly among** many items.
  - To **highlight priorities or complex stories** requiring further discussion.

Dot Voting

- Present all backlog items.
- Each participant **receives N dots/votes** (usually 3–5).
- Members **distribute votes among items**, all on one item or spread out.
- **Count dots**: items with more votes **represent higher perceived value**, effort, or uncertainty.



Dot Voting

Pros	Drawbacks/Limitations
Fast and democratic	**Not a full estimation method** (gives ranking, not effort values.)
Focuses on what matters most	**Prone to popularity bias** (people follow visible trends).
Narrow down items for deeper estimation	Should be combined with another technique for quantitative results.
Useful for prioritization, risk identification, or complexity perception.	

Three-Point Estimation

- **A quantitative estimation technique** that models uncertainty by considering three scenarios for each task:
  - **Optimistic (O)**: Best-case scenario with minimal issues.
  - **Most Likely (M)**: Typical case under normal conditions.
  - **Pessimistic (P)**: Worst-case scenario accounting for risks and delays.
- Provides a **more realistic estimate** by incorporating uncertainty and risk.
- Used for **scientific, engineering, or research-oriented** Agile projects where precision matters.

Three-Point Estimation

- Identify task or story to estimate.
- Determine O, M, and P based on team experience.
- Compute expected value (E) and optionally variance.
- Aggregate estimates for total project/sprint forecasting.

Weighted Average

Emphasizes the **most likely** scenario while factoring in uncertainty.

$$E = \frac{O + 4M + P}{6}$$

Standard Deviation

To estimate confidence interval

$$\sigma = \frac{P - O}{6}$$

Three-Point Estimation: Example

- Values for estimating a task like login page:
  - Optimistic (O): 2 days
  - Most Likely (M): 4 days
  - Pessimistic (P): 8 days

$$E = \frac{2 + 16 + 8}{6} = \frac{26}{6} = 4.33$$

$$\sigma = \frac{8 - 2}{6} = 1day$$

$$\lceil 4.33 \rceil = 5$$

Three-Point Estimation: Example

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$$E = \frac{2 + 16 + 8}{6} = \frac{26}{6} = 4.33$$

$$\lceil 4.33 \rceil = 5$$

$$5 \pm 1 \; days$$

$$\sigma = \frac{8 - 2}{6} = 1day$$

Three-Point Estimation

Pros	Drawbacks/Limitations
Accounts for **uncertainty** instead of a single-point guess.	**Time consuming**
Useful for complex or uncertain stories.	Relies on accurate judgment for O, M, and P values.
	Not intuitive for non-technical stakeholders.

	Planning Poker	T-Shirt Sizing	Three-Point
Use	Sprint estimation	Early backlog sizing	Risk-aware forecasting
Basis	Story points (Fibonacci)	Size buckets (XS-XL)	O, M, P scenarios
Speed	Medium	Fast	**Slow**
Accuracy	Medium to High	Low to Medium	High
Best For	**Teams with shared understanding**	**Quick early planning**	**Complex, uncertain tasks**
Pros	Encourages discussion & consensus	**Simple, visual, fast**	Models uncertainty & variance
Cons	Time-consuming for many stories	**Too coarse for tracking**	**Needs data & math effort**

Break

From Estimation to Forecasting

- Difference between Estimation and Forecasting
- Role of Historical Data
- Handling Uncertainty and Risk
- Continuous Refinement and Re-Forecasting

Difference Between Estimation and Forecasting

Estimation	Forecasting
The **process of evaluating the effort**, complexity, or size of individual tasks or user stories. It answers “How big or difficult is this work?”	The process of **predicting when work will be completed**, based on actual performance data (e.g., velocity). It answers “When will this work be done?”
Estimates are inputs to forecasting.	Combines **estimates with team velocity, capacity, and empirical data** to produce realistic delivery timelines.
More of speculations.	**Evolves empirically: using real sprint data instead of speculation.**

