Magazine

Human echolocation: Using tongue-clicks to navigate the world

By William Kremer
BBC World Service

12 September 2012 | Magazine

Daniel Kish has been blind since he was a baby but that hasn't stopped him living an incredibly active life that includes hiking and mountain-biking. To do this, he has perfected a form of human echolocation, using reflected sound waves to build a mental picture of his surroundings.

When Daniel Kish clicks his tongue, the world answers back.

Cars, trees, doorways, bollards on the pavement… all are identified and mapped in his brain using

In today's Magazine

How I got rich beating men at their own game

Top

Rebe
Syrian
city a
evacu
27

'Old
envo
36

'Tho
US p
1 h

information gleaned from a series of sharp little taps of his tongue against the roof of his mouth, two or three times a second.

From an early age, the Californian developed a sonar technique which allowed him to navigate using echoes from repeated tongue-clicks. The skill has led to him being dubbed a "real-life Batman" - a description he welcomes.

"It is the same process bats use," he says. "You send out a sound or a call and sound waves are physical waves - they bounce back from physical surfaces.

"So if a person is clicking and they're listening to surfaces around them they do get an instantaneous sense of the positioning of these surfaces."

The echoes from his clicks inform Kish about an object's distance, size, texture and density. It's enough for him to differentiate between, say, a metal fence and a wooden fence.

"It's not that I can really tell metal from wood, but I can tell the difference between the arrangement of structures," he says.

"For example, a wooden fence is likely to have thicker structures than a metal fence and when the area is very quiet, wood tends to reflect a warmer, duller sound than metal."

But, he adds, conditions really have to be right to discern this reliably.

Echolocation has allowed Kish to pursue outdoor hobbies such as hiking, despite being totally blind. Kish also says echolocation allows him to engage aesthetically with the world.

"The sense of imagery is very rich for an experienced user. One can get a sense of

Do smoke-free stoves really save lives?

The mothers who are pressured to give up their children

The model changing the face of fashion

Find out more

- Daniel Kish spoke to Outlook on the BBC World Service

Listen to his interview on Outlook

Browse the Outlook podcast archive

More from BBC World Service

beauty or starkness or whatever - from sound as well as echo," he says.

"Even architecture has some distinction. One can click at a building, for example, and hear whether or not the building is ornamented or featureless."

Kish now devotes almost all his time to training other blind people in his technique, which he calls FlashSonar. More than 500 students in at least 25 countries have taken the course which is run by not-for-profit organisation, World Access for the Blind.

On one level, there is nothing revolutionary in human echolocation. Emma Tracey, who writes for the **BBC's Ouch! disability blog** and has been blind since birth, says all blind people use sound as they move around in their daily lives.

This can vary between "passive echolocation", in which incidental echoes are used to help navigate, and "active echolocation", in which the subject emits a noise in order to produce echoes - whether it be a click of a tongue or a tap of a cane.

"You find yourself using your footsteps a bit loudly sometimes to just get your bearings," says Tracey. "Sometimes you click your fingers, almost without thinking."

She says that the echoes created by the sounds she makes vary depending on whether she is in a wide open space or around dense objects, and this helps to inform her movements.

But, she says, using sound to navigate has its limitations. "If it's snowing it's very difficult to get around, very difficult," she says.

Fiona Sandford, who runs Glasgow-based blind support charity Visibility, invited Kish over to train her outreach staff in FlashSonar several years ago.

Is echolocation a form of seeing?

In 2011, a team of scientists in Canada scanned the brains of two blind volunteers who said they could echolocate and two sighted non-echolocators.

As they were scanned, the participants listened to two sets of sound recordings - ones which contained echoes and ones in which the echoes had been removed.

The scans showed activity in the calcarine cortex - the part of the brain associated with processing vision for sighted people. However, this was only the case for those participants who said they could echolocate. Most interestingly, the activity in the calcarine cortex was stronger when these

Quee
How I
game

Air F
Why i
exper

Smo
Resea
do no

"Many people who are blind do use a form of echolocation," she Sandford. "And what Daniel Kish does, he takes that ability and hones it."

She likens the impact of his training to a piano student progressing from the ability to play a simple tune to performing a concerto.

And yet it seems that relatively few blind people use active echolocation to the extent advocated by Kish and a few others around the world.

