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THE POWER OF WALKING

Be it ever so humble, there’s still nothing that beats our most basic form of local motion

By Bruce Grierson
Illustrations by Aaron Leighton
LAST YEAR, Max Donelan, a professor of kinesiology at Simon Fraser University in Burnaby, B.C., received a prestigious Michael Smith Foundation grant for his research into how to help stroke victims walk again, or walk better. (It turns out that walking after you've had a stroke takes twice the energy it did before, and no one is quite sure why.) But that work isn't what has made Donelan a little bit famous. The big bang, publicity-wise, was the device that was sitting on the table the day I met him recently in the "locomotion lab" on campus.

It looks a bit like the brace a physiotherapist fits you with after you tear up important things in your knee skiing. Donelan calls it a "bionic energy harvester." What it does is extract power from people as they walk, by tapping the natural braking action that leg muscles engineer at the end of each stride. Turns out you can capture at least seven continuous watts of power this way—which is plenty to run your iPod or cellphone, or to charge lights or an emergency radio that a soldier or rescue worker might need in the field if the electrical grid is down. (The first large-scale client of Bionic Power Inc.—the company spun off to sell the device commercially—is the Canadian military.) And here's the thing: it doesn't feel like you're working any harder to do it. It is energy for free.

Possibly against his better judgment—for there is more R & D money and person-hours in this thing than I could pay back in my lifetime if I broke it—Donelan let me try the generator out. I strapped it on over my pants, at the knee. It was light (around two pounds) and comfortable. I strode out of the lab, past students so deep in concentration for mid-terms they didn't hear the soft whirring of the little plastic gear in the prototype. As I walked, I thought about the implications of the device, and it felt like I was stepping into the future.

MAX DONELAN THINKS about walking more than most of us do. But maybe now's the time for everybody to give this humble activity its due. At a historical moment when we're trying to free cities from the grip of cars and return them to pedestrians, it makes sense to have another plank in the argument: not just why cars are bad, but why walking is so good.

But is it? Actually good? Well, we know about the health benefits—all that low-impact, modest heart work, yadda yadda. But walking delivers all sorts of other things you can't get any other way.

For instance: it helps you know how mad you are. The Inuit have a tradition of encouraging anyone who's really really upset to just start walking, the writer Lucy Lippard notes. You walk and walk, in a straight line, until you've walked the anger out. Then, when you no longer feel mad, you pound a stake into the ground. The distance between that stake and home is the size of your anger. It's not a bad thing to know.

Some people believe walking helps prevent cancer—indeed, the Chinese walking meditation Guolin Quigong, named after the Taoist Chinese woman who supposedly beat inoperable cancer by walking hours a day, has millions of daily practitioners. That's a claim, however slippery, that I've never seen attached to, say, running.

And that's just the effects on the body. For working out ideas, there's no better activity than a lazy hike. (Who ever heard of a Socratic jog?) Not long ago, a psychologist in Manhattan named Clay Cockrell grew frustrated trying to book appointments with a busy broker client and so agreed to meet the fellow and conduct the session on the fly as he walked across town. It worked so well that he has moved his entire practice outside. He even changed the name of what he does: "walk-and-talk therapy." The mind seems to work best at five kilometres an hour, as author Rebecca Solnit put it. At that speed—well below the pace of 90 per cent of modern life—it falls in tune with "the unwilled rhythms of the body, to the breathing and the beating of the heart," and the quality of the thought that emerges is hard to capture any other way.

At least sometimes. Often enough, when the mind isn't ready to brew a great thought, it'll brew some plonk in the vacuum. These are the earworms that every hiker has experienced, songs that lodge in the brain, and loop. On
long walks. Thoreau found himself “mechanically repeating some verse of the Robin Hood ballads.” Colin Angus, the Comox, B.C.-based adventurer who circumnavigated the globe on human power alone, says that on the 650-kilometre walking leg of the journey, across Siberia, his skull echoed with the lyrics “I would walk 500 miles” by the Proclaimers.

At hiking speed, and maybe only at hiking speed, the landscape registers on our senses in a way that produces an accurate psychological map of the ground we have covered. So you could say that when people stopped walking and invented other ways of getting places more quickly, that was when we started becoming “lost,” in space and time.

“We weren’t evolved to ride the bus or an airplane, but we were evolved to walk,” Colin Angus told me recently, “so only when you’re walking does the mind have a full comprehension of what you’ve done and where you’ve been.”

![Image: Walking is preposterously simple. It is in some sense a mindless activity, but it’s the farthest thing from simple to reproduce. Which is why today’s walking robots aren’t very close to the real thing.](image)

The walking bits of Angus’s odyssey were by no means the longest portions of the trip, but they were the most primal. On the Siberian marshland the group—at that point it was Angus and a friend and a Russian interpreter—were freestyling out there, carving a line where no previous tracks showed a way, like doodling on a blank sheet of paper. They walked until they were tired and then they stopped. The only deadlines were imposed by hunger, just as would have been the case for hunters a million years ago. *(Gotta be at the river by Friday, because that’s when the caribou will be crossing.)*

“If you were stripped of everything you had and plopped naked in the land, there’s only two things you could do: one is walk and the other is run,” Angus said. And you couldn’t run for long. Out there, to Angus, walking felt like the absolute denominator of human activity. “Down to the muscles and joints, it’s what we were built for.”

**IT’S WHAT WE WERE BUILT FOR.** That could be the tagline of an international conference that Max Donelan will be co-hosting at Simon Fraser in June. The event is a kind of mixer for experts in human locomotion. It will attract scientists working with patients who don’t walk (well) and scientists trying to build robots that do. The theme is “dynamic walking.”

