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“The Embodiment of Pure Thought”? Digital Fabrication, Disability, and New Possibilities for Auto|Biography

By Ursula Hurley 

Frieder Nake describes the process of digital fabrication as “the embodiment of pure thought” (80). An idea, expressed virtually within a computer drawing program, can be made concrete through the use of machines including laser-cutters, routers, and three-dimensional (3-D) printers. The concept becomes particularly intriguing when it is considered in terms of what Timothy Barrett describes as “‘auto/biographical’ potentiality” (1576). The ability to materialize hitherto intangible aspects of selfhood opens new possibilities for auto|biographical inscription and interpretation. These opportunities are pertinent for disabled people, who might engage digital fabrication practices as conscious affirmations of agency, challenging hegemonic cultural narratives of lack and deficiency. To support these claims, I draw on the findings from a UK Arts and Humanities Research Council project, “In the Making: A Co-Constructed Mapping and Feasibility Study of Digital Fabrication Labs and Their Potential to Catalyze Cultural Change” (Hurley, Connolly, and Taylor).

Many pieces of hardware can be employed in digital fabrication. Our project chose to work with 3-D printers because they “make it remarkably clear how an idea (or at least the virtual, digitally designed representation of an idea) can become a material object” (Walter-Herrmann and Büching 11). The printer’s software “slices” a digital design into tiny topographical layers, which the machine then materializes physically by depositing these layers incrementally via a nozzle that usually extrudes hot PLA (plastic) filament, although more sophisticated printers can work with other materials. Entry-level 3-D printers are readily available to the home user, and early adopters already share a wealth of designs via open-source websites such as Thingiverse.

Our funding allowed us to secure the equipment to produce simple 3-D prints and to enlist expert facilitation.¹ We took the mobile lab “on tour” around Greater Manchester, a large conurbation in the northwest of the UK that contains many postindustrial areas with their attendant issues of economic and social disconnection. The two-day courses were widely advertised,

free to attend, and nonselective. The recruitment strategy targeted people who identified themselves as disabled or as having experience with disability (e.g. as a carer), but no one was excluded. Travel, subsistence, and caring costs were met wherever possible. Via inclusive practices and adaptations, the project aspired (1) to bring Fab Lab facilities to people in their own setting; (2) to offer bespoke training and facilitation, designed around the expressed or apparent needs of participants; (3) to furnish an inclusive maker-space in which users participate in a supportive community of practice; (4) to explore the political potential of making in terms of expressing wants and needs and raising cultural visibility; and (5) to explore making as a “fabulous” opportunity, offering ways into self-expression via the processes and products of making.

The workshops engaged over one-hundred disabled people, some of whom traveled significant distances to be involved.² The approach throughout was guided by the motto, “I can make it.” Project-leaders affiliated with Disability Rights UK used this phrase with conscious reference to the layers of meaning contained therein. Bound up with the sense of physically making a useful or beautiful object is the abstract sense of “making it” by succeeding in life, crossing the finish-line, achieving a goal. Digital fabrication supports the “I can make it” ethos through its ability to materialize previously hidden or inexpressible aspects of being, opening a route to the reclamation of agency (Connolly). Making concrete the intangible aspects of selfhood may call for a reconceptualization of how identity is constructed. If thought can be expressed physically, how might this shift or even disrupt conceptions of embodied personhood and the disabled self? We posed these questions as means of exploring alternative auto|biographical practices, in particular those challenging “hegemonic associations between disability and personal tragedy” (Barrett 1570). The opportunities and risks inherent in this endeavor will be considered shortly, with specific examples from our project.

