



Inventors' inbox: Inventing for the disabled

From powered exoskeletons to mobile-phone-charging wheelchairs - our tireless inventors exchange emails on how technology can help the disabled.

Patrick: I'm a bit wary about inventing for 'the disabled'. First, people's disabilities are as diverse as they themselves are - there's no reason why someone in a wheelchair will know what a deaf person might benefit from. Second, lots of inventors happen to be disabled but don't need help with their creativity. Third, handing out some of the latest techno junk is usually not actually helping people for whom the fundamentals, like being listened to, remain unaddressed.

Mark: Yes, I have met many inventors who have disabilities via my mentoring role as 'Inventor in Residence' at the British Library. Necessity being the mother of invention, dire situations can sometimes lead to an inspired solution to a problem, generally related to these inventors' own disability. I see a similar pattern with young mothers and 'house-husbands' - who invent new prams, baby bottles and toys, etc.

If I am honest with myself, up until recently - only after a painful debilitating bout of gout - I have not given much thought to being disabled. Although, in order to assist me in designing better packaging caps and closures technologies, I have studied the human hand's motor skills and the cognitive abilities in the young, old and disabled.

Some years ago I remember seeing a prototype elevating wheelchair, raising the user up, as if standing, to the eye level of standing people, making it easier to communicate. I am not sure how successful this is, but I recently had an amazing go on a Segway PT (a two-wheeled, self-balancing electric vehicle), at the British Invention Show, and felt it could be adapted and used successfully by the more able-bodied disabled person.

Patrick: Haven't these been banned from British pavements and roads?

As a big fan of 'Star Trek', I remember an episode ('The Menagerie') in which injured crew members were provided with a virtual-reality environment where they could remain unaware of their disabilities. Although this is escapist stuff, there may be ways in future by which avatars can interact in much more realistic ways than an online game, like 'Second Life', currently allows. A simulated world where everything mirrors what's going on in one's immediate reality (within a single room, say) might someday allow able-bodied avatars to be 'pasted' in as effective substitutes - thus providing an out-of-body experience of the kind that has been shown to help with phantom limb pain.

A simpler version of this idea, which could be made available today, is to set up a system to simulate living with a range of disabilities, for example. This would be used in schools to help people appreciate some of the frustrations disability can create.

Mark: I imagine if your body has let you down, many disabled people have no choice but to live in their head/mind more. They say that many blind people dream in techno-colour and some limbless individuals can walk in their sleep. If we can design tools to assist those sensations, that's great, but I am not sure I agree with the education approach you mentioned. Yes, we want to help encourage an understanding and caring society, but to have real impact it needs to be up-close and personal, interacting directly with disabled people, not some virtual stimulus.

Patrick: Okay, but we shouldn't forget that certain approaches can actually provide disabled people with some advantages over the wider population. A classic example occurs in the brewing industry, where profoundly deaf people can clean vessels from the inside without concern for the noise generated by the abrasion equipment.

I find it odd too that we have no disabled astronauts in training, since some of their physical restrictions are bound to be less of a handicap in microgravity.

Similarly, Formula One could surely benefit from the reduced body mass of e.g. drivers without legs?

In athletics, wheelchair users complete marathons faster than those on two feet and amputee athletes with carbon fibre blades, instead of lower legs, are approaching Olympic levels of ability.

Mark: There are very few advantages in having a disability; by definition it is a physical or mental impairment that substantially limits one or more major life activities, so my list is very different from yours. Blind people have heightened other senses - hearing, smell and touch and that is about it!

Patrick: Having said all that, there are now many inventions that already help disabled people. There are domestic 'carer' robots; assistive tools for partially-sighted people; mind-controlled wheelchairs.

Here's an alternative solution to one pressing issue: that of access. Specially-equipped tanks can place a bridge over some obstacle, drive across and then collect the bridge again. Rather than have all those ramps manhandled on public transport, I'd like to see an aerospace-quality bridge unit, carried over the top of a wheelchair as a weatherproof roof and pivoting down and in front, so as to allow the chair to roll over gaps and then rotate the bridge unidirectionally overhead. Think of it as skipping slowly forward, with the bridge in the role of the 'skipping rope'.

