
Trail of Hacks: Poster Co-Design as a Tool for Collaborative Reflection

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ABSTRACT

This paper describes a process of collaborative sense-making through co-designing a reflective poster. We used this method in the 'Empowering Hacks' project which gathered two non-academic individuals with disabilities (authors 2 & 3) and a non-disabled HCI researcher (author 1) around DIY/Making by, for and with people with disabilities. To collectively review the achievements and challenges we experienced in this project, we designed a timeline which allowed us to equally engage in reflective thinking and curatorial discussions on how to present and explain identified key moments. We see the instance of this co-created poster as an opportunity to discuss with the CHI-community the potential and relevance of including research participants in analysis processes.

KEYWORDS

Making; DIY; diversity; disabilities; participatory; action research; reflection; co-design; method.

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INTRODUCTION

The Maker Movement refers to a trend of people making their own 'stuff' with Do-It-Yourself (DIY) technologies such as 3D-printers, laser-cutters, and microcontrollers. In theory, everyone can now fabricate everything – even non-experts without any particular tech-knowledge. However, in practice not everyone has the same opportunities to take part. Given its resource-intensive nature (expensive tools that require certain technical skills), DIY-Making tends to remain a practice of rather privileged individuals with enough disposable time and access to knowledge and tools [6], while those who potentially could benefit most are often still excluded. There is a paradox in that the capacity of empowerment around Making is not reflected in the communities evolving around it [9]. Empowerment in the social sciences sense involves subjects seeking to overcome inequalities due to such as for example racism, sexism, ageism and ableism [8]. So, if HCI researchers specifically seek the participation of underrepresented groups, what implications does this have for their research practices and sense-making of research data?

This paper shares some initial reflections on this question in the context of 'Empowering Hacks', a Participatory Action Research (PAR) project involving three collaborators. Two collaborators (authors 2 & 3, Nicholas and Norman) are non-academic makers with disabilities and one collaborator (author 1, Janis) is a non-disabled HCI researcher. All of us were actively involved in deciding on project aims, collecting data and disseminating research outcomes. Eventually, we co-created a poster, using it as a collaborative sense-making tool to reflect on the project. The method prompted us to revisit and review the project progress, our achievements and the challenges we faced. Beyond this, we see the instance of this co-created poster as an opportunity to discuss with the CHI-community the potential and relevance of including HCI research participants in analysis processes.



Figure 1: "The Trail of the Hacks" is a co-designed poster created by the co-researchers to reflect on the "Empowering Hacks" project. The poster can be downloaded and viewed in full size here: <https://goo.gl/go8inU>

BACKGROUND: MAKING WITH DISABILITIES

Personal scale fabrication holds great potential for people with disabilities. Many off-the-shelf assistive technology (AT) products are expensive, have limited availability, and it is hard to tell before purchasing if these products actually meet individual needs (or personal taste!), which results in high abandonment rates [4]. Individually manufactured AT can be a promising approach to overcome the short-comings of the mass-market, and maker technologies can provide the necessary tools. Indeed, a growing body of HCI research has emerged around the idea of Do-It-Yourself AT (DIY-AT) [e.g. 2–4], the umbrella term for non-professional initiatives to customise commercial ATs or to design privately manufactured aids. However, most of this work concentrated on the extended care network being the makers rather than attempting to engage those with disabilities themselves. Furthermore, hardly any of this work has addressed accessibility issues around maker resources wider than those of specific technologies and that not everyone has the same opportunities to take part in making [9] (especially with a disability).



Figure 2: Poster detail referring to the DIY-Abilities workshops and how the project began.

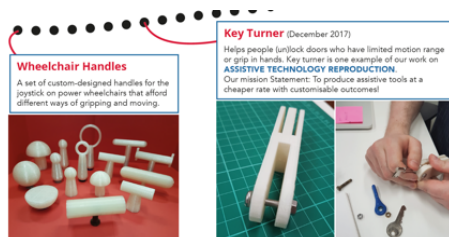


Figure 3: Poster detail showing some of our DIY-AT creations: Set of 15 wheelchair handles (left) and a key turner (right)

METHOD: POSTER CO-DESIGN AS A PARTICIPATORY TOOL FOR REFLECTION

'Empowering Hacks' started as a practical critical response to the insights that hardly any DIY-AT literature engaged people with disabilities as makers themselves. For Janis it was important to include Nicholas and Norman as much as possible, so we chose to frame the project methodologically as Participatory Action Research (PAR) [5]. Given that her life experience would always differ from theirs, the aim was to work as co-researchers and involve everyone in all aspects of the research. The project was open-ended and flexible which allowed us to actively experiment with different factors that could assist Nicholas and Norman in becoming makers.