First, it is worth noting the broader cultural context in which digital fabrication is situated. The democratization and personalization of manufacturing raise profound questions about intellectual property and economic models, leading some to hail the “maker” movement as the dawning of a new industrial revolution (Gershenfeld; Lau et al.). Such claims, however, require critical appraisal. Sascha Dickel and Jan-Felix Schrape identify utopian narratives in current media coverage, which assert that “the digital future of the ‘prosumer society’ is to be materialized by 3D printers and their socio-technological ecosystems” (48). Disrupting the traditional roles of producer and consumer has radical potential, but prevailing paradigms tend to privilege the affluent, technically adept maker and risk the exclusion of many groups and individuals.

Autoethnographer Selena Nemorin, for example, documents the frustrations of working with the technical restrictions of currently available 3-D

printers. She uses the phrase “mediated alienation” to describe the practical difficulties inherent in the claim that 3-D printers can materialize thoughts: “My labour in this setting was controlled by digital rules set by an external entity with the power to dictate how I was able to embody myself through what I made” (18). Nemorin’s experience seems to suggest that, far from opening new possibilities for concrete expressions of selfhood, the practical restrictions of currently available 3-D printers (rather than their utopian future capabilities) may close down, dictate, and discourage.

Laura Devendorf and her coresearchers offer a posthumanist critique of these potentially limiting qualities. Difficulties like those experienced by Nemorin arise because 3-D printers are designed on anthropocentric terms, framing “the human maker as the locus of innovation and creativity and their building materials as passive receptors or container for makers’ ideas” (Devendorf et al. 172). Inherent in the operation of 3-D printers for the consumer-market is the assumption that accuracy of replication is the primary goal, and where this does not happen, the print is seen to have “failed.” Conventionally, the competence of a maker is judged by their ability to coax the machine into faultless replication of the virtual design: “the heuristic that has driven ... 3D printers, is fidelity to the original digital model” (Devendorf et al. 172). When fidelity is lost in the process of translation, the human maker is framed as unsuccessful. Managing the “affective labour of failing” (Nemorin 1) became particularly pressing in our project, working with novice makers who were already starting from a socially defined position of lack.

This is not to say that disabled people are excluded entirely from the maker movement. Some early adopters have been at the forefront of developing their own customized practical aids. The e-NABLE network, for example, connects makers with people who need prosthetic hands. Cynthia L. Bennett and her coresearchers have begun to explore how the making of 3-D-printed prosthetic limbs relates to the construction of self and the “development of ability identity” (1746). However, e-NABLE and other networks largely reproduce the boundaries between expert makers and the disabled recipients of that skill: “women and minorities are underrepresented” in making communities, while questions remain about how “people with disabilities begin to be recognized as makers” (Bennett et al. 1748).

Researchers, facilitators, and collaborators involved with “In the Making” situate the project as a possible response to inquiries about how disabled people might recast themselves as makers of their own solutions. With Joe McLeod-Iredale, founder and director of Daedalus Design, our team developed an inclusive pedagogy entitled “Digital Fabrication for the 99%.” Everyone, no matter their diverse capacities, was given support to be actively involved in the making process, be that expressing preferences via an interpreter, making a sketch, taking a photograph, or learning the software to an advanced level of independent practice. The outputs from these making

sessions ranged from the practical (a dog-tag), to the assistive (a finger-splint), to the political (wearable text), to the aesthetic (abstract sculpture).

The enabling factor in our collaborators' achievements was the coevolution of what Devendorf and her colleagues identify as a postanthropocentric maker-space, "challenging norms around what it means to be a 'maker'" (171). Initially, some of our facilitators were alarmed by the dehierarchized space in which disabled people, often accompanied by their own machines, prostheses, and assistance animals, improvised accessible modes of making. Those instructors used to more conventional making environments were challenged to recalibrate their perceptions of what constitutes legitimate making practices. Together, facilitators and collaborators evolved approaches that "de-emphasize[d] precision in order to make space for new ideas, forms and experiences to emerge" (Devendorf et al. 175).

