Inclusive design and making in practice: Bringing bodily experience into closer contact with making

Rachael Luck, The Design Group, School of Engineering and Innovation, The Open University, Milton Keynes MK7 6AA, UK

This paper develops our understanding of the nature of inclusive design, first through critique of controversies that to some degree downplay inclusive design as a distinct design movement. Attentive of these criticisms we then observe designer-making practices in two cases, which respect individual difference and encourage a more material mode of participation. By bringing the bodily experience of people with (dis)abilities more closely into their own design processes we see positive characteristics and advantage in inclusive design’s closer connections with making. This research advocates the expansion of inclusive design into a more material, inclusive designer-making movement, to acknowledge the universal problem of designing for everyone’s unique difference.

Keywords: design process, inclusive design, making, social design, participatory design

Recent more critical and political interest in design has ignited debate on whether there are different kinds of design. The call to designers and researchers to ‘just design’ (Tonkinwise, 2015) prompts the reflexive question, what are we doing when we qualify ‘design’ with another term? This act draws attention to what design practice routinely does not do. This action can highlight problems in society for design to address (Manzini, 2015), to identify the social causes and problems that motivate design work (Koskinen, 2016). It is, however, precisely this critical attention that the inclusive design movement aims to provoke, that is, to shed light on what design should routinely address but currently does not do well. Through this research we seek out ways to improve (to re-configure and raise awareness of) inclusive design processes and practices.

The inclusive design movement aims to bring about change, to redress through design the many situations in everyday life that do not accommodate the diverse capabilities of people with (dis)abilities. In this paper we will examine what this means for design (researchers and designers) in more depth and what it might involve in designer-making practices. In contrast with ‘the design community [which] has not produced its own arguments about what kinds
of change it would like to see’ (Margolin, 2007) the inclusive design movement, as we will see, has been vocal and active in several ways. It is by inspecting the nature of inclusive design, its conceptual foundations, processes and situated practices that a future, more material inclusive design movement is proposed.

1 What kind of thing is inclusive design?

Roger Coleman, the first Director of the Helen Hamlyn Centre states that ‘Inclusive design is not a new type of design but an intentional project that sets out to include significant sectors of society that are all too frequently ignored or overlooked’ (Coleman et al., 2003). He identifies the design intent to include an overlooked niche market but does not mark this out as a different kind of design. Indeed, its difference is again downplayed, ‘inclusive design is neither an entirely new genre of design nor a separate specialism. It is framed with a more generalist approach to designing … products and services [to] address the needs of the widest possible audience, irrespective of age or ability. Inclusive design … is a complex field incorporating many different facets and viewpoints’ (Morris, 2003: p viii). Coleman and Morris both emphasise the inclusion of broader groups of the population in the design of products, services and environments and consider that inclusive design should not be separate from ‘good design’, a point that is further scrutinised by Heylighen and Bianchin (2013). These characterisations of inclusive design are insightful, however vague in their description of what designing in this way might involve. This challenge is taken up in this paper.

Inclusive design is both routine, part of the everyday backdrop to our lives, and also embraces the exceptional situations and circumstances that people encounter but are these positions in tension? What are the characteristics of inclusive design, how are these paradox manifest in everyday situations and how might design methods, processes and practices respond? These questions require further attention. Another problem is, when we speak of inclusive design are we always describing the same thing? The first purpose of this paper therefore is to advance our understanding of the nature of inclusive design (a project started by Heylighen, 2014), to provide further clarity and explore how inclusive design can be routine and at the same time exceptional. This is approached through critique of the controversies and paradox in the conceptual foundations of inclusive design, which position inclusion amongst other social design concerns. Then, we examine two cases to see how the individual capabilities of these people were met by their makers. The position this research aims to develop, and that these cases illustrate, is that inclusive design’s potential is yet to be fully realised. It is through stronger alignment with the maker movement (low-volume modes of production, sometimes referred to as post-industrial, batch size one) that designer-makers can offer personalised processes to participate in the design of unique things (see for example Coons & Ratto, 2015). This research provides a reasoned argument for the re-
alignment of the inclusive design movement in closer connection with makers and making in twenty-first century. This expanded design practice is referred to as inclusive designer-making. It is proposed that by scaling-out inclusive designer-making sensibilities we can begin to challenge and redress the universal problem of designing for everyone’s unique difference.

2 Controversies and paradox in the inclusive design movement

Inclusive design is a prominent twentieth century design movement that can be viewed as part of a value-explicit design and research agenda (Moore et al., 1986: p 21) and what is more recently referred to as social design (Armstrong et al., 2014; Koskinen, 2016; Margolin & Margolin, 2002). The social problem that inclusive design addresses is designing the world with and for people with disabilities’ different capabilities. However, the concept of inclusion underscores the values of many social design concerns (Koskinen, 2016) and this connection is not unproblematic. Some tensions in understanding what inclusive design is manifest in the terminology used and often centre on how we disambiguate inclusion from inclusive design and generalise on distinctions between individuals and collectives.

