How well can you know your own mind?

Even an evidence-based decision is fallible when made by a human. **Mike Beck** and **Charles Johnson** reveal the biases and fallacies every asset manager should watch out for.

Decision-making is at the core of asset management. It is generally assumed that, once the right data are available, the right decision will be made – but unfortunately, we are typically confronted with data that is of insufficient quality, out of date, or needs combining with other data sources before it can be interpreted and applied.

Research from a range of disciplines, including economics, psychology and cognitive science, has shown that in such circumstances, decision-makers are affected by many cognitive biases which prevent them from making rational decisions.

Thinking fast and slow

There is a theory that our thought processes work on two levels:

- fast thinking – unconscious, constantly active and fast judging, based mostly on stereotyping and comparing patterns to reach decisions instantly
- slow thinking – conscious deliberation on complex problems. As this uses a lot more energy and attention, it is only activated when we recognise a problem as too complex for fast thinking.

This theory was popularised in *Thinking fast and slow* by Daniel Kahneman, who developed many modern ideas about cognitive biases with Amos Tversky.

For an example of how it works, try answering this question quickly: *a bat and a ball together cost €1.10. The bat costs €1 more than the ball. How much does the ball cost?*

Fast thinking tends to lead you to the answer €0.10, but slow thinking helps you understand why the answer is really €0.05.

Obviously we should always use slow thinking for important decisions. However, the evidence suggests this is often not the case. In the real world, people have to make complex decisions at speed in conditions of uncertainty. In such situations, people resort to a number of decision-making techniques to make the task possible, including simplifying either the problem or the analysis through the use of heuristics.

Such techniques can be valuable, but are also vulnerable to a range of cognitive biases.

Asset management decision-making is most at risk from the following fallacies.

Replacing the question

Faced with a difficult problem, people typically try to simplify it. For instance:

How successful will Real Madrid be in 10 years?

What will the condition of my steel pipes be in 10 years?

If you are interested in soccer, the first question might seem easy to answer. But if you try to analyse how you reached your answer, you might realise that a well-founded answer would need to account for the likely future performance not only of Real Madrid, but also of every other team they might play, plus possible future changes in rules, financing and other factors.

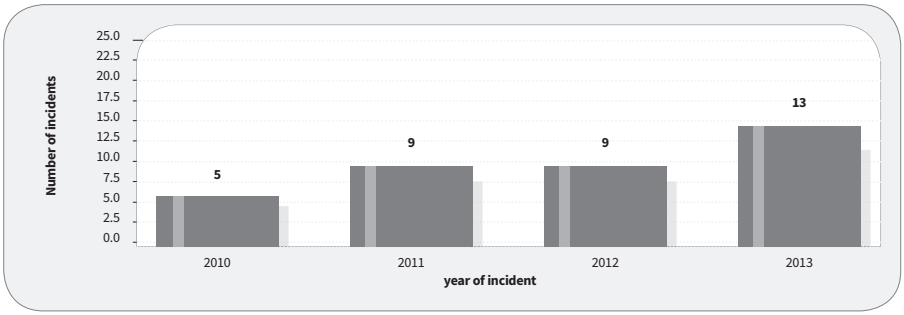
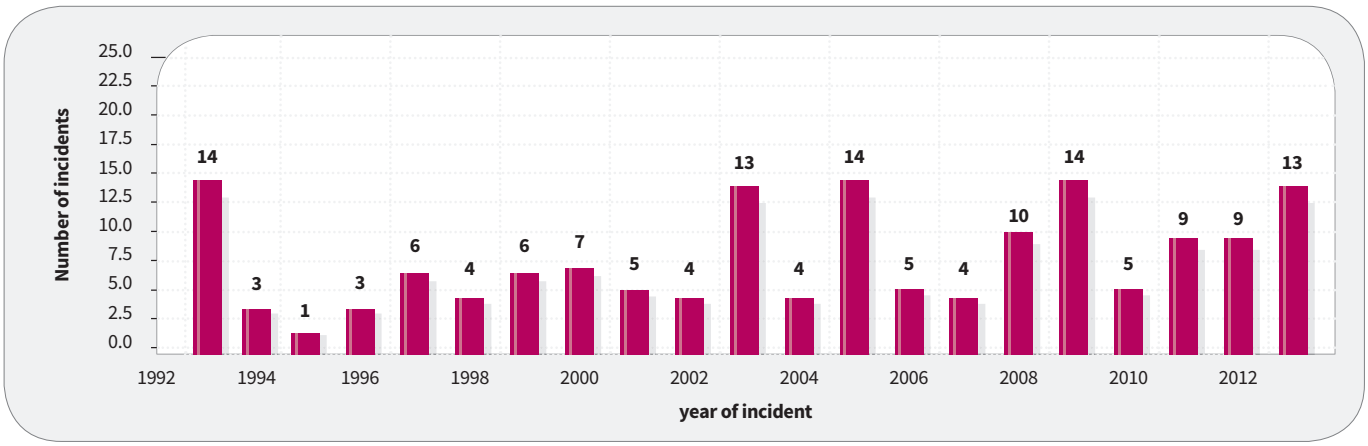


