ABSTRACT
People with disabilities who rely on assistive technologies (AT) for their daily tasks face difficulties in accessing and successfully adopting devices. Commercially provided AT is often expensive and delivery time may take years. In addition, AT abandonment rates are high due to poor usability, changes to requirements over time, and psychosocial factors. Homemade, do-it-yourself AT can provide a cost-effective alternative solution for some and may even help people evaluate whether or not similar commercial solutions will be a good fit before committing to a larger investment. An online community to exchange DIY AT ideas and needs is being proposed to provide a common resource for those seeking an alternative. This paper presents a low-fidelity prototype developed by requirements gathered from user interviews and refined by task-based usability testing. It explores the need for such a community and employs a user-centered design approach to improve its user adoption rate.

Categories and Subject Descriptors

General Terms
Human Factors, Design

Keywords
Online Communities, User-Centered Design, Do-it-yourself, Assistive Technology.

1. INTRODUCTION
People with disabilities rely on assistive technologies, or adaptive devices, to perform functional activities on a daily basis. Unfortunately, these devices have many access barriers and technology abandonment rates are problematic. Oftentimes, assistive technologies are expensive and the service delivery of technology is a long and complicated process. In some cases, it can take years before it reaches a person in need and the technology may be outgrown before or shortly after it’s delivered. In other cases, technology abandonment is an issue.

Customer satisfaction plays an integral part in how effectively and how long it will be used and, when only functional user needs are taken into consideration during the design process, the risk of technology abandonment increases. This is typically due to factors in poor usability, changes to requirements, and psychosocial factors. In a study conducted by Phillips and Zao (1993), they found the four most significant factors that lead to technology abandonment are (1) failure of providers to take consumers' opinions into account, (2) easy device procurement, and (3) poor device performance, and (4) changes in consumers’ needs or priorities (Hussey, 2008).

1.1.1 AT Alternatives
Due to barriers in cost, access, and adoption, many people with disabilities ultimately rely on alternative, homemade solutions to meet their needs. These alternatives are cost-effective and may even help people evaluate whether or not similar commercial solutions will be a good fit before committing to any type of investment. Accessibility of do-it-yourself, homemade alternatives still remains somewhat of a challenge in that, there currently isn’t a commonplace to find them. To help bridge that gap, a proposal to create an online community for people with disabilities, their families, friends, and caretakers is being presented.

1.1.2 Online Community for AT Do-it-Yourselfers
An online community for AT do-it-yourselfers focuses on enabling users to (1) search, or browse, for assistive technologies, (2) contribute design ideas, and (3) request solutions to their needs. To ensure the effectiveness of the site, a user-centered design approach is employed that includes participatory practices from conception to implementation and then relies on crowd sourcing for seeding and generating content. The design process included literature review, user interviews and research for requirements gathering, comparative analysis, user reviews, and usability testing of low fidelity prototypes.

2. USER-CENTERED DESIGN APPROACH
User-centered design is a broad term to describe design processes in which end-users influence how a design takes shape. The key to user-centered design is that it somehow incorporates the user during the design process in an effort to ensure a usable product and greater acceptance (Abras, 2004). In a software research study conducted by Keil et al, projects that engaged end users during the design process showed dramatic improvements in the quality and cost benefits of a project (Keil, 1995). The short-term challenges lie in the time and cost required to prepare, gather and analyze data. Oftentimes, recruitment of participants is difficult and time-consuming and intermediaries are used as alternatives. Engaging users to participate in design reviews and usability testing is challenging. Albeit the user participation sessions are brief, it can take many days or weeks to set up (e.g.
lab and equipment set up, protocol preparation, recruitment, scheduling, dealing with no shows, etc.) (Pawson, 2009). As a result, discount usability testing methods were conducted in addition to several informal design reviews that were done both remotely and in person.

