

## PART THREE THINKING ABOUT TOMORROW

### 99.999% certainty humans are driving global warming: new study



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There is less than 1 chance in 100,000 that global average temperature over the past 60 years would have been as high without human-caused greenhouse gas emissions, our new research shows.

Published in the journal *Climate Risk Management* today, our research is the first to quantify the probability of historical changes in global temperatures and examine the links to greenhouse gas emissions using rigorous statistical techniques.

Our new CSIRO work provides an objective assessment linking global temperature increases to human activity, which points to a close to certain probability exceeding 99.999%.

Our work extends existing approaches undertaken internationally to detect climate change and attribute it to human or natural causes. The 2013 Intergovernmental Panel on Climate Change Fifth Assessment Report provided an expert consensus that:

It is extremely likely [defined as 95–100% certainty] that more than half of the observed increase in global

average surface temperature from 1951 to 2010 was caused by the anthropogenic [human-caused] increase in greenhouse gas concentrations and other anthropogenic forcings together.

## **Decades of extraordinary temperatures**

July 2014 was the 353rd consecutive month in which global land and ocean average surface temperature exceeded the 20th-century monthly average. The last time the global average surface temperature fell below that 20th-century monthly average was in February 1985, as reported by the US-based National Climate Data Center.

This means that anyone born after February 1985 has not lived a single month where the global temperature was below the long-term average for that month.

We developed a statistical model that related global temperature to various well-known drivers of temperature variation, including El Niño, solar radiation, volcanic aerosols and greenhouse gas concentrations. We tested it to make sure it worked on the historical record and then re-ran it with and without the human influence of greenhouse gas emissions.

Our analysis showed that the probability of getting the same run of warmer-than-average months without the human influence was less than 1 chance in 100,000.

We do not use physical models of Earth's climate, but observational data and rigorous statistical analysis, which has the advantage that it provides independent validation of the results.

## **Detecting and measuring human influence**

Our research team also explored the chance of relatively short periods of declining global temperature. We found that rather than being an indicator that global warming is not occurring, the observed number of cooling periods in the past 60 years strongly reinforces the case for human influence.

We identified periods of declining temperature by using a moving 10-year window (1950 to 1959, 1951 to 1960, 1952 to 1961, and so on) through the entire 60-year record. We identified 11 such short time periods where global temperatures declined.

Our analysis showed that in the absence of human-caused greenhouse gas emissions, there would have been more than twice as many periods of short-term cooling than are found in the observed data.

There was less than 1 chance in 100,000 of observing 11 or fewer such events without the effects of human greenhouse gas emissions.

### **The problem and the solution**

Why is this research important? For a start, it might help put to rest some common misunderstandings about there being no link between human activity and the observed, long-term trend of increasing global temperatures.

Our analysis — as well as the work of many others — shows beyond reasonable doubt that humans are contributing to significant changes in our climate.

Good risk management is all about identifying the most likely causes of a problem, and then acting to reduce those risks. Some of the projected impacts of climate change can be avoided, reduced or delayed by effective reduction in global net greenhouse gas emissions and by effective adaptation to the changing climate.

Ignoring the problem is no longer an option. If we are thinking about action to respond to climate change or doing nothing, with a probability exceeding 99.999% that the warming we are seeing is human-induced, we certainly shouldn't be taking the chance of doing nothing.



## An insider's story of the global attack on climate science

Jim Salinger

A headline this year – “Failed doubters trust leaves taxpayers six-figure loss” – marked the end of a four-year epic saga of secretly funded climate denial, harassment of scientists and tying-up of valuable government resources in New Zealand.

It is likely to be a familiar story to my scientist colleagues in Australia, the UK, USA and elsewhere around the world.

But if you're not a scientist, and are genuinely trying to work out who to believe when it comes to climate change, then it's a story you need to hear too. Because while the New Zealand fight over climate data appears finally to be over, it is part of a much larger, ongoing war against evidence-based science.

### **From number crunching to controversy**

In 1981 as part of my PhD work, I produced a seven-station New Zealand temperature series, known as 7SS, to monitor historic temperature trends and variations from Auckland to as far south as Dunedin in southern New Zealand.

A decade later, in 1991–92 while at the NZ Meteorological Service, I revised the 7SS using a new homogenisation approach to make New Zealand's temperature records more accurate, such as adjusting for when temperature gauges were moved to new sites.

For example, in 1928, Wellington's temperature gauge was relocated from an inner suburb near sea level up into the hills at Kelburn, where — due to its higher, cooler location — it recorded much cooler temperatures for the city than before.

With statistical analysis, we could work out how much Wellington's temperature has *really* gone up or down since the city's temperature records began back in 1862, and how much of that change was simply due to the gauge being moved uphill.

So far, so uncontroversial.

But then in 2008, while working for a NZ government-owned research organisation, the National Institute of Water and Atmospheric Research (NIWA), we updated the 7SS. And we found that at those seven stations across the country, from Auckland down to Dunedin, between 1909 and 2008 there was a warming trend of 0.91°C.

Soon after that, things started to get heated.

The New Zealand Climate Science Coalition, linked to a global climate change denial group, the International Climate Science Coalition, began to question the adjustments I had made to the 7SS.