2.1 Disambiguating inclusion from inclusive design, controversies in generalisation

The tension between human equality and distinction, between what we universally share in common and the specificity of individual, exceptional characteristics, in our situated encounters with the world is described by Ardent:

‘Human plurality, the basic condition of both action and speech, has the twofold character of equality and distinction. If men were not equal, they could neither understand each other and those who came before them nor plan for the future and foresee the needs of those who will come after them. If men were not distinct, each human being distinguished from any other who is, was, or ever will be, they would need neither speech nor action to make themselves understood. Signs and sounds to communicate immediate, identical needs and wants would be enough’ (Arendt, 1958: p 175).

It is this twofold character that we navigate when designing. If we could communicate immediate, identical needs and wants that would be enough, instead we are human and individual. The politics of every, each different, design situation hinges on our treatment of individual and collective views. Confronting this problem, Tony Fry disambiguates plurality from pluralism, to deduce that plurality invites a multi-perspectival point of view whereas pluralism becomes a relativistic normative value, thereby reducing difference to equivalence (Fry, 2011: p 151). Paradoxically these similar terms come to
have opposite meanings. There is a similar tension in the way that ‘the universalism of Universal Design tries to force the variety of users into the uniqueness of one materiality thereby reducing diversity to the universal’ (Winance, 2014).

It is also now less clear what is inclusive about inclusive design, as it is entangled with other inclusion movements that aim for a more sustainable world (Bichard & Gheerawo, 2013; Heylighen, 2008). Even the language associated with the design movement is not straightforward. America and Japan refer to universal design (Fletcher et al., 2015; Kawahara & Karikawa, 2015), the UK uses the term inclusive design and most Scandinavian countries use the concept of ‘design for all’ (Bendixen & Benktzon, 2015). Different expressions of intent, belief or volition in what design can achieve are entangled in this terminology (Erkiliç, 2013). For example, universal design and design for all are underscored by a universalist intent, which brings into question whether these ideals are ever practically achieved (Imrie, 2012). One controversy is an assumption that by making adjustments for people with disabilities, these changes will improve accessibility for all (older people, people with push chairs etc.) which plays to the widest possible audience universalist generalisations on what is ‘good design’. This view downplays the different requirements of people with similar disabilities and the sometimes-conflicting requirements of different disability groupings (Boys, 2014: p 31). Another controversy is that the voice, and especially the bodies, of people with disabilities are often overlooked (Imrie & Luck, 2014). In recognition of these controversies we next outline several design perspectives and research initiatives that seek to reconfigure disability in inclusive design processes.

2.2 Bringing bodily experience into design processes

The very act of designing makes assumptions about how the world is and the circumstances someone will encounter in their daily lives (including our own). It is through our lived-embodied actions that we phenomenologically experience the world. Just how is it possible to anticipate someone else's lived-experience and design for what they encounter? How do we design for individual preference, diverse characteristics and the variable capabilities of different people? What are our processes for designing with and for individual difference?

Throughout the twentieth century there have been several moments when design’s relationship with disability has been examined more closely. The inclusive design movement stems from the civil rights uprising and the actions of disability activists, who drew attention to the political ergonomics of a range of social and legal policies and features that tended to discriminate against people with disabilities (Winner, 1995). Indeed the politics of social justice are foundational in both the critical fields of disability studies and inclusive design (D’Souza, 2004; Hamraie, 2012). The Eronomi Design Gruppen (EDG) was critical of product design ‘as if everyone was a 25–30 year old
successful professional’ and developed the pyramid model with three categories of users, dependent on their capabilities (Benktzon, 1993). This perspective had product marketing implications, aiming to reposition design for older people from the margins to the mainstream. In more recent design circles there has been movement away from design for disability and generic, mass-produced, white appliances (Coleman et al., 2003; Pullin, 2009) to recognise the limitations of assistive technologies designed around rehabilitation engineering principles (De Couvreur & Goossens, 2011) suggesting a design cube model and customised mass-production as an alternative (Lewis & Clarkson, 2005). Reference to the ‘user’ is sometimes criticised as a universalist concept, although the term user-centered design still has currency in HCI circles and when considering function in user-making contexts (Vardouli, 2015).