In practice, the most commonly used methods in UCD are iterative design, usability evaluation, task analysis, informal expert review, and field studies (Vredenburg, 2002). Our user-centered design approach started with literature research on AT accessibility issues as well as web accessibility issues. In conjunction with the research, interviews were conducted with potential users to determine the need for a DIY AT online community, define requirements, and seek participants for participatory design and usability testing. In conjunction with the interviews, a comparative analysis of related sites was conducted to find best practices in information architecture and user engagement. Then, a blueprint and wireframes were created based on interview findings and informal design reviews. Finally, the prototypes were tested with 2 participants and the design was modified to reflect some of the observations and findings.

2.1 Interviews
The interview goals were to validate need, help define requirements, and establish relationships for future participatory design reviews and usability tests. In this section we describe our participants then highlight key points and findings from the interview sessions.

2.1.1 Participants
In total, eight participants were interviewed for the proposed online community for exchanging AT solutions. The participants were selected as potential users who (1.) may be in need of a DIY AT solution for themselves or someone they cared for, (2.) as potential users who might contribute as DIY AT designers, and (3.) as subject matter experts for existing DIY online communities. Table 1 describes the participants and identifies them as potentially needing DIY AT, seeking DIY AT, and/or sharing DIY AT.

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Need</th>
<th>Seek</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Able-bodied, unknown cognitive impairment, Male, 25-30</td>
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<td></td>
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<tr>
<td>P2</td>
<td>Limited mobility of one leg and uses walker; Affected by Sturge Weber Syndrome, Todd’s Paralysis, and Lymphedema; Female 35-30</td>
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<td>X</td>
<td></td>
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<tr>
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<td>Some vision impairment, no use of lower limbs and limited hand mobility; Affected by Cerebral Palsy; Wheelchair user; Female 35-40</td>
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<td></td>
<td></td>
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<tr>
<td>P4</td>
<td>Partially sighted; Affected by Albinism; Parent of child with same conditions; Male 35-40</td>
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<td>X</td>
<td>X</td>
</tr>
<tr>
<td>P5</td>
<td>Able-bodied, parent of child with cognitive impairment – Autism; Female 35-40</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>P6</td>
<td>Able-bodied DIY AT Designer,</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1

2.1.2 The Need for DIY AT Online
Of the participants who have sought out AT solutions, none were able to identify an online resource for their needs. They all relied on advice or anecdotes from physicians or other parents and caregivers who shared similar challenges and when searching online, were only somewhat successful with finding ideas from others on forums.

P5 described their deep frustration in trying to find solutions for their Autistic child.

“We’re so desperate to find something, anything that will help and we try just about everything but so many of those things (AT) are on the pricy side. It would be great to have a site that shared those ideas because, let’s face it, some of those things are really not that difficult to make. We just need to know how to make them. …They’re definitely not really worth their price but there are so few companies out there who provide these things and they know we need them so they mark them up. It’s ridiculous”

Another perspective shared by P4, who is also a parent of a child with low vision and Albinism, describes the desire for a central online place to find solutions that would increase simplicity of daily tasks and enable them to do more.

“We use the web for everything and it would be really nice to have a central place to find ideas for some of our needs. Right now, I don’t cook much because it’s difficult for me to see the knobs on the stove. If I could easily find a way to label it, I would cook more often but right now, it’s really a pain…I understand BG&E or something will come out to your house to mark your appliances but who wants to deal with that. I just want to find a quick fix and do it myself… I don’t even know where I would begin to look for something like that. I guess I would search forums or check out Staples for some sort of labeling system.”

2.1.3 Searching for DIY AT
Both P5 and P4 further expressed concern about being able to search for things they need online. They described how they were not quite sure how they would begin their search and said they probably would not have thought to start with terms such as “do-it-yourself,” “assistance technology,” or “adaptive device.” When trying to play out the scenario, they described trying to search for a keyword or term for a specific type of product or idea. For instance, P5 said she would look for “weighted blanket,” or “therapeutic aids” while P4 said he might try “appliance markers for low vision.”

