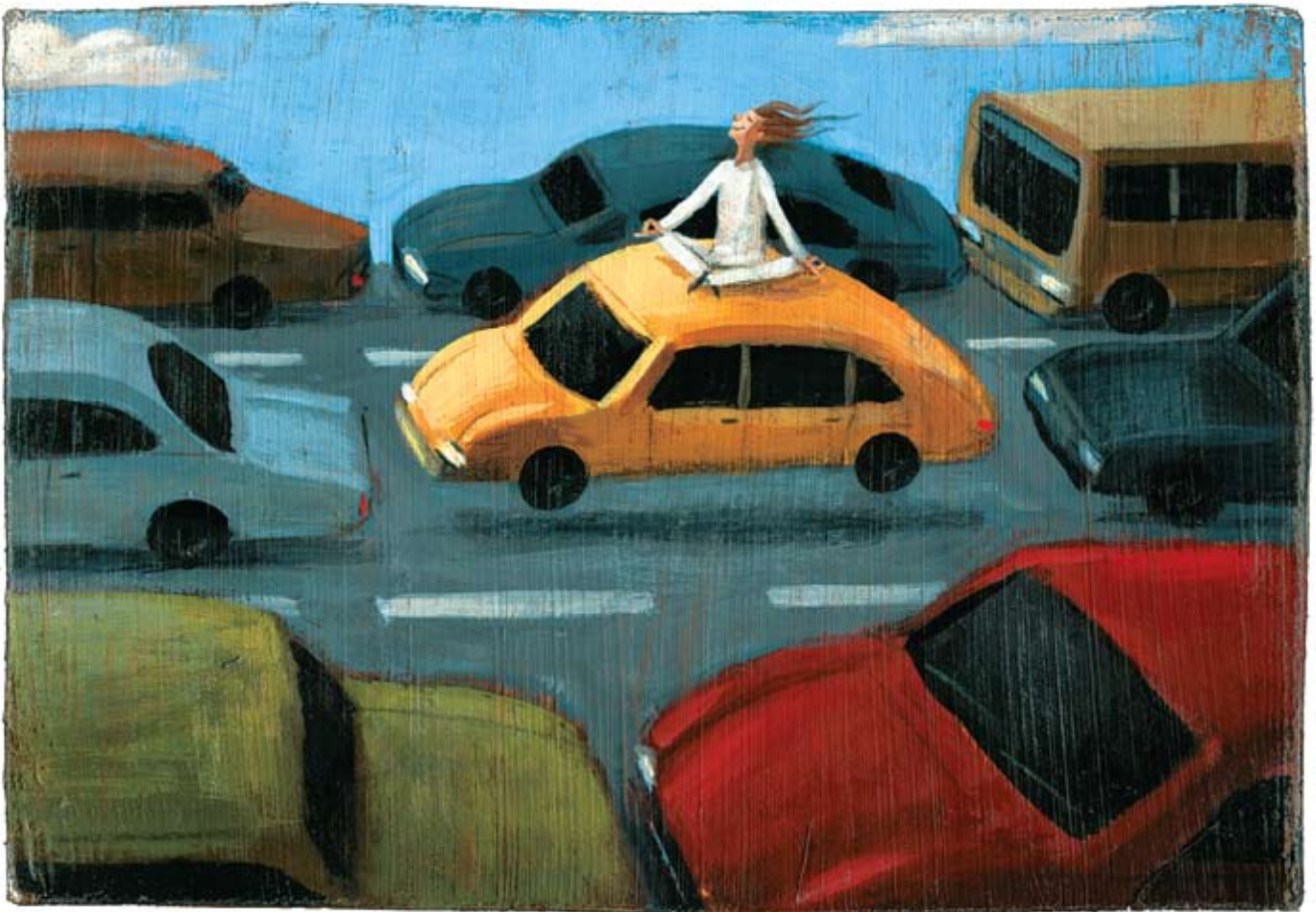


Traffic Shockwaves

Science has new theories about gridlock

by Lisa Ricciotti • illustration by Steve Adams



Living in Saskatchewan has its benefits, including no traffic jams.

