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Parallel C Menteith
Rehabilitation

>> Let's get started. So thank you everyone for coming to this session on rehabilitation. We are going to hear from four speakers talking to you about some really interesting topics from gait analysis through to hacking wheelchairs. I will present each speaker and invite them to take the podium. After each speaker's presentation you will have five minutes to ask questions and at the end if there is any additional questions you have, you will have the opportunity to have questions then. We will have someone with a microphone and will bring that to you, if you'll say where you're from and state your name and your question then our typist can pick it up on that screen. As you heard in the opening session, we will be taking feedback from today and the feeding that into the closing session. In particular, we are interested in hearing about what you want us to stop doing, what we need to continue doing, and what we need to start doing, so if you have comments or points based on the presentation that you want to feedback into the closing ceremony, please do either your questions or at the end of the talk. I'm Gemma hope by the way. Without further adieu, I will hand over to our first speaker. Gwen who is talking about development of a hospital-based gait analysis system. Can I invite her to take the podium. Thanks, Gwen.

>> Thanks. So today I'm going to talk to you about gait analysis can be used as a rehabilitative tool in a clinical environment. First of all, I will explain what it is. It is a method of analyzing movement and the way that humans walk and the technology that we use to do this can be used to analyse any other type of movement. What we are looking at in particular are the schematics and kinetics. So this can be done in two or three dimensions. Because of recent advances in the technology, three dimensional gait analysis is much more common nowadays and the way we do this is we place retroreflective markers on the skin of individuals and they represent landmarks and we get them to do certain tasks in front of infrared cameras and we can use special software to track their movements and calculate outcomes that we're interested in. We do this to identify pathological movement patterns and if we can identify where the issues are we can then use this information to guide the rehabilitation and treatment programs so the aim is to improve mobility in patients who have disability. It's not very often used in clinical environments and this is because the current protocols have a lot of disadvantages so gait laboratories are typically massive empty

rooms and hospitals can't accommodate this type of space for laboratory. Also the protocols are very time consuming so when an individual comes to the lab, they need to get changed into tight fitting clothing and so the markers represent their bone underneath and that is problematic and so a lot of people don't want to do that, and once you have done that, you need to put the markers on to the patients which can take time and then do the assessments. After the assessments themselves you need to go through the data and frame by frame and label all the markers which can take hours and the data itself that you analyse after is complicated and all in the form of graphs, so if you are not someone who studied biomechanics you might not understand straightaway what the data means. Because of all these limitations clinicians often don't get training in how to use this technology, so that is another reason this isn't used in hospital environments. Some of the technology as well is expensive, so that is a limitation in itself. As a consequence there is limited accessibility to gait analysis technology which means that a lot of people who could get benefits from it are not getting the correct assessments they should be getting and with that there is limited evidence of effectiveness of gait analysis in clinical fields. So why should we use it? It is a gold standard method of analyzing human movements and one good thing about it is that it is noninvasive, so it is a good assessment that could be used in a clinic. Also you can measure a lot of different variabilities at the same time and get information on how functional a person is, so someone of the assessments that are currently carried out in hospitals are under static conditions so you don't know how mobile the person is. What is also good that I mentioned earlier and we can get information to guide rehabilitative treatment plans and recent zests have shown that people who have under gone gait analysis have improved functional outcome following a treatment in comparison to those who haven't. One reason is patients can get feedback of how they are doing before and after treatment and this can be encouraging and have them understand why they need to do certain physiotherapy and certain treatments to improve mobility. The same of my PhD is to develop a clinic appropriate gait analysis system to assess lower limb function and I'm particularly looking at patients who suffer from knee osteoarthritis. The first thing I want to do is make a small scale lab that can fit in a hospital, so instead of them having a big open room we've now developed a little treadmill that can be used in a hospital room, so ours is in a physiotherapy gym our sounded by cameras that can track the movements of the person. All this can be done on the treadmill. I want to make the marker simpler to use. Instead of using individual markers we use clusters of markers to track where the bony landmarks are. You point at the landmarks instead of putting the sticky markers on, so this saves time and also means that patients don't need to change into revealing clothing, they are just wear what they are wearing when they come to the hospital. Because I was looking at knee replacement patients I wanted to build applications that would test outcomes of interest in this field. One is to see what the range of motion is at the knee which is really important in orthopedics. This was measured with a plastic goniometer and results are often inaccurate in patients with high BMI, which is often the case. I