2.1.4 DIY AT Currently Online
The need for DIY AT is most evident in an interview with P7, a DIY AT enthusiast and creator of a small website providing free do-it-yourself project ideas for AT, www.workshopsolutions.com.
The participant’s site hosts over 170 AT designs that have been contributed by himself and a small community of other like-minded AT designers. They range from anything like a wheelchair cup holder and bath transfer stools to miniature go-kart shaped wheelchairs for children and skiing devices for people without lower limb movement. These devices are much more economical to build than products that may be available commercially. For instance, a homemade wheelchair cup holder on his site cost less than $2 to make but similar products from medical supply companies have a suggested retail of $110.

According to P7, the most common website inquiries he receives are from users (1) seeking help in trying to build ideas that are posted, (2) users trying to purchase the ideas posted on his site, and (3) users requesting to have something built for them. These inquiries suggest that there is a need for AT ideas and an audience who will build them. P7 and his site’s contributors also prove there are AT designers willing to freely share their ideas online.

2.1.5 Participation in Online Communities

All but one of the interview participants engaged in online communities on a regular basis. P3 was the only participant who did not engage in online communities because they didn’t have access to a computer at home or, when one was available, they did not have permission to use it. P3 did say, “I really wished I was allowed but I don’t have one and the one my brother uses I’m not allowed to get on… but it would be nice like some of these other people who get to talk to their friends.” P1 and P2, however, used the computer almost solely to visit online communities, namely Facebook, to connect with friends. P1 said they used Facebook almost every day to see what other friends were doing, to look at their pictures, and to talk. P1 occasionally also used iTunes to listen to music and YouTube to watch videos. P3 acknowledged using Facebook a few times a week but wished they could use it more often. P3 relied on others to access and interact with the web but expressed a great desire to use it more. When asked why they didn’t use it as often as wished, P3 replied, “Nobody asks me if I want to but, I do.”

P1 and P2 illustrate that although they may not be cognizant enough to initiate seeking DIY AT online, they are actively engaged in online communities and, in the case of P2 and P3, there is a strong desire to do so. It is plausible that online communities may be popular for people with disabilities as it opens a new social channel to them without being faced by social stigma. It is possible that success, for an individual user, could be the experience of ‘talking’ without being ignored because of the individual’s physical characteristics or disabilities. Visual cues of disability, such as a cane or a hearing aid, do not appear in computer-mediated communication. The only thing that appears is your words (Lazar, 2002).

P3, P5, P6, P7 and P8 all used the computer to get online on a daily basis to conduct both personal and work related business. They described the importance of Facebook keeping them in touch with friends and family when factors like time and distance, has made it otherwise difficult. P4 explains:

“It would be so much easier to just get online and look for these (AT) ideas and talk to other people having the same problem…or having to drive to all these different places to get them or be assessed when all I need is something simple I can make myself.”

When talking about other online communities they’ve participated in such as NetFlix and Amazon.com, participants P4, P5, and P7 noted the importance of social validation – in terms of ranking, comments, and credibility – playing a key role in whether or not they ultimately trusted a product or site.

“People look to others to decide what they should do. This is especially true when they are uncertain about whether or what action to take. Online ratings and reviews influence us greatly – most powerfully at a non-conscious level.” (Weinshenk, 2009)

2.1.6 Online Community Success Factors

We highlight key points discussed during interviews with P7 and P8 regarding …

P7 stressed the importance of keeping it simple and consistent. Every item on the website is laid the same way…with the Problem and Solution…. it’s nice and clean of any advertising, and has nothing to do with money.” P7 believes that users of his site are “like-minded, like me…maybe they’ve been inspired by something they saw on my site or maybe they already built something and just want to have a place to share it”

Like P7, P8 suggests that “people have a cool design and want to share it… then the biggest segment are the people looking for cool stuff to make. He explains that people are motivated by recognition and “need somewhere to be able to share and know there’s a community to take interest and give feedback.” He describes that there are users who like to help and give tips for users who share how far they’ve progressed with a design and need help with ideas to finish it or make it better.

