

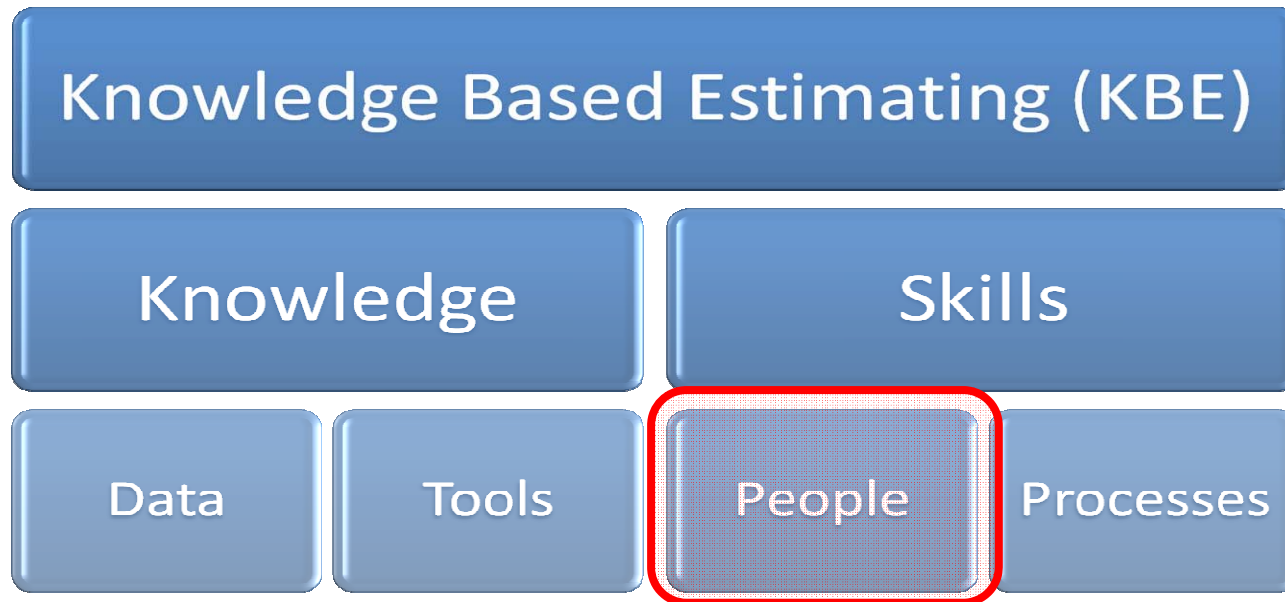
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Knowledge Based Estimating (KBE) is the philosophy that underpins the QinetiQ approach to Cost Forecasting. The building blocks of all good cost forecasts combine:

- **Data** – understanding the current project in the context of past projects
- **Tools** – the analytical and forecasting capabilities
- **People** – proactive staff certified and trained, looking to add value
- **Process** – structured approach to the task

ackground –

Economics – traditionally based upon ***Homo economicus***

- a rational and narrowly self-interested individual
- has the ability to make judgments toward his subjectively defined end
- maximises utility as a consumer and economic profit as a producer

