STAR WEST

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W12

Test Strategy, Planning, Metrics
Wednesday, October 3rd, 2018 1:45 PM

Improve Planning Estimates by Reducing Your Human Biases

Presented by:

Andrew Brown

SQS

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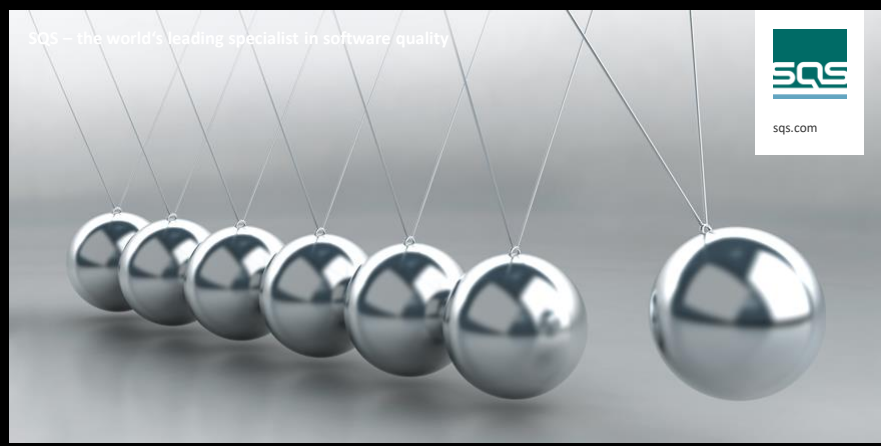
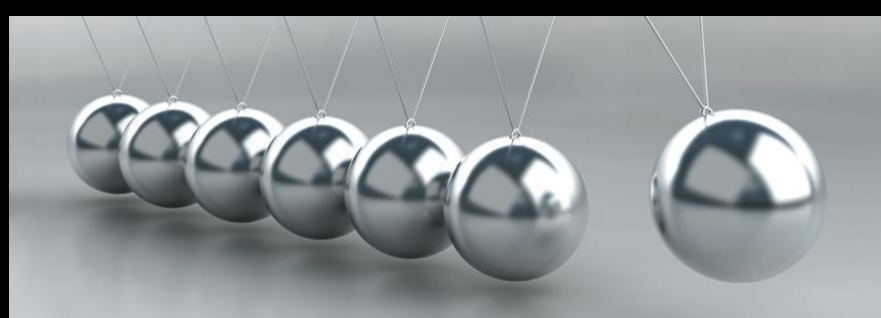
Andrew Brown

Dr. Andrew Brown is a principal consultant at SQS. Recently, he has developed an independent line of research into understanding why we humans make the mistakes that lead to software defects. He has spoken at several conferences on this subject and was winner of the EuroSTAR 2017 best paper award for a tutorial on cognitive biases in testing. He has 25 years' experience in the software industry. Previous roles include Heading up QA at HMV, Head of QA at a financial software house and a test manager in Japan. He holds a degree in Physics and Maths, an MBA from Warwick Business School and a doctorate from Imperial College.



Improve planning estimates through reducing your human biases

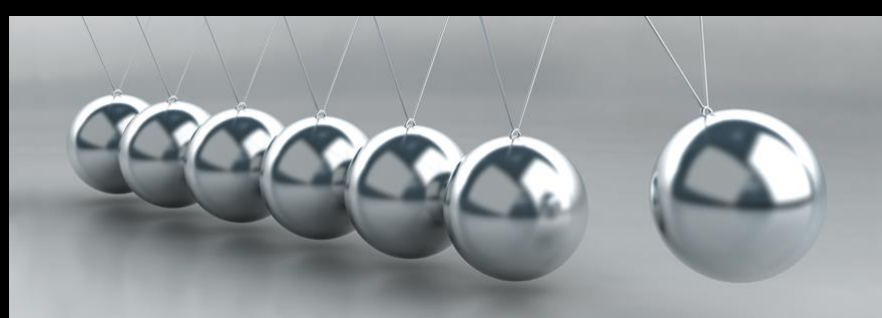
Dr Andrew Brown SQS, AssystemsTechnologies



The problem

The problem

Inaccurate estimation of projects and tasks

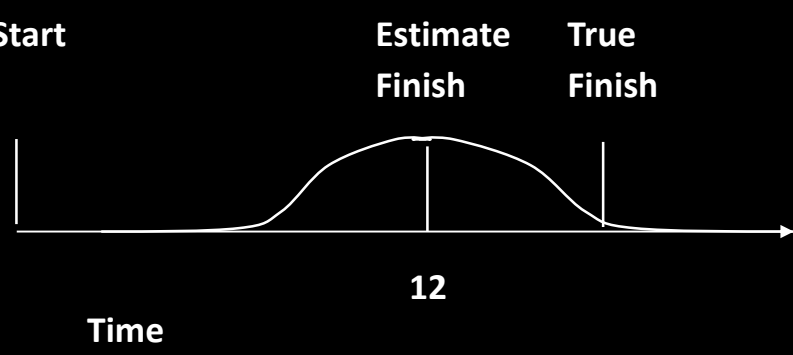


Problem in a little more depth

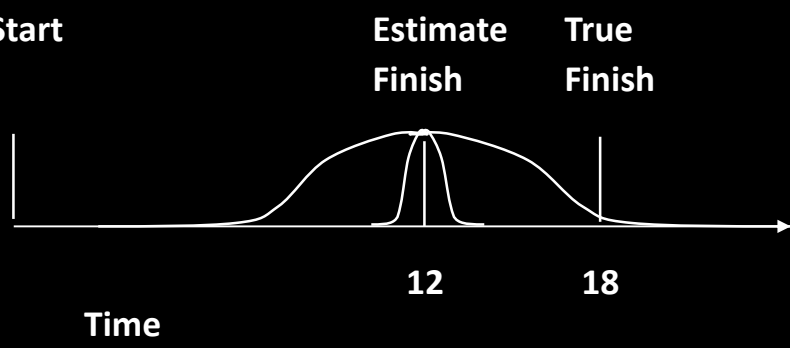
Problem in a little more depth

1. **Systematic underestimation**
2. **Actual delivery outside predicted range**
3. **Chronic, repeated problem**

Systematic underestimation



Actual delivery outside predicted range

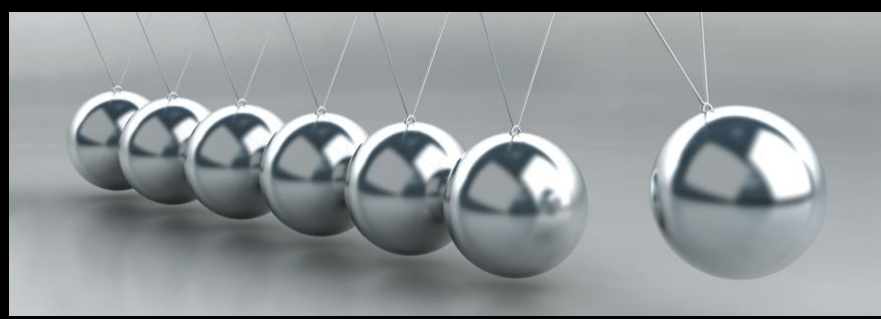


Confidence limits will be too narrow

Chronic effect

Olympic cost overrun:

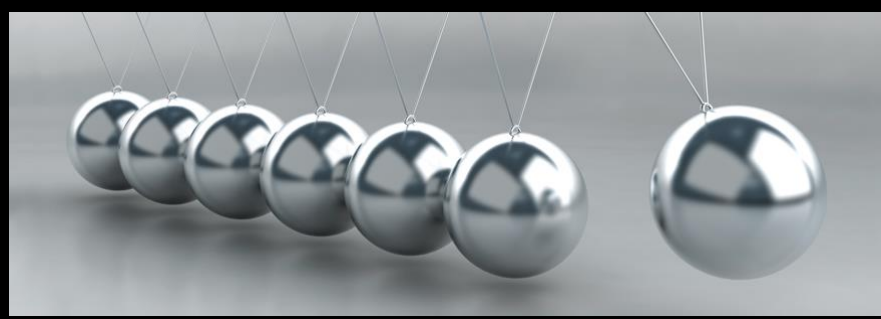
- Rio 2016: 51%
- London 2012: 76%
- Montreal 1976: 720%
- Avg since 1960: 176%



Consequences

Consequences

1. **Incorrect funding decisions**
2. **Under-resourced, under-funded**
3. **Project overrun. Leading to…**
4. **Risk-seeking and irrational behaviour**
5. **Project stress & burn-out**
6. **Adverse perception**



Known contributors

Known contributors

1. Technology uncertainty
2. Intentionally manipulated estimates
3. Developer gold plating
4. Adverse selection

Technology uncertainty

Montréal Olympic roof

- **Complex, never before attempted**
- **Estimated cost of stadium: $120 million**

- **Actual cost: $120 million**
- **For the roof alone**

Intentionally manipulated estimates

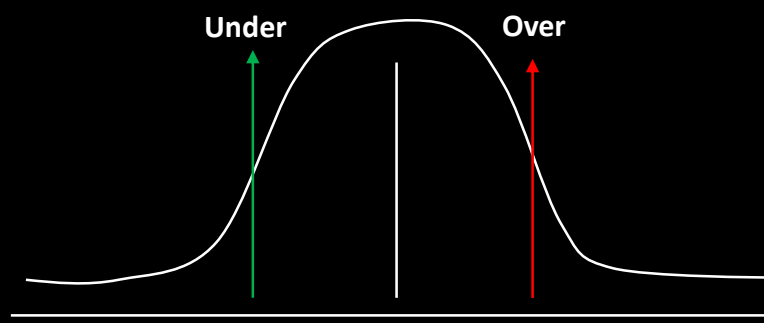
- Large projects often funded by corporate or taxpayer
- Advocates may provide overly optimistic estimate
  - Do not bear consequences
  - Sunk cost effect

Gold plating

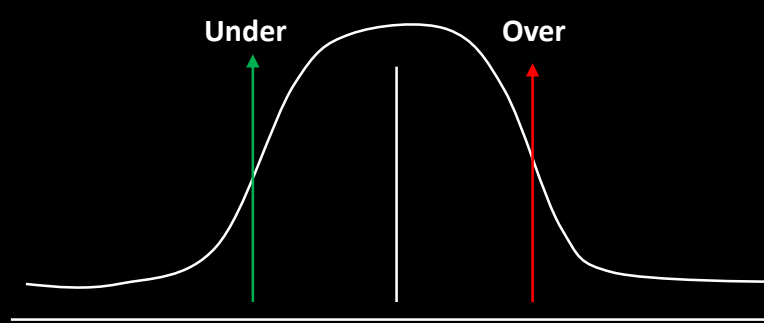
Saved time consumed by completing task to high standard or adding features

Causes over-run, even if estimation average is accurate

Gold plating

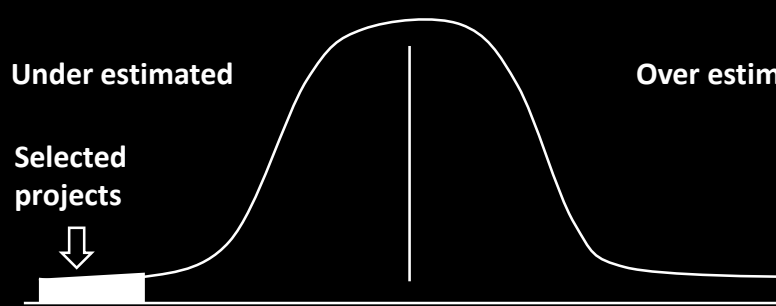


Gold plating

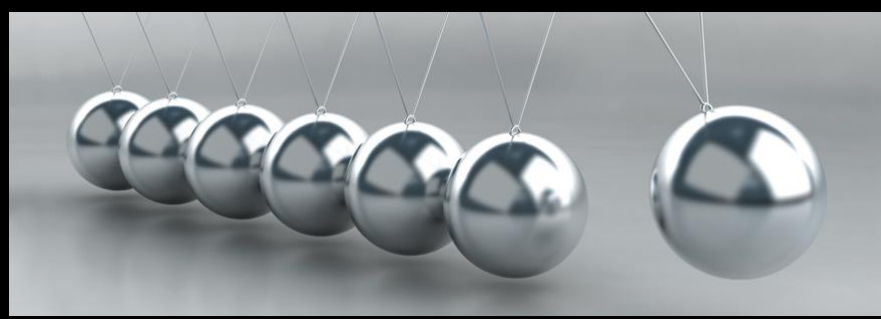


Adverse selection

Adverse selection



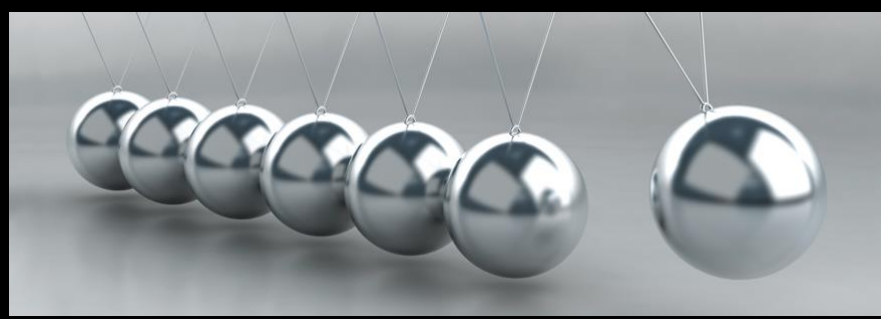
- **Will select projects with best ROI**
- **If investment is underestimated, ROI is boosted**