But if you happen to find yourself stuck in bumper-to-bumper traffic on your out-of-province roadtrip this summer, a bit of gridlock knowledge just might help ease the pain. Firstly, think of Japan. That's where Nagoya University's Dr. Yuki Sugiyama has solved the mystery of why traffic jams occur. Sugiyama's research shows that when the loss of momentum so maddening to motorists can't be blamed on the usual suspects (collisions,

construction or stalled vehicles), the cause is attributed to drivers themselves. Or more specifically, traffic jams are caused by fluctuations in drivers' speeds on maxed-to-capacity roads.

As Sugiyama puts it: "When a large number of vehicles, beyond the road capacity, are successively injected into the road, the

density exceeds the critical value and the free flow state becomes unstable." Translation: traffic jam.

It sounds like a "Well, duh!" conclusion, but Sugiyama puzzled over the traffic jam dilemma for more than a decade by building on a mathematical model of traffic flow called shockwaves, developed around 1990.

Its premise: just one small event, a driver slowing in dense traffic, for example, can have far-reaching consequences – including massive snarl-ups. Sugiyama's team recently went into the record books as the first researchers to prove the ripple-effect theory in real life. But the question still remains: how to avoid traffic jams?

Think Like a Road Engineer

The challenge: Efforts to smooth traffic flow through improved road design help, but reducing vehicle density is most important. That's the conclusion some experts have drawn from Sugiyama's research, noting that speed variations create shockwaves in heavy traffic but have little impact when

cars are spread out.

Solution: Build more roads – lots of them. Over the past 20 years, the number of passenger vehicles in Canada has increased by 60 per cent. The increase in roadways for the same period? Twenty per cent.

Think Like an Environmentalist

The challenge: Adding more roads is a band-aid solution. Focus on a real fix – reduce the need for cars by getting drivers off their auto addiction.

Solution: Commuters need to opt more often for public transit, biking, carpooling and living within walking distance of their work. And cities need to build more LRTs, not more highways.

Think Like an Android

The challenge: The problem is obvious: humans. Robot-driven vehicles are programmed to automatically maintain the same speed and distance from each other; human-driven vehicles aren't.

Solution: Equip vehicles with drive-by-wire technology (adaptive cruise control, a.k.a.

ACC). Sophisticated electronics and radar automatically adjust vehicle speed and distance settings between moving vehicles. No fluctuations + no sudden braking = no jammin'.

Think Like a Buddhist

The challenge: The aftermath of shockwaves isn't just jams. Commuters suffer extra stress from extended travel times, which on average grew by 17 per cent between 1992 and 2005. Health-care professionals are now seeing a link between rising respiratory diseases and rising car emissions, along with higher obesity rates from prolonged car usage. Lost productivity to businesses: between \$2.3 and \$3.7 billion annually. Cost of wasted time per average commuter: \$521 a year, according to a recent B.C. study.

Solution: Think Zen and find the road less travelled. Don't block road energy: slower drivers keep right.

Think Like a Geek

The challenge: 470 to 570 million litres of fuel are wasted annually in big-city traffic jams, producing 1.2 to 1.4 megatonnes of

greenhouse gas emissions each year.

Solution: Befriend technology by tapping into GPS systems that deliver real-time traffic maps via cellphone, then plan the best route before departure by asking the GPS to chart an appropriate course. Globis Data, for example, recently launched its system in Ottawa and also offers Toronto traffic info at drivesmobile.com.

Think Positive

The challenge: If drivers cause traffic jams, then drivers can play a part in prevention.

Solution: Allow more travel time. Above all, don't add to the problem with bad driving. Impatient lane jumpers often cause sudden braking, which in turn can cause rear-enders that bring already slow traffic to a standstill. Keep vehicles in good repair; idling in stop-and-go traffic is hard on an engine, causing overheating in summer and wasting fuel at any time of year. The no-jammin' goal: smooth, consistent speed with a minimum of erratic changes. ▣

i To observe how Dr. Sugiyama proved the shockwave theory of traffic jams, see video at youtube.com/watch?v=Suugn-p5C1M