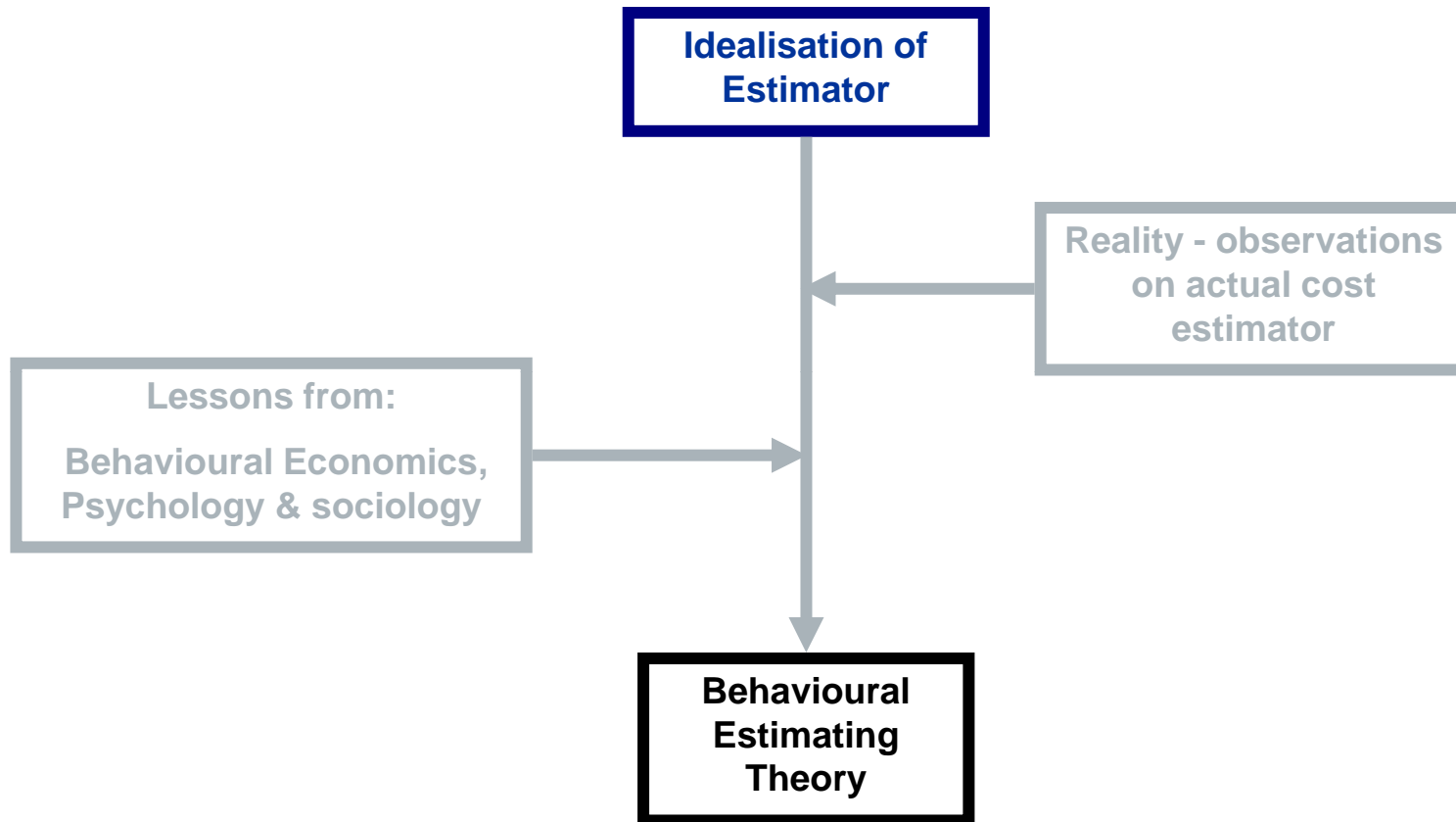
Failings:

- individuals have bounded rationality
- individuals make emotional decisions
- Individuals act altruistically



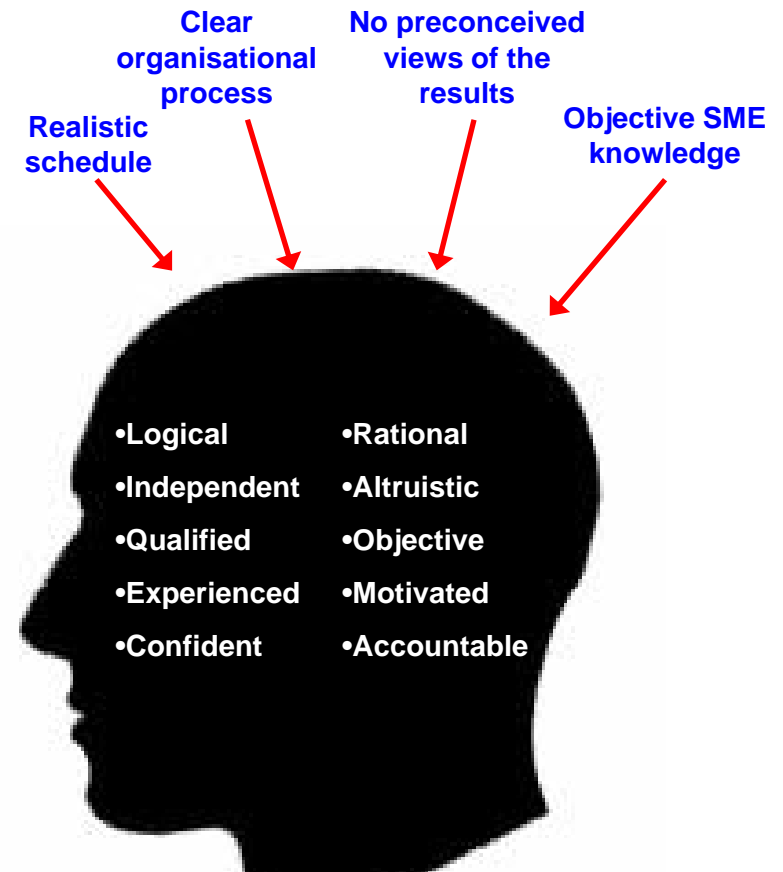
Behavioural economics introduces the human element to economics and explains these variances

Can we use similar principles (combining psychology with our estimating observations) to explain why we sometimes get our estimates wrong?