In terms of challenges, P7 gets many inquiries about how to buy the products on his site and moderates all support questions about how to make products instead of allowing other community members to do this. P8 faces challenges that come with a growing community. The site outgrown its design and architecture and must serve users with varying degrees of technical savviness. And most recently, challenges with intellectual property rights have surfaced.

2.1.7 Interview Findings

It was discovered that not all participants who may have a potential need for DIY AT have the ability to seek DIY AT online. This was not due to a physical barrier but a cognitive one. For example, P1 did not recognize having impairment so, therefore, did not recognize the possibility of needing any AT. In these cases, a caregiver would be a potential user of the proposed online community as opposed to the person in actual need.

Our preliminary interviews suggest (1) there is a need and audience seeking alternative AT online solutions, (2) there is an audience willing to create homemade adaptive devices found online, (3) the disability community is already engaged in online communities and find social validation to be an important factor in site and product trust, and (5) users are motivated by different forms of recognition.

In terms of design implications, it will be important to keep the site design and functionality simple. We assume that
functionality as easy as or easier than that found on Facebook is acceptable.

2.2 Comparative Analysis
Currently, there isn’t a robust online community that specifically addresses the need to share and exchange DIY AT online but there are similarly related sites that do exist. In general three types of sites were analyzed: (1.) sites providing commercial AT products or services (2.) sites providing free AT products and services by volunteers and (3) online communities that focus on sharing DIY creations. These sites were reviewed to find best practices in site design with a focus on content, functionality, usability, information architecture and social interaction. These sites played an important factor in understanding user expectations, taxonomy, labels, and organizational schemes. We review these sites and discuss our observations and the implications they had on our prototypes.

2.2.1 Sites Providing Commercial AT Products and Services
We review three sites that provide commercially available AT products and services at a cost. They were primarily reviewed for organizational schemes and labeling but, in general, were not well organized. The most notable features such as advanced searches, user stories, and categorization by disability are described.

*AbleData.com* helps people seeking AT products and services by providing objective product information to assist consumers with making the most appropriate AT selection and finding retailers. It allows users to perform an advanced search for products by limiting search terms and sections to search. It supplements its search results with feedback to validate whether or not the results were helpful as well as provides a list of related Search Categories.

*AbleNetInc.com* provides AT products, curriculum, and software to help educators teach students with disabilities effectively. Its product detail pages include tabbed navigation for Product Details, Additional Info listing links of related resources, and User Stories that have been submitted by site visitors illustrating creative and successful product use.

*EnableMart.com* is an online store providing commercially manufactured AT products. It allows visitors to navigate the site through a product search, persistent vertical navigation by disability, and persistent left navigation by department. The vertical navigation categorizes disabilities by Low Vision, Blindness, Hearing, Communication, and Learning and also includes two other topical labels.

2.2.2 Sites Providing Free AT Products and Services by Volunteers
All four sites currently providing free AT products and services by volunteers do provide evidence that there is already a community actively willing to provide free DIY and an audience available in need of their products. This section describes sites that are currently providing custom made, free AT products and services by volunteers and non-profit organizations. While similar in concept, many of these sites offer free services to create custom solutions only when no other commercially available solutions exist and while the services are free, the materials and cost of travel is covered by the consumer. Only one of the sites, provide DIY AT solutions with the concept of freely sharing the designs for the end user to build. This site, however, lacks the sophistication required to support a thriving community and wide outreach. The review of these sites also notes any relevant observations in labeling, social feature sets, and organization.