Role of Historical Data

- **Past performance records** including completed story points, sprint velocity…
- Helps the team **calibrate story points by comparing new work to similar completed stories.**
- Reduces **guesswork and bias**, especially for recurring or comparable tasks.
- **Reveals patterns of delays, bottlenecks, or rework.**
- Example: *The last 5-point API story took 2 days; this new one feels similar.*

Handling Uncertainty and Risk

- Agile tracks forecasts **with variability.**
- **Large stories carry more uncertainty.**
- Splitting **big stories into smaller**, clearer ones reduces estimation risk.
- **Teams may include capacity buffers** (like 80% of total velocity) to account for unknowns.
- **Estimates are refined iteratively** as more information becomes available.
- **Teams use retrospectives and historical data to improve estimation accuracy over time.**

Continuous Refinement and Re-Forecasting

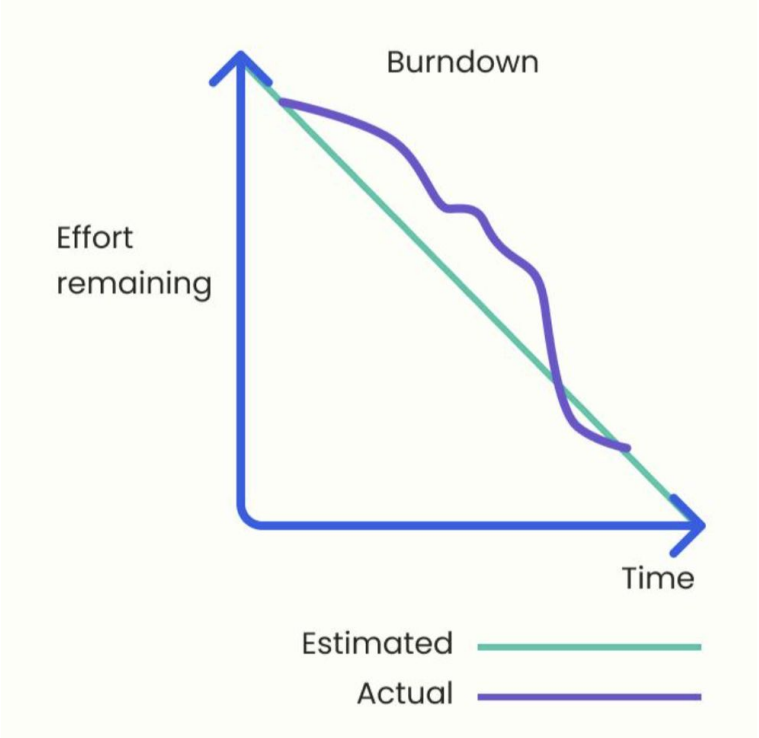
- Estimation **is not a one-time event, it's a living process.**
- Continuous refinement means **regularly revisiting and updating estimates as new information emerges.**
- Re-forecasting is the process of **adjusting delivery predictions** based on updated estimates, actual velocity, or changing priorities.
- Requirements evolve, risks surface, and team capacity fluctuates.
- **Without refinement, estimates quickly become outdated or misleading.**
- Regular updates maintain transparency and trust with stakeholders.

Continuous Refinement and Re-Forecasting

- When It Happens
  - **Backlog Refinement**.
  - **Sprint Reviews & Retrospectives**: compare estimates vs. actual outcomes.
  - **Major Changes**.
- Enables early detection of slippage or unrealistic goals.

