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Collaborative Web Accessibility Improvement: Challenges and Possibilities

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ABSTRACT

Collaborative accessibility improvement has great potential to make the Web more adaptive in a timely manner by inviting users into the improvement process. The Social Accessibility Project is an experimental service for a new needs-driven improvement model based on collaborative metadata authoring technologies. In 10 months, about 18,000 pieces of metadata were created for 2,930 webpages through collaboration. We encountered many challenges as we sought to create a new mainstream approach. The productivity of the volunteer activities exceeded our expectation, but we found large and important problems in the screen reader users' lack of awareness of their own accessibility problems. In this paper, we first introduce examples, analyze some statistics from the pilot service and then discuss our findings and challenges. Three future directions including site-wide authoring are considered.

Categories and Subject Descriptors

K.4.2 [Social Issues]: Assistive technologies for persons with disabilities; H.3.5 [Information Storage and retrieval]: Online Information Services

General Terms

Human Factors, Standardization.

Keywords

Web, accessibility, social computing, metadata, collaboration.

1. Introduction

We are witnessing a great shift from traditional media to the Web in every aspect of our daily activities. Online shopping services are changing the behavior of consumers, online courses are making learning more democratic, and remote work is allowing our society to benefit from white collar services provided by employees who are working in their own homes. These changes are profound. Web access is becoming an urgent social issue.

In spite of the importance of the Internet, barriers are still appearing in many Web-related services, isolating various groups of users. Visually impaired people are one of these groups.

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Thanks to recent Web accessibility activities, there are bright spots in various categories of websites, such as e-government sites, news and publication sites, and text-oriented consumer-generated content such as wikis and blogs. At the same time, new types of services are emerging with new accessibility problems. Blind users are often unable to buy goods, to learn vital skills, or to apply for remote work.

Collaborative accessibility improvement is a new approach to improve accessibility through collaboration among users, developers, site-owners, and any Web users who have a passion for accessibility. The basic strategy is the “wisdom of crowds”, making the Web more accessible through collaborative metadata authoring. The Social Accessibility is one such project, launched in July 2008. The service is characterized by its exploitation of advanced external metadata technologies such as easy-to-use authoring tools, an open database scheme, and support of many browsers and screen readers.

This paper discusses successes and failures in the experience, and then proposes future directions not only for this specific project, but also for similar projects that aim at achieving accessibility through collaboration. Our central theme is: How can the collaborative approaches make the Web more adaptive and improve its usability? In order to answer this central theme, we decomposed our analysis into three sub-themes:

- Can supporters fix the reported problems in a timely manner? What types of metadata support can they create?
- How can users report their problems to the service? What types of requests were reported on what types of sites?
- How can we create a self-sustaining service with active participation?

Based on our experiences, the productivity of supporters was higher than we had anticipated. They were able to work effectively to respond to the requests from users in a timely manner. At the same time, challenges exist on the user side. Many users are not even aware of the problems they are facing, and we had not expected this. It encouraged us to design a new collaboration model with more advanced functions as described in the “next steps” section. The goal is to help end users to access more usable sites through collaboration while also helping the site owners with accessibility, including guideline-based compliance.

2. Related Work

The strategy of collaborative accessibility improvement is a new solution to address accessibility needs by gathering the power of society. Bookshare.org [4] is an example of this approach. This is a “social scanning” service for printed books. Registered users can access the books on the site that are collaboratively scanned by volunteers. Helen [11] is a website rating service created by

American Foundation for the Blind. Users can submit and share ratings and comments about the accessibility of various websites.

Social captioning for the deaf and hard of hearing is also becoming popular, especially for movies. YouTube Subtitler [26] is an experimental service for YouTube videos. Welcome [8][9] is a captioning system for e-learning content. Nico-Nico Douga [17] is a Japanese movie sharing service with an overlay comment function, which is often used to create collaborative captions.

Social labeling allows users to add and share labels, mainly alternative texts and landmarks. The 1997 ALT-server [7] was the earliest proposal for social labeling. WebInsight [2] is a unique system combining social approaches with automatic optical character recognition to generate appropriate alternative texts. Serotek [18] is providing a commercial service for users of their browser while WebVisum [25] is a free service for Firefox users.

In these ways, collaborative improvements are becoming popular because they generate accessibility metadata without disrupting daily activities. To date, only a few projects have been notably successful, but the knowledge and experience are accumulating in the accessibility industry. Our Social Accessibility is also seeking to contribute to society by providing experience with an advanced collaborative service.

Metadata-based transcoding technology is a key underlying technology for our collaborative Web accessibility improvements [20]. HearSay [5] is an experimental voice browser with advanced automatic metadata generation and labeling by users. IBM's transcoding system was characterized by its template-based metadata matching for site-wide metadata [20][21]. SADIE [10] is an approach to utilize styling information for transcoding. aiBrowser [15] has a function for transcoding DHTML and Flash content with declarative metadata and AxsJAX [6] is a library for transcoding Ajax applications with procedural JavaScript code.

