

Hack-Ability

Using Co-Design to Develop an Accessible Toolkit for Adding Pockets to Garments

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ABSTRACT

Fashion brands have started to include adaptive lines for individuals with dressing challenges, but they are often expensive, and are not always suited to an individual's personal style or functional needs. To help with this we have co-designed a toolkit with collaborators with mobility disabilities so that they can alter their own garments or off-the-rack garments with accessible tools. In this paper we describe the co-design process for a stitch-less pocket adaptation and the tools and stencils that were developed with 9 collaborators as part of the Open Style Lab program. We discuss how our collaborators designed their garment adaptations to reflect their own style, all while using the same set of accessible stencils and tools.

CCS CONCEPTS

• **Human-centered computing:** • **Accessibility;**

KEYWORDS

Co-design, participatory design, accessibility, fashion, adaptive fashion, wearables

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Figure 1: – Items from the Hack-Ability toolkit

1 INTRODUCTION

Many individuals with mobility disabilities experience barriers because they cannot access suitable clothing [5]. Functional needs include safety, freedom of movement, easy fastening, dressing and undressing, toileting and avoiding friction [1]. Social needs include whether the garment is suitable for different social environments, such as school, hanging out with friends, or going to an internship [5]. To help with these requirements, we have co-designed a toolkit with individuals with disabilities so that they can alter their own clothes with accessible tools.

Early in the co-design process our collaborators expressed difficulty carrying their valuable items around with them. To aggravate this problem, pockets on women's clothing are often too small to be useful. As a result, many participants felt dependent on others to pass them their valuables, such as their smart phone or wallet. To help with this challenge, this paper focuses on the co-design process for a pocket adaptation. To co-design this garment adaptation, our collaborators became designers and partners in research rather than participants, and were involved in the design process from the very beginning [[4], 24]. Our research goals for this adaptation included:

- 1) Creating an accessible toolkit that enables individuals to customize garments without dictating style

- 2) Enabling meaningful activities by focusing on the tasks that our collaborators are interested in

2 RELATED WORK

Participating in one's community is vital to wellbeing and quality of life [6]. In contrast a lack of accessible clothing creates barriers to social participation and encourages a "disablement process", whereby individuals withdraw from social engagements leading to further isolation and lower quality of life [6]. This can have an even greater impact depending on the individual's life stage. For example, during adolescence, peer acceptance is especially important for developing socialization skills and self-esteem [7]. Carroll et al. [4] found that individuals with disabilities want their clothes to be fashionable, but industry assumptions present the greatest barrier to producing stylish adaptive products.

Overall, individuals are more attached to products that they feel reflect their sense of self [13] including an individual's culture, life stage, and social role [12]. Psychological needs include the garment being aesthetically pleasing, helping the individual to socially integrate, and providing moral and psychological comfort [1]. Co-design can help to integrate these psychological and social needs into garment design. In contrast, when people are not involved in product selection they are more likely to abandon their assistive devices [12].

Making can also have positive effects on wellbeing [10]. Beyond co-designing for how the product will look, it is also important to co-design what activities the product will help with as people are also more likely to use assistive devices if they can promote meaningful activities [12]. The maker movement can help with this by democratizing learning and enabling individuals to be makers instead of consumers by designing and building their own objects. Individuals with disabilities are one group who could benefit from these types of customization opportunities, but there is limited research on making accessible tools to enable them [11]. Previous work with individuals with disabilities has found that individuals are motivated both by the process and the final result of making [11]. In another study with vulnerable populations "Making Things" participatory workshops helped with "self-esteem, learning by doing, and broadening horizons" [15]. Our goal in this co-design research was to facilitate meaningful participation by giving participants the tools to express their design ideas [9].

3 METHODOLOGY: ITERATIVE CO-DESIGN

This paper describes Open Style Lab's four-week co-design program where we met with collaborators once a week and updated the toolkit in between. The activities for each week developed iteratively based on the feedback we received. The research teams for this project were multidisciplinary and included a fashion designer, an engineer, and an occupational therapist. So there was co-design with individuals with disabilities as well as within the research team [17].