Human biases

Human biases

1. Anchoring effect
2. Optimism bias
3. Overconfidence effect
4. Planning fallacy

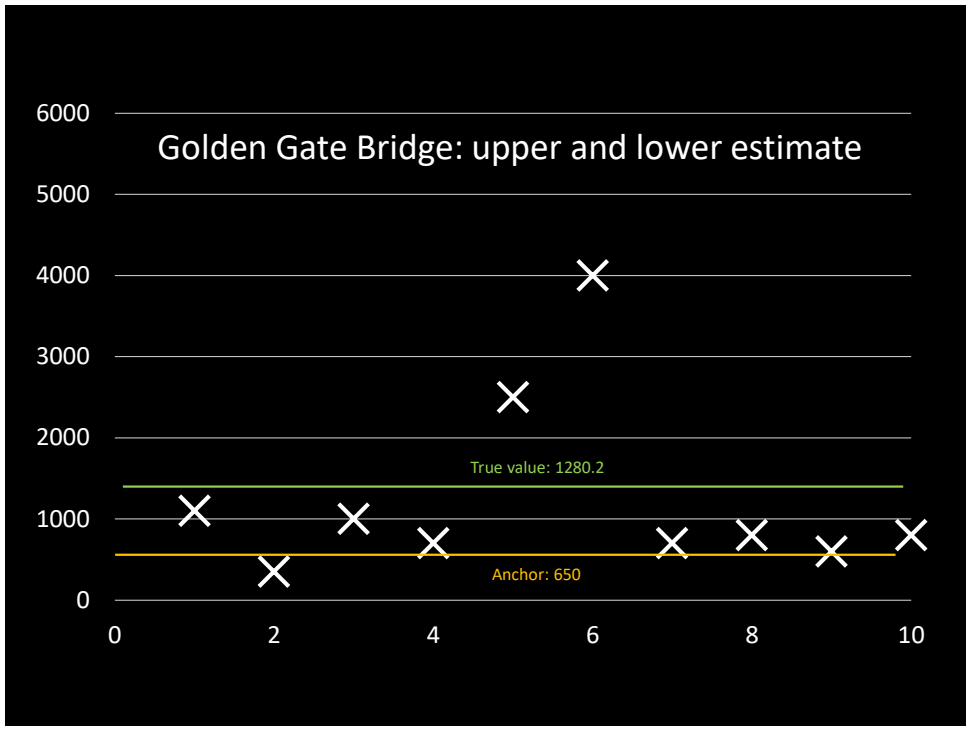


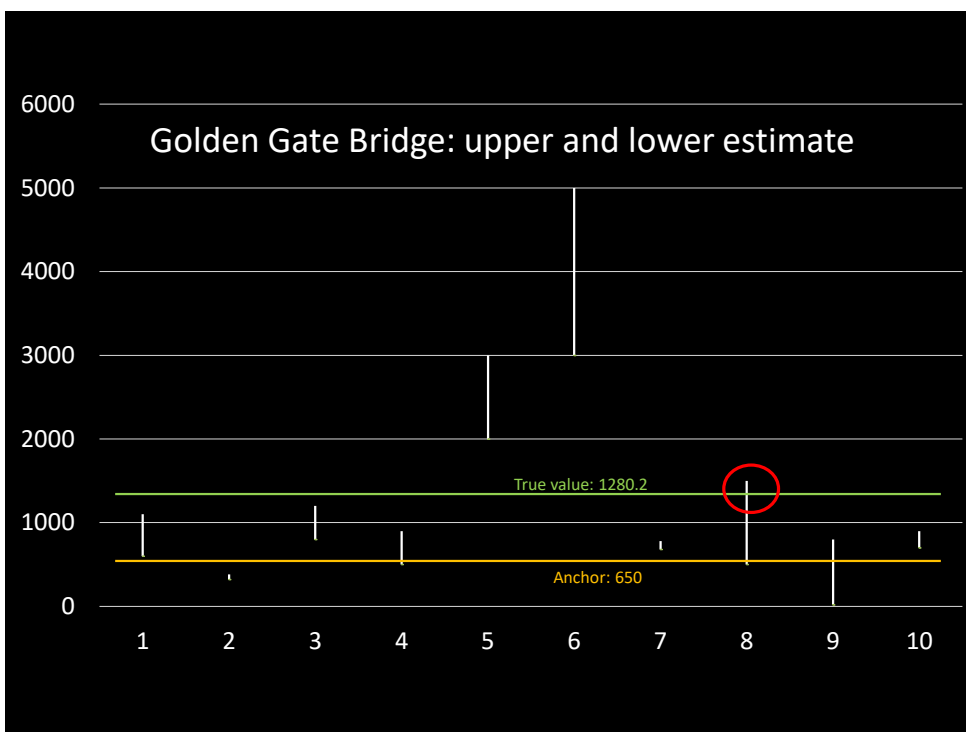
Anchoring effect

Is the Golden Gate Bridge longer or shorter than 650m? (longest span)

Estimate the length of the Golden Gate Bridge

Estimate your upper and lower 90% confidence limits


Golden Gate Bridge: upper and lower estimate
6000
5000
4000
3000
2000
1000
0
0
2
4
6
8
10
True value: 1280.2
Anchor: 650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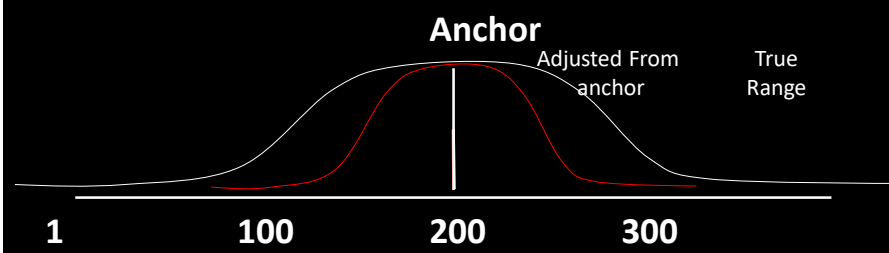
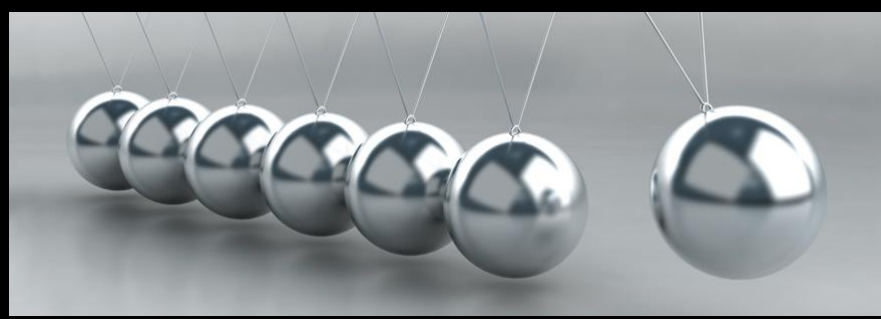


