# Transcript for How Smart Socks could transform dementia care

Robin Christopherson

Welcome to another episode of The AbilityNet Podcast. Disability. Technology. Inclusion. I'm your host Robin Christopherson, Head of Digital Inclusion at AbilityNet a pioneering UK (United Kingdom) charity with a mission to make a digital world accessible to all. You can download a transcript of this episode from [www.abilitynet.org.uk/podcast](http://www.abilitynet.org.uk/podcast) . So, sit back, grab your favourite beverage and let's get started.

So, I am back and really, really excited about this one guys. This is another AbilityNet podcast talking to the Tech4Good Award winners.

And I’m excited to be speaking with Zeke from Milbotix. Zeke, do you want to introduce yourself and a bit about your organisation, your company as well?

Zeke Steer:

Absolutely. Yeah. So, pleasure to be here. I'm Zeke Steer the co-founder and CEO of Milbotix. We're an award-winning health tech startup and a spin out from the University of Bristol.

And we're creating a line of wearable devices called Smart Socks that are designed for people who find communication difficult and that includes people living with dementia, with other conditions as well, like autism, potentially learning disabilities too.

The Smart Socks use sensors embedded in socks to detect signs of pain and anxiety that the wearer might be unable to communicate for themselves. And the idea is that through the technology we can detect these early signs of distress, alert a carer so that they can intervene much sooner and support that person before well-being decreases and behaviour becomes challenging.

Robin Christopherson:

Fantastic summary. Thank you so much. I'm desperate to get into the nitty gritty of the tech.

And how it, you know, has a real-life impact. But first of all, I'm going to ask you, oh no, I'm first going to ask you if you've got a drink, a hot or cold beverage to get you through this ordeal. I've got a nice, very strong cup of tea with a splurge of milk in. How about you?

Zeke Steer:

I have an Earl Grey which is my preferred tipple, so yeah, I'm all set.

Robin Christopherson:

Much more sophisticated. Nice one. Cool, got that out of the way.

So yeah. First question then. How did you feel and how did the team feel about winning the Ageing Society award? That was the category that you guys won at the Tech4Good Awards. You know what, do you think it will mean for Milbotix.

Zeke Steer:

Yeah, it's a good question. So actually, during the awards, I was in an at another event in London pitching to some investors. So, I did my pitch and then I came out and I checked my phone and had the amazing news that we've won the award and obviously very exciting and very, very grateful for the award. I think we've had a lot of recognition as a result. And its really exciting now to see how we can leverage that to promote the product and hopefully, yeah, get our name out there.

Robin Christopherson:

Yeah, we'll do our best to help.

So, brilliant. Now let's talk about the actual tech, then. These smart socks. What makes them smart? You've alluded to. You know, how they work, what they do.

But yeah, let's dive into it. You know, they sound miraculous on the face of it, these smart socks. So, tell us about them and how they came about, you know, what was the kind of origin story of them.

Zeke Steer:

Yeah. OK. So, the origin story actually was really very much driven by my great grandmother and her experience with dementia. So, I have a background working as an engineer in the defence sector. And my great grandmother was diagnosed with dementia and became very aggressive.

It was a side of dementia that I wasn't aware of. My family were quite ill equipped to deal with.

And she would become very aggressive. They were trying to take care of at home but really struggling with the behaviour and ultimately her behaviour became so challenging that they had no option but to place her into a care home and sadly she deteriorated quite quickly in that home. And yeah, it was. It was such a tragic end. She had such a rich life.

And just to see her there, diminishing with no connection to family.

Very isolated and becoming a very different person. It was. It was really awful. So, it got me thinking about how I could use the experience that I developed as an engineer to help people going on this journey with dementia.

It led to my PhD at the University of Bristol and ultimately laid the groundwork for the technology smart socks. So, what we've got is a textile, a sock, and it contains some conductive materials that enable us to measure a parameter called electrodermal activity. And this is a sweat response very closely associated with stress.