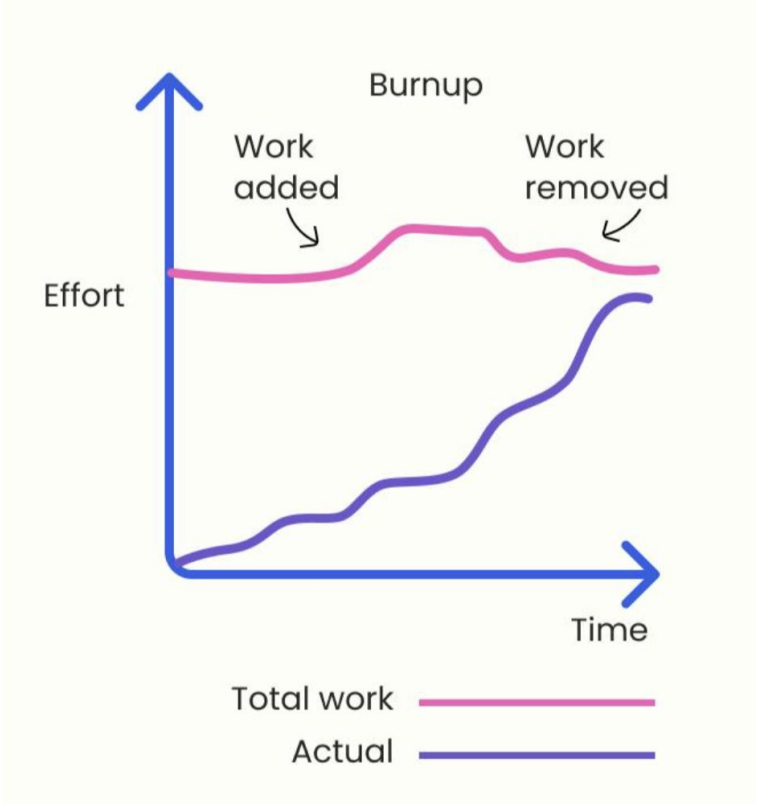
Burn-Down Charts

- **Shows how much work remains in a sprint or project over time.**
- Helps identify **if the team is on pace to complete planned work.**
- The ideal trend line shows expected progress
- The actual line reveals deviations or slowdowns.
- A flat or rising burn-down indicates blockers, scope changes, or underestimated effort.



Burn-Up Charts

- Shows how much work has been completed **toward the total scope**.
- Displays both total scope and completed work lines, making scope changes visible.
- **Useful for release forecasting based on team velocity and total story points.**
- Provides a positive visual cue: **progress rises instead of falls,** motivating the team.



Common Pitfalls and Biases

- Common Pitfalls
- Cognitive Biases in Estimation

Common Estimation Pitfalls

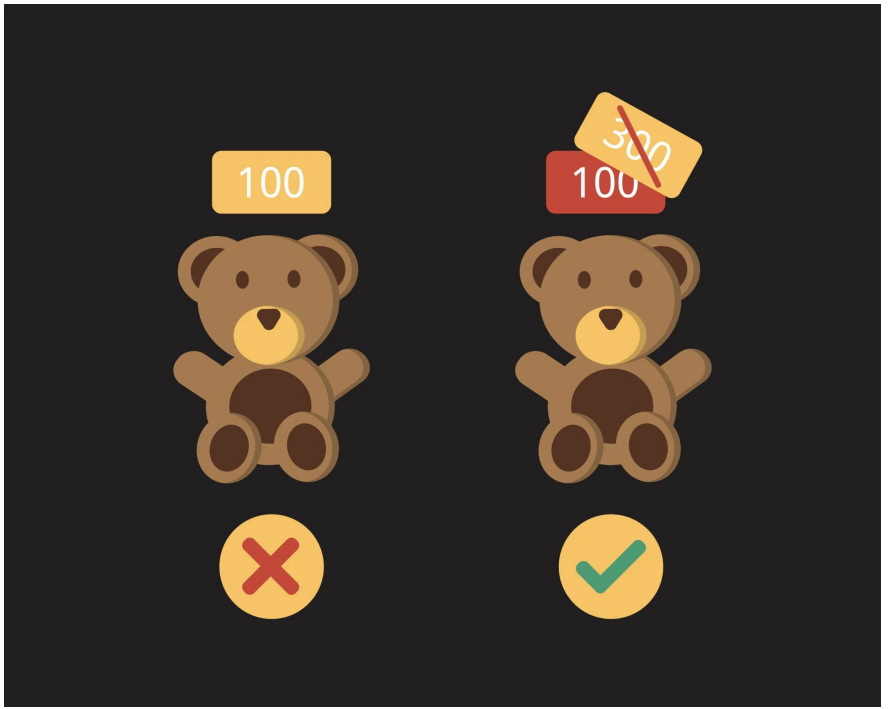
- Treating estimates as **commitments instead of forecasts** creates pressure.
- Spending too much time **chasing precision estimation.**
- **Ignoring uncertainty** and risks leads to underestimation and hidden blockers.
- **Making estimates individually** rather than collaboratively.
- **Comparing velocity across teams.**