Anchoring will cause insufficient adjustment

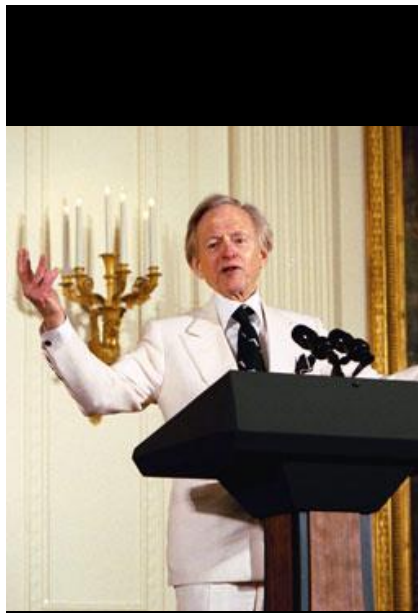
- **Where does anchor come from?**
- **Business – desired date**
- **Desired to be ASAP**
- **Anchoring - underestimate**



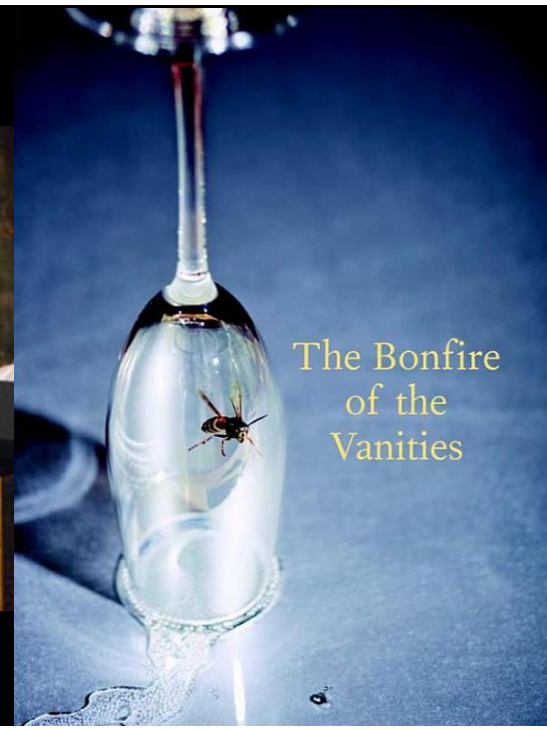
Optimism bias

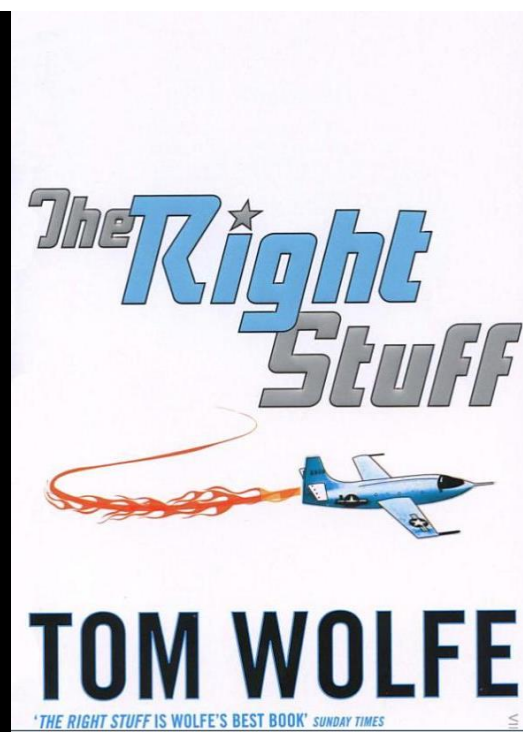
Optimism Bias

- **Overestimate favourable and pleasing outcomes**
- **Believe at less risk of negative event than others**

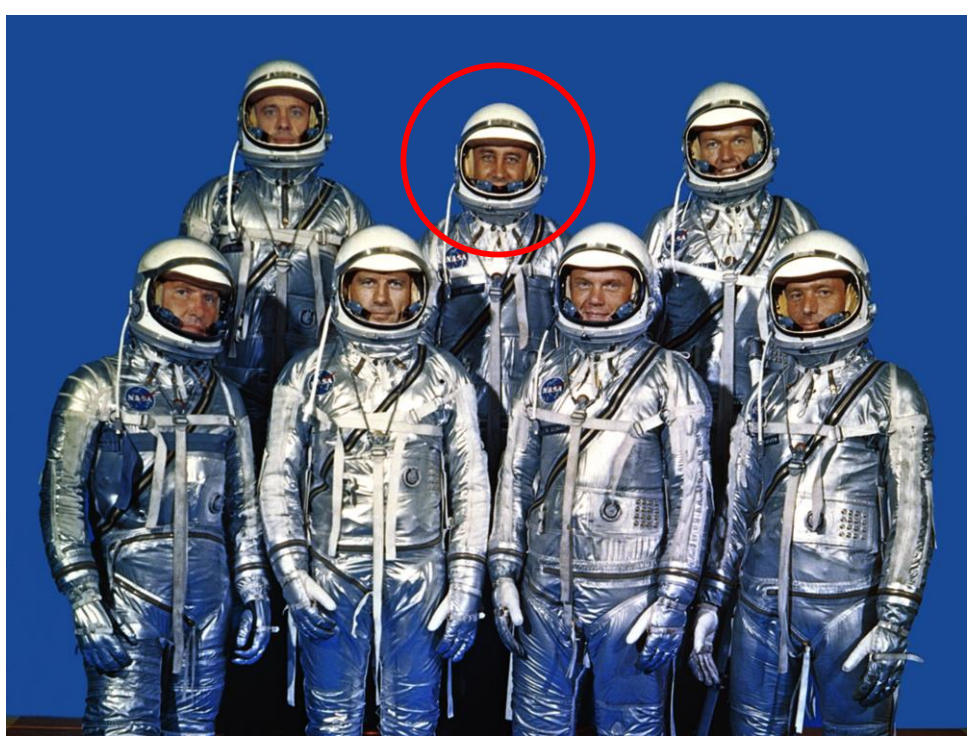


White House Photo by Susan Sterner





The Right Stuff
• People selected to become US astronauts
• Selected: Fighter pilots or test pilots
• Why?
• Physical & mental fitness
• Accustomed to danger
By NASA (Great Images in NASA Description) [Public domain], via Wikimedia Commons