And one of the reasons that we've chosen to use a sock is that the best location on the human body for measuring this is actually either the palms of the hands or on the soles of the feet due to the high density of sweat glands. So, we get a very accurate recognition of when that person is stressed.

We also have some electronics in the sock that collect that data and transmit it wirelessly over to a receiving station over the Internet. And there we have some artificial intelligence, some really clever algorithms that process that data can detect when somebody is at risk of becoming distressed and alerting the carer through an app.

And then they can and that's their response, which might be as simple as providing A painkiller to manage the person's pain, maybe even just a cup of tea to calm them down, bring them back to a state of well-being, and hopefully avoiding all the negative consequences that come if that distress is left unmanaged.

Robin Christopherson:

Wow. Brilliant. So, sweat related but what about if, you know, someone's just turned the heating up in their care home, for example.

Zeke Steer:

Yeah, very good question. Yeah. So we actually baseline the data over a period of time. So, we can detect somebody's, you know, ready state and we'll look for deviations from that. So, it enables us to capture the sort of, you know, typical conditions that the person might have, maybe if they have naturally sweaty feet, we can accommodate that through our algorithms and we're looking for differences on that baseline.

Robin Christopherson:

Could you have a number of people within the same location wearing them and you could baseline based on the fact that everyone's getting sweaty, cause somebody's you know accidentally turned the heat up as well? Maybe, I don't know, but I'm sure there's a lot of clever AI going on at the back end to kind of.

Zeke Steer:

Yeah. I think integrating with passive sensors in the environment is a huge opportunity.

Robin Christopherson:

Oh, that's true.

Zeke Steer:

Yeah, you've got smart home type sensors that have been slowly adopted in care homes, providing all kinds of different information about activity, about the environment, temperature, lighting. So, there's a massive opportunity to bring in physiological data collecting through our device to provide much more holistic insights around that person's health and well-being.

Robin Christopherson:

Fantastic. A lot of the smart speakers as well. The latest gens of echoes, for example, have in thermostats in them as well for indoor temperature. So,, I don't know if you could tap into those. But yeah, sounds really innovative and just so smart, you know, just a brilliant early warning system.

OK, looking at the electronics, so I was really intrigued to hear that they don't need charging. So, I'm thinking are we talking like really small currents here or are we talking about a sock with a like a great big box on the side where the ankle is that needs to be powered significantly, in which case how does that, how does it get powered?

Zeke Steer:

Another good question. So there the innovation is actually not so much in the technology but in the business model.

Our plan is to provide the socks on a subscription plan that we call, “socks as a service”.

And they will have a fixed battery life as that battery runs down, we will be providing a fresh batch of socks and in that way, removing the need to charge them. So, it's all about how we supply continuous supply of socks ready for the person to use.

Robin Christopherson:

Wow, that's brilliant and they're washable as well, aren't they? So, I mean, do they last the sort of average lifetime of a pair of socks anyway?

Zeke Steer:

We specified 50 washes, so we're looking at, you know, maybe slightly less than you would get out of a typical pair of socks, but certainly you'll get some decent use out of them.

Robin Christopherson:

And the battery life similar or?

Zeke Steer:

Battery life around three months we're aiming for.

Robin Christopherson:

Yeah, ok.

Zeke Steer:

And then we'll be shipping out, you know, fresh batch of socks to replace the existing ones and hopefully getting existing ones back because what we don't want to happen is for all of these socks with the electronics in them to end up in landfill, that's not really going to be very sustainable. So, looking at how we can encourage people to return used socks.

We can then obviously dispose of them in a safe way or potentially even refurbished them.

Robin Christopherson:

This is such a brilliant initiative or kind of business plan. It's amazing, really, really good so.

Zeke Steer:

Thank you.