However, it was not just a matter of sitting people in front of the equipment and saying, "Go ahead, make something that speaks about your life." Being offered access to technology that can, subject to practical restrictions, "make anything" can be overwhelming: "that idea of saying 'make whatever you want' is quite a frightening thing" (Armson). Auto|biographical practice implies the presence of a sense of selfhood considered worthy of expression. People who have spent their whole lives subject to the "single story" of disability (Schormans and Chambon 174) and who may have internalized its positioning of them as Other "are less likely to consider their lives worthy of auto/biography. Stigma serves to silence the stigmatized" (Couser 79). People came to our workshops visibly apprehensive: exhausted, nervous, and sometimes in physical or mental discomfort. Many had already experienced hours of difficulty negotiating medical issues, transport arrangements, and care provision just to reach our doors. It was common for each new arrival to begin with a self-deprecating statement: "I'm just not creative, I don't think I'll be any good at it, I probably shouldn't be here, this isn't for the likes of me."

The inclusive, postanthropocentric Fab Lab, therefore, begins with facilitation of imaginative and creative processes, offering activities designed to open an accessible making-space in which people feel comfortable expressing their needs and aspirations. However, having an idea, wishing to express it and finding the confidence to do so, evolving a mutually comprehensible language, and translating that into digital format presupposes the success of many complex negotiations. Inevitably, we encountered irresolvable gaps. Some designs were too complex for the plastic filament, which "limits the experiential range of 3D printers" (Devendorf et al. 172). Occasionally, we struggled to coevolve communication strategies. Sometimes, people responded that they just did not want to make anything. Respectfully exploring such "nonmaking" responses often revealed doubt, anxiety, and confidence issues, which are particularly pertinent to practices that seek to open routes to the reclaiming of agency.

Our strategy was to nurture feelings of self-worth and validity without announcing that we were doing or making anything special. Reiterative tasks were introduced via mindful activities such as molding clay shapes, playing with textures, selecting images from magazines, and chatting about daily routines. We termed this phase of the making “guerilla creativity,” gently shifting people into calming routines designed to relieve self-consciousness and the pressure of expectation. Throughout the introductory activities, our “Ultimaker” 3-D printers were running, printing demonstration objects so that the link between imaginative work and its eventual destination was always present. These machines are designed to be appealing. Brightly lit, with a friendly robot logo, they are used regularly in schools for design-education (Figure 1).

While it is working, a printer makes a distinctive noise, and when more than one is working at the same time, this becomes a “happy” burbling, which is almost musical and invites one to imagine them talking to each other.

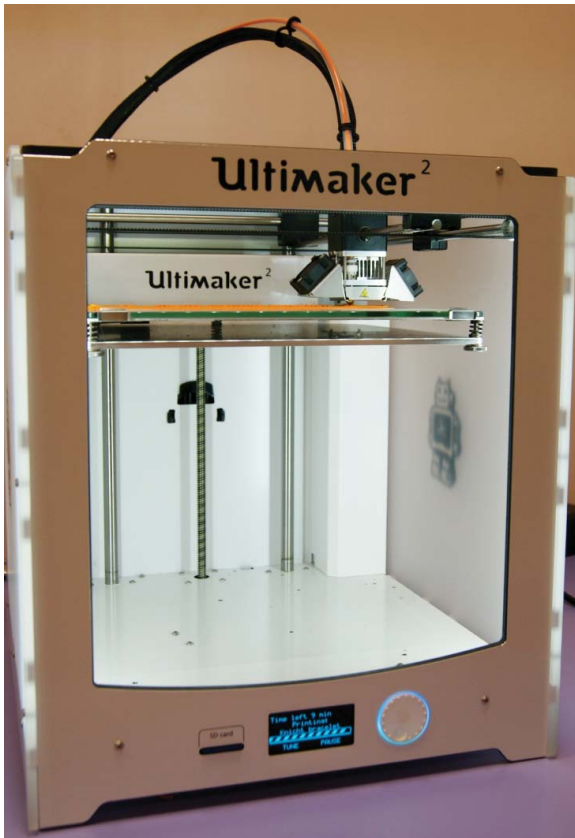


Figure 1. One of our Ultimaker printers in action. The cartoon robot is visible in reverse, through the transparent right-hand side.