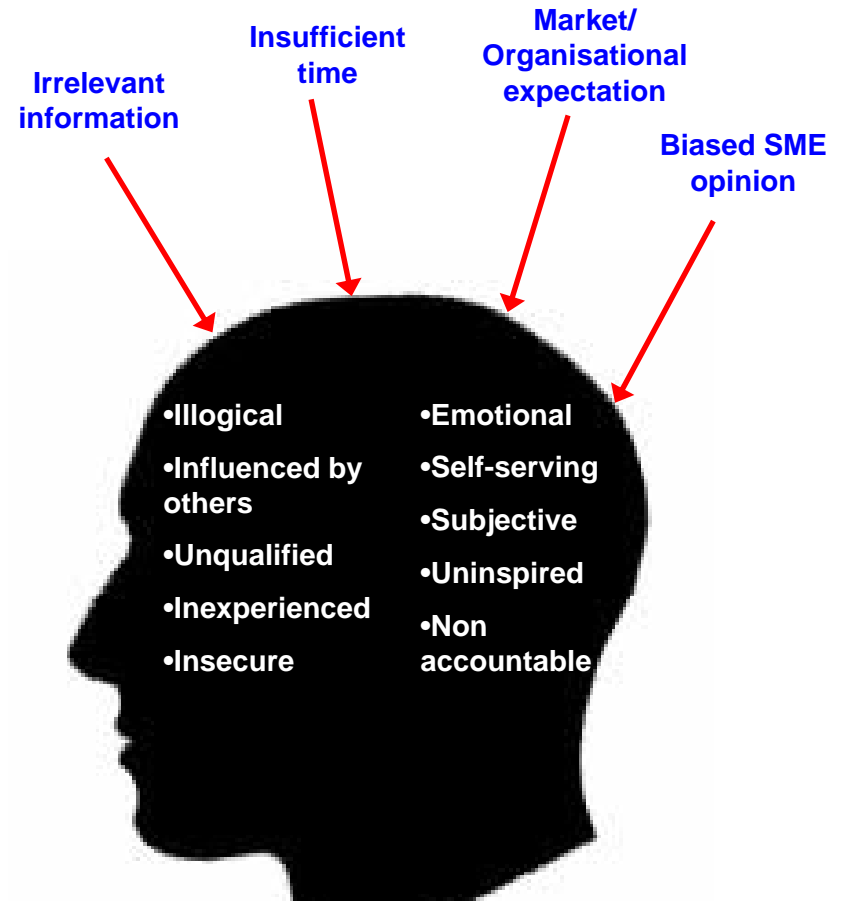
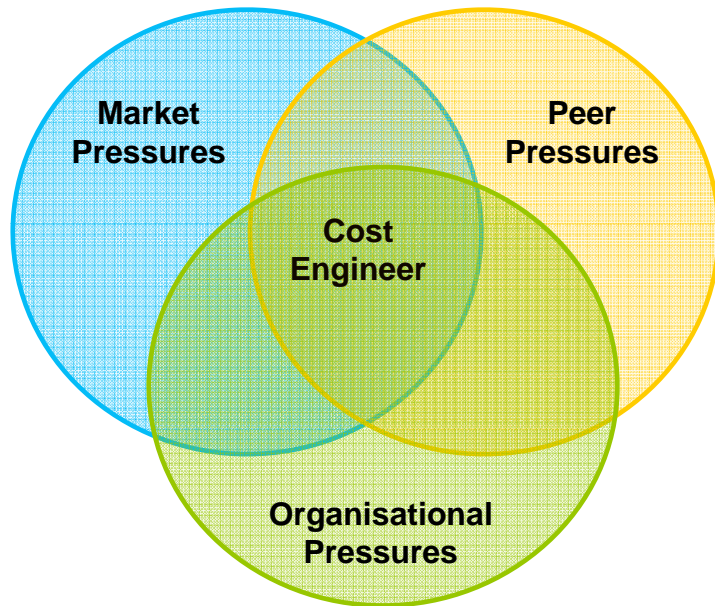
Within estimating People are needed to:

- Understand costing requirements – decision support
- Communicate effectively with individuals from government, industry and armed forces
- Understand technical & programmatic characteristics of new concepts
- Draw analogies with historic systems
- Objectively interpret historical data, define cost drivers and identify logical CERs
- Apply CERs & develop rational estimates
- Scrutinise estimates for validity
- Confidently present (sell) results to peers & decision makers
- Defend results under external scrutiny



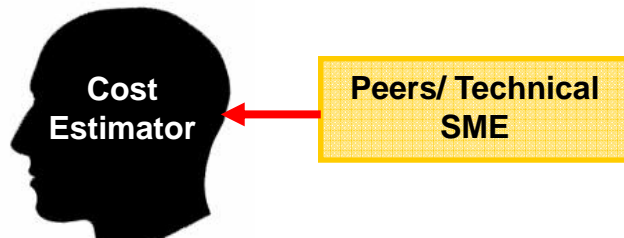
The Ideal Cost Estimator
(“Homo Estimatus”)

So why are our estimates often wrong?



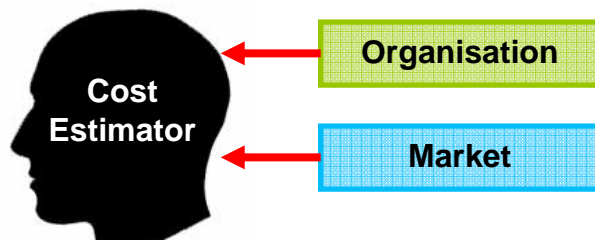
The Real Cost Estimator

SMEs (often engineers) are biased by nature and this often leads to biased cost estimates.



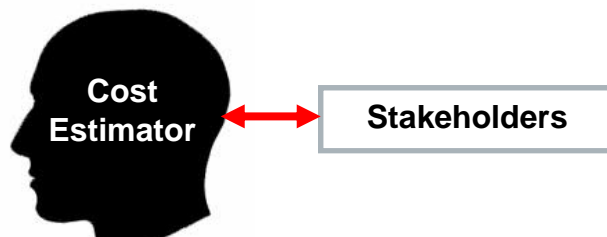
- **Selective Recall** - Even if an SME has interpreted evidence in a neutral manner, they **may still remember it selectively** to reinforce their expectations. It has been demonstrated with psychology and sociology that **individuals act in their own self interest** to satisfy their own goals or to reinforce the opinions they hold of themselves
- **Illusory correlation** - Humans have a natural tendency to seek relationships between variables but this can lead to seeing **non-existent correlations**.
- **Optimism bias** - the human tend towards optimism where they believe they are **less at risk of experiencing a negative event** compared to others.
- **Pessimism bias** - Certain individuals have been demonstrated to **exaggerate the likelihood of negative things occurring**. This principle should be considered as equally valid as optimism bias.
- **Serial Position Effect (Recency and primacy effect)** - When recalling a list of items in any order (free recall), people tend to **begin recall with the end of the list**, recalling those items best . Among earlier list items, the first few items are recalled more frequently than the middle items.

Estimation is conducted within the context of an organisational (and Market) setting, and the expectations of that organisation (and Market) will impact on the quality of the estimate generated.



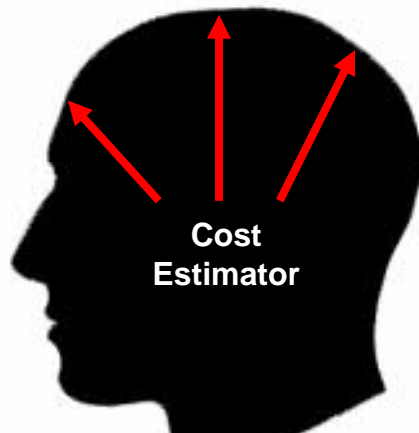
- **Group strength & social identity** - groups with **perceived social norms** can invoke within an individual the **need to comply with its social influence**.
- **Group proximity** – the **proximity of the group impacts an individual conformance and compliance** with a group’s commonly held consensus. Within the context of cost estimating as there is always the trade-off between the advantage that a cost estimator will have when embedded within a project team with the need to maintain a degree of professional independence from the project .
- **Relationship to group** - Pressures are strongest when a **group contains authority figures**. Consider the situation in which a cost estimator is answerable to a particular manager, say a cost estimating team manager, or a project manager. and that these individuals have control over the potential success of the cost estimators career.
- **Group Size** – it has been shown that **compliance of an individual increases as the number of people in the group increases** but once the size exceeds 4 or 5 compliance is less likely to occur.

