

**HUMANITY'S OLDEST COUSIN**  
Earliest known primate evolved in hothouse world

# NewScientist

WEEKLY 8 June 2013

*I think he knows  
my secret*

*When is my phone?*

## MIND

How we get inside other people's heads. *And why some of us are better at it than others*

## READERS

*She won't know  
where her keys are*

*If I laugh she'll think  
he's funny*

*Do you think I'm right?*

*He wants me to leave*

*He thinks she loves him*

*He wants us to think  
that she likes you*

*Do you love me as much  
and for as long?*

*Why are you doing this?*

## GOLDBLOCKS PLANET

Earth's just right for life - but for how much longer?

### EXOSKELETON RISING

Man with severed spinal cord walks with his thoughts

### WATER EATER

The bacteria that changed the world

### PYRAMID SCHEMERS

Egypt's lost city of bean counters

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Earliest primate evolved in a hothouse world



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Cover image  
Darren Hopes

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One of them must go - but which?

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# Get your move on

An exoskeleton is helping people without the use of their legs to walk again - using thought alone

Helen Thomson, Rome

TWO years ago, Antonio Melillo was in a car crash that completely severed his spinal cord. He has not been able to move or feel his legs since. And yet here I am, in a lab at the Santa Lucia Foundation hospital in Rome, Italy, watching him walk.

Melillo is one of the first people with lower limb paralysis to try out MindWalker - the world's first exoskeleton that aims to enable paralysed and locked-in people to walk using only their mind.

Five people have been involved in the clinical trial of MindWalker over the past eight weeks. The trial culminates this week with a review by the European Commission, which funded the work.

It's the end of a three-year development period for the project, which has three main elements. There is the exoskeleton itself, a contraption that holds a person's body weight and moves their legs when instructed. People learn how to use it in the second element: a virtual-reality environment. And then there's the mind-reading component.

Over in the corner of the lab, Thomas Hoellinger of the Free University of Brussels (ULB) in Belgium is wearing an EEG cap, which measures electrical activity at various points across his scalp. There are several ways he can use it to control the exoskeleton through thought alone - at the moment, the most promising involves wearing a pair of glasses with flickering diodes attached to each lens.

Each set of diodes flashes at a different frequency in the wearer's peripheral vision. The light is processed by an area of

the brain called the occipital cortex. Measurements from this part of the brain can detect whether Hoellinger is concentrating on the left diode or the right. He shows me how concentrating on the left starts the exoskeleton walking, while concentrating on the right stops it. All this happens in under a second.

Melillo isn't wearing the cap

right now, because the team has hit a snag. When the exoskeleton moves, its motors induce electrical noise in the EEG signal, making the readings unreliable.

So instead of mind control, Melillo is walking by moving his upper body. As he leans left, a pressure sensor just above his buttock registers the movement and moves the opposite leg of the exoskeleton. He repeats

the process on the other side to begin walking. "It's great, such an amazing sensation," he says. "Not just walking but even being able to stand upright."

Two days after my visit, the team identified flickering frequencies that are less affected by the mechanical noise and filmed a researcher controlling the exoskeleton with his mind alone (see video at [bit.ly/exowalk](http://bit.ly/exowalk)).

The team plans to spend another five years refining MindWalker with an eye towards building a commercial product. "We're going to make it more lightweight and smooth out the movements," says Jeremi Gancet of Space Application Services in Zaventem, Belgium, a deputy coordinator on the project, "and possibly even incorporate it all into a pair of pants to make it a little less 'Robocop'."

They also want to ditch the glasses with the flashing diodes. A team led by Guy Chéron at ULB has identified the brain activity that corresponds with the intention of walking. This activity

**"We're hoping to incorporate the exoskeleton into a pair of pants to make it a little less 'Robocop'"**

occurs about a second before you actually move and can be identified by EEG signals from the motor cortex. The team can even distinguish between the intention to walk quickly or slowly.

The creation of an algorithm that can recognise these signals reliably opens up the tantalising possibility that much more intuitive walking control could be given both to people who are paralysed and to those who are completely locked-in, unable to move even their eyes.

After some tentative first steps, Melillo is looking more confident. He won't be swapping his wheelchair for a MindWalker just yet, but hopefully one day. "It's great finally being able to look people in the eye," he says. ■



Step by step