have developed another method so clinicians don't have to learn how to carry out a different assess. All the patient needs to do is lie on the treadmill and assessment can be lar reed out to see how far they can bend their neat. The second assessment can be done with a system to see what the strength of the knee is because we need to have Savony to carry out certain activity such as going up and downstairs, so it's very important that we now how strong those muscles are. This isn't always carried out in a clinical environment, but it's something that should be because it's so informative. Sometimes when it is carried out clinicians use dynamometers which is bulky and expensive. Again it's familiar to clinicians and all patients need to do is it on the chair and pull or push on the strap which is attached to something that can measure force and we can estimate the strength of the muscles around the knees. So as I mentioned earlier seeing what patients walk like is important, so we can get patients walking on the treadmill and we can see the angles of the hips, knees, and ankles are moving as they walk and we can see how unbalance the person is as they are carrying out this task and this can be done to identify pathological gait and with this information we can then try and improve the way that they're walking and doing other tasks such as walking up and downstairs or getting in and out of cars. This can gauge the level of mobility. So while I was doing all of this, I wanted to make sure that the whole system was easy to use in the clinic because nobody is going to use it if it's complicated. As I mentioned previously, the setup time is quick, you just need to put the clusters on and point the pointer at all the different anatomical landmarks and then you can carry out the assessments they are noninvasive and patient friendly. Another thing that I was considering when I was making that was the clinician wants to be with the patient during the assessment and not be the computer, so they can control the assessment with a foot switch as they are with the patient as opposed to running between the computer and patient. There is not need to label markers you can get them in realtime so you don't have to wait hours to get results and they are in simple format which is what clinicians want. It is gently in numeric format and can be seen as the patient is done assessment. I have seen about 92 patients so far with total knee replacement and the whole assessment including putting the markers on and off has taken about 17 minutes which is at least an hour faster than it currently is, so it is much more feasible for a clinical environment than current protocols. To conclude it's analysis is a gold standard method of analyzing walking and human movements but the current protocols aren't very appropriate for clinical use so our method is a smaller scale system and can record the data quickly and in large time so has the potential for large-scale use. We are hoping this can be used to gauge the level of mobility in patients and hopefully use that information to then improve their function pre or post treatment. So I would just like to they -- for funding my PhD and to my supervisors and trial team I'm working with at the moment. Thank you very much. (Applause).

>> Does anybody have any questions for Gwen?

>> Thank you for the nice presentation. I have a comment. Did you use any balancing like EMT because if

you used only the velocity and -- you can't cross refer --

>> That is a really good question, so you can get some treadmills that have the force place built into the treadmill itself, but they are much more expensive, so at the moment we are just using traditional treadmill because if you're trying to essentially sell this system to the clinical environment and you say oh, you can buy the system but it's going to cost 30,000 pound, then they might not be as willing to do it. If you say well you have already got a treadmill, so you just need a couple cameras at 200 pounds each it is much cheaper, but it is definitely a possibility, so maybe in the future when costs come down it could be done.

>> Thank you.

>> You're welcome.

>> Does anybody have additional questions. Thank you very much Gwen. There will be an opportunity to ask further questions at the end.

Could I please invite now and I'm really sorry about the pronunciation of your name Yeonsoo Jeong the assistant professor at Daegucyber University.

>> Thank you my name is Yeonsoo Jeong from the University of Korea and in this presentation professor Kyungsoon Park and Jeong yon. The title is the legislation of act and end dependence living support for adults with developmental disabilities in Korea. Introduction, movement of parents for enactment of law, the third is research method and procedures, result and interpretation and finally to plan for the future. The purpose of this study is to support independence living of adults with severe developmental disabilities after graduating school in Korea. This study background, severe developmental disabilities is ASDD have not been provided the same support level like their school age from the government and returned home again or entered livering institutions in Korean circumstance. Recently, the movements of parents and disabled advocacy groups have been proceeding actively to settle a program center and customised support system for independence living support of ASDD. The movement of parents for enactment of law. There was not concrete act to help ASDD but there are just the relevant acts until before then. The unified movements of the parents and the advocacy groups became the foundation of supporting policy for ASDD at the time.