After having refined our research scope and collecting data together, we needed a participatory reflective method for analysis. Collaborative sense-making was of particular importance given the original motivation for choosing a PAR methodology and that analysis should not solely rely on the interpretation by the non-disabled researcher. We found that formal methods for qualitative analysis (such as for example thematic analysis) did not work well in this configuration. We needed something more fun and easier to understand how to do it. Due to our shared interest in making and designing, we eventually decided to co-create a poster with a visual timeline of our project (see figure 1). Nicholas and Norman started by writing a list of memorable moments which Janis complemented with what was most significant for her. We then co-curated the visual content, co-wrote annotations for the images and co-laid out everything in a design software. The method engaged us equally in reflective thinking, revisiting the collected data and identifying key moments in our progress. Furthermore, it prompted curatorial discussions on how to present and explain them to others.

TRAIL OF HACKS (OR THE EMPOWERING HACKS TIMELINE)

The poster is titled '*The Trail of the Hacks*' and presents a timeline of the Empowering Hacks project. Visually, the timeline is shaped as a dotted wiggly line which is inspired by an obstacle course (like the one we set up in a test session for power wheelchair users), expressing that we had challenges to overcome throughout the project. Specific moments are indicated along the trail, illustrated with images and described in annotations.

The timeline starts with *DIY-Abilities* [7], a workshop series organised by Janis that invited people with disabilities to learn to use different DIY technologies and to work on their own projects. Nicholas and Norman participated with no prior experience in making. The sessions trained them to the level of novice makers with basic skills in 3D-printing, laser-cutting and electronics programming. They applied their new skills creatively in their personal projects, and the resulting creations (shown in fig. 2) demonstrated their aspirations of what they hoped to use Making for. They added important nuances besides just wanting to design practical hacks for addressing accessibility issues in daily life, highlighting the importance of creating means for helping others and showcasing skill.

POSTER INTRODUCTION

"Disabled problems have usually been solved by the able-bodied which miss out key issues that disabled people have. By having disabled people work on the problems that affect them, it should lead to better solutions being found and enabling them to solve their own problems through making. The trail below takes you on the journey of the Hacks including errors/problems encountered and shows progression from amateur makers to makers with a track record."

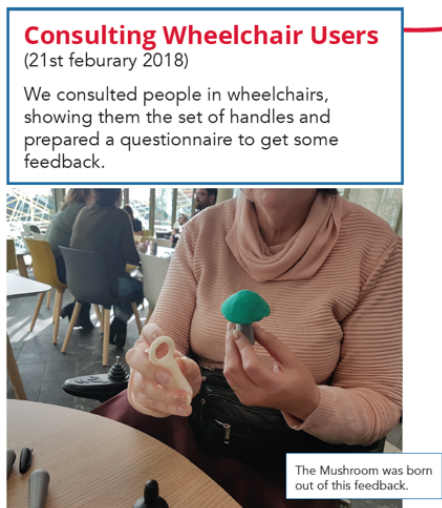


Figure 4: Poster detail about testing and refining our DIY-ATs with the help of our wheelchair-using networks

After DIY-Abilities Nicholas and Norman were eager to continue making, we started a new series of making sessions at the University which eventually evolved into what we now call the 'Empowering Hacks' project. Nicholas wrote an introduction for the poster (see textbox) in which he described the project in his own words. The quote expresses that our emphasis was on providing positive practical examples that disabilities do not imply an inability to engage in Making. The 'track record' serves as material evidence of hands-on skill-building. Our resistance to accepting stereotypes around disabilities gave an activist aspect to the project. In an initial brainstorming session, we decided to align our Making with the mission to *"produce assistive tools at a cheaper rate with customisable outcomes"* and foster an agenda of design by people with disabilities for and with people with disabilities.

We started off with 3D-printing a 'wheelchair golf ball' for extending the joystick on power chairs. The original product is an actual golf ball with a hole drilled into it so that it can be put over the joystick. At the proud price of 7-15 GBP per ball, it is a popular product among wheelchair users to make it easier to grip and to move the small steering interface. It took Nicholas and Norman only a single session to replicate the golf ball. After several more sessions they created a set of 15 different handle designs in total ranging from T-shapes and ring cones to mushrooms (see Figure 3).

The initial project phase was mostly focused on designing, fabricating and training and there was also a clear role distribution among us: Janis was serving as a facilitator and mentor sharing her skills to support Nicholas and Norman's ideas as learners. These roles came however soon to evolve and be re-negotiated: Nicholas turned into our 'coding expert' and started to 3D-model at home, asking for challenges to work on between sessions. Norman specialized on operating the 3D printer and post-processing tasks. He also promoted the project to wheelchair using friends and with his interest in photography he started to create high-quality documentation. Eventually, Nicholas and Norman became design researchers organising a test session for evaluating the usability of the wheelchair handles. They also considered additional feedback from their wheelchair-using networks to refine the designs iteratively. The project provided them with an opportunity to improve their making skills and gain experience in design thinking and assessment. Operating between their personal networks and the University, Nicholas and Norman began to develop their maker identities as they started to use the equipment increasingly independently. Training activities became less frequent, instead they increasingly took initiative, came up with new project ideas, conducted self-paced experiments and actively managed our bigger collaborative endeavours.