*Workshopsolutions.com* provides over 170 free do-it-yourself project ideas for AT which are contributed by the site creator and a small group of other AT designers. Membership is not required and project ideas are simply emailed to the site creator to review, revise, and manually edit so they fit the current framework – providing the Problem, Solution, and up to 6 photos. The site uses the term “homebuilt assistive devices” to describe DIY AT.

*Remap.org.uk* provides free custom made AT created by local volunteer groups for communities across the UK. The site is operated by a charity that relies on material and monetary donations to create AT for people with disabilities when no commercial solutions are available. The site uses the terms “technical aids” and “adaptation solutions” to describe AT.

*www.tadvic.asn.au* provides custom made AT services by local volunteers for people with disabilities throughout Victoria, Australia. Users must call the organization directly to make a request and, upon assessment, services provided are free but the user is responsible for covering the cost of materials and travel. Only solutions that are not already commercially available are provided. The organization is funded by donations and a grant from the Department of Human Services, Victoria. The site uses terms such as “technology for independent living” and “custom equipment” to describe AT.

*Tetrasociety.org* is an online community that provides free custom made AT created by local volunteers in Canada and the United States. Like Tadvic, the non-profit organization assesses requests, only creates AT that does not already commercially exist, and asks users to contribute to the cost of only materials and travel expenses incurred. The site uses the term “customized assistive devices” to describe AT and allows users to Connect to a nearby chapter, Search their database of past AT, and Request assistance by filling out an online form. It also includes a forum and video gallery featuring its products in use. The site also provides an audience-based navigation option for Children, Students, Adults, and Seniors.

2.2.3 Online Communities Focused on Sharing DIY Creations
We review four thriving online communities and denote observations made in regards to organizational scheme (especially controlled vocabularies vs. social classification), feature sets, and ways in which users are motivated to participate.

*MarthaStewart.com* provides creative inspiration and DIY project ideas for food, entertaining, crafts, home and garden, pets, and more. Its ideas are contributed by the site’s content editors as well as its community members. It includes step by step instructions with photos displayed next to its respective step making creation easy to follow. Members of the community can engage with the site by providing comments on project ideas, rating, saving, and sharing them. They are further encouraged to participate through blogs, discussion board, and sweepstakes and promotions. It also features a micro community, *Dreamers Into
Doers, that inspires women to “turn their dreams into their businesses.”

DIYNetwork.com provides users with DIY home improvement project ideas via step by step instructions and video. While members are limited to sharing tips, making comments, and asking questions, the strength of this site is its vast library of project ideas and the several ways to support finding these ideas. In addition to its large, persistent topical navigation and search with auto suggestions, it includes an Easy Project Finder that helps users locate projects through a three-step refinement process. At the project detail level, in addition to useful information about length of project time, materials needed, cost, and difficulty level, related projects, products, and topics are presented through a controlled classification system. Unfortunately, the site also has a fair amount of advertisements.

GrabCad.com enables manufacturing and product development companies to connect with CAD engineers globally. Contributors can upload their CAD models while members can download them, comment, rate, and participate in blogs. GrabCad’s home page encourages users to select from two prominently displayed choices. The user must identify themselves as either needing work done or as an engineer wanting to join or browse. A search with auto suggestions are also displayed along with a few other options located in less important positions. The model library can be sorted by most recent and most downloaded and can be further filtered by system type and category. Information on this page is chunked into logical groups and separated by a generous amount of white space, simplifying navigation choices. At the model detail level, the number of comments, downloads and people who like the model is presented to gain user confidence through popularity. Similar models and other creations by the contributor are presented as related content. A collaborative classification system is used in conjunction with topical categories. Like the library of models, a list of all members is available and can be displayed by top contributors, recently joined, system, category, and an additional filter, country. Contributors who have posted many models are given “Top Uploader” badges for recognition. Their profile pages have basic photo and contact information in addition to a library of their models.