It is understood that there is no boilerplate design solution or (co-design) process that can be cut-and-paste from one situation to the next (Lee, 2012, 2014), nor reliable characteristics for a ‘type’ of disability (Hendriks et al., 2015). Methods and approaches that are founded on generalisation in positivist science (the percentage of the population accommodated) are increasingly challenged by new insights from the active and creative participation of people in their own design processes (for example Heylighen & Nijs, 2014; Rajapakse et al., 2014) and through theory that understands everyone has a material, lived-embodied, performative experience of the world (Ingold, 2013; Streeck et al., 2011). Acknowledging these developments this research takes an individual’s participation in design further, into processes of making. This research advocates stronger alignment between designing and making informed by an individual’s embodied experience of the material world.

Provocatively named, it is an anti-social model of disability that calls for an alternate design position, to let people speak for themselves.

"We suggest that … what is needed is this alternate position from which to understand disability, that considers disability ‘from within’. This is attending to members’ perspectives as a practical matter, replacing political rhetoric with recommendations for design. Technology development for disabled people faces further problems … as … there is no neutral, ‘untainted’, language with which to begin the process of discussion. The language and categories we use influence both the definition and ‘solution’ of the problem. Our response to this is, of course, to let people speak for themselves, to document their own experience, to tell their own stories revealed through a range of ethnographic methods” (Dewsbury et al., 2004).

This quote reflects the ethnomethodological position, which seeks to present an emic, participant’s view from within in any design situation. It also acknowledges a discursive problem (previously noted by Ardent) where the
person who owns and experiences a problem should voice this. Priority is given to the participants’ (members’) view of any situation.

Also approaching disability from an ethnomethodological perspective, Boys offers disability as a creative way to generate an architectural avant-garde and an alternate way of designing for everyday life (Boys, 2014: p 1). Experiencing the world from an alternate perspective, from disability, this research draws attention to the creative practices in everyday life, to the (bodily) adjustments, kludges and workarounds that are necessarily part of routine, daily encounters for everyone with a (dis)ability (also see Siebers, 2003; Winance, 2014). Furthermore this perspective challenges disability’s historic association with therapeutic creative practices to re-position disability more positively. Disability is offered as a critical mode of inquiry on design as the embodied experience of disability is re-configured as a creative design practice. It can become a creative intervention, a new way to understand a situation and how to design (see for example Heylighen & Nijs, 2014).

The argument so far draws attention to controversies and paradox in the characterisation of inclusive design. It also offers a way forward, suggesting that we bring the bodily experience of people with (dis)abilities more closely into their own design processes. In this, how an event is organised, who is facilitating, curating the infrastructure and how people with different abilities can actively participate in design (Brereton et al., 2015; Keshavarz & Maze, 2013; Le Dantec & DiSalvo, 2013; Luck, 2007) become practical matters. Acknowledging that many controversies in inclusive design are manifest in practice, in the next section we examine an approach to see how individual bodily experience can be brought into closer contact with design and making.

3 Studying inclusive designer-making in practice: theory and methods

Inhabiting a world where many things do not suit everyone’s individual capabilities bespoke designed products are one solution, however these are expensive. An alternative route is offered by Remap, a UK registered charity (civil society organisation). It is the practices of Remap that are studied to show how they collaborate with people to custom-make solutions for disabled people to lead more independent lives. Remap have regional panels and volunteer members (designer-makers who are often engineers) who make something (a gadget, physical material change or technological fix to solve a problem). Remap were advisors to the BBC on the television series The Big Life Fix. It was their process, collaboratively exploring a problem then making a solution to suit someone’s particular circumstances that was adopted on the programme. The researcher joined a local Remap panel and has oversight of more than forty projects and, as a participant-observer has followed the process of Remap designer-makers, making gadgets for clients (people with a disability).
The two cases that are presented were selected because each addresses an everyday difficulty, posing a design challenge requiring in-depth exploration, to arrive at a solution. A more complex challenge, therefore, illustrates a broader range of design practices, including: the discussion of an individual’s circumstances, self-identification of a problem and, with a designer-maker, jointly work at finding a solution. Other projects where, for example, the design solution was to attach padding to existing assistive equipment, or to make adjustments to the height of furniture – although also important personal concerns – involved less design thought. Importantly, it is through the detailed study of situated actions, rather than the number of similar situations or the time spent in the field that are significant from an ethnomethodological position on fieldwork and generalisation in design (Crabtree et al., 2013). This methodological position on generalisation is especially apt for this research, as it is the specifics of an individual’s circumstances that each case will draw attention to.

Importantly these cases shadow the designer-makers when making a component and not just when preparing a design specification or a drawing for a manufacturer to take into production. The design conversations were recorded using a hand-held video camera, following the action in various locations where a project took place (at Remap meetings, a client’s house, making in garage/workshops), with the informed consent of all participants. These were authentic interactions (i.e. not an experiment or event that was constructed for the observational purposes of this research). The interactions would have taken place whether or not the researcher was present and, given the observer’s paradox (Labov, 1972: p 209), we can never know whether these actions would have been different had the event not been observed.