What is dynamic walking?

“The easiest way to explain what it is is to show what it isn’t,” Donelan said, after walking dynamically, if a wee bit gingerly, to his office down the hall. (Donelan broke a rib mountain biking on the North Shore’s Fromme Mountain, which led to a ruptured disk that would require surgery.) He sat down at the computer and brought up a YouTube clip of a robot called Asimo, which was created by engineers at Honda. Asimo may be the world’s smartest and most sophisticated walking robot—the sort that will soon be bringing Japanese businessmen their pipe tobacco in bed. In the clip, Asimo strides across a stage, wearing a huge backpack that houses its batteries. (Asimo is an undignified energy hog.) The robot starts up some stairs, slowly, deliberately, like a teenager past cute being creeping to his bedroom and trying not to make the steps creak. It walks like that because its programmers aimed to make it as stable as a chair at every step. The action doesn’t look quite human—because it isn’t. “It’s incredibly impressive,” Donelan said, “but a lot of us think that there’s an essence to walking—perhaps the main thing about walking—that this misses.”

A human being walking is actually the opposite of an energy hog. Evolution created an economical way for us to get around by letting gravity do most of the work. We fall forward and catch ourselves, over and over.

Donelan brought up another YouTube clip now, by way of comparison. Here was a different walking robot, built almost 20 years ago, just down the hall here at Simon Fraser, by a then-assistant professor of kinesiology named Tad McGeer. McGeer is the son of former British Columbia cabinet minister Pat McGeer, and though still a young man, he’s considered the godfather of dynamic walking, because of this invention. In the demo, a sim-
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ple robot ambles across a low table in a way that does look human. But hang on. Where’s the motor? There is none. Turns out the table is slightly inclined, and it’s the natural momentum of the swinging gait that propels the robot forward, like a kind of walking Slinky. There’s no source of propulsion, and no brain. McGee called this “passive dynamic walking.”

McGeer has since moved on to other things—he’s now designing autonomous unmanned aircraft, including one that flew from Newfoundland to Scotland on a dollar and thirty-five-cents’ worth of gasoline. But his original robot moved forward on the trajectory he had abandoned, in the sense that it inspired every inventor who is coming to the conference. One presenter, a Cornell engineer named Andy Ruina, developed a walking robot that’s stable only when it’s on the move. If it stands still, it falls over. But get it walking and it’s unflappable in its perpetual forward-falling, as if demonstrating the Taoist idea of seeking stillness in motion. It has walked farther in one go than any other walking robot, and it has done so with only a few crude sensors standing in for a noggin.

That’s the element of all of this that’s so intriguing. On one hand walking is preposterously simple. It is in some sense a mindless activity. Ultrasonic images of 17-week-old fetuses “walking” in utero suggest the impulse to walk is there even before our spine and midbrain are formed. So simple is walking—to do, to appreciate—that we take it for granted. But it’s the farthest thing from simple to understand well enough to reproduce. Robots like Asimo do things that robots like Andy Ruina can’t (and vice versa), but neither are really very close to the real thing. “It’s funny,” we can make computers that beat the world’s chess players, and yet the best walking robots aren’t much better than a toddler,” Doneelan says. “We put a man on the moon before we had any idea how he moved once he got there.”

The two competing approaches to building robots that walk reveal a bigger divide. They represent fundamentally different ways of thinking about nature. One—the Honda way—says we should use our technology to beef nature up. The other—the McGee way—says we should learn from nature in order to beef up our technology. We think of scientists being in one camp or the other, but it’s not at all clear which is the right path, and sometimes they flip flop. The late, famed aeronautics engineer Paul MacCready once cooked up something he called “Technalegs”—basically a set of robotic legs that attach to your own legs and sort of shadow their every movement. He figured they might really make life easier for, say, hikers. “With Technalegs you can carry an 80-pound pack more easily than pushing the weight on a bike,” he gushed in the early going. Iron Man, baby! But the problem with limbs or exoskeleton suits that amplify our own power is that it takes power—humongous amounts of it—to run them: not exactly a less-is-more concept (which maybe is why MacCready, who in the latter years of his life was all about less is more, ultimately abandoned it.) A world with Technalegs is not necessarily a better world, except inasmuch as Robert Downey Jr. can get to the gym faster.

There’s still no firm consensus about why we walk, why we rose up from all fours in the first place. One long-sivering theory, the “Savannah hypothesis,” held that when climate change denuded the jungle, our ancestors suddenly had to cover vast stretches of bald land, and the fastest way to do it was upright. If that’s true, then there was nothing inevitable about walking, design wise. (And, indeed, if you suffer lower back pain, it’s tempting to say there was a flaw in the blueprints.)

But these days, the Savannah theory is out of fashion, trumped by others like the wading hypothesis,” which suppose that walking grew out of paddling in the transition from sea to land. By these lights, walking is a perfectly elegant evolutionary solution. It is freeware, bestowed from nature to us. We can tap it for free power, or crib notes to build robots that probe the surface of Mars, or learn lessons in energy-efficiency that will show the way forward in the age of peak oil. But we can’t improve on it.

“I have a constant internal battle about whether I want more technology in my life or less,” Max Doneelan says. “But McGee’s work suggests that sometimes the best thing is to get out of the way of what the body is already doing.”

Bruce Grierson wrote about Vancouver’s North Shore Rescue team in our May issue.