Many parents of children with disabilities demonstrated against the government to improve their children's quality of life and to acquire the educational opportunities, and they also demanded a face-to-face talk with the mayor of Seoul. Several parents shaved their heads and marched through the streets to accomplish their demands.

And this movement influenced on the other provinces, especially key where you know gee province near Seoul.

The parents movement and direction as a result of the legislation of act and parents movement in Seoul,

now three centers were established in three districts and the education was progressing as center system for education and care program using of ASDD. instead, recently Kyunggi province suggested to apply place train model of the vocational rehabilitation areas to the provincial governor.

They think this model need for residential living, community, adaptation and vocational rehabilitation of ASDD.

Movements and activities of various parents societies for ASDD contributed to establish the act on right promotion and support of people developmental disabilities in April 2014 and this law was implemented since November of 2015. Many parents and advocasy groups participated in the improvement of legislation of law. The related photos is as follows and this is the YouTube site. These are the scenes I wanted to capture and the first is a sit-down strike of parents and advocasy groups in city or street. The next scene is shaving parents' head. The next is demand of the mothers. The next is inauguration ceremony of promoting solidarity.

After this movement of parents, the various areas of opinion were corrected. The next discussion for acceptance of the area are discussion for acceptance of the opinion, bill proposal of the act, parliament try passage of the act, and then the parents and the advocacy groups went out to the street and they cheered each other. Their demands were to study the methods, how the act can be legislated, and how their children can live in their community, and how their children get and maintain the human rights after the parents died. At that time, the government said, we will begin to consider a good solution with you. the study is progressing with qualitative research, so the participants of this study were some parents among the parents union for ASDD and workers of lifelong education support center where operation is just beginning. For this study, interviewed with parents about their activities for legislation, their demands to the government and the policy determination contents, and effective ways for independence living and community inclusion. And this study also interviewed with workers of centers about what is most necessary education for the ASDD. What was the most difficult experience in this course?

This is data processing and analysis method. The data collection consisted of depth interviews of parents and the workers. The analysis of checking data was proceeded by a qualitative case study method. This study generated the results and interpretation through transcription, conceptualization, encoding, subtopic, and core theme. The results and interpretation: The results are generated from two aspects: The parents and the workers. Their opinion is different. The motives of the legislation from parents, children who are equal to the last railroad station, this is -- research so I use the method of priority. The children's parents said to me their children even though they teach their children but last railroad station is equal not to be denied in the society, so acquire the opportunity of continuous education after graduating school without return to home is the parent's opinion. The experience of education program operation for ASDD from workers in the center: Doubt and disbelief about adults education, look of the surveillance of

parents is the worker's opinion even though an Ernest desire of appropriate educational program by various area experts, and they hope understanding lifelong education as the continuous education. In my country in Korea, we divided the lifelong education areas into six areas: Basic literacy, humanities and refinement, vocational education, citizen participation, and culture and the arts. They have a joint opinion about future improvement plans. Control tower and cooperation between the organisations. Special education, vocational rehabilitation area, social welfare and lifelong education of general. They suggested about these areas cooperation and cooperative system for program development from inclusion to engagement and various researches and the studies for continuous education. They think that continuous education is a lifelong education for ASDD. Thank you. (Applause).

>> Thank you very much. Really interesting presentation and good to see the law was changed in Korea for the legislation. Does anybody have any questions for the professor?

>> Do you have any questions?

>> Okay, well there will be an opportunity to ask any questions again at the end if you do think of something as you go along, so thank you very much. We are now going to here from Justin Brockie who will be talking about practical applications of leveraging web based software in provision of inclusive support worldwide.