When makers become attentive to the rich, sensory experiences of the process rather than focusing on the goal of perfect replication, we move toward the concept of the postanthropocentric making-space, in which the behaviors of the machines constitute integral aspects of the environment (Devendorf et al. 174).

In our maker-space, the sound of the printers seemed to function like white noise in its calming properties, helping to support a relaxed atmosphere. Participants gave the printers personalities (one was well behaved, the other was “naughty”) and began to construct biographies for them. People enjoyed creating back-stories to explain these perceived personalities. The “naughty” printer was supposed to have had a difficult start at the factory; consistently gendered male, he had been made to feel different because his build-plate was bronze instead of the standard silver; he was protesting at being covered in sticky hairspray (used to stop the prints sliding around as they emerge). Notably, people were much more drawn to the “naughty” printer, empathizing with his imagined Otherness and justifying “his” frequent “refusals” to “do as he was told.” Rather than bemoan a “failed” print, people would delight in the printer’s apparent mischief, ask questions about how and why prints deviated from their digital coding, and explore playful uses for the “3-D scribble” that emerged in place of the intended object. This curiosity about the machines’ operating conditions and tolerance of unexpected outcomes resonates with the observation that 3-D printers “foster close, careful, and attentive relationships among humans, machines and materials” (Devendorf et al 178). It may be that disabled people, through their own life experiences, are better equipped than most to occupy imaginatively another marginalized position: that of the machine.

In particular, the project team noticed that people with autistic spectrum conditions or with intellectual disabilities seemed to establish the strongest rapport with the printers. Friends and family frequently commented that they had never seen their loved one so engaged with anything, be that a person, a machine, or an object. Some participants stood for hours, enraptured, watching a print emerge. That process of transformation and materialization seemed to speak profoundly to everyone involved in the project. This observation encompasses collaborators, researchers, facilitators, curious visitors, volunteers, carers, and supporters. Even the technical experts would stand silently and smile, engaging a ritualistic flourish as they enjoyed the wonder of the novice maker who had succeeded in materializing an imagined object.

This wonder, I argue, is key to exploring the potential of digital fabrication practices in disability-arts. My experiential account resonates with Lucas D. Introna’s description of wonder when an archaeologist encounters a newly revealed artifact. He uses Graham Harman’s concept of allure to explain “this bursting forth of the thing in its thingness” and likens the experience to “the image of a young child staring with wonder into an empty glass, or a pile of

toys, as if everything that is important, wonderful and relevant is revealed there” (Introna 52). This staring with wonder is exactly what we saw again and again in the maker-space as a 3-D print materialized. Having located a process for generating experiences of wonder, the question became, What is it for? How might wonder be engaged to effect the reclaiming of agency?

The postanthropocentric maker-space provides a link to politically engaged practice: “the process of making transforms from a way to produce things to a way to inquire about relationships among things, spaces, people and material” (Devendorf et al. 178). This attention to roles, situations, and identities is prompted by digital fabrication technologies engaging space and time, matter and thought. The exploration of such interactions resonates not only with posthumanist criticism but also with disability studies scholarship. Digital fabrication is productive for interrogating and recasting experiences of disability because it creates affects of wonder. Tanya Titchkosky proposes that the affect of wonder prompts those engaged with it to “pay attention to the politics we make use of to respond to the place of disability in our society” (129). Through identifying and deploying the wonder inherent in digital fabrication, we saw an opportunity to explore how disabled people might situate themselves as makers of their own solutions. We theorized that wonder in the context of 3-D printing was located in the technology’s ability to materialize the imagination. Titchkosky’s articulation of wonder’s political aspects helped to develop our thesis. The embodiment of thought made possible by 3-D printers might offer a powerful energy in support of what she calls “a reflexive politics of embodied life” (132). But to do that, our collaborators needed effective processes to generate designs amenable to materialization.