Common Estimation Pitfalls

- Failing to **use historical data** prevents learning and improvement over time.
- Using **estimates for individual performance evaluation** creates fear and distorts results.
- Not splitting large stories:
  - Hides complexity
  - Increases delivery risk.
- Forgetting to include non-development tasks (testing, documentation, reviews) causes underestimation.

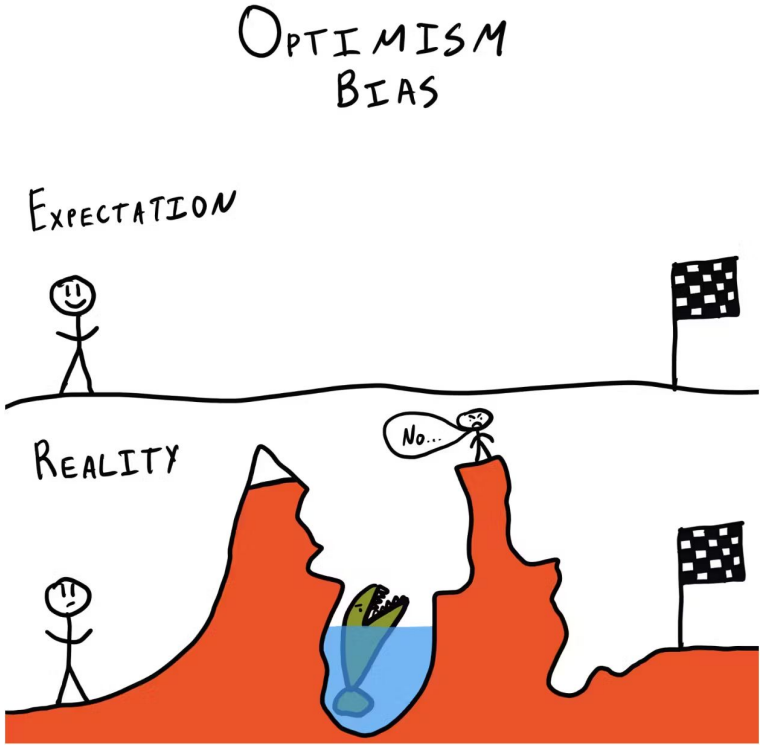
Anchoring bias

- Relying **too heavily on the first number mentioned** (an early estimate) influences later judgments.
- Even early estimates can distort later discussions.



Optimism bias

- Planning fallacy: Believing tasks will take less time than they actually do despite past evidence.
- Optimism bias: **Assuming everything will go smoothly**, leading to underestimated effort or duration.