And rather than ever contacting me to ask for an explanation of the science, as I have tried to briefly cover above, the Coalition appeared determined to find a conspiracy.

### **“Shonky” claims**

The attack on the science was led by then MP for the free market ACT New Zealand party, Rodney Hide, who claimed in the NZ Parliament in February 2010 that:

NIWA's raw data for their official temperature graph shows no warming. But NIWA shifted the bulk of the temperature record pre-1950 downwards and the bulk of the data post-1950 upwards to produce a sharply rising trend ... NIWA's entire argument for warming was a result of adjustments to data which can't be justified or checked. It's shonky.

Mr Hide's attack continued for 18 months, with more than 80 parliamentary questions being put to NIWA between February 2010 and July 2011, all of which required NIWA input for the answers.

The science minister asked NIWA to re-examine the temperature records, which required several months of science time. In December 2010, the results were in. After the methodology was reviewed and endorsed by the Australian Bureau of Meteorology, it was found that at the seven stations from Auckland to Dunedin, between 1909 and 2008 there was a warming trend of 0.91°C.

That is, the same result as before. But, in the meantime, before NIWA even had had time to produce that report, a new line of attack had been launched.

### **Off to court**

In July 2010, a statement of claim against NIWA was filed in the High Court of New Zealand, under the guise of a new charitable trust: the New Zealand Climate Science Education Trust (NZCSET). Its trustees were all members of the NZ Climate Science Coalition.

The NZCSET challenged the decision of NIWA to publish the adjusted 7SS, claiming that the “unscientific” methods used created an unrealistic indication of climate warming.

The Trust ignored the evidence in the Meteorological Service report I first authored, which stated a particular adjustment methodology had been used. The Trust incorrectly claimed this methodology should have been used but wasn't.

In July 2011, the Trust produced a document that attempted to reproduce the Meteorological Service adjustments, but failed to, instead making lots of errors.

On 7 September 2012, High Court Justice Geoffrey Venning delivered a 49-page ruling, finding that the NZCSET had not succeeded in any of its challenges against NIWA.

The judge was particularly critical about retired journalist and NZCSET Trustee Terry Dunleavy's lack of scientific expertise.

Justice Venning described some of the Trust's evidence as tediously lengthy and said “it is particularly unsuited to a satisfactory resolution of a difference of opinion on scientific matters”.

## **Taxpayers left to foot the bill**

After an appeal that was withdrawn at the last minute, late last year the NZCSET was ordered to pay NIWA NZ\$89,000 in costs from the original case, plus further costs from the appeal.

But just this month, we have learned that the people behind the NZCSET have sent it into liquidation as they cannot afford the fees, leaving the New Zealand taxpayer at a substantial, six-figure loss.

Commenting on the lost time and money involved with the case, NIWA's chief executive John Morgan has said that:

On the surface it looks like the trust was purely for the purpose of taking action, which is not what one would consider the normal use of a charitable trust.

This has been an insidious saga. The Trust aggressively attacked the scientists, instead of engaging with them to understand the technical issues; they ignored evidence that didn't suit their case; and they regularly misrepresented NIWA statements by taking them out of context.

Yet, their attack has now been repeatedly rejected in parliament, by scientists, and by the courts.

The end result of the antics by a few individuals and this Trust is probably going to be a six-figure bill for New Zealanders to pay.

My former colleagues have had valuable weeks tied up with wasted time in defending these manufactured allegations. That's time that could have profitably been used investigating further what is happening with our climate.

But there is a bigger picture here too.

## **Merchants of doubt**

Doubt-mongering is an old strategy. It is a strategy that has been pursued before to combat the ideas that cigarette smoking is harmful to your health, and it has been assiduously followed by climate deniers for the past 20 years.

One of the best known international proponents of such strategies is US think tank, the Heartland Institute.

Just to be clear: there is no evidence that the Heartland Institute helped fund the NZ court challenge. In 2012, one of the trustees who brought the action against NIWA said Heartland had not donated anything to the case.

However, Heartland is known to have been active in New Zealand in the past, providing funding to the NZ Climate Science Coalition and a related International Coalition, as well as financially backing prominent climate “sceptic” campaigns in Australia.

The Heartland Institute also has a long record of working with tobacco companies. Earlier this month, the news broke that major tobacco companies will finally admit they “deliberately deceived the American public”, in “corrective statements” that would run on prime-time TV, in newspapers and even on cigarette packs.

It’s taken a 15-year court battle with the US government to reach this point, and it shows that evidence can trump doubt-mongering in the long run.

A similar day may come for those who actively work to cast doubt on climate science.

# Nuclear waste is safe to store in our suburbs, not just the bush



Ben Heard



Barry Brook

Ben Heard  
and Barry W. Brook

Right now, radioactive material is stored at more than 100 locations in cities and suburbs across Australia. Yet after the withdrawal of a proposed remote site for a “nuclear waste dump” at Muckaty Station in the Northern Territory, we’re back to square one to find a longer-term nuclear waste site.

Instead of trying to dump the dump on one remote community, we should be looking in our own backyards — including in the suburbs of our biggest cities — to solve Australia’s growing nuclear dilemma.

## **Mucking up the process at Muckaty**

After years of debate, last week’s withdrawal of Muckaty Station as a possible nuclear waste site was the inevitable outcome of a flawed process.