Thingiverse.com allows its online community to freely share and download digital designs to build with rapid prototyping tools. It organizes its designs by newest, featured, and most popular. It leverages collaborative classification and provides related content by “Other People’s Copies.” It also allows designs to be shared and liked through social media channels, commented on, rated and “Flattr’d” to help generate small donations.

Instructables.com has a massive collection of DIY project ideas and a thriving community to consume it. By posting photos, step-by-step instructions, or video, it allows its members to easily share how to make just about anything. Contributors learn from other members who rate their projects or ideas and leave comments that often lead to design improvements. In addition to what’s typically found in online communities – forums, blogs, sharing via social media channels, commenting, rating, etc. – members can also follow other members (and their projects), send them patches as an acknowledgment of good work, and view contributor stats which include ratings and number of views and comments. Members can send each other private messages as well as customize their navigation settings based on preferences. Contests are run regularly to excite members and promote design contributions. On the project detail page, step-by-step instructions are navigated by clicking on photos that then list their respective step and related content to guides, the contributor, and other projects are displayed. The content is organized by topics and uses a controlled vocabulary.

2.2.4 Design Implications of Comparative Analysis

From the comparative analysis, we have found that a hybrid navigation system using high level topical navigation and social classification with a prominent advanced search would be the most suitable framework for the information architecture. Categorization by disability type, and the ability to view content by popularity, newest, and featured is common. Supplementary navigation aids such as top tags and related content to products and contributors is needed. In context, features such as ratings and reviews, sharing via social media channels, commenting, saving, sharing, printing, and private messaging should be incorporated.

Other things to consider are (1) the ability to view content by audience type (children, students, adults, and seniors), (2) the use of promotions and contests to inspire and motivate users, and (3) other terms used to describe AT and DIY as part of the content strategy for search optimization.

2.3 Low-fidelity Prototypes

Blueprints and wireframe designs were created based on best practices observed from the previous comparative analysis and requirements gathered from the user interviews. A total of 15 key screens were designed including the home page, all top level pages including Browse, Share, Request, Discuss, and Community, followed by secondary and tertiary level pages from Browse and Request. The wireframes were presented on screen using PowerPoint during usability testing sessions.

2.4 Usability Testing

We conducted two usability tests with the intent to continue with subsequent tests. According to Neilson (1994), the law of diminishing returns begins after 5 participants but, a study by Faulkner found that testing 5 participants did not have consistent results. On average, according to Faulkner’s study testing with 10 participants resulted in finding 80% of usability issues, while testing with 20 participants increased to 95%. While we may not be able to feasibly test 20 participants, we will continue to test more participants and believe that the preliminary results of our discount usability testing is valuable in that it helps uncover as many usability flaws as possible within the given timeframe as opposed to uncovering none. As Wixon (2002) states, “Even limited field data is better than no data.”

Two preliminary usability tests were conducted to evaluate the ease-of-use of the first low-fidelity prototype design. More specifically, it hoped to find gaps in user expectations, label choices, flow, organization, and feature sets. The first test was conducted remotely via web meeting while the second test was conducted in a small conference room. Both tests were approximately one hour and only included the moderator and the participant. Each participant was asked to think aloud as they observed the on-screen wireframes and were instructed to complete tasks and discuss what they expected to find from each
perceived interaction. The table below (Figure 2) describes each participant.

<table>
<thead>
<tr>
<th>ID</th>
<th>Participant Description</th>
<th>Location Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>P 1</td>
<td>Parent of person with disability, female, age 35-40, homemaker</td>
<td>Remote</td>
</tr>
<tr>
<td>P 2</td>
<td>Member of DIY online community, male, age 30-35, software engineer</td>
<td>In Person</td>
</tr>
</tbody>
</table>

Table 2

2.4.1 Usability Test Findings

The findings described identify areas for further review and improvement. On the homepage (Figure 1), participants were first asked to describe what they were looking at and what they expected from the items they were looking at.