>> Thank you, my name is Justin Brockie and trained in what was known at the time as a registered nurse for the handicapped. I worked with people with developmental disabilities all my life. I moved to the United States about 20 years ago and having worked there a while, I joined a software company called Therap and we've developed a system used by direct support staff primarily for doing what used to be written in books and on sheets of paper and things like that and we've had 13 or 14 years of experience of seeing the impact this has on the lives of folks with disabilities themselves, their families, their friends and their communities, so I would like to give you a brief introduction to how that's going. We now have 13-14 years into this and have records for over 300,000 individuals all across the United States as well as in Bangladesh, Sri Lanka and Nepal. When we started our model was, and again -- living was our thought at the time and we thought we will have an Internet-accessible computer in every group home. This called consternation because people said you can't use the phone. We were also told if it's not socially normative to have a computer in your living room. Things have changed. What we were seeing at the time was the solution to this problem was cloud-based computing, which again, 2003, no one cared where rain came from and where the Internet came from. We've moved on and our basic supports for why and how they are provided is mostly everybody has an Internet device in their pocket, and I suspect most of you do, and rather than putting something on a piece of paper which can be given to someone else to enter into a computer system, why not have the people providing supports enter that data into the system as they go along wherever they are as they are and giving you the ability to support people wherever they live and

work. Really it's remarkable. I'm also the parent of a daughter with fairly profound disabilities, and the amount of information that is required just to be a parent these days is quite remarkable and if you're an NGO providing services just enormous amounts of data that need to be tracked around the person, and what we've done is developed a web-based application that has somewhere to put all that and because it's cloud computing, all the hard work that would be required for you to do that yourself is taken care of. That's out there on the Internet and no need for installing software or maintaining software, all you need is a browser and a phone. Over the course of the last few years in the United States, we've been granted a few patents on this, so particularly with regards to how do you share the data between multiple organizations. The average person with a intellectual disability is probably receiving supports from three or four different organisations, how do they communicate securely and in realtime with the right information and the right people. A few statistics: I like these numbers because it shows that it is actually working. We've a thing we called the t-log. And that is just a communication note that a member of staff might have left for another, and the moment we are running around three million of those getting written every month in the system, which is quite a lot. The really interesting thing about these notes is on average each one of them is read 12 times and if you are in a residential care home or something like that where notes are getting written in books they are getting written and nobody is looking at them, so that change in communication is the factors we've seen. There is so much less of this, well, I didn't know that and nobody told me, because people are able to process this. Just in terms of the data we've every day a million leads of t-logs so a million note reads are going on every single day inside the system. This ISP data is people taking measurable data that can either be calculated on afterwards to compute progress towards outcomes, learning skills, getting to places they need to be and can be used from a billing perspective, so if there is a funder involved and they need to know how much service was provided it can come out of that and you can see almost 8 million a month. Instant reports bad things happen unfortunately, but there is a process so that rather than having to wait for a piece of paper to get from A to B to C to D and in order to be able to react to that can happen in much more realtime because we are all online. Because it's the United States everything costs lots of money. Most of the people we work with are providing Medicaid services so they are funded by the government through what is effectively social insurance, and our customers are billing about 1.5 billion worth of services every year through that. Again relying on this data to make sure they get paid for the services they provide. This one because it's a scary big number. We've a medication administration record, somewhere where staff usually not nurses, but rather trained, unlicensed staff are passing medications to the people they are working with and every month about 13 million medications passes are documented, and again, that's critical data. That's people trusting you with people that really, really matters. Again, as I said, we've gone very much from having done things on a desktop to doing things on laptops to now a vast amount of data is collected on phones, and some really