By failing to trust average Australians for so many years, successive federal governments have been unwittingly co-opted into the role of villains in an orchestrated campaign of radiological fearmongering.

Nuclear technologies are used all over the world, and bring great benefits in generating zero-carbon electricity, as well as applications in health science, food hygiene, industrial processing and fundamental research. Many of those technologies are in use

here in Australia, including at hospitals and at ANSTO's OPAL reactor in Lucas Heights, 40 km south-west of Sydney's city centre

Radioactive waste is not automatically more hazardous than other waste. Indeed, it is demonstrably less hazardous than the organo-chlorine pesticides, poly-chlorinated biphenyls and heavy metal mixtures that also feature in Australia's hazardous waste portfolio.

Our radiological waste is produced for good reasons. The most radiologically hazardous waste is the result of producing life-saving diagnostic medicines (radio-pharmaceuticals) that are essential in our health-care system.

That's why we need a centralised facility to house our waste in Australia. Fortunately, this material is relatively small in volume: about 4,500 m<sup>3</sup>, or roughly the volume of a couple of Olympic swimming pools for the entire country. That waste is predominantly lightly contaminated soil, mostly relatively low in hazard, and well understood, with mature techniques for treatment and storage. These are quantifiable facts and it is an entirely manageable problem.

But our point is this: if the authorities know, as we know, that this waste stream just isn't that dangerous, why outback Muckaty or similarly remote sites in the past?

How have we ended up with a process that includes only one site, with that site in the middle of nowhere? What message does that send to every Australian about this waste stream?

"Wow. It must be really, really dangerous if we have to put it there."

And if that's the message, what might any Australian with an interest in the land in and around Muckaty think about ending up with the facility in their backyard?

"How completely unfair. No way!"

The irony is that while the first statement is dead wrong, the second statement is quite reasonable.

Our cities are already home to nuclear waste.

When dealing with any controversial issue — especially something as emotive as a nuclear waste “dump” — fairness eats facts for breakfast.

Once a process is popularly perceived as “unfair” and the proponent perceived as untrustworthy, the facts about the hazard itself are irrelevant. So, why have successive Australian governments from both major parties seemed hell-bent on starting a process from that impossible position?

Most of our radioactive material can and should be transported and stored safely above ground in a suitably dedicated centralised storage facility for use on an intermediate basis (that is, for some decades). The identification of suitable sites for this storage facility ought to be principally a matter of infrastructure and zoning. Suitable sites for open discussion could and probably should be in the outer industrial areas of our capital cities.

That’s right. Australian capital cities.

That’s where it is stored today, at more than 100 locations in the major population centres, while it awaits long-term disposal. But this dispersed and disorganised arrangement is less than ideal; a centralised repository makes sense.

Our cities are peppered with facilities managing all manner of wastes. They range from mundane but potentially hazardous municipal garbage, to the pretty unpleasant and decidedly toxic liquid wastes from commercial and industrial facilities, to the aforementioned intractable wastes for which there is no firm solution.

We would never, as a society, consent to shipping this material from our cities to the outback. Even if we secretly wanted to, we know it would fail the fairness test. Proposing to treat one specific waste stream in this way only succeeds in tagging that waste stream as dangerous. That’s hardly helpful.

### **The French and Finnish solutions**

If a suitable intermediate site is not available in a capital city, then perhaps it could be found near a regional centre or a rural centre.

Yes, the remote option is also available in Australia. But a process that begins and ends with a remote location is, by definition, a bad process. Bad, unhelpful and completely unnecessary.

Countries that have had the good sense to deploy nuclear energy have a radiological waste stream that is larger and more hazardous than Australia's. Yet reprocessed French nuclear fuel is stored in an above-ground facility a mere 300 kilometres from Paris. We don't see Australians cancelling their trips to France.

Eventually, some of this waste material warrants more permanent disposal. At that stage, specific environmental characteristics become of paramount importance.

Over a period of decades, Finland treated their population to such transparency and respect that two communities, shortlisted from four sites, were actively competing for the right to host Finland's underground spent fuel repository. The winning town's council voted 20:7 in favour and celebrated the decision.

### **Getting it right**

Muckaty was reportedly being offered a A\$12.2 million "compensation package" for hosting the facility. Like any contract of that value, we should be opening the process up to competition.

Good, transparent process, focused on consultation, information sharing and education could identify dozens of locations around Australia that would look seriously at taking on a facility in return for a negotiated package of benefits to be shared across the community.

In this case, we are not likely to be looking at capital city locations. But it need not automatically be the most remote location possible.

Australians are as capable of making rational decisions as any other nationality. But like everyone else, our willingness to engage in a rational discussion is tied inextricably to perceptions of fairness, trust and transparency.

## A question of trust

Risk communication legend Peter Sandman says this:

The problem isn't that the public doesn't trust my clients. The problem is that my clients expect the public to trust them. They keep asking to be trusted, instead of working to be accountable so they don't need to be trusted. And the problem is that my clients don't trust the public.

So, a message to our politicians and authorities from two people who understand and are not frightened of radiation: you can't tell Australians something is not dangerous while trying to park it in the deep outback.