- Both felt the interface was “very simple” and “pretty basic”. “That’s good, though,” said P1.
- Both made remarks about the duplication of navigation choices on the homepage and felt the duplicated navigation in the persistent horizontal menu was unnecessary but not particularly bothersome.
- Both believed that clicking on the photo would take them to a product detail page and read the cost comparison text next to the photo. P2 responded, “Wow that would definitely make me want to see more like that.”
- Both were unsure of what the Community label linked to. P1 assumed it may lead to separate smaller communities per disability but later thought it could also be a list of members. P2 assumed it may lead to some sort of discussion forum or, like P1, may lead to a list of members but said, “…that wouldn’t make sense with the rest of the content there.”
- P1 was confused with the difference between Request and Discuss. P1 assumed that Request was a blog-like feature that allowed a user to look for an idea and if it’s not there then post a message asking for a specific idea. P1 then thought Discuss could be a forum or maybe it was somewhat redundant (to Request).
- P2 expressed the hope that the Search had auto completion and auto suggestions with the ability to refine search queries.

![DIYAbility](image)

**Figure 1 – Homepage.**

When participants were given tasks and asked to find specific items, they both indicated they would use the Search first and would only use the Browse if they couldn’t find results after refining their searches. P1 indicated they would only use Browse when they weren’t looking for anything specific and wanted to get general ideas of what might be possible.

**Browse:**

- On the Browse landing page, P2 was not initially sure if the categories were “hard coded” (not tags) but after further exploration, realized they were and said it might be helpful if they had short descriptions similar to those in the Request form. While looking at the Top Tags in the right column, P2 said they would hope that “those were intelligent tags” so that variations of one term with the same meaning were not repeated. For example, “home made” would be the same as “homemade” and recognized as one term.
- On the category specific, Mobility page, P2 requested the ability to control the quantity of items to display at one time and identify how many items are in a category.
- On the product detail page (Figure 2), both P1 and P2 assumed the star ratings could be clicked on to vote. P2 noticed that there did not appear to be a specific correlation between which image was shown and what step it belonged to. P2 also could not distinguish a difference between Reviews and Comments. “In a situation like this, I don’t know why you would review it. I don’t understand the difference,” he explained. P1 stated that “it might be nice to remain anonymous in the comments and reviews sections. I feel like people are more likely to tell the truth if they don’t have to leave their info. P2 also desired the ability to suggest a tag to the author.
P2 indicated that he would like the ability to see what requests have been made and what requests may be currently in the making available somewhere in this section.

**Figure 2 – Product detail page within Browse section.**

**Share:**

On the Share landing page (Figure 4), P2 indicated that for more complex projects that required longer instructions, it would be helpful to be able to start the step-by-step instructions but be able to save it and return to it at a later time.

**Figure 4 – Share**

**Request:**

- P2 indicated that the Become a Member button (Figure 5) was confusing because “I can already see the form so I figure I can go ahead and fill it out. Maybe if I’m not a member the form should be grayed out.”

- P2 noted that they would first look in the Browse section before making a request to make sure they’re not duplicating a request but was concerned that that behavior was probably not typical and “most people will just make requests without even looking.”

- On the Current Requests detail page (Figure 6), P1 had challenges understanding the concept of voting in the Request section and indicated that it felt “like a Help Wanted section so voting on a request doesn’t feel right. If I’m requesting something and I know exactly what I want then why do people get to vote on it?”

**Figure 6 – Current request page within Request section**

**Discuss:**

P2 expected to have the ability to “sticky” conversations for quick reference at a later date and didn’t see the relevance of Top Tags in the right column (which was an actual design oversight).

**Community:**

- P2 expected to see a rendered version of his profile before being able to see an editable version.

- P2 indicated the tab label Browsers was “creepy” because it implied there were just people who did nothing but looked around and that maybe “All Users” was a better label.