interesting things have happened some of which we didn't predict when we originally started. These are two ladies supported by one of our customers in the buffalo, New York area and they came to one of our conferences to talk about what the impact of using Therap's web based system had been on them and their families because not only did they and their staff have access to this data, so did their families. The big thing that has come up on this is the improvement in the relationship between families and support agencies. Okay. My theory on why this is is that family members of a person with disability who is in care have lots and lots of really small questions. They want to know oh, it's colder today than yesterday, did they remember to put their jacket on? How did that appointment go? Are they still feeling with well? If you call the group home or wherever it is your loved one is supported every day with three or four of those questions pretty soon you become annoying, so the staff become resentful and you become resentful and things break down, whereas if you can just go online and get the answers to those simple questions, then that's done and you don't have to be worrying people and that leaves the conversations for dealing with the big, important matters and we have had this happen time after time after time and it's quite interesting because I will talk to people and I will be saying yeah, what you should do is give the mothers and fathers of the people you support access and they give me this look like I must be out of my mind. It's the same look I see every time. What I've learned is they all have one particular mother they're thinking of, one particular scary mother they are scared of and thinking I'm never giving access to this data that our staff write before we vetted it. I point out to them that scary mother is actually my wife and she is the one calling every day asking things is the one you want to do it with first because she is the one with those hundreds and hundreds of little questions and if you can get that information out, she is going to end up liking you a whole lot more, and time after time around the whole country, we've seen that happen that those formerly afraid of mothers are now becoming active parts of teams because the communication is really going better. The other interesting sort of thing from a therapeutic perspective when you're giving the people you're supporting again realtime access to the data they are looking at, it forces people to write documentation in a manner that is respectful. Support agencies spend a lot of time and effort trying to teach their staff to write in-person centered language and usually not very successfully, but if people know that mom is going to read and that person themselves is going to read that, they are likely to write it in a more humane way. If you're supporting individuals with behavioral challenges and they are going to read things that were written about them later on, it becomes a very interesting dynamic. If I have had a bad day and ended up picking up a chair and throwing it through the window, I'm then going to have to deal with that later on as I read the note that says I picked up the chair and through it through the window. I will have to take responsibility for that and deal with that. Lori did interesting talk about how things like that impacted her and provided a new focus on what that documentation is and what it does. Just quickly just to go through the folks involved in this and if you're interested I'm downstairs in the exhibit hall and I

would be delighted to talk more about this stuff. We've a number of agencies and seven states that use the system now across the entire state for supporting their services for all the reasons you can imagine, getting that incite to what's going on. Our primary customer is the provider agency, but more and more getting to the parents and family members and the self-advocates themselves awe lowing people to really take more ownership and more control of the supports that they are receiving. If you're going to be self-directed in the supports that you're receiving, somewhere along the line you are going to want to be able to measure that. Let me just go very quickly to here. What we can now do based on this is some really, really interesting data analysis in terms of how are people actually progressing, what are the things that are happening that are doing people good, and what are things that are happening that are not so good for people but are happening anyway, and we can do that based on real data collected at the point of service. With that, thank you very much. Again, I'd be delighted to answer some questions now if you have them or chat with you downstairs afterwards. (Applause).

>> Thank you very much Justin. Does anybody have questions?

>> I work in Pakistan in a center for children with disability and we do keep your data in soft copy, so we are fans of keeping data properly written, however I have huge concerns about consent, about interference from outside agencies like Therap has more data, who is giving them the consent to hold that data in people? The fact that parents of adults will have access. I just find this whole big data thing, insurance companies have the access, there is some things here where the disabled person can be quite easily abused and that's a huge problem for me. I totally agree that we've to keep good records so that we can keep an understanding between different agencies but this idea that is held in the cloud worries me.

>> I think you have to be very, very concerned about data security, but here is what my take on this has been based on a lifetime of providing these services was in the last agency I worked at which was paper based completely. I thought of the abuse and neglect investigations, you had no idea who had looked at that. There were documents left on people's tables.

>> But I'm saying we don't do that. We've our own server, secure server, so we within our organisation and we've an access because parents are the guardians of their children and when they get to older adolescence there are privacy issues here and it is the big data going to all these other organisations that worries me because we cannot say that the cloud is secure we see it in the tabloids all the time about thing getting stolen.

>> The cloud is not a single place. This data is stored on servers that we own and maintain in a location that is ours. So security is obviously a big deal but I think that is a big deal wherever the data, not casting -- certainly someone can hack in, nothing is hack proof and for the social service agency to be able to forward the degree of security they need around that data better to have it in a shared environment.