Figure 1: History of breakages



First published in Assets, the magazine for Members of the IAM. November 2016

Unconsciously, you replaced the original question with a heuristic one: *"How successful is Real Madrid now?"* This heuristic makes the assumption that past performance is the best predictor of future results. Of course, this is not always the case. If you fail to realise you have insufficient data for a well-founded decision, you may not question your own judgement sufficiently.

The second question can only be answered fully if there is an ageing model showing how fast pipes in each section of the network deteriorate, considering all influencing factors. In fast thinking mode, even an experienced engineer is likely to replace this question with a heuristic one like *"How many breakages were there among our steel pipes last year?"*

Base rate fallacy

When gauging how likely an event is, we tend to ignore our prior knowledge of the probability of that event. This tends to happen when we look only at one specific case, without considering our general experience with similar problems.

Kahneman provides an example that should sound familiar to project managers. At the beginning of a book project he asked the co-authors how long they assumed the project would take. They looked at the tasks involved and estimated two years. But when Kahneman asked an experienced team member how long such projects usually take, they said 60 per cent of such projects never reached completion, and those that did had taken about seven years.

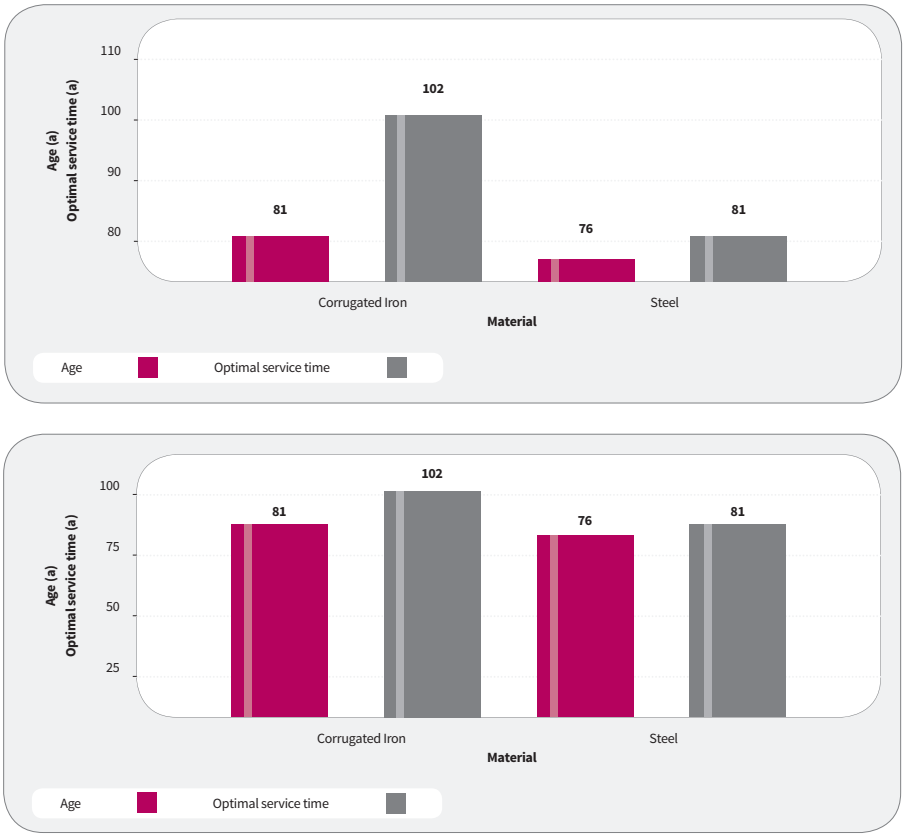
This fallacy is part of the "planning fallacy" – a reason why big construction works never seem to finish on time.