Robin Christopherson:

Yeah, really good. So impact wise then how many people have got these on their feet at the moment? How many you know, what data have you got around the impact that it's had on you know different end users and what kind of case studies have you got?

Zeke Steer:

Yeah. So, we we're quite early in our trials and so it's part of my PhD research. I developed an early research prototype that was trialled with over 70 people. That's part of my research.

It got very good feedback on the ability of the technology to detect periods of stress from periods of relaxation.

Building on that, we obviously got the funding from Alzheimer's Society, which is enabled us now to develop a much more complete prototype, and this has been in trials for about 3 months, so we've been trialling through research institutes, including the UK Dimension Research Institute. We've also completed our first care home trial and we have very positive outcomes of the back of that.

So, there was a lady wearing the socks. She had a history of quite severe agitation, and the care team were finding it quite difficult to manage her behaviour. And so, the first key finding is actually that lady responded very well to socks compared to other forms of wearable, like a wristband. And so obviously that's a really good finding for us. It means that the sock could be a superior solution to other wearables, albeit we're very early in our evidence collection. The other key finding is that the lady's agitation actually decreased over the course of the trial.

So clearly there's some benefit being delivered through the technology. At this stage, we can't generalise that. It's just a point sample we're going to be doing a lot more trials. We've got a second trial starting in November and we've got about 15 more organisations waiting to trial the socks and hopefully collect some evidence of benefit. So yeah, within a few months, we should be shouting about how well they're working and hopefully yeah, seeing what we can do to help people.

Robin Christopherson:

Fantastic. So, what was the process by which in her wearing the socks helped reduce her sort of day-to-day stress or anxiety levels? Is it because it was an earlier intervention? Is that how it works?

Zeke Steer:

Quite possibly. I mean, given that we've only got one trial that's completed so far, we can't really make too many conclusions from that. We need to do a lot more rigorous research. So we've got Cranfield University supporting us with these trials.

They're responsible for managing it and drawing the conclusions from the data. What we don't want to do is put forward our views on it. We want to have this independent academic validation, so we'll wait and see what Cranfield University say. Once the trials are complete and hopefully, it'll be favourable towards technology.

Robin Christopherson:

Fantastic. I'm really impressed about the rigour that you're applying to the process.

It's not just like, “Hey, guys, we've got, you know, magic socks. Check. You know, this is how much they are and it will revolutionise your aged relatives lives.”

But so I'm still trying to get to the bottom of how they help kind of people that are, you know, they're getting anxious, the socks fire off a signal that says that they're getting stressed. What's the process by which wearing these socks helps them day-to-day?

Zeke Steer

So, it will depend on the individual. Everybody responds in different ways, experience different stress in different ways, but also the behaviour can, you know, be manifested in different ways and they respond to different types of support. So one of the things that we're doing through our AI is to provide at a very granular level, an indication of what kind of distress that person is experiencing. And that comes about through the different physiological parameters that we collect through the socks.

And so we're collecting temperature, collecting heart rate and collecting this electrodermal activity data, we're collecting motion data. We've got all different sensors in there.

And that gives us an indication about what kind of distress the person is experiencing and how best that the carer can manage it.

Robin Christopherson:

I mean the mind boggles really what you could do with it. You know you could customise it based on the specific, you know, needs and preferences of the individual, so it could be that it could, you know, activate some calming music or some mood lighting. Or it could be that it would, you know, fire up a video call with a relative or something like that that would be able to, yeah, kind of intercept and kind if avoid the escalation. Potentially. Yeah. Amazing.

Zeke Steer:

That's absolutely right.

And when we're having those conversations, we are really keen to integrate with third parties.

So yeah, massive opportunities for the technology. We can go a long way.

Robin Christopherson:

But just at the most basic level, having a notification to the relevant carer or family member, et cetera, that you know this is starting is amazing, really, really good, yeah.