>> What are your responsibilities as a company not to use that data for your own promotion? What is your

ethical position about using the data you've used today about I can tell you this and this and this, where is your authority to use your data of all these different organizations for insurance companies? I do understand that we need to plan, but I'm just --

>> I'm a big fan of skepticism. I am. All I gave you was counts of events I didn't come up here and tell you what's going on with anybody. Most of the work we do is in the United States and is covered under two or three major data security laws that say what we can and can't do. It's interesting. We are having internal discussions just now because we basically don't do anything in the way of studies on the data. Our view is the data belongs to those people and so as it were we've had a number of universities say can we run a study on that data and our response is always no. The insurance companies get very, very limited event based, you know, was this service provided and that data is going to them anyway, because it's billing data. They don't get access they send the data the customer needs to be paid, so we don't do any of that. There is an interesting question of we are now looking at how could you get predictive with some of this data? Could we use this data to say this person based on the things that have happened to them over the last X weeks or years this is likely to happen. That potentially has some huge benefits, we are just not sure whether we can use that data in order to do the studies to see if we can make that happen, and so we as a company, our personal corporate ethics say we don't use the people's data unless you can and it is actually up to our customers to get the consent for the individuals whose record is going in there and the data itself is controlled you know, I think if you can compare the way we store data to the way something like a health information exchange would store it, very different access mechanism. It is default to -- if you go into the hospital, for example, the doctor in the hospital needs to be able to see. You don't want him to have to wait for access to your record. With ours you only get access to the specific individuals you have the right to see.

>> Thank you for that robust question. Anybody else have questions? At the front please for the microphone.

>> I have basically a similar question. So you said that the app is now on the phone. How easy is it for me to go into your phone or anybody's phone and get data?

>> Again good question, but it's almost impossible. For a part, none of the data is stored on the phone. The data is continually stored in our servers where it's encrypted. All the data moving is encrypted and all the data at rest is encrypted, so there is nothing there. You phone is just an access. It's one of the reasons, some people would like us to have an offline mode so you can do things when not connect ed to the Internet, but then you end up having data on that device which is something we don't think is a good idea.

>> Thank you.

>> Thank you.

>> Anymore questions for Justin.

>> I have a question about implementation. I am from the Netherlands and I noticed a lot of different ideas about collecting data about serving the customers, the parents and the people, the professionals. We observe a lot of resistant, mostly with professionals. They are afraid of Internet, afraid of digital data and the afraid of everything to do with computers mostly so what barriers do you see and how do you overcome them.

>> That is a great point. In general we find that the direct support staff who tend to be younger, basically you don't need to teach them anything. You give them a login name and password and point them at the app and they move forward. Traditionally it's the director of nursing who says I became a nurse to look after people not to work with computers that is difficult. What we found is when they start to see the data that they could never see before, so if you can imagine what a community nurse has to do by the time they spend driveing to find bits of paper when they can see data in realtime for all the people they support, that tends to be what convinces them. It takes time and a very hands on approach we've a lot of support staff training people in the field. One of the things I've learned is people get invested in their paper forms. They have spent the last 20 years making this perfect and when you say you have to stop using that form and start using a computer instead, there is a little bit of grief that goes on during that, but generally I think it's results based. When they can do things, we have had nurses saying they are saving two hours a day which is invaluable.

>> Thank you very much. Now can I invite Molly to the stage. She will be talking about hacking wheelchair with digital fabrication

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>> Hi, I'm Molly from disruptdisability and I'm going to be talking about our project HackOnWheels which is a community-led initiative to develop open source design for wheelchairs I'm going to give an overview about how and why we started disrupt disability and the problem the problem was as we saw it and where we got inspiration from and where we are today. Thank you.

So the former director of disrupt disability can't be here today because she is at Stanford studying for her MBA and that is Rachael Wallach. Our story began when Rachael was traveling in Cambodia and as a wheelchair user herself, she was surprised she wasn't seeing have much other wheelchair users out and about on the streets in Cambodia. So being curious she tracked down different organisations there working with wheelchair users. And through a number of conversations she had with those groups in Cambodia, it began to be apparent that to give freedom and independence a wheelchair kneads to be customised to the body, lifestyle and environment of the wheelchair user, but with traditional design and manufacture and distribution, that level of customizing comes for a price. The average salary in Cambodia is about 950-dollars. That might explain why wheelchair users there weren't able to obtain customised wheelchairs. They have limited choice and control over their wheelchairs and the diagram below shows a

typical customer journey. You might work with a wheelchair therapist who in the majority of cases will purchase a wheelchair from a retailer and they in turn have gone to a manufacturer and they have worked with a designer, so the wheelchair user never comes in contact with the designer and rarely comes in contact with the manufacturer or the retailer. Across the world 65 million people require a wheelchair but eight out of ten cannot access one that meets their needs. That amounts to 52 million people. Having identified the problem, we started to notice other organisations doing interest things particularly in the area of prosthetics. E-N ABLE is one Rachael came across in Jordan.