3. Social Accessibility Pilot Service

3.1 Overview

Social Accessibility [23] is characterized by its use of external metadata and the participation of an open community. It allows improving the accessibility of any webpage without asking the site owners to modify the website. The pilot system consists of the three components shown in Figure 1: end-user tools for problem reporting and client-side webpage transcoding based on external metadata; volunteer tools for metadata authoring; and a public server as the metadata repository. Both end users and volunteers (also called supporters) access the repository using client-side tools, which interact with the server through Web APIs. They can also access the repository by visiting the portal site with their Web browsers. Figure 2 shows a typical interaction for accessibility improvement. First, an end user reports an accessibility problem on a webpage. This report goes to the supporter community instead of to the site owner (as with a contact form). Then a supporter creates external metadata to fix the reported problem. As a result, the end user can browse the webpage made accessible with the metadata. This reporting-based strategy allows quick solutions to accessibility problems, while reducing the supporters' work, and focuses on problems that end-users actually encounter. The public repository allows that metadata to benefit every end user, not just the first user who reported the problem.

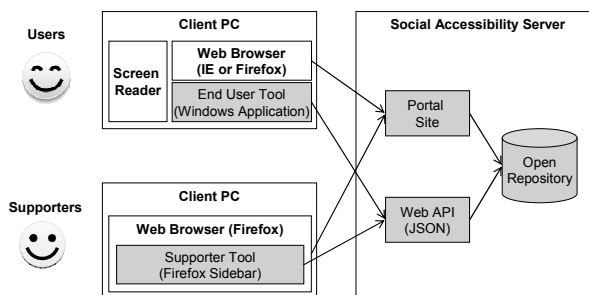


Figure 1. Basic Architecture of Social Accessibility Service

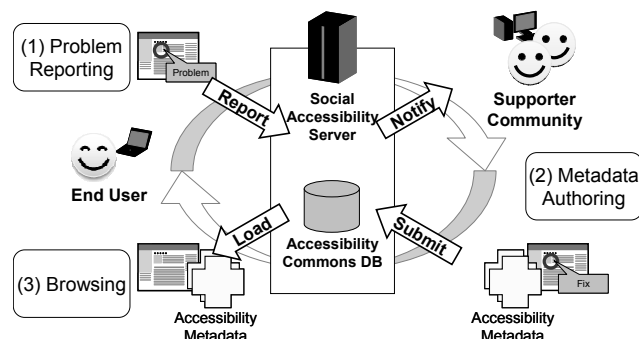


Figure 2. Current Process Model

3.2 Recent Improvements

Considering the feedback we received and the analyses of user activities in the pilot study, we have frequently updated our prototype service. As of April 2009, two major updates have been made since the study started at July 2008.

3.2.1 Screen-reader-independent end-user tool

The original end-user tool was offered as a plug-in for Jaws®, the most popular screen reader in the U.S. This prevented many blind users with other screen readers from using the pilot service.

For that reason, we also developed a native application for Windows® as an alternative to the Jaws-based end-user tool. This resident utility shows a menu dialog when the user presses a short-cut key. The menu includes problem reporting and metadata loading. The resident utility works by injecting special JavaScript code into the webpages for the selected functions. This approach is independent of the screen reader and supports two major Web browsers, Microsoft Internet Explorer® and Mozilla Firefox®.

This native application also added an advanced feature to handle elements ignored and inaccessible with earlier approaches. These elements include images with no alternative text and Flash movies in the opaque mode. Since screen readers ignored these elements they were completely inaccessible, our new feature creates a menu. It also creates a submenu allowing the user to navigate in the sub-elements of an opaque Flash movie. This addresses one of the major new gaps between visual browsers and screen readers for exploring modern webpages with multimedia content. In addition, these menus allow expert users to create alternative text labels for the previously inaccessible elements based on the context. Once specified, the text labels are stored in the public

repository. This is another way blind users can participate in the project as metadata authors, not just as problem reporters.

3.2.2 Visual metadata authoring interfaces

The original supporter tool had a text-based interface for metadata authoring. That forced the supporter to locate the problems in the HTML representations of the webpages. This unfriendly interface discouraged supporters from participating in the pilot study.

To address this problem, we added two visual interfaces, a *page map* (Figure 3) and a *quick fix wizard*.