Optimism Bias

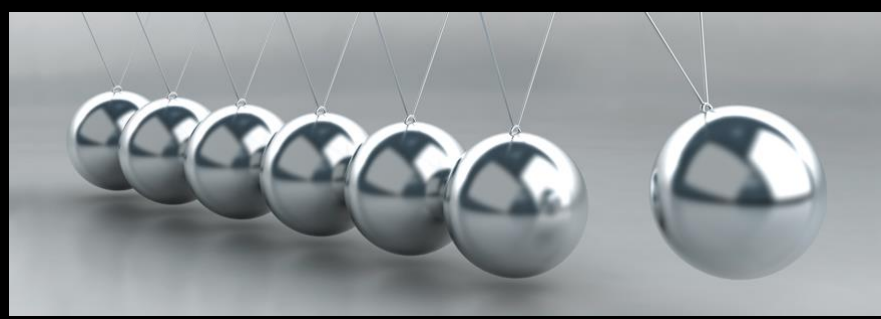
- **Career navy pilot – 23% chance of fatal accident**
- **Test pilots even riskier**
- **Why choose to risk life every day?**
- **Belief that 23% does not apply to YOU**
  - **Optimism bias**
  - **Overconfidence effect**

Attempts to eliminate Optimism Bias

- **Difficult to eliminate**
- **Attempts to reduce bias may result in more bias**

Relevance to Planning and Estimation

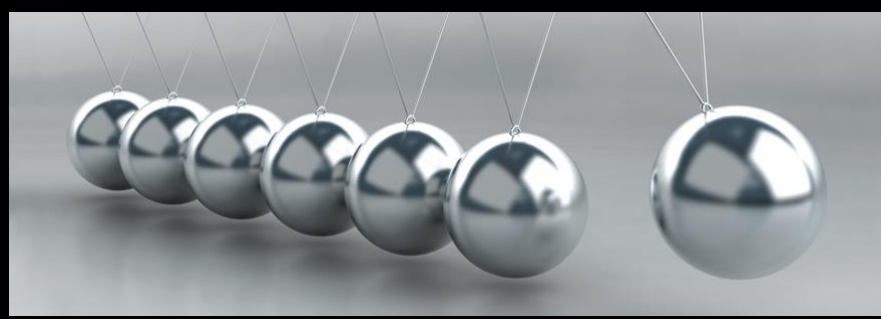
- **Use optimistic values, even if distribution has long tail**
- **Believe several events will all go to plan**
- **Discount catastrophic outcomes**



Overconfidence effect

Overconfidence effect

- **Excessive confidence in own judgements**
- **“I’m 99% certain“**
- **Wrong 40% of time**



How safe a driver are you?

How safe a driver are you?

- **Compare your safety with others in the room**
- **There is a least safe and a most safe driver in the room**

How safe a driver are you?

- **Please use the scale below:**

Top 10%
20%
30%
40%
50%
Bottom 40%
30%
20%
10%

How safe a driver are you?

- **81 American Students**
- **80 Swedish Students**

How safe a driver are you?

- **US: half believe they are in safest 20%**
- **Sweden: half believe they are in safest 30%**

How safe a driver are you?

Survey:

- **50 drivers involved in accidents**
- **50 drivers with no accidents**
- **When asked how skilful, avg response was same**
- **(Police judged 34 in accident group as responsible for accidents)**

How safe a driver are you?

Similar views in:

- **Ethics**
- **Success in sales management**
- **Corporate presidents**
  - Overly optimistic and risky planning (more skilful)

Overconfidence effect

3 faces of overconfidence:

1. **Overestimation – thinking you are better than you are**
2. **Overplacement – exaggerated belief you are better than others on given dimension**
3. **Overprecision – excessive belief you know the truth**

Overconfidence effect

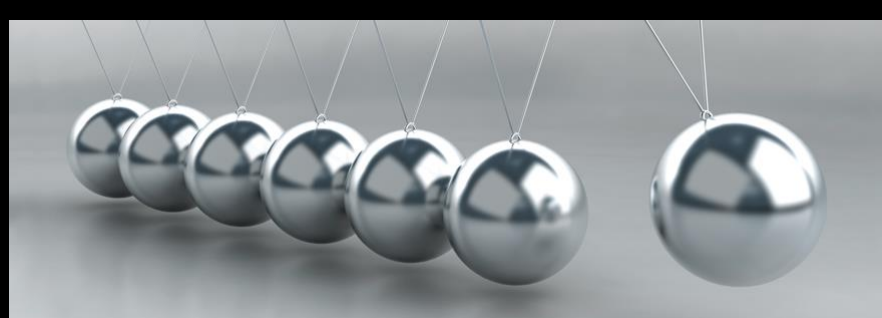
1. **Overestimation – thinking you are better than U are**
2. **Overplacement – exaggerated belief you are better**
3. **Overprecision – excessive belief you know the truth**

- **Focuses on the certainty we feel in:**
  - **own ability**
  - **Performance**
  - **level of control**
  - **chance of success**
- **Excessive confidence in ability to deliver tasks**

Overconfidence effect

1. Overestimation – thinking you are better than U are
2. Overplacement – exaggerated belief you are better
3. **Overprecision** – excessive belief you know the truth

- **Evidence – CONFIDENCE INTERVALS**
- **Estimation will have unwarranted precision**



Horserace handicappers

Racehorse trainers

Horserace handicappers shown list of 88 variables:

- **Weight to be carried**
- **Percentage races horse finished 1st, 2nd, 3rd prev year**
- **Jockey's record**
- **Number of days since the horse's last race**
- **…**

Racehorse trainers

Handicapper asked to identify:

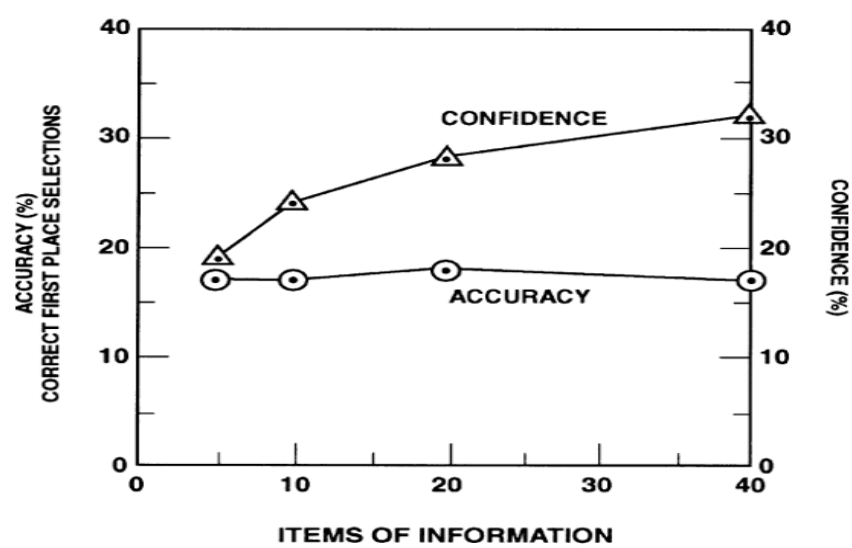
- **5 most important bits of information**
- **10 most important bits of information**
- **20 most important bits of information**
- **40 most important bits of information**