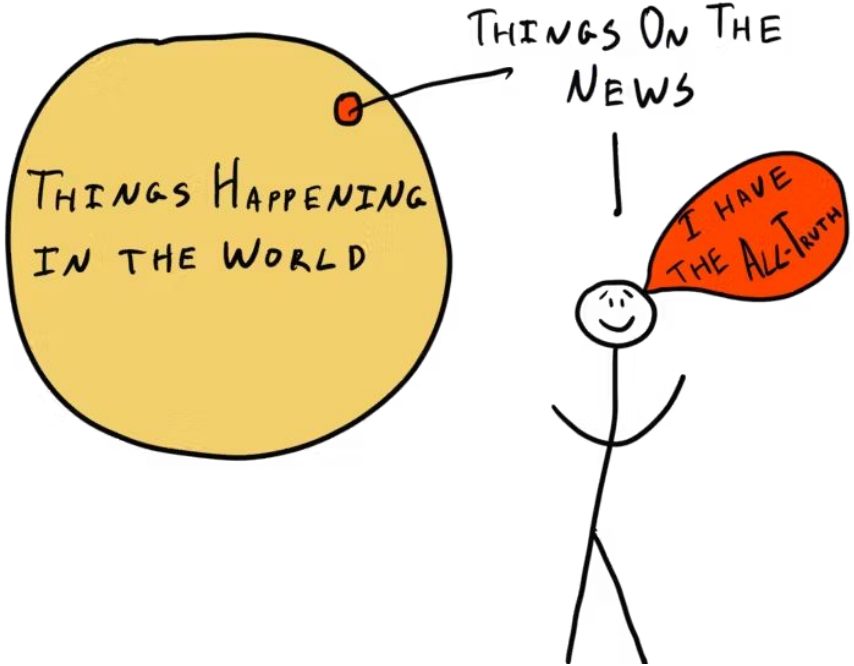


Confirmation Bias

- Focusing only on information that supports an initial estimate or assumption.

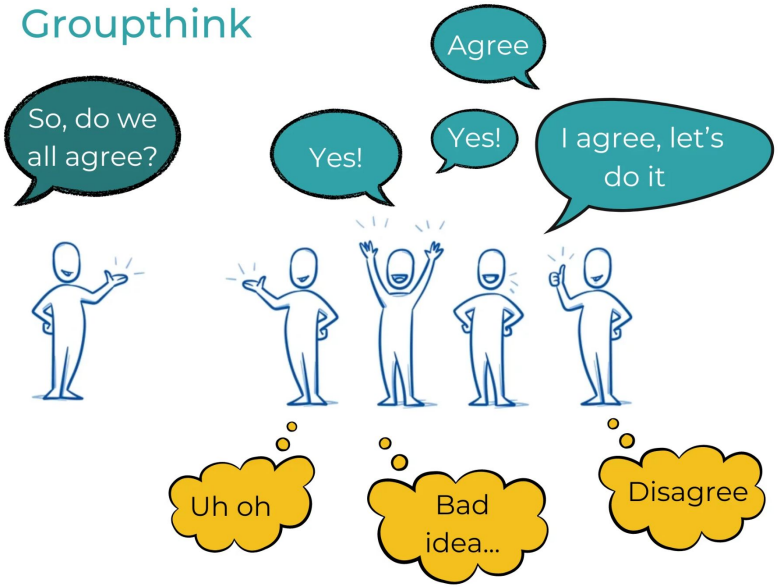
Availability Bias

- Basing estimates only on **known or memorable experiences** instead of representative data.



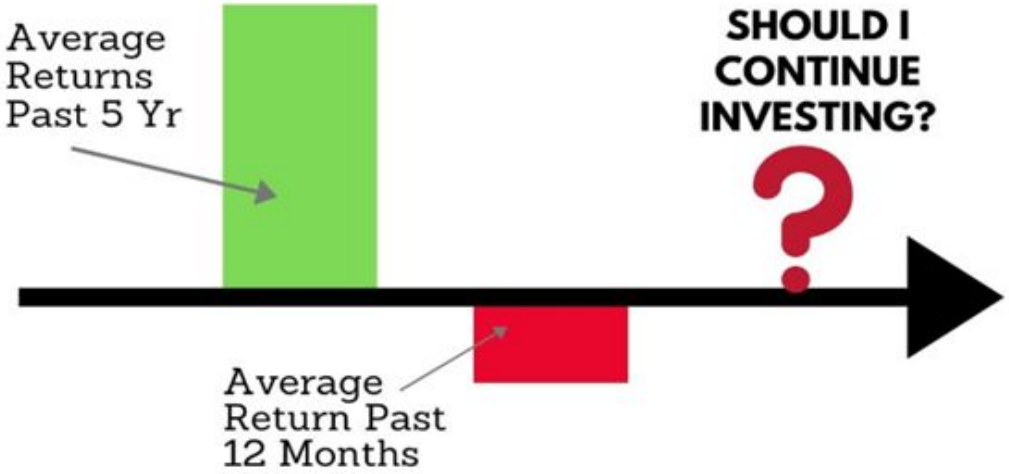
Groupthink

Agreeing too quickly with **the majority opinion**, discouraging alternative viewpoints.