Many people may be wrong about the radiological hazard it poses, but they are dead right about your behaviour. It's inconsistent with perceptions of fairness, trust and transparency, and they will hang you for it, ably assisted by those ideologically opposed to all things nuclear — even sensible solutions.

The type of technical knowledge experts trade in is next to worthless when the true currency of trust is in short supply.

Until Australia's political leaders and relevant institutions are prepared to trust the bulk of Australians to engage with radiation issues as grown-ups, and until they are prepared to commit the time, resources and evidence-based practice to make this happen, they should prepare themselves to remain at the mercy of narrow and committed interests who will drive every bad process to its inevitable bad end.

## Put down the smart drugs — cognitive enhancement is ethically risky business



Nicole Vincent



Emma Jane

Nicole A. Vincent  
and Emma A. Jane

In Australia and all around the world, students, academics and professionals of various stripes are increasingly experimenting with new cognitive enhancement technologies to boost their memory, attention, reflexes, clarity of thought and ability to function well with little sleep.

In many cases, this involves the repurposing of medications that have previously been used to help the sick become “normal”, rather than to boost the well into some sort of superhuman sphere. These include controlled drugs such as Ritalin (a central nervous system stimulant usually prescribed for hyperactivity and impulse control), modafinil (a medication used for increasing wakefulness in patients with conditions such as narcolepsy) and donepezil (used to treat dementia).

Interest is also growing in transcranial direct current stimulation (tDCS) devices, which stimulate the brain using electricity drawn from nine-volt batteries. These largely unregulated and under-tested devices are said to sort out everything from depression to poor sports performance. But there are concerns that the DIY use of such “electroceuticals” may result in at-home users zapping their brains in ways that harm rather than help.

Because these techniques and technologies are new — or at least are being put to novel use — the issues that tend to get most

attention in academia and in the media relate to their effectiveness and safety.

The jury is still out on which of these techniques and technologies work, for whom they work, and how and how well they work. There is also breathtaking disagreement about such fundamental issues as: what percentage of people are using them; whether their effects are best described as “enhancement” or only as “treatment”; and what side effects they might produce.

Several recent studies report around a 30% improvement in language learning by subjects who used modafinil or tDCS over those who did not.

Other researchers, however, warn that the hype surrounding cognitive enhancement is unhelpful and possibly even dangerous. This, they say, adds to the pressure people already feel to use these technologies, even though claims about their effectiveness and safety are at least premature, if not overstated and even outright misleading.

But while safety and effectiveness are indeed important concerns, some ethico-legal issues are even more critical. Let’s imagine, for instance, that modafinil and tDCS turn out to be as effective and safe as the optimistic studies suggest; that they are as relatively inexpensive, innocuous and helpful as all those other prosaic props that regularly help us get through the day (coffee, painkillers and post-work flutes of prosecco, as just three examples).

Despite the benefits, we think there is good reason not to embrace these new technologies: namely, to ensure that cognitive enhancement does not become the new “normal”. Put another way, we don’t want to find ourselves in a scenario where mildly electrifying our brains is no longer considered a personal choice but is instead a socially and legally enforced responsibility. Yet, right now, concerns about effectiveness and safety are all that stands between us and that scenario.

## The new ‘normal’

To understand this situation, consider two examples one of us discussed recently at TEDxSydney.

In a clever article written for *Limelight Magazine* last year, the very talented and accomplished Sydney-based concert pianist Simon Tedeschi writes about how a significant portion of concert musicians nowadays use or feel pressured to use medications called beta blockers. This is to calm their nerves before recitals for jobs, and on stage to deliver the superior performances we have come to expect of them.

Off-label uses of beta blockers began quietly in classical music circles in the late 1970s when small numbers of performers began using these cardiac medications to prevent crippling performance anxiety such as slippery palms, thumping hearts and flute-unfriendly lip quivers.

But, as time passed, increasing numbers of musicians turned to these medications, to the point where this practice is becoming a new “normal”. Other concert musicians are increasingly wondering whether they too should start using beta blockers simply to keep up and remain competitive with those who already use them.

What was once a choice for a few disadvantaged people is becoming a de facto necessity for all. And this did not occur because anybody intended it to be this way, but simply because of the way in which competition (and audience expectations) works.

A second example comes from three years ago, when members of a Jetstar cabin crew complained to the media that their employer, a Thai company based in Bangkok called Tour East Thailand, was increasingly expecting them to work 20-hour shifts. The crew members were concerned that in the event of an emergency they would be too tired to be able to respond effectively and passengers’ safety could be compromised.

Imagine, though, what might happen in scenarios like this if enhancers such as modafinil turn out to be effective and safe

health-wise. Given the enormous pressure on workers to achieve ever-rising levels of productivity, there is a risk that employers might make it a condition of employment that cabin crew use such medications to remain alert for the duration of their shifts.

This would be an industrial relations nightmare: nobody should be expected to enhance themselves just to do their job.

When the debate focuses on effectiveness and safety it's too easy to overlook myriad social, political and ethical reasons to say "no" to cognitive enhancement right now. This risks dystopic scenarios where corporations use such medications to save money by demanding superhuman efforts from workers rather than simply employing more staff.

At present social attitudes towards cognitive enhancement range from fanatical enthusiasm to dismissive scepticism and frightened resistance. But these polarised reactions are likely to disappear once safety, effectiveness and equity of access can be assured.