It is the process and practices of designer-makers working with people in their everyday environments that are reported. Each case recounts the spoken and embodied actions of the client, as they show a maker the problem, what it is they can do and what they cannot do (but would like to). Each account also reports the designer-maker’s actions, as they work with materials to craft and shape a component to suit someone’s particular circumstances. Through these accounts we gain momentary insight into how other human beings experience the world, each with their body (not just their mind) situated in their own socio-cultural context (Koskinen & Battarbee, 2003).

The accounts adopt an ethnomethodological sensibility (Lee, 2012) and are informed by the narrative style of a method story (Hendriks et al., 2015). The benefits of combining an ethnomethodological sensibility with a method story is that this approach remains faithful to ethnomethodology’s maxim of sequential dependency, that is, treating ‘what happened’ and ‘what happened next’ as central to an account. This approach therefore sits, in scale, between detailed micro-analysis of interactional sequences and high level,
narrative, story account and remains systematic in the selection of key moments without (what is sometimes received as) an overly detailed presentation of conversational sequences. An ethnomethodological sensibility makes no judgment or interpretation of the motive behind an action. This stance is in keeping with a designer-maker’s ambivalence to the details of someone’s disability, where, instead of asking for a back-story and explanation of a condition when they first meet, the discussion or naming of a disability is only revealed if a client brings this into conversation (in this way there is no design pre-assumption about what someone can do or the likely design solution to solve a problem).

The relevance of each case is not about a category of disability, nor attempting to generalise a design solution from one situation to another. Instead it is what someone is capable of doing, as this is revealed in conversation through actions, including speech and bodily movement that are noteworthy. What happened and what happened next are the witnessable and accountable practices in each setting. It is therefore as a sequence of actions unfolds that someone makes their capabilities witnessable and known.

3.1 Making in metal: re-making wheelchair football possible

In the first case we meet Richard (the client) and Peter, the Remap designer-maker, who volunteered to meet Richard to discuss the problem. The researcher was also present as a participant-observer watching events unfold, seldom contributing to the conversation.

Richard plays football from a wheelchair. A wheelchair and its owner configure and mutually shape (dis)ability in adjustment to the device, where the specifics of what someone is capable of doing is in negotiation with a device (Winance, 2006). Richard is able to play football by fitting a bumper foot onto his wheelchair but his circumstances change. Consultation with an occupational therapist started a process where a new wheelchair was specified, made by a manufacturer and then tested by Richard in everyday use. The wheelchair foot, although also precision-engineered, was designed to a more generic specification. The two designed objects (the new wheelchair and original bumper) formed an assemblage, configuring a situation where the football bumper could no longer be connected to the wheelchair.

The re-design process started when Richard sent an e-mail to Remap describing the difficulty attaching the bumper to the wheelchair. Richard’s statement of the problem was an implicit request, can Remap solve the problem by making something. There is an expectation that something technological will be produced as an outcome. At the next Remap meeting the problem was presented to the group. Present were five engineers, an ergonomist, an occupational therapist and the researcher. One of the engineers, Peter,
volunteered to take on this project. The nature of the problem was to make a mechanical fixing able to withstand the forces of wheelchair football. Peter explained, ‘I tend to do the metal work. We work a bit like “men in sheds” but I have a fully equipped workshop and access to an engine builder with a lathe’. The project was assigned to him.

Peter arranged to visit Richard at his home and the researcher joined them. Seeing the problem in the domestic setting was important to better understand the physical and practical constraints when fitting the foot (Figure 1). On first sight, Peter’s reaction to the football bumper was, ‘this is a bit of a monster’ and Richard explained, ‘I can’t put it on myself’. The design problem was mechanical, connecting the bumper to the wheelchair, the inclusive design and societal concern was to extend Richard’s independence, enabling him to do this by himself.

Handling the bumper and offering it to Richard sitting in the wheelchair, Peter began to speculate on how the assembly of components was intended to work, ‘so that bit fits, that’s fairly clumsy’. He started to reason how the problem might be solved, ‘what I’m looking at initially is fitting straight, straight down into these tubes’. Richard’s interruption ‘but I’ve got a footplate’ made it known why the first suggestion would not work. Richard uses a different foot when he is not playing football. Richard was participating in this conversation as an

![Figure 1 The wheelchair football bumper](image)
expert, knowing what will and will not work for him. In this way he was instrumental in shaping the design problem as well as volunteering assessment on the feasibility of various solutions.