They crowd source the design and manufacturing, so they establish a basic principle for designing prosthetic hand and share that with anyone anywhere in the world online and then they connect people to local manufactures in their area able to manufacture prosthetic hand and they primarily use 3D printing. We also got in touch with Paul, Denise, and autodesk in Germany. Denise is the first ever athlete to come Pete with a prosthetic. It took less time to produce this and a lot less. Another organisation are open bionics.

They take a similar approach but combine it with robotics. They can create a robotic arm in 42 hours for 3,000 pound which is it still sounds like a lot, but it is around 30 times less than comparable prosthetics on the market and they recently won the James Dyson award. This left us with this question, what would happen if we disrupt the design manufacture and distribution of wheelchairs with user innovation, open source design, and distributes man ewe fracture, and what would happen if we developed a community of makers and people with wheelchairs who could be enabled to make customised wheelchairs. We were real inspired and we wanted to understand if there was potential for us to apply those developments, particularly around the technology to wheelchairs. For me the most exciting response was I'm not a wheelchair user I wear my wheels. We found a wheelchair is an extension of your body. You wear it every day and like that pair of shoes it's something that you would not go out without and if you can have choice and control other the look and feel of that wheelchair, if it's something that feels part of you, then it's not a medical device, it's fashion or wearable tech, or a lifestyle project. I'm not a wheelchair user myself, but I was talking to my father who also wears glasses and when he was a kid he was prescribed glasses and had limited choice or control over what they looked like land his experience toward them as a child was different than mine. So we apply what has happened with eyeglasses to wheelchairs. Practical things. We started talking to wheelchair users and designers and makers about how can this work and how can we enable the greatest level of customization. We want them to be able to take elements they dislike and change that. What does that look like? The pictures on the presentation show some Lego blocks, which is probably the most identifiable modular design system there is and like Lego, we share that compatibility. At the end of the day, we want to take that process map I showed you earlier and change it so that the wheelchair user or wearer has the direct control over design, customizing. We think that the designs

libraries and making should always be open and free to access. We see a role for the service, yes it's a profession and there is a lot that goes into it, but also it's something that we think a bit like the presentation earlier like gait analysis, that we can use senses to digitalise so the wheelchair user has more control over how they use that service and individuals will be able to select a design and customise it and send it to manufactures to produce their design, and also workshop making events. So far we have had 120 people attended HackOnWheels and hack-a-athons. We have had the support of 150 different organisations and we've built a movement of 1,000 people who are directly involved with us through attending events and contacting and getting involved online and just providing their feedback and letting us know what they think is most important. We've a volunteer design team creating a modular system and building a library on wevolver. At the moment we are running a design brief for the RSA student design awards sponsored by the GDI design hub. We are hoping to have 300 designs submitted for the competition. They are the only student design awards that are accessible that anyone can enter regardless of their course that they are doing they just have to be in higher education. If you know any students looking to get involved we've two really great challenges you can ask me about afterwards. Together we are disrupting disabilities. This how you can get in touch if you want any further information after today. (Applause).

>> Thank you for that Molly, it's exciting what you're doing and the potential it can have around the world. Does anyone have questions for Molly? Yes, lady at the back. Can you just wait for the microphone.

>> This won't be a robust question like the last one. This is really excited because in Pakistan we've no manufacturer of wheelchairs at all. Our rehab section is trying to develop willing and looking at light-weight wheelchairs do you have any contact with international committee of the Red Cross?

>> Not that I know of.

>> I will ask them. Thank you very much, really interesting. Thank you.