Our worry is that — at precisely that point — cognitive enhancement will join coffee, painkillers, antibiotics and even smart phones in becoming the commonsensical and expected choice. The burden of proof will have shifted such that everyone will be expected to enhance themselves; justifications will have to be given to explain why we should not comply.

### **Enhancement as a responsibility**

Here is another way to see this point.

Imagine you are a surgeon about to perform a delicate, difficult, lengthy and ultimately risky operation, and that you could substantially improve your patient's chances of survival by safely taking a pill that would increase your wakefulness, mental acuity, perceptiveness and ability to stay focused.

If the pill really were that effective, and if it really had so few side effects, would it be a *fait accompli* that you should take it? Should you now have to take this pill to give your patients the

best chance of recovery and survival? And would you be negligent — perhaps even reckless — if you didn't take it?

When we are asked about whether we *ought* to enhance ourselves — and whether we would be responsible for any bad consequences and held responsible under the law if we don't — it's much less obvious that the answer should automatically be “yes”.

What we're concerned about is the slippery slope that might lead from enhancement being a *choice* to it being a *responsibility* — that what is initially freely chosen as a way of bettering ourselves, accomplishing more, or just making life easier and keeping up, may eventually become expected and even required. Sound unlikely? Consider hints by Queensland Health that medical staff might have a duty to fight fatigue by, among other forms of cognitive enhancement, consuming the equivalent of five to six cups of coffee a night.

Despite these sort of caffeine-friendly suggestions, judges are not likely to recognise a duty for surgeons to enhance themselves any time soon. This is a good thing. What's more, though, if we wish things to stay this way, we may need to resist the temptation to pop pills to enhance ourselves — even if the immediate benefits seem attractive. The long-term consequences may be distinctly unattractive.

### **Exercising restraint**

Advances in science and technology subtly shape our lives by gradually, and often imperceptibly, changing the moral, legal and social landscape. What we expect of ourselves and of one another also changes with the times. It changes with what we think people are capable of doing and what we think is reasonable to expect people to be capable of doing.

If we wish to retain our choice, we may need to resist the temptation to use even safe and effective enhancers.

Or, at least, if the benefits of cognitive enhancement are ultimately worth it, we should keep the conversation going about how to ensure that cognitive enhancement does not just become

the new “normal”. We must not allow our expectations to creep upwards and ultimately coerce us collectively into having to enhance ourselves.

This will require intelligent regulation of these exciting — but ethically challenging — new technologies in a way that transcends the current dominance of discussions about effectiveness and safety.



## Spritz and other speed reading apps: prose and cons

Sally Andrews

Most adults read about 200–250 words per minute (wpm), but Spritz, a new reading application that is attracting considerable social media attention, claims that most people can easily double or triple this speed without any special training.

Normally when we read, our eyes move along the lines of a text, landing (fixating) on words for a tenth to a quarter of a second, then making short jumps (saccades) to the next word.

The developers of Spritz claim that in the traditional method of reading only 20% of reading time is spent processing the content of a text and 80% is devoted to moving the eyes between words.

Their solution is to eliminate the need to make eye movements. Words are presented one at a time, beginning at the typical reading rate of 200 wpm, and the reader is encouraged to gradually increase it to rates of up to 1,000 wpm.

Sounds good, doesn't it? At that rate, you could read a novel in 90 minutes. But there are some aspects of reading that apps such as Spritz don't quite nail.

## The science of speed reading

The science underlying the Spritz technique relies on two well-established characteristics of eye movements during reading:

1. Skilled readers' perceptual span — the window of text we use during reading — is about 13 characters. This is the maximum length of word exposed in the Spritz “redicle”.
2. We characteristically land our eyes at a predictable position in the word — between the beginning and middle of the word — that Spritz refers to as the optimal recognition point (ORP).

Spritz's major innovation is to centre the word in the redicle on the ORP and highlight it in red. This is claimed to speed up reading by ensuring that the reader fixates at the optimal location to identify the word, while eliminating the time required for the reader to compute this location and move their eyes to it.

Spritz takes almost the opposite approach to increasing reading speed as the “standard” approaches to speed reading spruiked in hundreds of YouTube clips.

These methods assume that sequential word-by-word reading is the major barrier to rapid reading and advocate a variety of methods designed to break this habit and adopt non-sequential scanning strategies, such as moving the eyes down the centre of the page, that are claimed to facilitate unconscious processing of relevant information in the text.

Despite the very different ways in which they aim to achieve it, the methods do, though, have a common goal of reducing subvocalisation — saying the words in your head — during reading. In standard methods, eliminating subvocalisation is a major focus of training.

In Spritz, it is an automatic outcome of “spritzing” because the average rate of speech is less than 200 wpm, so subvocalisation cannot be maintained at rates higher than that.

## Comprehension (or lack thereof)

On the surface, Spritz is better aligned with scientific evidence about the skilled reading process than standard speed reading methods. Even skilled readers fixate on most of the content words (nouns, verbs, adjectives) in a text, although they often skip over short function words (such as “to”, “in”, “on”, “the”) and highly predictable words.

Skilled readers’ general strategy is, therefore, more similar to the sequential strategy forced by Spritz than the non-sequential scanning strategies advocated by many standard approaches to increasing reading speed. A sequential reading strategy is also important for comprehension, particularly in English where the order of words is important for meaning.