After a couple of minutes inspecting and handling alternate footplates Peter offered another solution, ‘I was looking at the fixing for the original footplate there and what I’m thinking is to drop some tubes straight down’ (Figure 2). Richard followed the idea and added ‘into the holes’. Peter agreed ‘yeah that might be simpler’. The practicality and viability of the solution was still being assessed. Peter handed the foot to Richard, ‘feel the weight of that’ Richard agreed ‘its heavy’ as he manoeuvred the bumper. Everyone present could see that Richard was able to lift and support the weight of the bumper on his own. Peter took the idea further, ‘Can we lift your legs here, lift over the top there, is that too high?’ It was too high, as Richard explained ‘cos the front wheels have got to be on the floor’. Again it was Richard’s lived-experience, adding additional insight into how this bit of kit works that developed the Peter’s understanding of the situation and how to connect this bumper to the chair. Richard explained ‘that bit goes back and you screw it round’. Peter asked, ‘does it go here, on this bottom level then?’ It did, well ‘that changes
the complexion of it’. Evidently the problem was more complex than Richard initially understood and this solution was also not going to work.

In this brief sequence the number of components within the assemblage has increased and the complexity of the problem had escalated. These were characteristic problem-solving actions, as when further details of the problem were known, the problem and solution space evolved and alternative solutions are offered (Dorst & Cross, 2001). At this point Peter moved away to reflect on the problem. The researcher asked, ‘what usually happens?’ (how was the bumper connected to the old chair?). Richard explained that ‘the carer has to do it but she’s not always here’ and Richard’s wife added ‘and I can’t do it’. From this response everyone present understood that Richard has always been dependent on someone else’s assistance.

Peter suggested another solution, ‘so I think if we come out of this tube here, we’ll have a fixing hole up, up across and down, it might take a bit of jiggling but I think that would be fairly strong’. Richard was satisfied with that suggestion. Now the spatial configuration was better understood it was the strength of materials and the practicality of making the fitting that were considered. ‘What I think I’ll do is make a tube that comes out across and up and it drops straight into there so you’ll be able to sit on the bed, plonk that in from the top’. Richard liked that idea ‘yeah’. Peter continued reasoning through the practicalities of the design, ‘how far do you think they should go in? Couple of inches maybe?’ Using the foot as a guide Peter continued ‘let’s take that bracket out and measure it, so that would give me the diameter’ (making a sketch and adding dimensions). ‘A bracket that comes up across and down into there, pin fixing so you can sit on the edge of the bed, conk that in instead of doing all those screws up … its not very practical to keep bolting and unbolting them’. This refinement seeks to simplify how the bumper connects to the chair.

Peter talked through what he was doing and plans to do next, ‘I can make that on the bench at work. Don’t always get it right first time, might have to drill that pin. I don’t want to affect the warranty [of the wheelchair], so I’ll use their fixings. I mean this is quite a thick tube here, my Martin mates say this is belt and braces all the way, this steel is thick and there’s a hole in there already’. Peter makes known his reasoning, how he will approach making the component, noting the thickness of the tubular steel of the wheelchair and his intent not to drill into it. Peter continues, ‘What I’ll do is make up a pair [of brackets] bring them over and try them, let you use them for a couple of weeks and when you’re satisfied I’ll finish them off with a powder coating. When I come back we should have this sorted’. Richard is satisfied with this explanation and succinctly characterises the problem, the ‘bumper’s the same, the wheelchair’s new and nothing matches’. Peter adds ‘but on this occasion I think we can help’.
In his workshop Peter began making the brackets by cutting a length of tubular steel to form the end that will drop into the tubes on the wheelchair (Figure 3). Welded to this was plate steel, flattened and bent into an S form shape to make the fixing between the wheelchair and the foot. The solution is a kind of coupling mechanism, where the bracket fits into an existing fitting on the wheelchair and the football bumper drops into the bracket. The solution is non-invasive, maintaining the integrity of the tubular steel of the wheelchair frame.

On the next visit Peter returned with a pair of brackets, to watch Richard connect the bumper to the wheelchair and then re-connect the foot in the configuration he uses everyday (Figure 4). Satisfied that Richard was able to assemble this by himself and change between foot/bumper on his own, Peter suggested that he return in a few weeks, for Richard to update on how satisfactorily this solution performs when playing football.

Several weeks later Peter returned to ask how well the equipment had worked when playing football. The assemblage of the bracket and bumper had worked well. This conversation did however open up the possibility that re-work might be necessary. Remap’s designer-makers were accustomed to making adjustments and modifications to their products. Peter was conscious of the different
ethos he adopted on his day job, handcrafting cars for Aston Martin and furniture for Marc Newson, from these volunteer activities, making 'belt and braces' things to make someone’s life easier. The same person approached the making of different bespoke products with a different sensibility, to suit each occasion.

3.2 Making in wood: putting on a coat by himself

In the next case we meet Dan (the client), who contacted the designer-maker Mark directly. Mark had completed a previous project for Dan. This kind of repeat business is not unusual. It exemplifies the trust and rapport that can develop between a client and ‘their’ Remap maker. At the first meeting Dan meet Mark to discuss a new project. The researcher was present as a participant observer and Dan’s wife was also in attendance.