The hinge of complexity within the process of digital fabrication is in distilling an idea and then expressing it in a form intelligible to computer-controlled machines. This is the interface between creative and technical skill-sets, and the most demanding step for participants in the inclusive maker-space. While evolving an inclusive digital fabrication practice, we were subject to false steps and failures.³ The great responsibility was to manage those failures carefully so as not to fail our coconstructors, who were already all too familiar with experiences of rejection, difficulty, and obstruction. While “creative failure” is to be expected (indeed invited as part of the creative process), a failure to create required careful management for our collaborators, who may have perceived the experience as reinforcing lifelong narratives of inadequacy and lack. Our aim, therefore, was that every participant should leave with a 3-D-printed object that was unique and personally meaningful.

We explored a number of different facilitation strategies to elicit and evolve ideas for things to print, including routines drawn from experimental poetic practices.⁴ While the role of poetry in our inclusive maker-space may seem tenuous, perhaps even exclusive, Titchkosky finds “poetic knowledge” and “disability” in the same place, “emerging in the intersection of the

perceiver and the perceived” to question “how we make the meaning of people” (131). Introna adds material possibilities to the argument: “The ‘poetic’ is taken here not in the sense of a romantic nostalgia but rather in the sense of a bringing forth that allows things to disclose themselves in their own terms” (52). Combined with digital fabrication, the practice also allows people to disclose themselves in their own terms through the embodiment of the imagination, troubling the ways in which disability is “cast as a strict matter of the body” (Titchkosky 131).

Facilitator Philip Davenport, codirector of community-arts group arthur +martha CIC, initiated collective poetry by asking simple questions and recording the responses of everyone around the table. Where necessary, this question was translated by interpreters. If anyone chose not to reply, this was respected as a valid response and the silence was recorded as a space on the page. So, in response to the questions “what makes you feel free?” and “what makes you feel trapped?,” in his workshop notes from 16 September 2015, Davenport recorded the following responses as they were spoken or translated:

trapped dyslexia
 non-conformity free
 independence
 ditto
 liberty
 freedom captures and bounds us
 no responsibility
 being on outside
 gravity
 writing I can go wherever I like
 flying much easier if I had wings
 freedom of choice
 driving
 to be able to the shops
 pressure—gotta do that, gotta do this
 good health opens the doors
 motorbikes
 to see the horizon and climb higher
 not having to justify

When this collective text was read back to the group, its coauthors were able to recognize it as having literary merit, taking pleasure and satisfaction in hearing and reviewing their creation. The complex and double-edged assertion that freedom itself (or perhaps the idea of it) can capture and bind us has, in my opinion, strong poetic quality in that it can sustain multiple interpretive possibilities.

The collective poem uses poetic knowledge to address a long-standing tension between auto|biography and disability. Barrett, for instance, describes

“intense antipathy and distrust within disability studies towards ‘individualism’” (1571) and goes on to identify the logic that “auto/biographical life writing tends towards a consideration of disability primarily in terms of individual experience, perpetuating the psychologised tropes of tragedy, struggle and overcoming rather than patterns of structural oppression” (1571). And, as G. Thomas Couser observes, dominant social narratives position disabled auto|biographers with “stories worth telling” as exceptional individuals or “supercrips” who overcome personal tragedy through sheer force of will in order to succeed in the ableist world (78–9). Dominant social narratives set an unfortunate precedent, then, implying that “ordinary” disabled people are simply not trying hard enough to live up to these inspiring examples, and those narratives draw attention away from the important work of identifying and critiquing the disabling social structures that underpin such positionings.