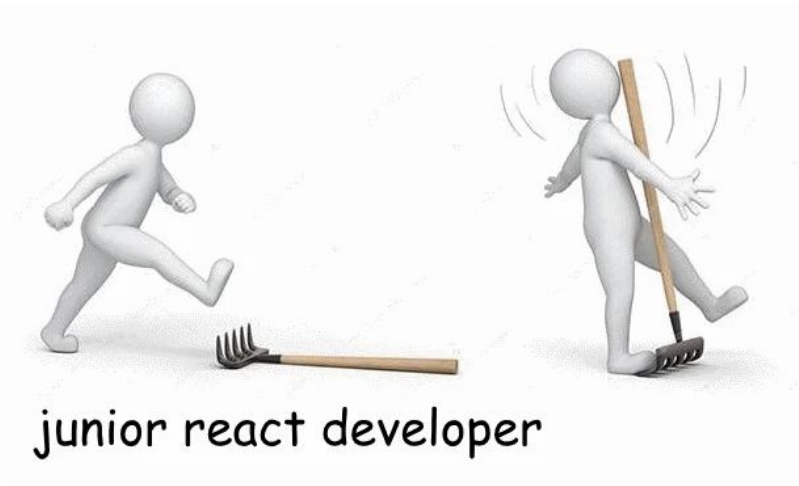
Recency Bias

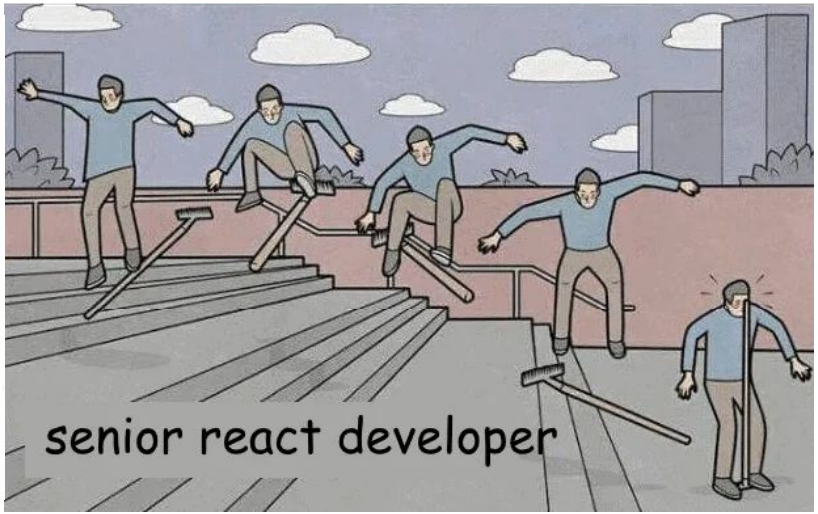
- Giving more weight to the **most recent sprint outcome** rather than the long-term trend.



Expert Bias

- Overvaluing senior team members' estimates while discounting others' input.





Best Practices

Best Practices for Accurate Estimation

- Involve the whole team.
- Use relative estimation.
- Break large stories into smaller ones.
- Leverage historical data.
- **Refine regularly**: revisit estimates during backlog grooming as new information emerges.
- Apply the **“Definition of Done”** to ensure all work (testing, documentation, reviews) is included.
- Account for uncertainty by including buffers or estimating in ranges instead of single numbers.
- **Avoid using estimates for performance evaluation.**

Retrospectives

- Retrospectives provide a **structured opportunity** for the team to reflect after each sprint.
- Encourage discussion on
  - **What went well.**
  - **What didn’t.**
  - **How estimation accuracy can improve.**
- Comparing estimated vs. actual effort helps identify recurring patterns of under-estimation or over-estimation.
- **Promote a blame-free culture focused on learning, not fault-finding.**

Retrospectives

- **Review velocity trends and capacity changes to improve future forecasts.**
- **Celebrate small improvements** to motivate consistent reflection and adaptation.
- Treat retrospectives as a **continuous feedback loop** to inspect, adapt, and evolve the team’s estimation practice.

Thank You!