The designer-maker and researcher visited Dan at his home to discuss the problem he has putting on a coat and to see the physical setting where a device would be used. Although Dan can drive a car he is unable to put on a coat by himself before leaving the house. Dan has tried standard dressing aids, a dressing stick and a pivoting frame hung from a door lintel but has not found these useful. The challenge for Mark was to make some form of mechanical assistance to enable Dan to put on a coat by himself and increase his independence.

In the living room was Dan’s walking frame. This started a conversation speculating whether hanging a coat over his walking frame with the arms hung over the sides of the frame, he could stand ‘backwards’ in the frame and put the coat on. This approach showed potential, provided somebody lifted the coat upwards by the collar. The shape of Dan’s walking frame provided initial inspiration for the design of a device. Dan’s walking frame was a mass-produced item, selected at a height to suit him. Exploring the design of a device inspired by the walking frame, Mark noted how the frame was shaped to Dan’s bodily proportions, his height and reach. The distance of the frame from his body left enough room to move his feet yet the frame was always within reach. What the frame did not accommodate was that Dan has a stronger right arm, with more movement and control than his left. Dan’s asymmetric capabilities came into play when he experimented with a device-in-the-making.

In his workshop Mark began making a wooden frame, knowing that working with wood the form could be modified at a later stage. Mark showed his work-in-progress to other members of the local panel (Figure 5) demonstrating how a coat is positioned with the frame. He talked through several unresolved problems: how to control lifting and only releasing a coat when it is in the right position.

Other members of the panel watched and then started to explore the problem by performing actions that are involved when putting on a coat, drawing on their
own bodily experience (Figure 6). The actions of the device were then inspected in more depth, what is the motion of the lifting arm, its height and range (Figure 7). Members of the panel commented on the precision that was needed to make the armholes accessible relative to Dan’s height, as well as the criticality in timing, releasing of the coat only when it is across his shoulders.

After the meeting Mark continued modifying the frame, connecting an electric motor to the lifting arm with a radio signal to remotely control the lifting motion. Mark took a near final version of the device to Dan at home. Mark explained, ‘I think it’s got to the stage now where it should be useable but its not absolutely right’ and encouraged Dan to ‘have a go at it .... tell me what you
think. You may well come up with some things oh well this is not very good or I’d that and we’ll take all that on board’.

Dan began experimenting with the device (Figure 8) placing his coat over the frame. The clasp mechanism at the back of the frame to hold the coat collar in place had been changed. Connected to the right hand arm of the frame was the receiver for the remote control. This activated the motor for the lifting arm. The jaws were connected to the lifting arm, which in turn are connected to
the mains power supply. At any intermediate point between top and bottom position if the rack is not powered the coat collar can be pulled from the jaws.

Dan stood backwards within the frame (Figure 9) with his arms inside both sleeves. Using the remote control he began to experiment with the device, activating the lifting mechanism to raise and then release the coat. Dan seldom spoke; his attention was focused on controlling the actions of the device. Observing his actions, to see how Dan was able to control the device, were especially important. There was an orchestration of his movements in synchronicity with the actions of the device that took a high degree of concentration. The coat was being lifted mechanically behind his back and out of his sight. Feeling where the coat was, listening and sensing what the device was doing and whether the collar was still connected, were new actions to learn through the use of this device. Dan began to develop and finesse a technique, putting his left arm in position over the armhole then using his right, more mobile arm and the buttons on the remote control lift the coat over his arms and shoulder.

Over time the project came to be referred to as the ‘coat-lifter’ signalling the action of the device. The project was difficult to characterise. This was a device
for putting on a coat and not any other piece of clothing. It's utility was more specific than other dressing aids but its significance was also more profound. Using this device Dan can put on a coat by himself, enabling him to leave home without anyone else's assistance.

In the next section we reflect on the previous cases and draw attention to several characteristics of the designer-makers’ sensibilities and what these add to our understanding of inclusive design.

4 Inclusive designer-making sensibilities, making stronger connections with material practices

Studying the practices of the charity Remap, with close inspection of two cases, this research sheds light on how the ideals of inclusive design were manifest in practice. In particular, examining how these ideals could be seen in physical actions and material practices. From these insights, we note three ways that this research makes closer connections between inclusive design and making. Firstly, by responding to inclusive design’s impetus for increased engagement of people in their own design processes. Secondly, through more embodied and concrete connections with materials in physical processes of making. Thirdly, by offering a bespoke service with important qualities that differentiate this form of designer-making from customised manufacturing. We reflect on each of these characteristics in more depth and suggest a future direction for the inclusive design movement.