Our project’s inclusive and collective creative procedures may offer one way of coconstructing accounts of lived experience that accommodate individual expression but also highlight the disabling factors of the social context in which the cowriters are located. Evident in the collective poem reproduced above is a sustained attention to physical positioning: going out, being outside, transitioning from one place to another via doors, or driving. Such a concern with “the way people are already situated” (Titchkosky 130) suggests a collective attention to independence and freedom of choice: hard-won, contested, and not to be taken for granted. Allusions to pressure and resistance to self-justification may speak to experiences of health and welfare systems whose requirements are becoming increasingly stringent in this period of austerity. For instance, the 2016 inquiry by the United Nations Committee on the Rights of Disabled Persons highlighted that benefits reforms in the UK “hindered disabled people’s right to live independently and be included in the community” (BBC News). In our collaborative poem, we may also find an implied critique of the medical model of health, where someone feels trapped by the fact of their dyslexia, resulting in a state of being that affects interior and exterior life.

Thus, before we reach the stage of generating material interpretable to a 3-D printer, the creative process itself does reflexive work, “constructing the poet himself or herself, even as the experience is unfolding. It is a self-revealing, self-constructing form of discovery” (Brady 630). Through this poetic routine, our collaborators explored and asserted selfhood—collectively and individually—while simultaneously developing techniques for articulating and ultimately materializing certain aspects of that selfhood.

Progressing from process to product, one route to printing is to use poetry itself as a direct source of material. Our technical facilitators developed a process for printing 3-D text, which could be purposed as wearable (a badge or a cuff) or as a wall-plaque, paperweight, or ruler. These decorative, self-

authored wearables resonate Julia Watson's framing of the posthuman prosthetic in auto|biographical production. Traditionally, prosthesis has been understood as "an artificial device that replaces a missing or impaired part of the body" (Bennett et al. 1746). Watson, however, reclaims prosthesis from its association with lack and posits it as "a dialectical method of self-engagement, and ultimately a way to reorganize the self-world relationship" (23). Watson's study focuses on the visual diary-keeping of performance-artist Bobby Baker, who documented her experiences of mental illness through an extensive series of dated, often abstract or surreal self-portraits. The wearable texts produced by our collaborators lend themselves to similar interpretive strategies as they reimagine and challenge the logic of the prosthetic.

From the poetic material, participants selected text; typed or dictated the words into the software; made aesthetic decisions about design, color, and font; and then wore their own words in a fascinating performance of embodied auto|biography. One woman with arthritic hands chose the word "overcome." Determined to materialize her sentiment, the participant made the word herself, weaving pipe-cleaners with her own hands, which caused her pain and difficulty but also tremendous satisfaction when she had finished (Figure 2). In engaging with this process, our collaborator fulfills the ethos of the postanthropocentric maker-space, where manual interactions with materials ravel the maker in nonhuman agencies (Devendorf et al. 175).

The physical text, embodying the woman's pain and difficulty, was imported via a 3-D scanner and sent to the printer, which was able to

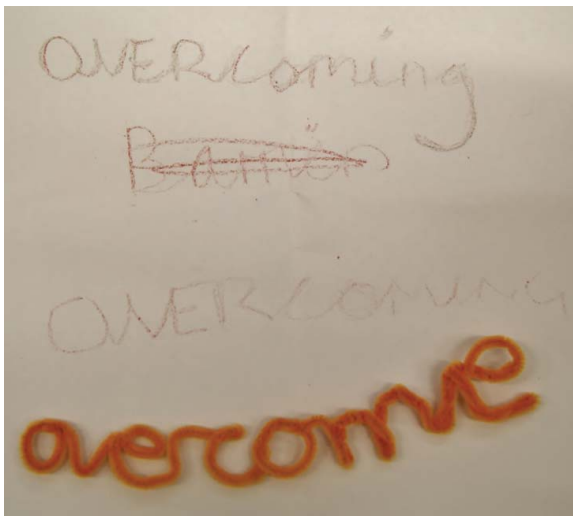


Figure 2. The initial written material and the physically generated text, shaped from pipe-cleaners.

reproduce this complex, organic lettering as a plaque or pendant in different colors to match its creator's aesthetic preferences (Figure 3).

