

A question of philosophy

It affects all facets of society, but probability and its objects aren't easily understood, **Nyssa Skilton** writes

Linda is 31 years old, single, outspoken and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations.

Is Linda more likely to be a) a bank teller or b) a feminist bank teller?

Psychologists Daniel Kahneman and Amos Tversky asked this question in the early 1980s in a study that tried to understand how people managed uncertainty.

Subjects consistently ranked Linda as being more likely to be a feminist bank teller rather than just a bank teller. The answer is a), there are many more bank tellers in the world than feminist ones.

The study and many others that followed have highlighted how people often fail at making rational probability judgments.

This may be costly in a game of chance, but there may also be more profound consequences that influence all facets of society, from the development of public policy to individual decision-making on an everyday level.

Australian National University mathematician turned philosopher Professor Alan Hájek has been studying probability for almost 30 years, trying to understand what it is, and more recently what the objects of probability are.

He has received about \$280,000 over three years from the Australian Research Council as part of its latest round of Discovery Project funding. The ANU was a major recipient of the grants, collecting \$39.7 million of the \$394 million delivered to 1145 research projects across the country.

Hájek plans to use the money to attract at least one postdoctoral researcher to help him nut out what the objects of probability are.

A typical probability equation looks something like this: $P(x) = r$. The probability of "x" occurring is equal to "r", for example the probability of a coin landing heads is equal to 1/2. The object of probability here is the "x", ie the coin landing heads.

Hájek says understanding these objects will help philosophers better understand probability itself as the two are interconnected.

He became hooked on thinking about probability when he majored in maths and statistics at university.

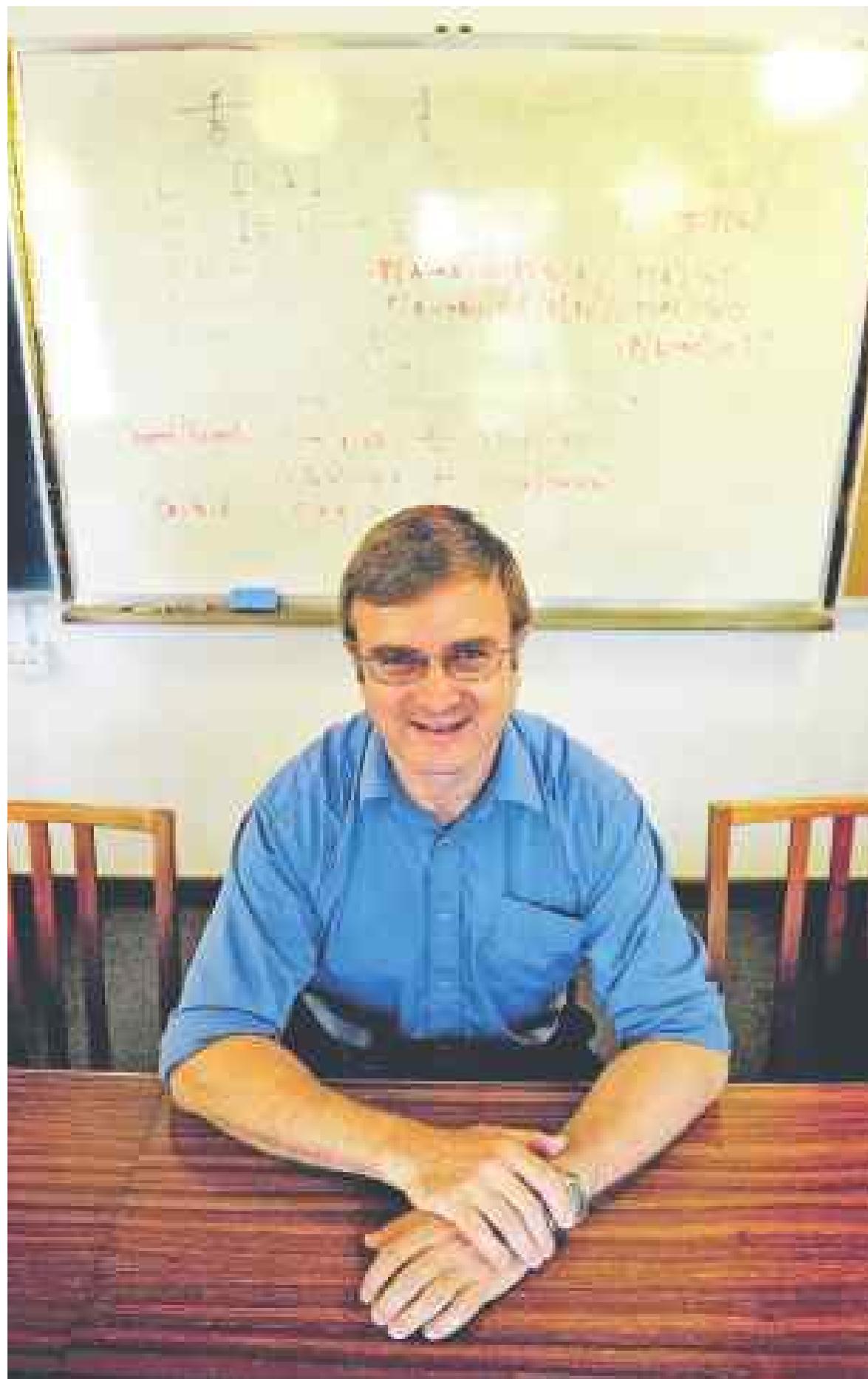
He recalls wondering what this "P" was that his professor kept writing on the board. So he asked him, what is probability?