But, at a deeper level, Spritz ignores critical aspects of the scientific evidence about eye movements in reading. Most importantly, it ignores the time and cognitive effort required to integrate the words in a text for comprehension.

Although there is some truth to the claim that the relatively slow pace of eye movements reflects physical constraints on eye movements, it is primarily due to the cognitive demands of word identification and comprehension.

The time we fixate on words depends on their familiarity, predictability and length — the factors that determine the time required to identify and integrate their meanings.

We also pause at clause and sentence boundaries to conduct “wrap-up” processes that are important for effective comprehension. Removing readers’ control over which words they fixate and how long they look at them reduces comprehension.

## Reading versus speech

Systematic research conducted in the 1970s investigating “rapid serial visual presentation” (RSVP) methods that present text one word at a time found that comprehension fell rapidly beyond rates of about 500 wpm, particularly for texts longer than single sentences.

The Spritz developers' assertion that retention levels are at least as high as for traditional reading requires more detail to convincingly demonstrate that using the ORP overcomes these limits on comprehension.

Essentially, Spritz forces people to process written language like speech — one word at a time, with no opportunity to go back to check any errors in word identification or interpretation, as we do quite frequently during normal reading.

Obviously, we are very effective at understanding speech, and can apply those same skills to spritzing. But speech contains a range of additional cues, such as intonation, pauses and gestures, which all contribute to comprehension.

Speech is also usually simpler than written language and focused on well-defined topics, reducing the demands on working memory associated with its sequential presentation.

Most critically, the typical rate of speech is around 200 wpm. The convergence with the typical rate of reading may be accidental, but most cognitive scientists would attribute the similarity to the bottleneck caused by the attention and memory processes required for comprehension in both modalities.

These concerns about comprehension may be of little relevance for the social media applications that Spritz is designed for. Such content may be closer to spoken than written language in its complexity.

Spritzing may be an effective delivery mode for tweets of less than 140 characters and for small-screen devices where there is little opportunity for readers to scan text. However, the need for users to stare even more fixedly at the middle of a screen may exacerbate the anti-social impact of such devices.

### **Where to for the written word?**

Will spritzing yield transferable skills that benefit reading of standard text? The claims about extraordinary increases in reading speed with training in standard approaches to speed

reading have not survived scientific scrutiny, but the skimming strategies they teach are useful in many reading contexts.

Perhaps similar benefits will follow from Spritz users discovering that they can understand text without “saying the words in their head”. This may encourage the use of more flexible strategies in “normal” reading contexts — but Spritz reinforces a sequential approach to reading that is incompatible with the flexible, meaning-guided scanning strategy needed for effective skimming.

Perhaps most frighteningly for a reading researcher — and reader — like me, the speech-like processing encouraged by Spritz might contribute to our evolution towards the world envisaged in Spike Jonze’s recent film *Her*, in which written text has become an anachronism.

Deprived of exposure to text, readers may gradually lose the sensitivity to the structure of written language that underlies our capacity to locate the ORP for words and capitalise on the multiple cues in written text that contribute to effective comprehension.

But maybe I am just revealing my age — or smartphone envy.



## What the departure of Toyota, Holden and Ford really means for workers

Sally Weller

People change jobs constantly, and the jobs lost in car manufacturing closures are insignificant in the context of total job changes — no different to everyday job changes. So say some commentators opining on the end of car manufacturing in Australia. The problem is, they’re wrong.

In reality, car industry job losses will be concentrated in particular localities and particular occupations at particular times, creating concentrated pools of workers with similar skills and experiences vying against each other for the relatively narrow range of jobs that suit their skills and experiences. This creates a long job queue that will take a long time to disperse.

Only the most highly skilled and well-connected among the job losers will find work in jobs that use their existing skill complements. There is often a loss of skill, a loss of income in the period between job loss and eventual re-employment, and lifetime income reduction as a consequence of starting again at the bottom rung in a new occupation.

A small number of workers will flourish and do better than in their previous job; this was the case with about 2% of clothing workers but perhaps 20% of Ansett workers, for example. The concentrated nature of these job losses demands intervention to minimise adverse social impacts.

Potentially, job losses include not only the workers who are directly affected in car and component manufacturing plants, but also workers in all those firms that supply those plants, from accountants to engineering consultants to cleaners, not to mention the local stores, lunch bars and services that workers buy with their wages.

The numbers of businesses that rely on auto-related work is much larger now than it was in the 1980s after tariff cuts because in the 1980s restructuring for “lean” production outsourced non-core activities. Some submissions to the Productivity Commission last year put these employment “multipliers” at 4.4 in South Australia, suggesting that for every 1,000 car maker jobs lost, 4,400 other jobs will disappear. In Detroit, the automotive multiplier effect has been estimated at 3.6. Note that the Productivity Commission rejected the multiplier effects argument as a justification for industry assistance, but based that conclusion on the questionable authority of a staff research paper.

## Which workers will be hardest hit?

Workers who lose their jobs at a time of economic expansion fare much better than those who lose their jobs in a recession, when vacancies are scarce. The Mitsubishi and Ansett airlines workers, for example, fared better in the longer term than automotive workers who lost their jobs in the tariff-reduction related restructuring during the 1990–92 recession.