RESULTS AND DISCUSSION

The timeline lists our designs as symbolic milestones. In this way, the poster reflects how the process of getting to these physical creations was empowering. Of particular importance were the aspects of skill-building, the experience of recognition as well as the challenges we dealt with on the way.



Figure 5: Poster detail referring to the commission of a bathbomb mold

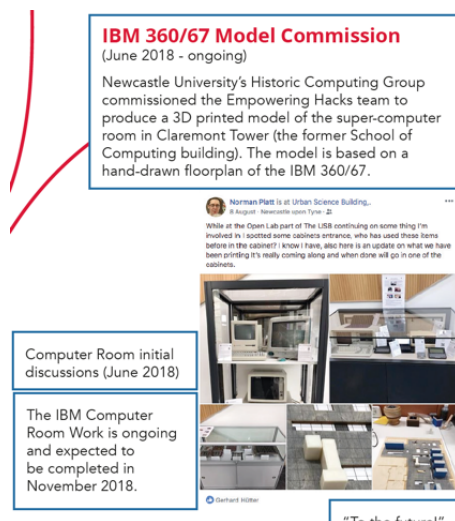


Figure 6: Poster detail referring to the commission of a scaled model of the university's supercomputer

Identifying Moments of Empowerment

Skill-Building. In the beginning Nicholas and Norman stated that by learning skills such as 3D-printing and programming, they hoped to improve their employability. Job hunting is a situation that has been described to be particularly challenging for people with disabilities [1]. 'Empowering Hacks' provided them with the opportunity to create a physical portfolio of advanced maker skills. Regardless if this will be helpful in finding a job or not, they stated that learning making (and research) skills was a confidence boost and gave them optimism and hope.

Gaining Recognition as Makers. The more we came to operate as a team of co-makers/co-researchers, the more it was the opportunities arising at the intersections of the academic institution, our personal social networks and the wider public that shaped the project. Commissions played a particular important role. No matter if we were asked to create a bathbomb mold or a scaled model of the University's IBM360/67 supercomputer, the requests demonstrated how people began to recognise our skills and made us materialise an even more diverse portfolio of designs.

Presenting to Different Audiences. We presented our creations (and ourselves as makers) at different occasions. Apart from Maker Faire, we also showcased our project at different university events. 'Empowering Hacks' seemed to be a good pick for demonstrating diversity of what computing could be and how research had a tangible impact on (at least) some members of the local community. Nicholas and Norman were often a bit nervous when these opportunities arose. Yet, eager to 'do a good job for the University', they took much pride out of these experiences, making them even braver about taking on next tasks.

Discussing Challenges

We identified three particular challenges that we faced in the 'Empowering Hacks' project:

Firstly, there are several accessibility issues related to the maker technologies we used. While Nicholas struggles with the movements needed for changing the 3D printer filament, Norman has problems to find tiny GUI details of professional design software. These issues can be usually overcome in the group by delegating tasks, yet this could be different if maker tools were designed for a greater diversity of users.

Secondly, such accessibility issues also apply to institutional spaces. University buildings need to comply with certain accessibility standards, yet not all measures are implemented equally well, and ironically, health and safety procedures can even form new barriers. For example, while well-meant, the need to create a personal evacuation plan for Nicholas and Norman involved a patronizing assessment and we needed to avoid having our visitors with disabilities going through the same assessment we needed to meet them outside the research lab.

Thirdly, Making is a resource-intensive activity with dependencies on materials, tools and time availabilities. Through our project, Nick and Norman gained access to the university's workshop facilities and Janis's research funding covers the expenses for materials. However, the question remains what will happen after Janis completes her PhD.

CONCLUSIONS

The 'Empowering Hacks' project enabled two persons with disabilities (representing a group of society who is not usually seen in makerspaces) to take part in the Maker Movement, and a non-disabled HCI researcher to learn about the relevance and potential of Making for people with disabilities directly through their experiences. Using PAR we sampled these rich experiences and explored the creative capacities through actively engaging in DIY/Making, creating meaningful objects, and eventually turning us into co-researchers. Co-designing the poster as part of our reflective practice and sense-making presented an opportunity to visualise our research journey together. It prompted us not only to identify the key moments in our collaboration, but also to discuss these in the group and curate representative content.

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