>> Any other questions? Question at the front.

>> Is there styles of wheelchairs that you're looking at? Have you looked at I'm thinking of my daughter's wheelchair which I think cost something like 16,000 dollars and has lots of bits and pieces rather than being a racing one, have you thought how that can be done?

>> We are open to all an we want to have that mix of motorised chair that have more structural support and more like Rachael's slick titanium chair she uses to climb mountains. It's being community led, so we run events to connect different people with different disabilities and different reasons they use a wheelchair and involve them and their carers in the design process, so at the moment because we are really quite new still, and light weight in terms of our resources we are reliant on the community to contribute and get involved which is another reason for promoting our way to get involves.

>> Very, very cool, indeed.

>> There is a question of this gentleman here in the striped top.

>> I'm Tom. I don't know much about wheelchairs but I was wondering depending on the level of customization you need, have you looked at the bike industry because with standard parts you can build your own bike.

>> That is what inspired us actually is thinking about how if I want to change something on my bike it's quite easy for me to just order a replacement seat online and drop into a bike workshop. I took a wheelchair that I'm working on at the moment to a local bike shop recently and I needed a particular type of tool. I was talking to them about the wheels and they had all the right tools but not quite all the right parts and nothing was quite compatible, and that customer experience that you have when you have a bike that's kind of what we want the customer journey an experience to be like for wheelchair users and that is a really cool project thinking about 3D printing and manufacturing, there is an open source 3D bike that you can make. That is a great comment and something that we're looking at.

>> Does anybody have any questions for Molly? Lady right at the back.

>> Great presentation. I just wanted to say it's fantastic what you're doing. I wondered if you want to say anything about make a space and their lack of accessibility.

>> Yeah, this is something we see as being a barrier particularly when we get further down the line towards having an online platform that people can use. At the moment we are working in a make a space in London, which is great because an open workshop there is all the tools there and everything is there for me to be able to adapt this wheelchair, but we recently had an exhibition and they are fantastic and big on accessibility, and they built a toilet, but they had an exhibition and the machines I can't actually 3D print something by myself at this level and the kind of things that we've where you can't get close to a table, so down the line we think that's an area we are looking into in terms of collaborations and partnerships and making this industry a lot more disability friendly and aware and trying to address those issues further on in the planning stages. The opportunity there is that the concept of make-a-space, maybe a show of hand of what knows what it is? Okay. But definitely like a year or two ago nobody would have had a clue, so an opportunity there is this is still quite new and the make a space and distribution and manufacturing movement is still growing so we can really embed some of these issues and awarenesses of disability access right in at the beginning.

>> Anymore questions for Molly? A question from the lady right in the middle she is just standing.

>> Suzanne from Denmark. I work with small startup companies, a great presentation and idea. Just wondering how are you deal with the regulatory issues when you change the product, who has the responsibility?

>> Kind of like hide behind -- online library at the moment is on revolver while it is accessible and can access the designs we don't promote it for that reason because as we grow we need to look into some of

those issues to be quite honest. Actually one of the opportunities here is in terms of being user-led with user-led design if you're taking the product and developing it for your purposes yourself, this already happens, please adapt their wheelchairs and one of our hack-a-athons we had he was talking about how he got his first wheelchair in 1973 and prior to being paralysed and having to use a wheelchair, he had those motorbikes and so he just took his wheelchair to his motorbike workshop and took it apart and adapted it and made it cooler and something he could do marathons in tanned play basketball and do marathons. You've got to have something that's livable. Someone gave me a stats that rather irritatingly forgotten last night about the number of wheelchairs discarded because they are given and they are not comfortable and that is an enormous waste, so we are hoping to tackle some of those things and drive it from a user-led perspective.

>> Does anybody have any additional questions for any of the other speakers before I invite them back on stage. If you could put your hand up if you do have any other speakers. I'm taking that stern silence as a no. If you've got no other questions or no other comments, then I thank you very much for coming and I will end the session there. I'm sure the speakers will be around if you want to come and approach them individually afterwards if you have any questions for them, so thanks very much for coming and I'm encouraging you to go to the next session on at 3:00. Thank you very much. (Applause).