Collaborators

Our collaborators included nine females with disabilities aged 13 to 21 from the Initiative for Women with Disabilities at NYU Langone. Our collaborators included individuals with mobility disabilities



Figure 2: - Pouch pocket co-design activity



Figure 3: - Collaborators testing the tools

that affected range of motion, manual dexterity and strength, such as cerebral palsy, spina bifida, and post-stroke hemiparesis. All collaborators self-selected to be part of the program based on an interest in fashion.

Week 1: Style and Moodboard Activities

The first week we did mood board activities with our collaborators to get to know their style preferences, build rapport, and gauge their interest in different sewing techniques and alternatives. Our collaborators used stencils and magazines to develop their mood boards while describing their style choices to one of the research fellows. This activity encouraged discussion with our collaborators on style and dressing challenges.

Week 2: Pouch Pocket Activity

The week earlier our collaborators expressed that they wanted to carry their personal items closer to them and an interest in adding adaptive pockets. In this activity our collaborators acted as designers and got to make their own pockets for personal items. To prepare for this activity we developed five pocket stencils based on common pocket patterns in several mediums (1) small paper ones for our miniature models (2) life-sized paper ones for placement (3) laser cut stencils with channels for chalk or glue.

Step 1) We talked about body placement and where they would like their pockets with both life-sized and miniature paper cut outs.

Step 2) We did a “What’s in your bag?” activity where we asked our collaborators to place items they would like to carry on the stencil of their choice.

Step 3) Participants made a pouch pocket (two pockets adhered together to make a bag), tracing the stencils, cutting them out, and using the adhesive techniques to attach the two pieces of fabric together. They brought their pouch pocket home for the week and were asked to consider whether it was large enough for their personal items, where they would want it placed, and whether the pocket was strong enough.

Week 3: Iteration on Stencils and Tools

Based on the previous activity, our collaborators updated their pocket choice and provided feedback on the stencil and tool designs. They began stenciling and cutting out pockets for their final garment (chosen from the Macy’s website based on their moodboards) and testing adaptive sewing tools for the collaborators who expressed interest in sewing.

Week 4: Co-designing Final Garments

Collaborators continued working on their pocket adaptations with a focus on final placement. During this session our collaborators tried on their garments, placed their pockets, and evaluated whether their pockets were suitable from both a style and function perspective.

Week 5: Fashion Show

The final fashion show was an opportunity for collaborators to showcase their garments for friends and family. At the end of the fashion show each collaborator received a copy of the final toolkit so that they could continue to adapt more garments after the program.

4 RESULTS

To capture the results from the co-design sessions we describe the artifacts of those sessions, and thematic analysis of an interview questionnaire that the participants completed to describe their experience.

4.1 The Co-Designed Pocket Toolkit

Our collaborators wanted their personal items within reach for easy access. One personal object that was often mentioned was their smart phone, and participants often needed help from their parent, or one of the other fellows, to access where it was located, often in a bag behind their chair. The alternative of keeping their phone on their lap also posed problems. P07: “I usually leave it between my legs and sometimes it falls.” To co-design for keeping personal items near the body, we iteratively developed an accessible pocket adaptation with our collaborators.

Pocket Stencils: Our collaborators chose 3 stencil shapes including: a kangaroo pocket, a classic pointed pocket, and a horizontal pocket, each with 3 channels to help with tracing, cutting, adhering and sewing.