"In many instances it's discouraged," says Kish. "I personally have worked with students who've come from schools for the blind, for whom clicking was actively discouraged.

"I believe it's discouraged because it's seen as a 'blindism' - if you're clicking then you're drawing undue or negative attention to yourself."

Fiona Sandford admits that the clicking noise is a barrier for some of her more self-conscious clients, particularly the adults.

"What we've found is the people that are most receptive to echolocation are young people."

In blind football there are boards around the pitch to reflect the sound

Much of Daniel Kish's work is focused on training children - some as young as toddlers - to gain confidence and independence by using a long cane together with echolocation.

The Royal London Society for Blind People's Dr Tom Pey believes that blind people should be introduced to the technique, but agrees that some people may resist it.

"In a world that is dominated by conservative forces of health and safety you are likely to encounter

participants were played recordings with the echoes intact.

No special activity was noted in the auditory cortex of these participants.

One of the scientists, Lore Thaler, says: "We don't know to what extent they're "seeing" but they're certainly using the part of the brain that sighted people use for vision."

Read the 2011 study (plosone.org)

Pers
What
before

Num
Do lic
polluti

Defe
Is cor
forces

Echolocation in

resistance," he says.

"Some organisations for blind people look at the solution in terms of the service they can provide, as opposed to the service that the blind person requires."

The Royal London Society for Blind People school does offer training in echolocation, but he doesn't think that it is for everyone.

"You have to be able to listen in a certain way in order to interpret the message you are getting back. Not everyone can do that. And clicking may not be for you.

"Not all of us will be able to do what Daniel does but he's shown us that it is possible. I really tip my hat to him - long may he continue to be an inspiration for blind people."

Daniel Kish spoke to **Outlook** *on the BBC World Service.* **Listen back to the programme** *or* **browse the podcast archive**.

nature

- Bats use calls to build up a sonic map of their surroundings. The bat can tell how far away something is by how long it takes the sounds to return to them
- These calls are usually pitched at a frequency too high for adult humans to hear naturally. Human hearing ranges from approximately 20Hz (cycles per second) to 15 to 20 kHz (1000Hz) depending on age. In comparison, some bats can hear sounds up to 110 kHz in frequency
- Toothed whales and dolphins, collectively known as odontocetes, also use echolocation to hunt and navigate in murky or dark water

BBC Nature: Ultrasound and echolocation

Bat conservation trust

▶
Beat
The ir
Rogu
Muse
Troll
A digi

Share this story About sharing

In today's Magazine

How I got rich beating men at their own game

6 December 2016

Do smoke-free stoves really save lives?

7 December 2016

The mothers who are pressured to give up their children

6 December 2016

The model changing the face of fashion

7 December 2016

100 Women 2016: Parents who regret having children

6 December 2016

Around the BBC

Questions for Daniel Kish by BBC Ouch

Related Internet links

World Access for the Blind

The Royal London Society for Blind People

Visibility

Subs

news

The lat
fingerti

Mos

Read

'Thous
US po

Trump
Year

First p
new o

'Old fr
envoy

Why is
expen

Trump
'Pizza

Magazine

How I got rich beating men at their own game

6 December 2016 | Magazine

Do smoke-free stoves really save lives?

7 December 2016 | Magazine

The mothers who are pressured to give up their children

6 December 2016 | Magazine

Rebel
Alepp

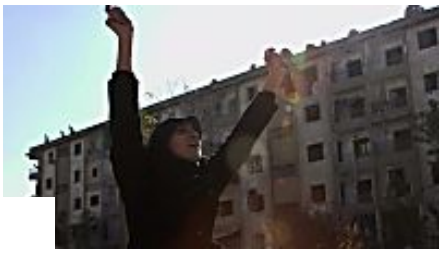
How I
their c

£5 not
circula

Mexic
1.2m

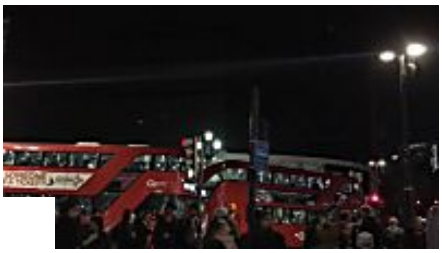
More Videos from the BBC

Recommended by Outbrain



Syria: Celebrations as families return to homes in Aleppo

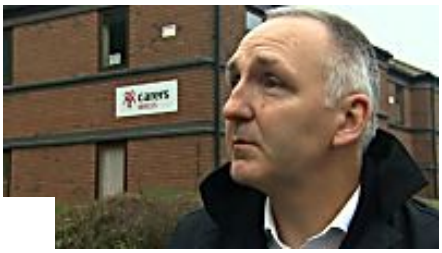
Filming the secret underwater world of grey seals