4.1 Inclusive design’s impetus for increased engagement of people in their own design processes

In the first case, re-making wheelchair football possible, we note how Richard remained central to his own design process. He initiated the contact
with Remap and was instrumental in showing and articulating the ‘problem’ that framed the requirements for the re-design task. In his material handling of the foot he showed what he was capable of doing, expressed preferences and offered insights into whether a solution might be viable; actions that led to the design of a bracket so that Richard can now assemble the wheelchair foot on his own. These actions indicate his investment and volition in the design situation; why the problem and design solution were his (and not someone else’s). While this example does not claim to show equal agency in the design process there was local empowerment through active engagement, which has previously been commended (Heylighen & Nijs, 2014). In the second case Dan approached one of the Remap engineers directly, and again working through his embodied actions the client and designer began to explore what was possible. In both cases the home provided an important setting for the problem to unfold and through practical actions inclusive ideals and design speculations were nurtured. Dan experimented with several versions of the coat lifter, refining how to control the device, the critical timing of lifting the coat and releasing the clasp. In this there was an orchestration of corporeal and mechanical movement, as he learnt how to use a more reliable device. These actions echo Winance’s observation of the mutual shaping of people through devices (Winance, 2006). It was through Dan’s embodied and performative ways of showing how satisfactorily each version of the device worked, which led eventually to the coat lifter becoming part of his routine when leaving the house.

By bringing Richard’s and Dan’s bodily experience into the design process each problem was framed by their particular capabilities. Through their bodily movements and accounts of lived-experience they performed and enacted their own participation in finding a viable solution. In the physicality of embodied actions they were experts in their own design process. This approach to design respects the performative characteristics of someone’s (dis)ability, understanding that this is irreducibly situated, as it is located in a particular domestic environment and creates a designed artefact to suit someone’s (not anyone’s) capabilities.

While there is a pattern to Remap’s processes each consultation is unique. It is this specific sensibility, through personalized consultation and creating a bespoke solution that challenge perspectives that generalise in inclusive design. Instead it is an individual’s situated perspective that is acknowledged. Involving people with (dis)abilities in this way values the material reality of unique bodily capabilities and how people move and occupy space in different ways. This approach is considered to have a more positive capabilities ethos than, for example, categorising someone by a type of disability or a model. Indeed, user models are antithetical to the ethos of these inclusive designer-makers way of working, a point that will be developed further.
4.2 Through more concrete connections with materials in physical processes of making

Remap’s process involved the making of an object to solve a problem as well as its design, which adds, literally, a more material dimension to their practices. This was evident in the manipulation of materials, in the design-makers’ physical actions working with metal and wood to make the bracket and coat frame.

The problem of re-connecting the bumper to Richard’s wheelchair can be viewed as an unexceptional design task. It was the mismatch between two designed objects that posed a problem and made the design of another component necessary. It illustrates what is known as design after design (Brereton et al., 2015; Ehn, 2008) where the design process continues in use. Although the bracket is not especially noteworthy as a designed object, it was through the act of designing and then making a component so that Richard was able to re-assemble the wheelchair by himself and maintain his independence that was remarkable.

Mark’s actions making the coat lifter, in common with Coons and Ratto (2015) observations, showed that craft production can lead to custom-made objects to suit the unique conditions of someone’s body. The making of this involved improvised actions of exploratory making where different design solutions were considered, trying different ways to raise and release the coat.

The process can be seen as an exploratory way of finding out the problem and designing creatively with someone with a disability (as noted by De Roeck et al., 2011; Rajapakse et al., 2014). This is a personal way of working, which may take time and several return visits to arrive at a suitable solution. The coat raiser took several months experimentation to arrive at a mechanically reliable solution. A partially complete frame was brought to a panel meeting, inviting other panel member’s intervention on how the coat lifting mechanism might be configured. There were no scale models. It was by experimenting physically with the full-sized object-in-the-making that they explored the problem, whilst also making a solution.

4.3 Qualities that differentiate inclusive designer-making from bespoke customised manufacturing

Another characteristic of this approach is that the designer-maker is in contact with a client throughout the process. This keeps to a minimum the number of people who are involved in design and making. It supports John Thackara’s view that, “Practice, experience, and observation persuade me that the fewer intermediaries there are between designers and their clients the better. Brokerage sounds like a good service, but in reality it more often confuses the matter than simplifies it” (Thackara, 1996).
Designer-makers offer a personalised way for a client to participate in their own design process. Had another designer-maker taken on a project, what was made might have been different. At each regional branch there is a range of expertise, with people who specialise in working with different materials: with wood, in metal or electronics etc. The design solution and what is eventually made will always be unique. There was no attempt to generalise or standardise, to apply the design solution from situation to another. When asked whether Remap had considered patenting solutions the response was ‘don’t even go there’. Bureaucratic processes, maintaining patent agreements are not part of the ethos of this social enterprise.