- P2 indicated the desire to be able to see all the activities he participated in. For instance, he would like to see the status of his requests, all the comments he’s made, and all the projects he’s posted.
DIYAbility

Community

[Image: Figure 7 – Community]

2.4.2 Design Implications of Usability Tests

All user expectations that did not match the current requirements were documented. Items that could be easily resolved and determined to be valid usability issues that interfered with the user’s ability to quickly and intuitively complete their tasks were addressed. Further research and analysis is required to evaluate and appropriately triage the remaining findings to further refine the designs. Issues that directly affect the user’s ability to perform a given task will receive the highest priority. The issues that were immediately resolved included (1) removing the redundant tabbed navigation from the homepage, (2) modifying the Community label, modifying the photos to match its step-by-step instruction, changing the Browsers tab label in Your Profile (Community), and (3) replacing the Top Tags in the Discuss landing page with something more useful.

3. DISCUSSION

3.1.1 Web Accessibility

Despite efforts to improve web accessibility, the gap between usability improvements and accessibility for people with disabilities prevail. One study evaluated fifty of the most popular websites and found 95% or more of those websites to be inaccessible to users with disabilities (Sullivan, 2000). More recently, according to a United Nations Global Audit of Web Accessibility that surveys a variety of global business sectors, 97% of websites were inaccessible (Kessling, 2008).

Web accessibility is a key factor given the audience so methods that extend beyond guidelines were evaluated and continue to be evaluated to provide optimal experiences compatible with newer technologies and approaches to accessibility design. With the increasing use of new development methods using HTML5 and Ajax, for instance, new challenges arise and we believe the increase in usability testing and feedback from crowd sourcing will be even more critical. In the interim, a combination of the 3 most common methods – use of automated tools, expert analysis, and usability testing – for evaluating web accessibility produces the most optimal results. We will need to conduct further research for creating an accessibility strategy for maintaining web accessible online community for DIY AT.

3.1.2 Relationships in Participatory Design

We have relied on the feedback from participants who have been involved in interviews, informal design reviews, and usability testing. It has been observed that their knowledge of the project has grown and has naturally shifted their ability to provide completely candid responses. For instance, one of the usability test participants was also an interviewee and an informal design review participant so it can be assumed that the participant was already knowledgeable of how certain features worked during the usability test. During informal design reviews, this same participant, now more familiar with the researchers, would give positive feedback immediately after what the participant may have perceived as negative feedback in an attempt to “soften the blow”. As a result, it will be important to find new participants for design reviews and usability tests to find real reactions from first time users. Our existing participants will still play a valuable role in usability testing and design reviews with the understanding that they have become more informed and thus changing their user role.

4. FUTURE WORK

Pending further analysis, the wireframe designs will undergo changes to reflect findings from the usability tests. They will also need to be expanded to include deeper level pages from key areas that were not yet designed. Once these have been developed and further refined, additional discount usability tests will need to be conducted. The goal would be to test 10 participants to find 80% of the issues, while the remaining issues will be identified through crowd sourcing post-implementation, perhaps during a pilot or beta version.

Additional work would also include further study of online communities and their success factors. Although a need for DIY AT online has been been identified, there is always the risk of lack of participation. It will be critical to understand what makes online communities thrive, what motivates users to join, and what keeps them actively engaged.

5. CONCLUSION

We discussed the challenges people with disabilities face with accessing AT and the need for alternative solutions. As a result, we proposed applying the concept of sharing do-it-yourself assistive technology in an online community that would allow users to share and exchange product ideas to create. Evidence was provided which suggests there is a need and audience seeking alternative AT solutions online, there is an audience willing to create DIY AT found online, and that the disability community is already familiar with and engaged in online communities. Finally, as a possible solution, we presented a low-fidelity prototype design that was evolved from UCD practices, utilizing interviews, comparative analysis, participatory design, and usability testing. Further usability testing and research on the success factors of online communities will need to be investigated.

6. REFERENCES