Estimation is facilitated by a complex set of social information exchanges, all of which impact the quality of the generated estimate.

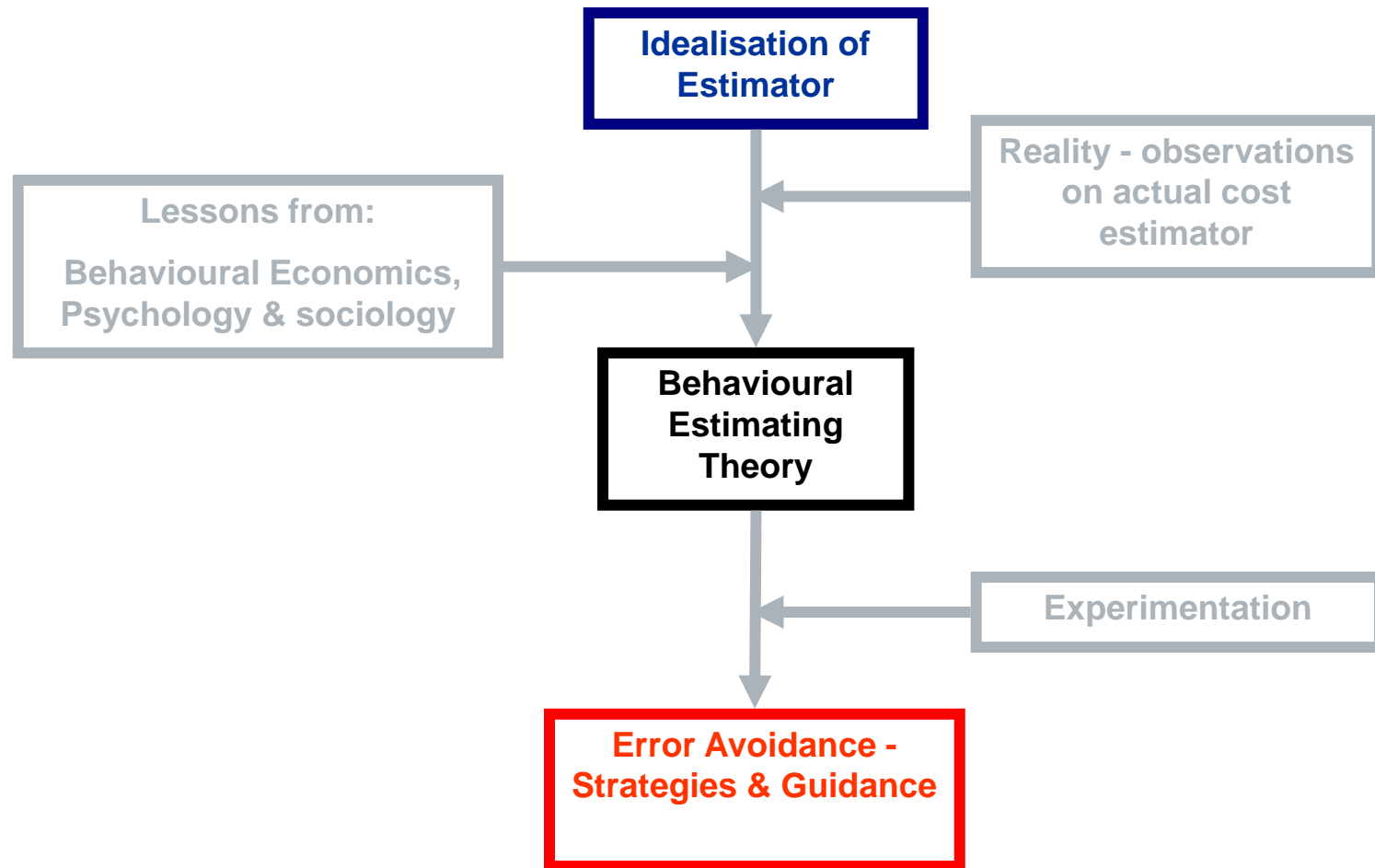


- **Reciprocity effect** - When approached for information, stakeholders are more likely to provide it if they believe that they will **get something worthwhile in return**. It is useful for a cost estimator to remember that if they can reward the individuals with something in return for their contribution of knowledge then they are more likely to get credible information in return
- **Anchoring effect** - Individuals have been shown to **rely too heavily on the first piece of information offered** when making decisions, and then make **insufficient adjustments away from this information** when arriving at their estimates
- **Framing effect** - People react differently to a particular choice depending on whether it is **presented as a loss or as a gain**. The principle is linked closely with **Prospect theory**, where it has been proven, through use of the loss function, that a loss is more devastating than the equivalent gain is gratifying.
- **Halo effect** - Individuals place greater confidence in an individual's evidence (or data or opinion) if they can find **attributes of the individual that they like**, regardless of whether that evidence (or data or opinion) is correct, or whether the quality that they like is something which is relevant to the estimating activity at hand.

The generation of justified and credible estimates needs to be produced by suitably qualified and experienced cost estimators.