Zeke Steer:

And there's a lot more functionality through the app as well. So, we do, we collect what we call a digital diary around that person. So, the carer can input distress triggers for the person that can input the types of behaviour that they exhibit. What kind of supports being attempted, whether that supports being effective or not, and all this information gets tracked, it gets managed, it supports the operation of our AI because that can then use that data to contextualise the physiological data from the socks.

But it also provides a source of information for new carers that are coming into that setting, really important within residential care homes and nursing homes because the staff turnover is so high. So, you know we retaining that information, we're allowing it to be disseminated around the home so that the person's care can be better managed.

Robin Christopherson:

Amazing. That's really good. So, I mean, it already sounds super impressive. I appreciate that it's relatively early days in terms of data collection kind of validating the whole premise, but still though, you know I think.

It's looking very promising, isn't it? What about future developments? Are there, have you got a road map for, you know? Socks Mark 2 smart socks, you know, plus, or whatever it might be. Or maybe it's some other products as well?

Zeke Steer:

We do indeed have a road map. Yeah. So we've just started an innovate UK funded project. So innovate UK, the governments grant Funding Agency.

And this project is developing the next version of smart socks and this will actually be the version that we look to sell. And given that the current version of those prototype it's just been used for our evaluations.

So that's really exciting. We've got a, a fantastic team behind us both internally with our own engineering team, but we're also working with a number of world leading subcontractors and universities to collect the independent academic validation that's going to prove that the technology really work.

And that it delivers benefits not only for the individuals wearing the socks, but also for care homes and nursing homes, given that they're facing some real challenges themselves. So that's exciting. And we've got also on the road map, a version of smart socks that designed more for at home use.

And this is a collaboration with the UK Dementia Research Institute at Imperial College London.

We're raising investment at the moment to unlock a government grant, another government grant that will fund this development, and we're thinking that this could be actually quite, quite different from the care home product, given that people living at home would be much more mobile, more likely to be going out, going to the shops, to looking at, maybe incorporating GPS for example.

So that person can be tracked by family members and family members will feel reassured.

But also, so that the wearer can request help if for whatever reason they lose track of where they are, so really important for dementia in particular.

Robin Christopherson

Wow. I'm thinking of a number of people that we know who are at home, but immobile, you know they rely on care to help them get from the seat to their bed and back. And that's the full extent of their travel. So, you could imagine that they would be able to use the, you know, the version that might be more appropriate to...

Zeke Steer:

Correct.

Robin Christopherson:

..the care home setting, et cetera. Yeah. Cool.

Zeke Steer:

Exactly right. Yeah, yeah.

Robin Christopherson:

The same thing as...

Zeke Steer:

Part of that as well, it's connecting through them to a support network, so we think, well, something we're calling a personal care network, which might consist of people in the vicinity, neighbours perhaps, extended family members who can come in when there is recognition that something's not quite awry. That can come in and support that person and hopefully avoid the need for hospitalisation and you know, some of the more severe outcomes that can happen if somebody isn't helped in a timely manner.

Robin Christopherson:

Absolutely. Yeah. Absolutely. Now there will, I'm sure, be people listening to this? For whom they have got, you know, relatives in a care home or in a in another situation who might be thinking well this sounds absolutely amazing. How long will I have to wait before I might be able to, you know, get a pair of smart socks for my relative. And what sort of price would we be talking about? Obviously, there's probably a kind of a volume price for care homes versus...Have you got any idea of pricing at all at this stage?

Zeke Steer:

I have to be a little bit cagey because we've not fully developed the pricing at this point. But we do want the price to be affordable for as many people as possible.

And we're thinking around £50 per month for the subscription plan, which would include three pairs of socks that would be replenished throughout the year. And so that's really what we're aiming for.

Robin Christopherson:

And how long?

Zeke Steer:

For that particular version of the product is going to be over a year.

And we, we do have a planned product launch in in the mid part of next year, but that's for a research platform using smart socks. So, it's a way that researchers can collect physiological data to support their studies. So that's not really intended for general use.