Adhesive Sticker Sheet: Participants expressed interest in the various stitch-less adhesion techniques. The easiest to apply, and

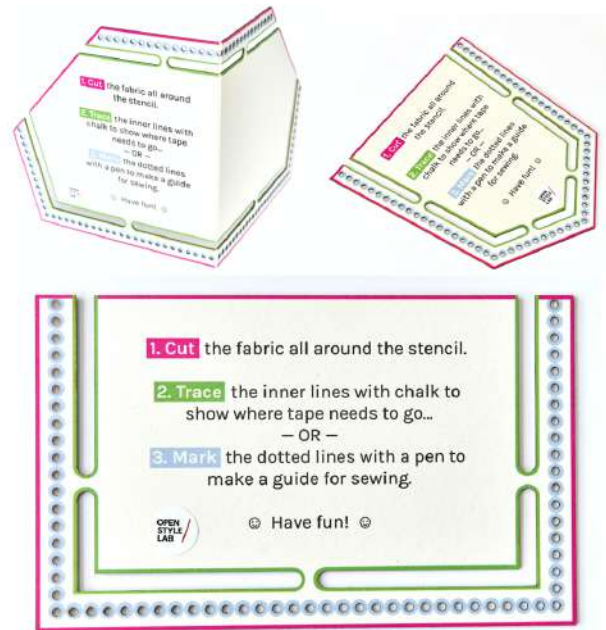


Figure 4: - The three pocket stencils (1) kangaroo pocket (2) classic pocket (3) horizontal pocket

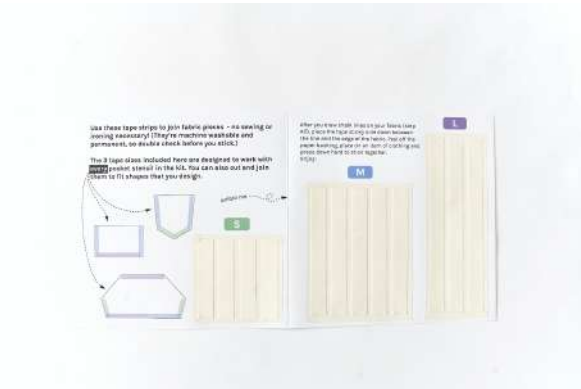


Figure 5: - The final adhesive sticker sheet with instructions



Figure 6: - The adaptive chalk with the foam grip, the adaptive threader, and the clips



Figure 7: - Three pocket hacks with varying styles (left) dressy, (middle) work-wear, and (right) casual

the strongest structurally, was the Peel'n'Stick fabric adhesive. Instead of having it as a roll our participants preferred strips of the adhesive. Most participants used the adhesive stickers, but a few also expressed interest in sewing so we also developed a few sewing tools.

Adaptive Chalk: While our collaborators drew with the stencils in the first session, they found it easier to use drawing tools that did not need applied pressure. So, we included board chalk instead of tailor's chalk since it requires less strength and force to make a mark on the garment, as well as a built-up foam in the kit to make the chalk easier to grasp.

Adaptive Threader: Traditional needle threaders were challenging for our collaborators to grasp so we co-designed a larger 3d printed version with a flat bottom so that threading the needle could be uni-manual task.

Sewing Clips: We included clips to help with stabilizing the fabric during tracing, cutting and placement testing.

4.2 Style Variability and Toolkit Flexibility

Many of our collaborators wanted garments for social events. Six wanted fancy dresses, two wanted fun overalls or rompers, and one wanted zebra patterned dress pants. Though there were some style trends, such as lots of colour and dress length, each individual had their own unique style inspirations, and colour and texture preferences. The same pocket stencils were used for fancy dresses, work wear, and casual wear and all participants described their style in different ways such as: P01 "bright colours", P03 "classy", P04 "sporty", P05 "trendy casual", P06 "hates dress, likes denim", P07 "floral".

Participants took pride in their designs and ability to "create their own fashions" (P06). They often described their design decisions in relation to the influences from their mood board. P07: "I like floral patterns, and the colour green, which is why I chose this dress. I chose to put a pocket on my left side so I can put my phone in, and we altered the arms so I can put it on easily." P08 "I wanted a colourful pattern dress. We added a pocket to hold my phone, and to add style." In total four participants mentioned the importance of being able to hold their phone and how it influenced their design decisions, but always without compromising style.