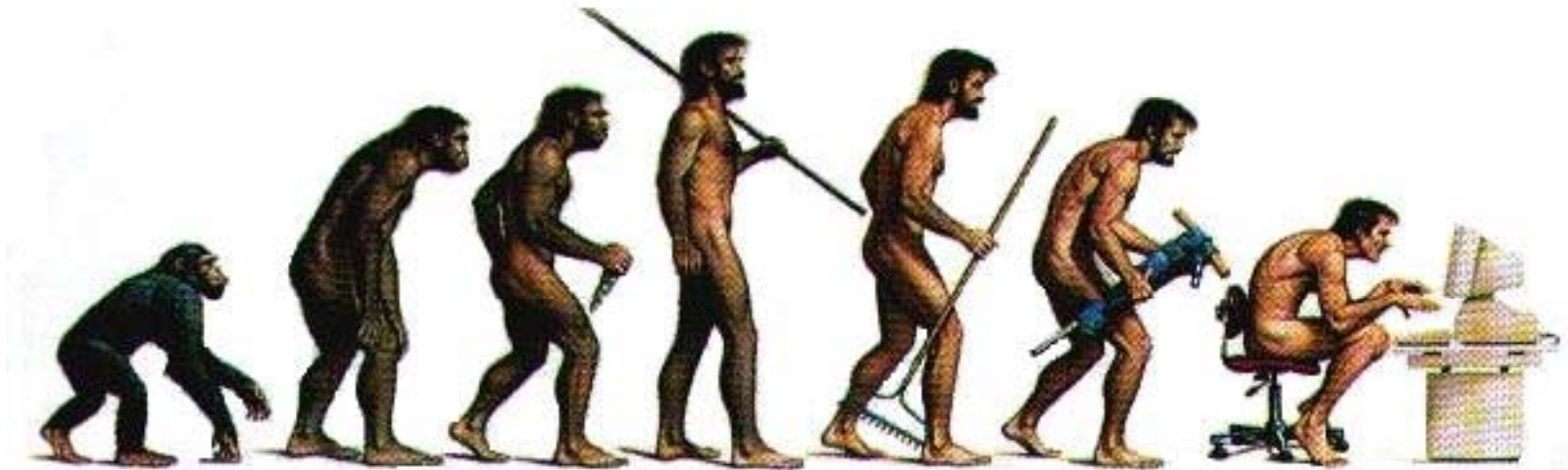


- **Over-confidence effect** - an individual's **subjective confidence in their judgments** is **reliably greater than their objective accuracy**, especially when confidence is relatively high .
- **Classical or operant conditioning** – individuals exercise **heuristics** because they always have, without ever having had them appropriately validated. The experience of a cost estimator may act to diminish their objectivity. For instance, perhaps a cost estimator always uses certain rules of thumb - if they believe that management review consistently reduce their estimates by 20%, they learn to add 20% to all their estimates.
- **Attentional biases** - Individuals who lack experience may **focus on limited information** within their immediate environment (localised dominant stimuli) but fail to understand the wider context of their tasking. The result - '**not seeing the wood for the trees**'.
- **Small probabilities** – people tend to **under-react to low-probability events** resulting in them being willing to make high risk choices. An experienced estimator will instinctively know not to ignore low probability events, regardless of how unlikely they are to occur.



Can psychology teach us to be better estimators? - YES

- There is a human element to cost estimating
- Peoples behaviours can introduce errors to cost estimates
- Understanding which behaviours introduce errors means that measures can be put in place to protect against them.





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