It would be helpful if policymakers tried to manage closure dates to avoid automotive job losses occurring at the same time as anticipated job losses in mining construction. At a minimum, the government needs to negotiate to ensure that Holden, Ford and Toyota close at different times. If Ford closed in 2016, Holden in 2017 and Toyota in 2018, the labour market would have longer to sift out with fewer casualties.

The employment prospects of automotive workers who are over 45 years of age are bleak, regardless of their skills. Those with poor English language skills will also face considerable challenges. Policy interventions need to be sensitive to established social structures, and not assume that workers will be in position to find jobs outside an expected stereotypical range.

Retrenched workers who live in neighbourhoods with large numbers of unemployed workers — that is, in automotive sector feeder suburbs — will have poorer outcomes in the longer term. Younger workers without dependents or financial commitments are likely to relocate, but those with teenage children or a working spouse will face insurmountable barriers to relocation. Some marriages will end as the need to work wins out over family.

In previous large-scale retrenchments, housing prices have fallen in the most severely affected neighbourhoods as housing demand stalls. Those who relocate will realise a financial loss. In addition to the costs of relocation, moving to a location where jobs are more plentiful is likely to involve higher housing costs. Costs aside, people with strong community links are disinclined

to relocate and will accept diminished occupational status instead. This outcome is a loss to the nation.

Those workers who are financially secure or who have a spouse in full-time work can usually afford to wait for an opportunity that maximises their use of skills and accords with their interests. Those in financial stress will have no option but to take any job that provides income. But careers have trajectories and the “any job” option is not the best option for sustaining a career.

Social security rules — on assets and savings — are going to penalise those former autoworkers who have saved and invested; while former colleagues who lived from week to week will qualify for full if meagre benefits. Free financial counselling for autoworkers before they finish work would help them know their position and negotiate with financial institutions regarding mortgages and loans.

### **Facing up to harsh realities**

While policymakers like to imagine that workers in “transitional” labour markets are accustomed to and comfortable with job change, in fact there will be significant numbers of mostly loyal and long-serving workers for whom job loss is going to trigger a significant personal crisis, perhaps leading to suicide.

The circumstances of the retrenchment have a lasting impact on the outcomes of mass job losses. In a nutshell, those people who believe that they have been mistreated or singled out in some way have significantly poorer outcomes. Dramatic and unexpected shutdowns and lock-outs actively produce poorer outcomes, especially for people who took out a loan the week before the event. The longer the warning of impending closure, the more time people have to adjust to the idea and plan for new circumstances before they have to cope with the reality.

The people most at risk — as the case of Ansett airlines demonstrated — are those who view their workplace as a family and rely on workmates for social interaction. A second highly

vulnerable group are employers in failing small firms who feel responsible for their workforce and carry the weight of failure. Sadly, loyalty and commitment puts workers at more risk. In the Ansett case, self-help groups of former workmates were useful. The establishment of automotive “men’s sheds” in affected suburbs would provide a venue for maintaining attachments and connecting to support services.

The adjustment has already started. The most able workers are going to be headhunted or will find better jobs quite quickly. If they are replaced, the replacement will be of a lower calibre. By the time of closure, remaining workers are likely to be less attractive to employers.

Some component manufacturers will be searching to re-orient their businesses and develop export markets, but many others will be working out ways to transfer the wealth held in their business to their personal accounts and then exit for the least cost. As component suppliers exit, supply chains will be disrupted. But lots of small closures are better in labour market terms than three major events, so this process has its benefits.

People who lose their jobs unexpectedly are likely to take about six weeks to come to terms with their situation; during that time many will feel paralysed and unable to search for work effectively. Between six weeks and six months the more employable among the workforce will have found work, although often in less skilled jobs. Between six and twelve months, the likelihood of finding work diminishes quickly, although percentages are boosted by the re-employment of affluent higher skilled workers who take longer to find and commence suitable work. After a year, the chances of finding work are poor and people tend to leave the workforce, often permanently. In short, the employment impacts of unemployment get worse over time (this is called hysteresis), which is the reason why the metaphor of “recovery” from job loss, as though it was an illness, is usually misplaced.

## **Is retraining a panacea?**

Retraining is a policy intervention with well documented benefits. But the options for retraining are not the same now as they were in the 1990s. The TAFE system is much diminished and those training for less skilled jobs would incur high costs unless there is ample assistance. People who have been out of the education system for a long time will need introductory preparatory courses before they can tackle skill retraining.

In the case of clothing workers, two years in retraining for low level vocational skills did not improve employment prospects but instead separated former workers from the labour market. The best retraining outcomes are achieved by workers who are able to turn a pre-existing hobby into a vocation (horse-training and scuba-diving, for example) and those who can upgrade existing skills at tertiary level.

Crucially, if retraining is to build on workers' pre-existing skills, then it should not be targeted in "skills-in-demand" areas. Experience shows that taking groups of retrenched workers and training them all in the same occupation (security guard, forklift driver) puts them exactly where they started: competing with each other for a small number of jobs.

