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

WEEKLY 8 June 2013

Tilliak be knows my secret

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

He wants us to think that she likes you

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

EXOSKELETON RISING

Man with severed spinal cord walks with his thoughts

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The bacteria that changed the world

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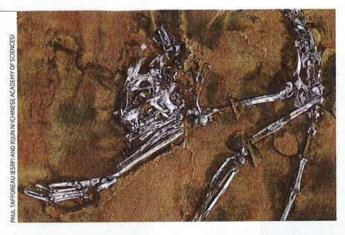
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News

Our oldest cousin

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On the cover

Mind readers

How we get inside other people's heads

Cover image Darren Hopes

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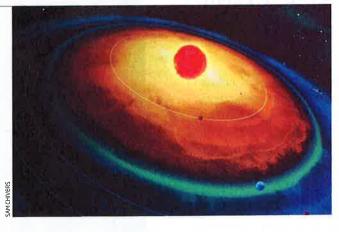
- 40 Goldilocks planet How long will Earth be just right for life?
- 19 Exoskeleton rising Walking by thought
- 44 Water eater World-changing bacteria
- 11 Pyramid schemers Egypt's lost city



Features

Goldilocks planet

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



Coming next week...

Space vs time

One of them must go - but which?

News

6 UPFRONT

First crowdsourced space scope. Turtle conservationist murdered. Modified wheat on the loose. Central Europe drowning

THIS WEEK

Hungry alga is relic of first photosynthesis. Egypt's lost city of bean counters. Deadly skin cancer reversed by immune therapy. Could CO₂ emissions hold back the deserts? Time cloak deletes chunks of history. Genes for intelligence evade largest ever study

10 INSIGHT

Testing a provocative theory of everything

IN BRIEF

Mars radiation risks. Universal flu antibody. Avatars help banish voices of schizophrenia. French wine has Italian origins

Technology

19 Mind-controlled exoskeleton. Phones listen in on illegal loggers. Predict weight from a face. Object recognition. Maps that know you

Aperture

24 Sunflower-like reflectors that follow the sun

Opinion

- 26 Work worries Michael Blastland and David Spiegelhalter on the fear of losing your job
- One minute with... Didier Queloz The continuing hunt for other worlds
- 28 Firing line Free will is real, says Peter Ulric Tse, if we look at neurons another way
- 30 LETTERS Martian holiday. Nuclear free

Features

- **32** Mind readers (see above left)
- **36** Code red Computer software is plagued by bugs - but fixes are on the way
- 40 Goldilocks planet (see left)
- **44 Water eater** The bacteria that changed the world

CultureLab

- 48 Unholy alliance Much modern thinking on the environment originated in the cold war
- 49 Being human What makes us unique? Take your pick of some wild and wonderful ideas

Regulars

- **EDITORIAL** It's time we all learned how to program our world
- **30 ENIGMA**
- 60 FEEDBACK The weight of money
- 61 THE LAST WORD Hot youth
- 50 JOBS & CAREERS





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 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

right now, because the team has

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

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



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).

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