London has been plunged into darkness by a power cut

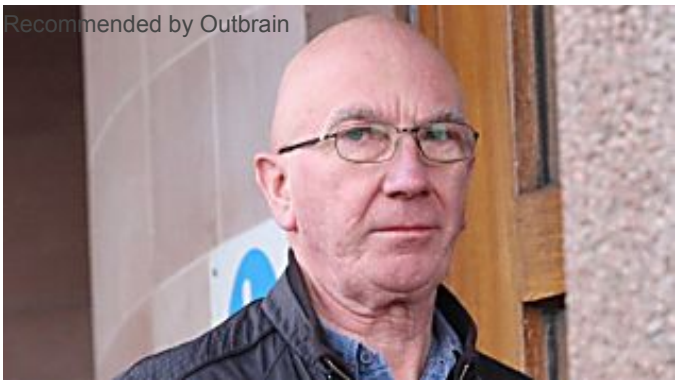
The Scottish village left £400,000 by former PoW

Ineos boss: 'Sense of humour' needed in Brexit talks



'Hardest hit' affected by Family Fund cut, charity says

Elsewhere on BBC

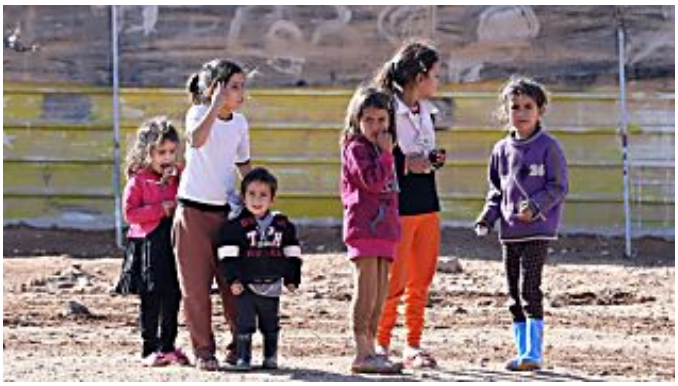


BBC News

Man who urinated in work colleagues' water bottles is sentenced

BBC Future

Why we should send politicians to space



BBC News

Syrian refugees enjoy more support than others, AMs told

BBC Future

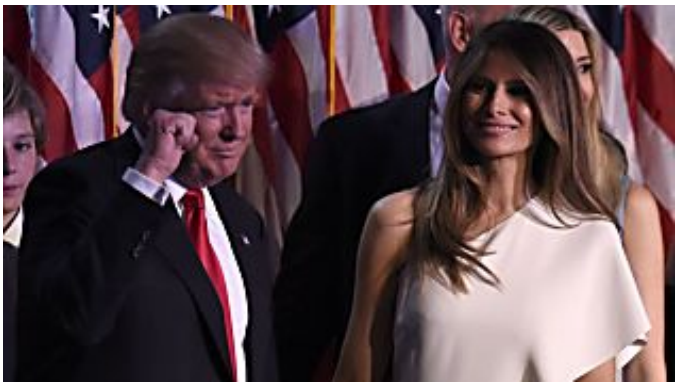
The next big leap in space travel will use hypersonic planes

Ad

Era
Simp
Truly
prefe

Free
Dow
Pow
safe

54,
Visit
This
infini



BBC News

Designers disagree about dressing Melania Trump

BBC Future

The colossal African solar farm that could power Europe

BBC News Services

On your mobile | On your connected tv | Get news alerts

Explore the BBC

News	Sport
Weather	Shop
Earth	Travel
Capital	Culture
Autos	Future
TV	Radio
CBBC	CBeebies
Food	iWonder
Bitesize	Music
Arts	Make It Digital