Robin Christopherson:

So, fingers crossed that all of the data reinforces and you're able to bring it to market, et cetera. So those hurdles, let's hope, will, you know, be effortlessly hurdled over, jumped over. The technology, though, that's all there is it? It's not like there's going to be a wrinkle with the technology going forward.

Zeke Steer:

No, we're very confident in in the technology and its ability to work. What we are working on at the moment is obviously how we can make a product out of this. So far, it's a prototype. We've got to obviously make it much more robust.

And yeah, just do a lot of development to ensure that once it's on the market, it's going to be effective in its role.

Which will be quite challenging in a care home, for example, where the washing at high temperatures, maybe it's not being very well cared for. It's going to be, yeah, there's a lot to think about to make sure that it's robust enough and reliable enough for use there.

Robin Christopherson:

I take it that if it loses connection because it's been, you know, it's run out of battery or it's been washed at too high a wash and it's died that will create a flag, you know there will be an alert that the person smart socks are no longer on the network as it were.

Zeke Steer

Absolutely. Yeah, it will all be handled through the app. We have a range of different notifications that get generated.

Robin Christopherson

Fantastic. Wow, sounds really, really amazing. Uh. So, yeah, before we go, anything else you wanted to talk about? If not or you know, please do. Otherwise, how can people find out more about Milbotix? And, you know, more information about the product and possible, you know, timelines and updates. How can people kind of keep abreast of the smart socks progress?

Zeke Steer:

Yeah, I think I'd just like to say a big thank you to everybody that supported us so far. I mean, this obviously isn't the work of 1 individual, it’s the coming together of many people in many guises that have helped to move things forward. And that includes the AbilityNet team and Tech4Good Awards. Really appreciate this recognition for all the work that's gone on to make this thing that it is today.

We do have a crowdfunding campaign underway on crowd cube, so we've set out to raise £200,000 actually almost £600,000 has been pledged from over 500 investors and this shows how much interest there is in the products and potential that it could make.

So be very grateful if you are listening in and you know do support us as well. We would love to have you join us on this journey and hopefully make a massive difference to the lives of people affected by dementia and other conditions.

And to find out more about us our website is www.milbotix.com, that's MILBOTIX.

And if you Google smart socks, you'll probably find this in the top results, so that might be an easier way to yeah to find out more.

Robin Christopherson:

Great. And the funding page is linked to from MILBOTIX as well, from the website as well, yeah.

Zeke Steer:

It is indeed. Yep. We have an invest tab on there and if you click on that you'll find a bit more about our investment round and you'll also be able to link through to crowd cube and make your investment directly on the page. So it couldn't be easier.

Robin Christopherson:

Fantastic. Thank you so much, Zeke. Really, really appreciate it. I'm really interested in this one. I can just see the practical applications and the public benefit going forward. So best of luck with the data, you know the research, the commercialisation of the product and let's hope that we see it on the feet of thousands of people by this time next year.

Zeke Steer:

I would. I would love that. Yeah, certainly drawing on the experience with my great grandmother, I would love to see it widely used. So, thank you very much.

Robin Christopherson:

Brilliant. Thanks a lot.

Zeke Steer:

Appreciate it.

Rob McLean

Hi, my name is Rob McLean. I'm the Digital Inclusion Programme Officer for AbilityNet in partnership with BT. So, I'm reaching out today to ask for your help in contacting organisations, clubs and charities that would benefit from our free service. We want to find older people that need our help on how to use their phones, laptops, access digital appointments, pay for parking or video call their family, the things that most of us take for granted every day, but our older generation, our parents and grandparents, feel they need our help with. So how can I encourage my older relatives to learn how to use the phones more effectively? Where can I direct my elderly client to get support with using tech? How do I get help setting my laptop up to a printer? If any of these questions are on your mind or that of someone that you know AbilityNet can help.

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