Racehorse trainers

Handicapper given true information for 40 past races:

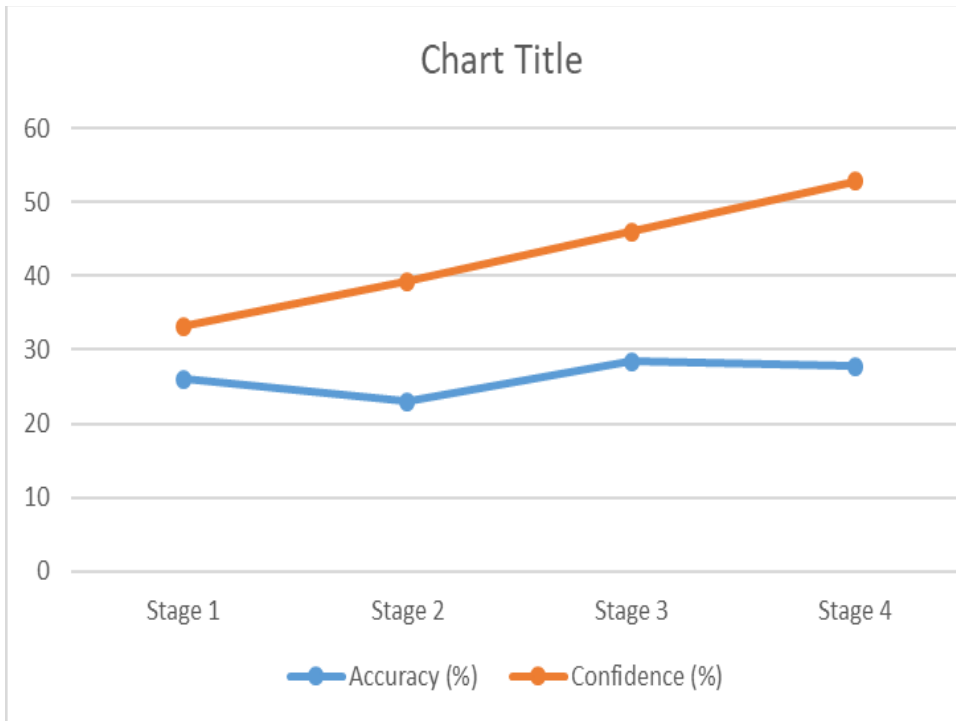
- **Asked to rank top 5 horses in each race**
- **Given data in increments: 5, 10, 20, 40 variables judged most useful**
- **(Predicted same race 4 times)**
- **Each time, assigned a level of confidence to accuracy**

Figure 5



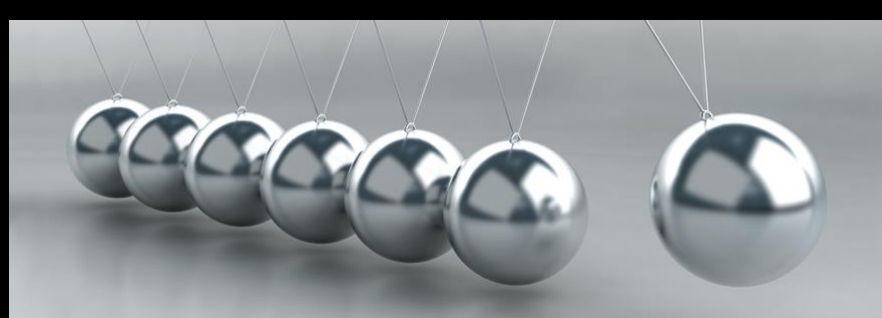
OVERCONFIDENCE IN CASE-STUDY JUDGMENTS
STUART OSKAMP

- **Clinical psychologists**
- **Assessment of patient from case-study notes**
- **Provided information**
- **Asked to make predictions**



OVERCONFIDENCE IN CASE-STUDY JUDGMENTS
STUART OSKAMP

- **Confidence of experienced psychologists LESS than rookies**
- **Confidence is not reliable sign of accuracy**

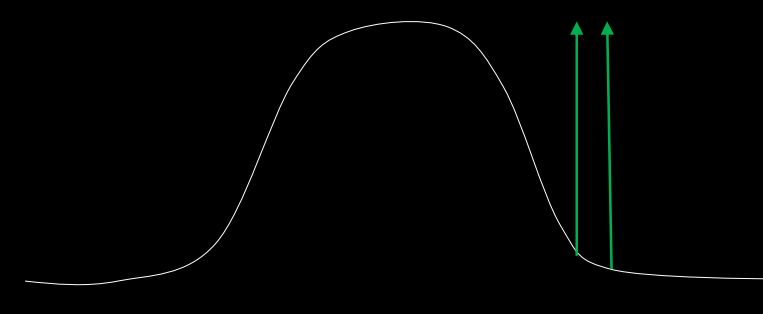


Planning fallacy

The Planning Fallacy Hypotheses

1. **Underestimate own plans but not other people's**
2. **Focus on plan-based scenarios, not relevant experiences**
3. **Diminish relevance of past experience using attributions**

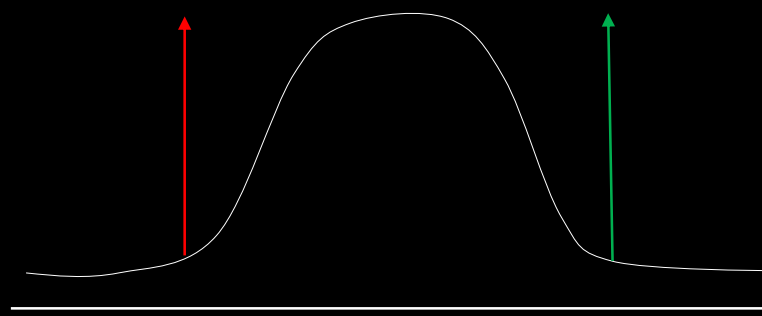
Planning Fallacy, Optimism Bias and self-enhancing biases



Optimism Bias and self-enhancing biases:

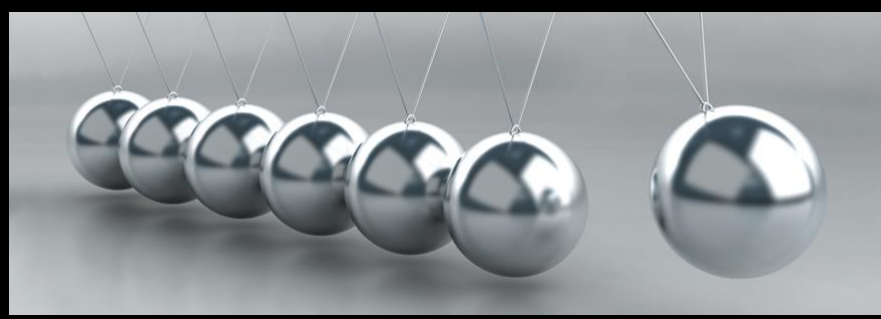
- **Optimistic general theories**
- **Optimistic specific judgments**

Planning Fallacy, Optimism Bias and self-enhancing biases



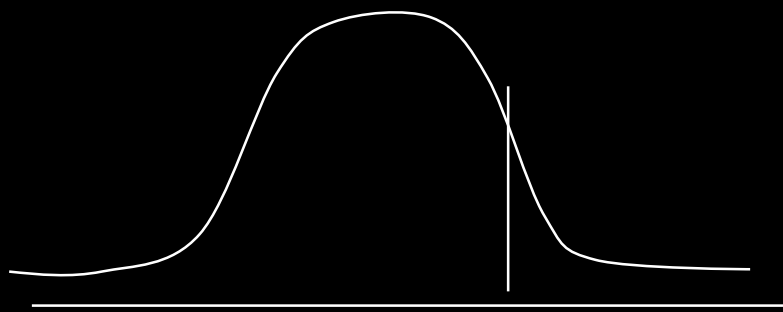
Planning Fallacy:

- **Pessimistic general theories**
- **Optimistic specific judgments**

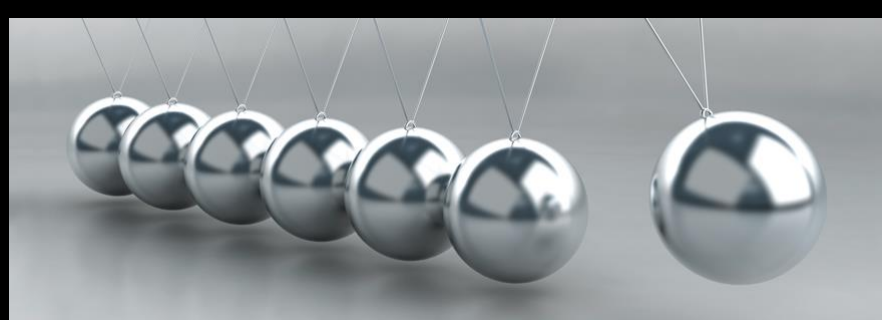


Underestimate own plans but not other people's

Underestimate own plans but not other people's



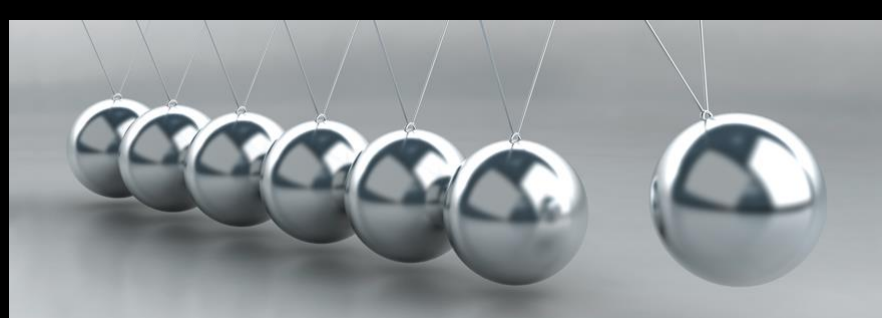
- **Underestimation bias reduced with external observer**
- **However, accuracy is unchanged**
- **Implies observer has no more insight**



Focus on plan-based scenarios, not relevant experiences

Focus on plan-based scenarios

- **Drill down into greater detail**
- **Switch from estimation into planning**



Obstacles to using past experience

See: Dawes 1988… Zukier (1988).

Obstacles to using past experience

Most likely to deny significance when dislike implications:

- **Cannot achieve goal**
- **Past event implies laziness, ineptitude, etc**

Think back to example past activities

Reasons (attributions) for our past failures:

- **External**
- **Transitory**
- **Specific**

Reasons (attributions) for colleague's past failures:

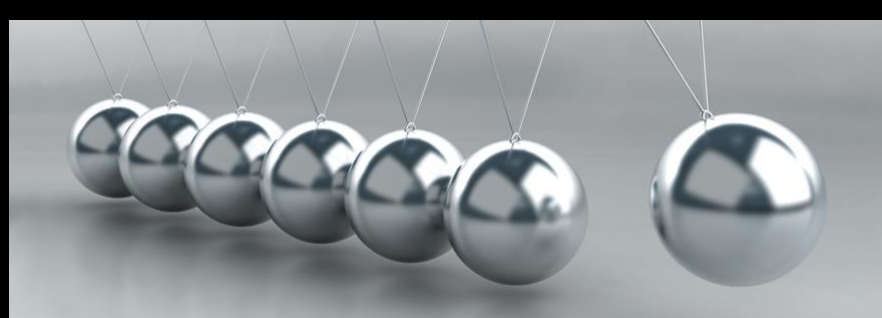
- **Internal**
- **Stable**
- **Global**

Key findings

If you need to make accurate forecasts,

- focus on relevant past experiences
- Include external observer

If you need to finish tasks promptly, focus on future plans



Debiasing

De-biasing

1- day training workshop

- **Estimation and risky behaviour**
- **Anchoring effect**
- **Optimism bias**
- **Overconfidence effect**
- **Planning fallacy**
- **Illusion of control**
- **Games/case studies**
  - Horserace handicapper
  - Planning game

Debiasing - anchoring

- **Understanding where anchor came from**
- **Alternate anchors**
- **Collect feedback**

Debiasing – optimism bias

- **Difficult. Limited effect**
- **Risk of backfire**
- **Raise awareness**

Debiasing – overconfidence effect

Variation of horserace handicapper case study

- **Present scenario**
- **Ask subject to predict outcome and confidence**
- **Present additional information, then repeat**

De-biasing the Planning Fallacy

Underestimate own plans but not other people's

1. **Pull in an external observer**
2. **Take note of what they say**

De-biasing the Planning Fallacy

Focus on plan-based scenarios,
not relevant experiences

- **Look to your past experiences**
- **If plans and experience conflict, trust experience**

De-biasing the Planning Fallacy

Diminish relevance of past experience using attributions

If you want to improve, look for reasons that are:

- **Internal vs External**
- **Stable vs Transitory**
- **Global vs Specific**

Both reasons will exist

Debiasing – planning fallacy

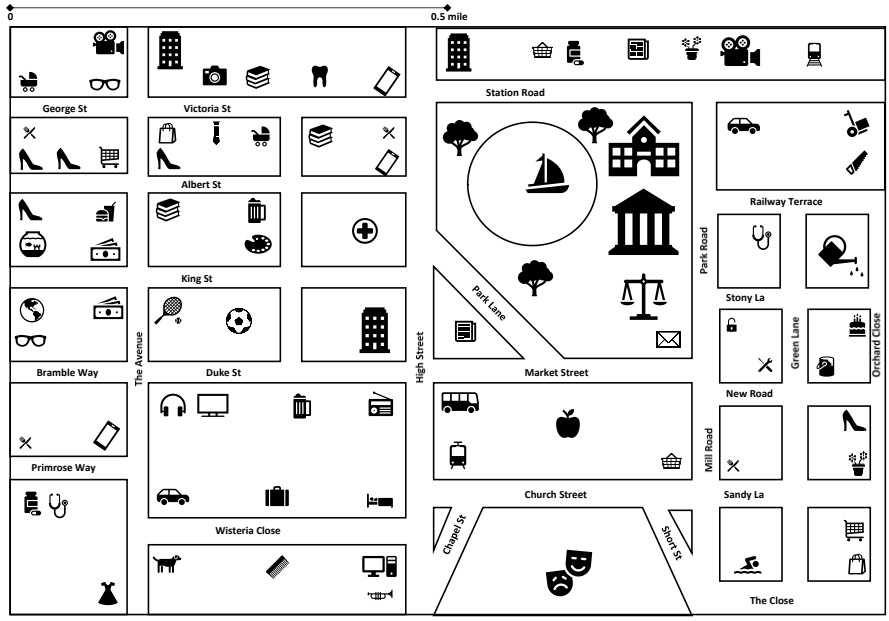
Planning game

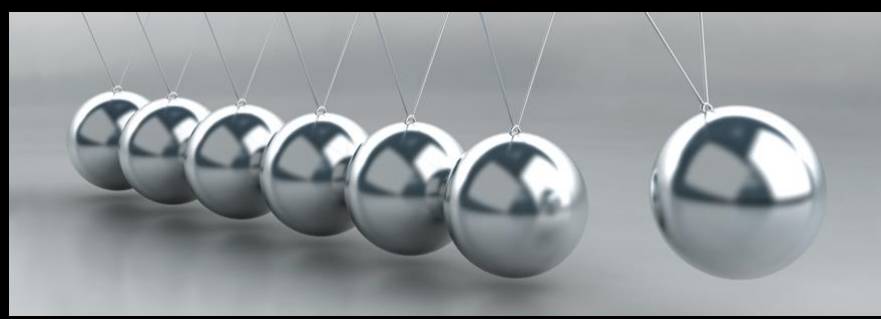
- **Present list of tasks**
- **Allow subjects to plan**
- **Provide feedback**
- **Repeat**

The planning game

You have just finished swimming at the pool. It is 11:00 AM and you can plan the rest of your day as you wish. However, you must pick up your car from the car park on the junction of Station Road and Park Road by 6:00 and then return home. You'd also like to see a film today, if possible. Film times at both cinemas are 1:00, 3:00, and 5:00. Both films are on your "must see" list, but go to whichever one best fits your plan. Your other errands are as follows:

1. Collect a prescription from the pharmacy on Primrose Way
2. Buy a kitchen knife from a department store
3. Buy food for a meal tonight
4. Meet a friend for lunch at a restaurant
5. View two of the three apartments
6. Collect a new mobile phone from the shop on Albert Street
7. Buy a pair of shoes from a shoe shop
8. Buy a mobile phone top up from a news stand
9. Buy a gift for your best friend's new-born baby
10. Order a book from the bookshop
11. Collect the dentures for your grandmother from the dentist
12. Choose a novelty tie for a party from the tie shop
13. Collect a pair of spectacles from the optician on George Street





Summary

Summary

Project estimation issues:

- **Systematic underestimate**
- **Narrow confidence limits**
- **Repeat same mistakes**

Summary

Consequences:

1. **Incorrect funding decisions**
2. **Under-resourced, under-funded**
3. **Project overrun. Leading to…**
4. **Risk-seeking and irrational behaviour**
5. **Project stress & burn-out**
6. **Adverse perception**

Summary

Known problems:

1. **Technology uncertainty**
2. **Manipulated estimates**
3. **Gold plating**
4. **Adverse selection**

Summary

Human biases:

1. **Anchoring**
2. **Optimism**
3. **Overconfidence**
4. **Planning fallacy**

Summary

Improve estimation by addressing biases

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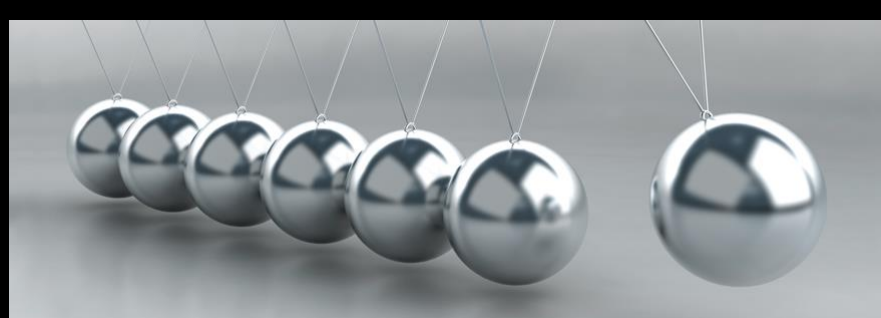
Thank you for your attention.



Resources

Resources

Exploring the "Planning Fallacy": Why People Underestimate Their Task Completion Times
Roger Buehler, Dale Griffin, and Michael Ross
Journal of Personality and Social Psychology
1994, Vol. 67, No. 3.366-381

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“Thinking, Fast and Slow”. Daniel Kahneman

Optimism bias
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Decision Research Technical Report PTR-1042-77-6. In Kahneman, Daniel; Slovic, Paul; Tversky, Amos, eds. (1982). Judgment Under Uncertainty: Heuristics and Biases. pp. 414–421.

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Overconfidence effect
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STUART OSKAMP. Journal of Consulting Psychology 1965, Vol. 29, No. 3, 261-265

ARE WE ALL LESS RISKY AND MORE SKILLFUL THAN OUR FELLOW DRIVERS?
Ola SVENSON. Acta Psychologica 47 (1981) 143-148
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(Horse race handicapping)
Behavioral problems of adhering to a decision policy. Slovic, P., & Corrigan, B. (1973). Talk presented at The Institute for Quantitative Research in Finance, May 1, Napa, CA.

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(Planning game)

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Proceedings of the Third Annual Conference of the Cognitive

Science Society. Berkeley, CA: Cognitive Science Society.

Hayes-Roth, B., & Hayes-Roth, F. (1979). A cognitive model of planning.

Cognitive Science, 3, 275-310.