Mark: Yes, there are many gadgets out there to help people with disabilities.

Being practical, I am not very keen on your wheelchair bridge unit idea. First, I do not believe a disabled person would want to sit in a top-heavy Fred Flintstone-looking contraption. It would also be quite an engineering feat and an added expense to achieve this bridge movement with minimal pay-back. It would be more of a hindrance - carrying around all that extra weight...

Patrick: Actually, on second thought, I agree: even a plastic version would probably be too cumbersome for most situations. Traditional markets seem not to cope well with supplying a wide variety of unique items, each in relatively small quantities. Maybe, providing inventions for the disabled is a 'long-tail' process, in which people will be able to share ideas online and download designs to a desktop replicator? Perhaps, what's therefore needed is a toolkit of components, which people can choose from to build a support system customised to help with their individual circumstances?

On a different tack, powered exoskeletons are being tested by various armies. I'd like to see much simpler prosthetic limb extensions developed which would be telescopic and thus provide potentially faster than normal walking and extended reach capabilities.

Mark: Patrick, do stop reading those comic books!

Patrick: Well what about DareDevil, Professor Xavier, Luke Skywalker and all the rest of the disabled superheroes? I reckon those guys have provided a pretty positive image of disability.

How about a simple support mechanism using mobile image search for those with limited verbal communication abilities? So, if you need to order two beers, you perform the required image search by typing in 'two beers', select the right image and show it to the bartender.

Mark: This system could also be useful for everyone when travelling abroad - although I personally would probably only need three pictures. I am not going to be drawn into what they are, but one is beer. The idea has some merit, but I would rather see it in a small book format, so you are not carrying around expensive equipment to be stolen or lost.

Patrick: I think your book might find itself confiscated in certain countries: beer is controversial enough in some places and it would depend on the other two pictures!

What about a 'gymchair'? In a conventional wheelchair, you already have some of the components of a mobile multigym. Why not create a new chair design in which a user could maintain as much physical fitness as possible by engaging in resistance exercises (e.g. via driving up a small ramp to hold the wheels off the ground and then engaging a friction belt attached to the main axle, while driving the wheels by hand).

Mark: I think it is probably hard enough for wheelchair users to get around, let alone work out at the same time!

Patrick: It's a sad fact that some disabled people are targets of attack, purely because their ability to defend themselves is limited. Another invention would therefore be a panic button. Not only would this issue an auditory alarm, but it would also spray assailants with a harmless but long-lasting fluorescent skin dye. This would be widely recognisable as only available to disabled people (via the parking badge process) and therefore label the attacker.

Here's a different problem. Autism is a disorder that may sometimes include extra abilities, such as enhanced memory for detail. Frequently, however, it involves a reduced ability to understand what others are feeling. I'd like to suggest an iPhone-type application that would allow autistic people to display a screenful of possible facial expressions as icons. People they were dealing with could occasionally communicate their feelings by selecting the right icon and thereby allow the autistic person to react in a more understanding way.

Mark: You say "...because their ability to defend themselves is limited". I think, for that reason alone, your iPhone application idea is flawed, as it is a bit like showing a mugger the inside of your wallet.

Security technologies are already available out there, so it would not be worth our while reinventing them again.

Neighbours of mine are an elderly married couple, both suffering from arthritis. Twice, the husband has fallen and could not, even with the help of his wife, get back up. Thankfully, I was able to help, but it was very difficult to get him back on his feet, because he was a dead weight, in pain and inflexible.

I want to invent something that would help this process by providing support and movement into a sitting-up position, with inbuilt assistance arrangements for the available helpers.

Patrick: I understand that the US military are already working with DARPA to create battlefield robots capable of retrieving wounded soldiers, but I'd question the wisdom of moving someone in pain... isn't it normally a better idea to lie still until medical help appears?

Thinking about wheelchairs again, these tend to be heavy and bulky, but why not take advantage of that shape factor? If they are electrically driven, there's room on board for all manner of useful stuff... extra battery-charging facilities for mobile phones or wireless modems that could be rented out to other members of the public making disabled people a source of some very valuable resources and encouraging communication with people who sometimes find themselves overlooked.