The product of this making may be read initially in the context of the “supercrip” narratives delineated by Couser, stating the wearer's determination to surmount her disabling circumstances. This maker was visibly Othered by arthritis. She came to the making sessions in a large electric wheelchair and evidently experienced a constant struggle with pain. She traveled long distances to collaborate with our project, “overcoming” considerable barriers to do so. However, further consideration suggests the word “overcome” as a double-edged, self-reflexive invitation. Nondisabled viewers, encountering this woman wearing a piece of self-made 3-D text, are prompted to wonder, to examine, and perhaps to overcome their own preconceptions about disability. When Watson describes Baker's diary-method as a strategy that “shifts the prosthetic from a reactive to a reflexive practice” (33), she might be talking about our collaborator's activities. Digital fabrication, particularly for those excluded from traditional expressive arts, enables the posthuman prosthesis to materialize emotion, to record and share states of being that challenge traditional, humanist notions of self and, ultimately, to place the self “in relation to objects as a process of self-reordering” (Watson 33).

A perhaps more subversive example of this prosthetic potential may be seen in the making activities of a young man with intellectual disabilities. A poet-facilitator collaborated one-on-one with this maker to generate a poem about what he enjoyed. He selected “going out weekends” as the text to be



Figure 3. The pipe-cleaner lettering emerges from the 3-D printer. Note the addition—visible on the left-hand side—of mounting holes to allow the text to hang from a thread or chain.

materialized. He typed the text into the computer himself, chose red plastic, and stipulated screw-holes so that the 3-D print could work as a plaque, fixed to the wall of his room (Figure 4). The young man's supporter told us something of the context for this making: a favorite activity was collecting badges and signs; living in a group home, personalizing his room with text and images of his own choosing was very important to him as an assertion of identity. He had never, though, had the opportunity to display text of his own making.

The choice expressed in this materialized text may be read in prosthetic terms as an "exercise of agency" (Watson 36), a statement asserting and affirming the maker's right to social and leisure activities. Cultural narratives about the kind of weekend young people may expect to experience include opportunities to initiate and explore sexual relationships. Such relationships, however, are widely regarded as taboo for people with intellectual disabilities. Mike Gill, in his groundbreaking work *Already Doing It*, points out that individuals "in certain settings such as group homes" are subject to "sexual ableism" (40). Such attitudes, even among disability-rights activists, result in the restriction of sexual liberty for people with intellectual disabilities "primarily because of their impairment label" (40). In a manner similar to the "overcome" print discussed above, the statement of agency implied in the assertion "going out weekends" is as much a challenge to the viewer's preconceptions as it is a materialization of the maker's desire. Anyone drawing attention to this potential reading of our collaborator's text risks implicating themselves in perpetuating sexual ableism, highlighting "the naiveté of the individual doing the uncovering" (Gill 193). Well-intentioned observers, in speaking out on behalf of a perceived "victim" of sexual ableism, become aware of their appropriation of another's experience and the double bind that has made them complicit in reproducing prejudice even as they seek to address it. The normatively able interlocutor is destabilized.

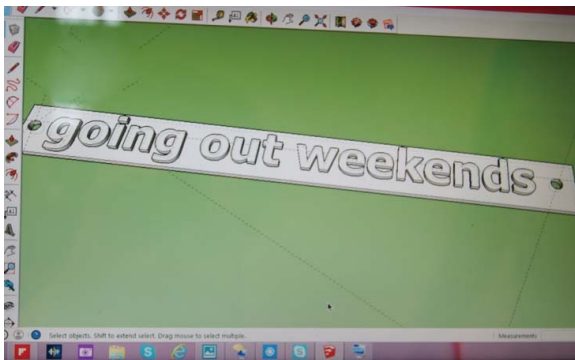


Figure 4. The plaque in its digital form. This is scalable, replicable, and easily modified. Note the holes for fixing, which the maker helped to measure and position.