"He looked at me like I was crazy and said you'd better go to the philosophy department and so I did," Hájek says.

"I found that philosophers were receptive to this question, what is 'P'. They didn't think I was crazy and I'm still asking that question."

Philosophers have various answers for what probability is, which they have been formulating and debating for almost 360 years.

One is the classical interpretation, which arises



ANU mathematician turned philosopher Professor Alan Hájek has been studying probability for almost 30 years. Photo: Marina Neil

intuitively in games of chance such as flipping a coin or rolling a dice where each possible outcome is equally weighted. It is the ratio of favourable possibilities to total possibilities: just count the number of favourable possibilities (heads) and divide by the total number of possibilities (heads and tails), to get the answer 1/2.

But when it comes to more natural events, such as the probability that the sun will rise in the morning, the theory fails. The sun can either rise or not rise, yet

our experience tells us the probability of it rising tomorrow is not 1/2. So other probability interpretations arise to account for factors such as previous experience, the tendency for an event to occur and even how confident we are in the outcome.

Some thought that it might be possible in principle predict the future.

In the early 1800s, French mathematician Pierre-Simon Laplace envisaged a demon, which had the powers to determine the

future by knowing the movement of every atom in the universe.

The creature, dubbed Laplace's demon, would know, for example, the acceleration of the coin as it left a hand and the speed of its rotation and hence be able to determine exactly how the coin would land.

But quantum mechanics – a field of physics that deals with incredibly small particles – tells another story.

"It seems that quantum mechanics is telling us that chance is not just a matter of ignorance," Hájek says. "There could be no Laplacian demon in the sense that quantum mechanical processes are inherently 'chancy' and unpredictable in some sense."

While debate has raged among philosophers on questions of what is probability, the objects of probability – the "x" of the equation – have often been overlooked.

"I think it's been underappreciated. There's an interaction between 'P' and 'x' and if you're going to determine 'r' you need to know what you're talking about," Hájek says.

"If you change your mind about what 'P' is, you'll change your mind about what 'x' is."

Some say "x" is an event, or a proposition, or a sentence in some logical language and Hájek wants a clearer understanding of what they mean and how they are relevant to rational choice and decision-making.

He says the values we assign to probability, the "r" of the equation, can make crucial differences to public policy and individual decisions.

Take global warming. Scientists from the US Environmental Protection Agency report there is a 10 per cent chance temperatures will rise more than 4 degrees in the next century. But how did they determine this 10 per cent probability figure?

"This is where these distinctions start to matter.

"Probability is ubiquitous . . . high stake decisions get made on the basis of probability judgments. We convict on the basis of jurors' tacit probability judgments. We put a drug on the market on the basis of a probability judgment. We respond to concerns about global warming on the basis of probability judgments, so we need to get clear on those judgments."

Hájek adopts the confidence interpretation of probability when he talks about the effect his philosophising may have on society.

He is confident he can contribute as a philosopher to this theoretical exercise, but it is harder to be confident when it comes to enacting changes in governments.

"But I hope there's a sort of trickle-down effect that getting clear on these concepts – what probability is, what it attaches to – will get us clear on what probability statements mean.

"If we could refine our probability judgements, I think we'd refine our decisions."

High stake decisions get made on the basis of probability judgments.
