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Senses

Over millennia, natural selection has shaped creatures to survive in nearly every habitat on the planet. This programme looks at how we are drawing on the natural world to find solutions to technological problems and enhance the ways in which we sense the world around us.

From the visual capacity of the butterfly to the auditory sensitivity of the elephant, scientists are beginning to unlock the amazing functionality of nature and enable us to see the world differently.

Rats can see, hear and smell, but their dominant sense is touch – through their whiskers. And with bad eyesight, whiskers are even more important for the shrew. The shrew can identify its prey, even the kind of prey, by a single touch, and process the information in a split second.

Martin Pearson at the *Bristol Robotic Lab* in the UK is adapting whiskers technology to build 'Shrewbot', a robot that 'sees' the world around it through whiskers, just like the rat and shrew. Using lasers, engineer John Beck of *Unmanned Systems* has scaled up the technology: fitted to 'TerraMax', the laser whiskers enable this huge truck to build up a picture of its environment and drive itself.

And we are only at the very beginning of our understanding of whisker technology. Experiments at the Rostock Research Centre in Germany show that seals, using their whiskers, can follow trails of swirling water through the sea – even more than 30 seconds after the trails have been made.

Other creatures use sound, and particularly sound as vibration through a solid object, as their primary sense. The elephant, for example, can send complex calls over long distances through the ground. The programme shows how this technique of seismic (very low frequency) sound can be used not only to send and pick up messages from a miner trapped underground - but also to 'talk' to the elephants.

At the other end of the frequency, drawing on the echo location technique of bats, Brian Hoyle of Leeds University has built an 'ultra-cane', a new type of walking cane for the blind: the tip of the cane detects objects and sets off a vibration signal in the handle to guide the user. Mounted on a bike, this same technology enables a blind person to navigate a mountain bike track.

We are also beginning to understand and replicate the navigation system of tiny creatures like the Monarch butterfly. They can see polarized light, and use this to navigate to their destination and to avoid collisions in the swarm.

Using technology that sees polarized light, engineers are developing systems that automatically stop a car getting too close to the one in front, and engineers at *Bristol Robotics Lab* and the *Veece Institute* at Harvard are getting close to replicating swarm behavior. They have not yet managed to create 'robo-bee' who can be used to supplement pollination due to depletion of the bee population, but you will see individual heli-robots can already play a tune.

Slowly, but surely, we're learning to see the world differently.