Regression to the mean

This is an example of selective attention to data. It often involves reading too much into spikes in your data when, in fact, spikes are rare and usually followed by a series of more average values.

As an example, consider **Figure 1**. Looking only at the past four years of data, there seems to be a trend of rising breakage rates. But if you have a longer history available, it becomes obvious that breakages varied only slightly around the long term average value in 2010-2012, followed by a spike in 2013 – a spike which has happened several times before and was never repeated in the following year.

Figure 2: Effect of truncating the y-axis



Availability bias

Our brains typically work on the principle that what you see is all there is. In the absence of better sources of information, we take what's available. One of the simplest and most common ways of misrepresenting data is to use an inappropriate scale on the y-axis (**Figure 2**).

The difference between the values seems much more significant in the upper diagram because the scale on the y-axis is truncated. This bias usually holds even when you provide the absolute figures or state that the y-axis has been truncated.

If you want a clear understanding of the numbers involved, don't rely on nicely laid out reports: play around yourself with the data and how it's displayed. Analysing data as a team in an intensive workshop is often much more useful than any report.

Zero-risk bias

One of Kahneman and Tversky's most interesting insights relates to how a person's risk appetite affects their decision-making. We may try to tell ourselves differently, but people are not good at differentiating between probabilities or criticalities on a subconscious or emotional level.

This leads to a fallacy where people try to reduce risk to zero per cent even when it would make much more sense to invest money elsewhere. The last few per cent between "nearly right" and "perfect" are usually the most difficult. So when we're faced with two risks, the most efficient approach is to get both risks as low as reasonably practicable (ALARP) – not to invest the whole budget trying to reduce one of them to zero.