They also discussed how the adapted garments made them feel, with five participants highlighting comfort, and six participants on improved mood. They described themselves as feeling for example, P01 "Excited, hot", P02 "beautiful", P04 "confident", P07 "happy".

These findings suggest that the pocket designs were socially accessible, in that they were both functionally usable and socially usable (self-expressive and identity-enhancing) [16]. Participants describing how they designed their garments to their style, and their enjoyment of those results, demonstrates how they recognized their voice in this participatory design process [3], and their role as decision-makers [2] and designers [8].

4.3 Pockets and Beyond

Six participants discussed how their favourite part of the program was skill development. P07: "My favourite part of the summer was learning how to thread a needle and use it." Five participants discussed how their favourite part of the program was learning how to sew or as P03 stated "how to use the tools in fashion". This was an important reason why we included sewing along with the adhesive tape. Even though they could adhere the tape on their own, they could often sew with help from a friend and enjoyed learning those skills. Participants also learned about the prototyping processes within fashion. P4: "I learned that fashion is interdisciplinary". They also learned about accessible design. P02: "This program taught me that you don't have to have a perfect body to have a dress fit you and feel comfortable, but by using the right tools the clothing can be made accessible to anybody."

4.4 Teamwork Makes the Dream Work

We thought that our collaborators would want to do every design task on their own. Instead we found that they enjoyed teamwork. For example, one would hold down a stencil while the other one cut, or one would push a needle in and the other would pull it out the other side. In doing so our collaborators leveraged their own strengths while supporting their teammates. P8: "I learned [...] how you can work with friends to create your dream clothing." Our collaborators also found the co-design activities to be enjoyable, P01 "I enjoyed working with the teams to design the hack."

5 DISCUSSION

Here we provide recommendations for future work on co-designing accessible toolkits.

Accessible Toolkit Recommendations

While doing this research we uncovered insights that other researchers can apply to develop accessible toolkits for individuals with dexterity impairments.

1. Utilize stencils and tactile cues: Using stencils made it easier for our participants to draw models for their mood boards, trace cutting lines, trace sewing dots, and cut using a rotary cutter. These guides turned many activities that our collaborators had previously thought of as inaccessible into accessible ones.

2. Utilize tools that do not require strength or pressure: By switching tailor's chalk for board chalk, and scissors for a rotary cutter, our collaborators were able to complete drawing and cutting tasks.

3. Design unilateral activities: Many of our tools became more accessible when we co-designed them to be used unilaterally. Threading a needle became a one-handed task when the threader had a flat bottom, and this enabled individuals to thread a needle

independently. Cutting became one-handed with the sewing clips to hold down the fabric.

4. Do not limit making methods based on impairments– diversify! Though our collaborators could use the adhesive tape independently, many of them also wanted to learn how to sew, and enjoyed doing so. Though most collaborators were not able to sew independently they could do so with a friend. We therefore developed our stencils for both sewing and adhesive tape, so participants could choose which activity they wanted to try. We suggest instead of reducing the making methods, to diversify to include all methods your collaborators are interested in.

By co-designing toolkits, our collaborators were able to use the same set of stencil patterns to develop pockets with a wide variety of styles based on fabric, colour, and placement decisions. Participants were then able to take the kits home with them at the end of the program to continue adapting their clothes. Our collaborators found learning new skills to be a valuable part of the co-design experience, and we would encourage researchers to consider how they can enable collaborators to become makers and designers.

6 CONCLUSION

In this paper we describe the co-design process of an accessible pocket toolkit that was designed with 9 young women with mobility disabilities. We found that by co-designing accessible toolkits that leveraged activities they were interested in they could design for their functional needs without compromising their personal style. Our collaborators valued teamwork during these design activities and learning new skills. In this paper we contribute recommendations for co-designing accessible maker toolkits with individuals with disabilities that researchers can leverage in future work.

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