The reflexive and radical potential of the posthuman prosthesis, and its relationship to desire, leads us back to the affect of wonder. Not only has this maker mobilized Introna's sense of allure, which "opens the possibility for the radically other to provoke" (56), but the viewer's sense of self has been "disrupted and unravelled by it" (54) and perhaps recruited to "the effort to achieve some confrontation with, and transformation of, society" (Brown 12). In terms of realizing a politics of wonder, this maker's statement of agency has opened an opportunity to "examine what it means to propose that disability represents personal tragedy, medical substance, and/or restrictions of individual activities addressed and remedied by experts" (Titchkosky 144). Without going through the process of making via poetry, the maker might not have articulated, for himself and others, this personal and political statement. We might relate this coconstructed, tangible assertion of rights and pleasures to Carl DiSalvo's concept of political making "as a way of giving material substance to ... desires and commitments" (97). Furthermore, we encounter a compelling example of poetic knowledge exceeding the limits of rational, intellectual knowledge to political ends, posing "the question of how we make the meaning of people" (Titchkosky 131). The politics of wonder is engaged via digitally fabricated expressions of agency.

As this reflection on Fab Lab art-therapy workshops has demonstrated, the possibilities opened by digital fabrication technologies constitute a powerful new modality of inclusive auto|biographical practice. The difficulties and tensions involved in delivering our project prompted us to evolve a postanthropocentric making-space, attending to provisional, unexpected, spontaneous, and playful interactions among machine, material, and maker. The productiveness of this approach affirms that digital fabrication practices can materialize thoughts and place them in a dynamic relationship with the physical world, that these practices can be inclusive and appealing to disabled people, and that "continued care, experimentation, and growth with a set of materials can form the basis of a sustained relationship with materials that many find pleasurable and even therapeutic" (Devendorf et al. 172). Beyond the pleasurable and therapeutic benefits of engaging in a postanthropocentric making-space, I have argued that the processes and products of digital fabrication can be read as auto|biographical inscriptions and assertions of agency. The deployment of 3-D-printed posthuman prostheses troubles the hierarchies of human, machine, and material, self-reflexively inviting the reconceptualization of embodied personhood, the disabled self, and art and scriptotherapies.

The University of Salford

Notes

1. The project team comprised the author, who led the investigation into autobiographical practices, in collaboration with Nick Taylor, a human-computer

interaction specialist at the University of Dundee, and Philip Connolly, policy and communications manager at Disability Rights UK. Technical advice and facilitation came from Fab Lab Manchester, pedagogical input from Joe MacLeod-Iredale of Daedalus Design, and creative facilitation from local community-artists, particularly arthur+martha CIC. A local steering-group, drawn from participants, researchers, and stakeholders, met regularly to guide the project's progress and to resolve issues of access and ethics. Reference to "we" and "our" implies the collective membership of the project: researchers, facilitators, and collaborators.

2. The project has ethical approval from the University of Salford. Each participant coconstructed a personalized permissions document, detailing, according to their expressed preferences, how much of their data the researchers could use and in what ways. All of the materials appearing in this essay were generated by people who have given permission for their work to be used in academic publications. However, individuals have not been identified because of the sensitive nature of the material.
3. Digital fabrication depends on a mix of creative and technical skills. The facilitators and researchers frequently encountered knowledge-gaps and mistranslations across disciplines as they worked to develop a mobile, inclusive making-space. The author is a novice at 3-D printing, which helped to frame the activities from the perspective of the participants rather than the experts. However, some of the creative facilitators found the technology and its current limitations highly frustrating, while the technical experts struggled to explain things in laypeople's terms. While we did provide a training day for the creative facilitators, a key learning point from the project is that much more time and resources need to be devoted to creative and technical experts working together to learn each other's languages and to explore how they might collaborate more effectively.
4. These methods are set out in detail by Smith.


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Disclosure statement

No potential conflict of interest was reported by the author.

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