Remap’s designer-makers collaborate with local people in the community. It is organised as a charitable social enterprise, which shares similarities with social innovation initiatives hacking products that were designed for (every)one (De Couvreur & Goossens, 2011). Remap make crafted objects, working in wood or metal, and on occasion customise existing devices. They approach each situation as it unfolds and by not categorizing a ‘user’. Remap’s approach is ambivalent to user models and resists the discussion of people by type of disability. To put this in perspective, the Eronomi Design Gruppen (EDG) developed the user pyramid model as a critical reaction against design ‘as if everyone was a 25–30 year old successful professional’ (Benktzon, 1993) and the cube model was a development from this, however, any user model is an abstraction. Remap’s approach is different from customized manufacturing in the material practices involved crafting each unique, sometimes lo-fi, gadget. There is individuality and precision in this form of craft production. Remap is a charity, drawing on local voluntary expertise and there is no payment for their services or the product that is made, which also differentiates this local, practical problem solving from bespoke customised manufacturing.

The speed of making a gadget in this way may be a viewed as limitation of the process, as it is dependent on a volunteer’s availability. These are crafted, improvisational actions, not optimised design and making processes. The approach works through personal contact with a maker, not a client aspiring to buy a branded off the shelf object. The social process of consultation can be mutually rewarding, for a client as well as a maker’s sense of satisfaction, making someone’s life a little easier. At a later stage, on both projects, the designer-makers returned to see how well the devices were working. This process was flexible and responsive to changing circumstances. It also anticipates that over time something might need to be adjusted.

4.4 Future momentum for the inclusive design movement
Given these characteristics of inclusive designer-making this research advocates the expansion of these practices, to bring inclusive design into closer contact
with makers and making in other communities. We can then begin to redress
the universal problem of designing for everyone’s unique difference. The ad-
vantages of closer collaboration, as we have seen, is it enables people to be
more engaged, to act as an expert in their own design process, articulating
and physically demonstrating a problem, suggesting routes towards a unique
design solution. This designer-making ethos is empathetic with inclusive
design ideals, which suggests that closer collaboration can be encouraged.

This research proposes a direction of travel and anticipates a design future
where the inclusive design movement is more closely connected with making.
We have seen two cases where designing inclusively is working well. What is
couraged is the scaling-out of this approach, that is, replicating this
approach in a similar way in other locations and with other communities
(this is a different scalability tactic from scaling-up, increasing the size of
this group). Indeed, Remap already have regional panels in other locations.
This model is dependent on a prospective client knowing that this service is
available and how to contact Remap. Since Remap were advisers on the first
series of the BBC tv programme The Big Life Fix there has been an increase in
the number of requests, as well as designers interested in joining local panels.
This suggests that the initiative is gaining traction.

5 Conclusion

This research has taken up the challenge to examine how the ideals of inclusive
design are manifest in practice. We conclude from these observations that
when people are able to participate more actively in design and making to
meet their particular requirements that this mode of engagement responds
positively to several controversies in inclusive design. By paying attention to
the individual this approach recognises the unique, everyday, exceptional sit-
uations people with different capabilities encounter in their lives (and reduces
generalisation on user stereotype or category of disability). This approach
foregrounds someone’s lived and embodied experience of the material world,
which makes one design solution more favourable than another. Importantly
by putting someone at the centre of their designer-making process they are
instrumental in determining what they want to change and what will work
for them. In the first case making a wheelchair bracket to extend Richard’s in-
dependence was not trivial. In the second, making a device so Dan could put
on a coat by himself enabled him to leave home without anyone else’s
assistance.

This research advocates, and provides a reasoned argument, for the inclusive
design movement’s closer connections with makers and making in twenty-first
century, to begin to redress the universal problem of designing for everyone’s
unique difference. Remap’s approach does keep to a minimum the number of
intermediaries between designers and their clients. This way of working
however is not suggested as a panacea to all the movement’s controversies. Inclusive designer-making will complement other forms of design activism and lobbying initiatives that also work towards better-designed products, services and environments for (every)one.

Acknowledgements
This research was conducted with the informed consent of all the participants and ethics approval granted at the Open University. Funding: This work was supported by the ERC European Research Council [Universalism, universal design and equitable access to the designed environment UNIDESIGN, 323777]. An earlier version of the wheelchair bumper case was presented as a methods story at an inclusive design workshop at the Participatory Design conference PDC 2016, Aarhus University. I would particularly like to thank the people who participated in this research, without whose cooperation this project would not have been possible, and the charitable organisation Remap.

References
D’Souza, N. (2004). In S. Keates, J. Clarkson, P. Langdon, & P. Robinson (Eds.), *Is universal design a critical theory?* (pp. 3–9), Designing a more inclusive world.