First published in Assets, the magazine for Members of the IAM. November 2016

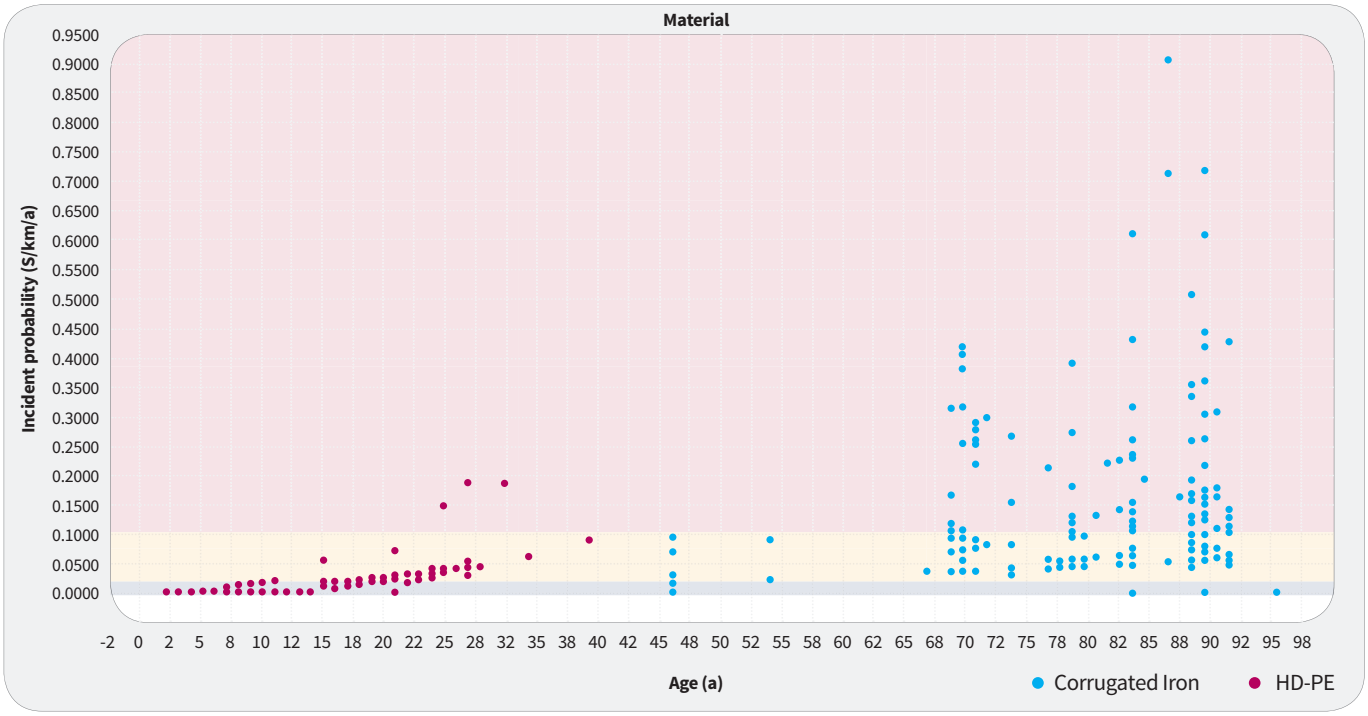


Figure 3: Breakage probability of pipe sections

Figure 3 shows the breakage probability of pipe sections in a network. The HD-PE pipes are newer and generally in much better health than the older corrugated iron pipes. But despite being less than 40 years old, some of the HD-PE pipes are more likely to break than some of the 80-year-old corrugated iron pipes.

Situations like this often lead to programmes to completely replace one material type with the other – especially in organisations where boiling down the facts into an easily understood story is the only way to defend the asset management budget. But this is unlikely to be the optimal strategy. This would focus on the corrugated iron pipes, investing most of the budget there. Still, one or two HD-PE pipe sections would need to be replaced before the best of the corrugated iron pipes.

Clustering illusion

Human beings tend to see patterns everywhere, whether they actually exist or not. This is one of the main reasons we misunderstand statistics. We find stories to explain whatever patterns we think we see in the data.

Kahneman gives the example of the British Secret Service during the Second World War. They analysed bombing patterns over London and concluded that there must be spies in certain areas: the pattern seemed to show that German planes avoided bombing those areas.

Luckily for people living in those areas, some statisticians looked at the patterns as well and explained to the Secret Service that this is what a random pattern looks like. Random patterns are not smooth – even with a sample size in the thousands, a genuinely random pattern will always include spikes and troughs.

So, especially in the context of Big Data, we should be wary of focusing on "special" features or characteristics of data to tell a compelling story to explain our decisions: the next set of data is likely to be completely different.

Correcting cognitive bias

The basis for a well-founded understanding of the interdependencies and ageing of assets is a detailed and objective understanding of the underlying data.

Flexible data analysis tools have proven helpful for re-considering the grounds for decisions without the need for advanced training in statistical techniques. Asset managers can get more objective and less error-prone views of their data by simply being more aware of the ways they are making decisions, the questions that need to be asked of data and the pitfalls they need to beware.

FURTHER READING

SSG 31 – Risk assessment and management, one of the IAM's new Subject Specific Guidelines publications, also references the most common biases affecting asset management decision-making. Find out more and purchase SSGs at **theIAM.org/SSG**

Authors' biographies

Mike Beck is OptNet Director at Fichtner Water and Transportation in Germany. He is part of the Core Drafting Group of the IAM SSG on risk assessment and management.

Dr Charles Johnson is Group Technical Director of CAS. He contributed to the IAM SSG on organisational structure and culture and is a member of the IAM Examinations Board.

First published in Assets, the magazine for Members of the IAM. November 2016