## **Has anyone seen the 'better jobs'?**

Some commentators have characterised the car industry closures as unleashing a round of creative destruction that will drive the growth of new industries and create new jobs. For that to be true, it is necessary to assume that existing investments in the car industry somehow inhibit the growth of other "better" opportunities. This is bunkum: if there were investment opportunities in these other sectors, the investments would have happened regardless of the automotive sector. In fact, spillover arguments would suggest such investments are now less likely without the critical mass of the automotive sector.

There is currently no obvious new job generator in the Australian economy except for domestic construction and infrastructure projects. This does not bode well for the future in Victoria and South Australia.



## Superannuation is too costly, so bill me

Alan Kohler

The main reason superannuation costs are too high in Australia is both simple and horrendously complex: it's the only service we buy where we give the service provider our money to look after.

It's true that we also give our money to banks, but mostly, especially when we're young, the banks give us money as loans.

The fact that super funds, and the investment managers and wealth advisers who run them, hold our money for us allows them to simply take some of it every month as their fee.

Everyone else has to send us a bill.

This might sound too obvious to even bother mentioning, but that system has two very powerful hidden effects:

1. The providers of investment services get to charge a percentage of the money, and almost nobody understands percentages and even fewer understand the power of compounding.
2. Since the fee is usually a fixed percentage of the client's account balance, it increases at the same rate as the balance, which is in turn being fed by the sum of investment returns and all contributions — mandatory and voluntary.

## Compounding fees

As a result, super and investment fees compound at several times the rate of inflation but the customers barely see what's happening, and those that do, don't understand it.

Say you're 25, earning \$50,000 and you start with \$1,000 balance in super. And say the fee is 1% (actually by the time you add in advice and investment management it's probably more like 2%, but let's stick with 1% for simplicity).

That 1% produces a \$10 fee. In the following 12 months you contribute 9% of your salary, or \$375 per month. On top of that the fund manages a return of 10% on the average balance.

At the end of the year your balance will be \$5,950 — marvelous. New fee: \$59.50 — a six-fold increase.

Next year, you got a pay rise of 5%, which means your contributions increased to \$393.75 per month, or \$4,725. Once again, the fund earns you 10%, so at the end of the year your new balance is \$11,506. New fee: \$115.06 — nearly twice last year's fee.

Obviously, that escalation in fees is dramatic because the balance started from a low base. That means, by the way, that people with low balances who are just starting out are subsidised by those with more money in their accounts, and that's the best thing about the percentage fee system.

So, let's look at the same metrics for someone more established in the workforce, with \$100,000 in super and a salary of \$100,000 a year.

First year fee is \$1,000 (1% of \$100,000). Next year, assuming 9% of salary in contributions and a 10% return on the average balance, the fee is \$1,194.50 — an increase of 19.45%.

Next year's fee, assuming a 5% salary increase and another 10% investment return, is \$1,336.25, 12% more than last year. And the year after you get a promotion! Salary goes to \$120,000 and contributions to \$10,800 for the year. Your new super balance is a very healthy \$158,270. New fee: \$1582.70 — an 18% increase over last year.

## **And yet we comply ...**

Do you ring and complain about being gouged? Well, no, because the fee is still 1% — it hasn't changed. And you're feeling good about the rising balance, so why complain? And anyway, you probably don't even know. The fee statement is there somewhere, but you never pay much attention to it.

There are two things to think about here. First, your salary is increasing by 5%, so it's a fair bet that the super fund's staff are also getting the same sort of pay rises, possibly less.

Yet the fees are increasing at 2–3 times that rate because the law requires us to contribute 9% of salary and because investment returns usually average about three times the inflation rate as well, simply as a result of the rising stockmarket (not the super fund's brilliance). That's the whole point of investing in shares — they return 2–3 times inflation over time.

Second, with \$150,000 in super you're probably paying 2% in management and adviser fees (not 1%), which is \$3,000 a year, or \$250 a month. Some people have account balances of \$500,000, especially when they retire, and pay fees of \$10,000 a year, or \$833 a month.

Think about how many services you pay \$800 a month for, month after month, year after year, or even \$250 a month for that matter.

## **What can be done?**

Super funds hate this description, but superannuation is a utility, like gas, electricity or the phone; in fact it's more so — a government-mandated utility.

What's more, you don't get much for the money — basically super funds put the money into large companies and ride the market up and down. This year's winner is next year's loser, and vice versa, and there's no way of telling the difference between them.

Yet, not only is it almost certainly the most expensive service you buy, the cost of it compounds at several times the inflation rate every year and the providers don't have to send you a bill like the other utilities — they just quietly take some of your money each month.

And remember that the prices charged by gas, electricity and communications companies are regulated by the ACCC, which actually determines what return on capital they're allowed to make. Super fees are not regulated at all.

So, to control the ballooning cost of super, three things should happen:

- Super funds and their advisers must be told to stop skimming the accounts for their fees, and to send a bill instead that we have to actually pay.
- The costs of compliance and regulation need to be brought down, which the government is trying to do.
- The fees that super funds charge, and the profits they make, should be regulated, just as other utilities are regulated.

On second thoughts, perhaps only the first of those would be needed.

If we started getting a bill for \$500 a month from our super fund, the price would quickly come down because customers wouldn't pay it ... especially when the share market was falling and along with it all the account balances.

Yes, stop making the super funds disclose the fees they skim, make them send us a bill instead.