The page map is a WYSIWYG-style editor for metadata authoring. It creates an image of the webpage and allows supporters to quickly choose a webpage element for external metadata by just clicking on that element. The created image adds exclamation marks for such metadata targets as inaccessible images to help the supporters add useful metadata (Figure 3 (a)). Inaccessible images include those without alternative text or with useless alternative text (such as “banner” or “spacer”). Also marked are image links pointing to the same destinations as nearby text links. Clicking on an exclamation mark invokes a dialog box with a description of the accessibility problem and how to fix it, with an easy-to-use form for new metadata. This visual editor also uses our brightness-gradation technique [22] to visualize the estimated times required for a screen reader to reach each element to help supporters with headings metadata. Darker elements take longer to access, indicating that additional headings may help. When a supporter clicks on such an element, a dialog box appears to specify a heading level (h1-h6) with an optional text description. The same dialog box also has options for other types of metadata such as alternative text for an image that the system failed to recognize as inaccessible. Once metadata is created, an icon indicating the metadata type is shown at the position where the metadata was added (Figure 3 (b)). A supporter can edit and improve metadata by clicking on a metadata icon.

The quick fix wizard is a simpler interface for making alternative text metadata. It sequentially displays each of the inaccessible images. Each image is followed by the description and the same form for new metadata. This wizard allows a supporter to quickly fix all of the image-related accessibility problems in a webpage by simply filling in the fields and clicking on the “next” button, as long as the heuristics successfully detect all of the inaccessible images.

4. Examples of Collaboration

The collaboration among users and supporters yielded various collaboration patterns. We regard a successful case as one that helped real users with problems and a failure case as one for which the service was unable to provide a solution. In this section we review three examples, two successes and one failure.

4.1 Case 1: Hospital Website

In this success case, a user found that a website for a local hospital was not understandable, and sent a request saying “I feel this page is too complicated and not easy to understand.” The underlying problems were things that the user was not even aware of when the request was sent. Within seven hours of the request, an active supporter analyzed the request and decided to respond to the request by addressing some basic problems in the page. The supporter created 10 alternative texts and 121 heading tags for 22 of the webpages near the original target page. During the same



(a) Before metadata authoring

(b) After metadata authoring

Figure 3. Page Map

period, a member of our development team created four alternative texts for buttons in a Flash movie on the target page, and described that work on the discussion board. On the following day, the first supporter created another alternative text and 61 heading tags for four additional pages, and changed the status to “resolved”. The status decision seemed to include reference to the public comment about the Flash movie. In this case, the initial solution was provided within 7 hours, and the final decision was made within 49 hours.

4.2 Case 2: Radio Station Website

This success involved a user who commented on a radio station page that “[the] heading jump function of my screen reader does not work well on this page and also it seems like some images don’t have alternative texts.” In this case, the request was concrete, since the user was aware of the problems. Two supporters created 5 alternative texts and 8 headings, and the status was changed to “resolved” 20 hours after the request was submitted. However, the user also requested some “site-wide” metadata for related pages. Four supporters responded, eventually creating 140 alternative texts and 96 heading tags. Finally the request was fully resolved in 6 days after the initial request.

4.3 Case 3: Sight Seeing Information Site

We classify this failure as an example of a technical gap that cannot be addressed with current technology. A user visited a webpage about sightseeing spots in a particular town. The request was “Please explain the map.” However the map was actually a scrollable widget which was mashed up into the page from a major map service website, which made it difficult to describe. After 30 minutes, a supporter changed the status to “call for experts” with the comment “It is difficult to describe the scrollable map. I want to call for the experts.” The accessibility of such visual information is an old research topic and it was difficult to provide any immediate help, so the appropriate status was “technical pending” for this case.

5. Activity Analysis

In the previous section, three example collaborations were summarized. This section presents some overall statistics about the service.

5.1 Problem Solving by Supporters

The supporters created 18,296 metadata records in response to requests from the users. Table 1 shows the ratio of metadata types. The most frequent metadata type was the “alttext”. This metadata covers alternative texts for non-textual objects, labels for input forms, and textual descriptions added to content. The script to apply the metadata directly modifies the DOM as appropriate for each target HTML element. There were only 47 items of metadata of this type that were created by users with the latest authoring function. The label “h+” refers to text added as a heading (even though the target may be inaccessible). “Landmarks” are new destinations added for navigation within a page.

The supporters resolved 275 requests (85.1%) of the 323 submitted requests and only 19 requests (5.9%) remained unresolved as of May 1, 2009. The requests are first labeled as “unanswered” and supporters can change the status with the authoring tool for supporters. When supporters cannot resolve a problem, there are two options. If the service is not technically capable of resolving the request, “technical pending” is the right option. Only 17 requests (5.0%) were classified this way, mostly in relation to Flash or DHTML. If a request (or solution) was unclear to the supporters, then the “call for experts” option was appropriate. Only 14 requests (4.2%) were given this status.

Figure 4 shows the accumulative time for solving requests. The vertical axis shows the percentage of requests resolved up to that time on the horizontal axes. All of the requests resolved within one week are included in this figure. A total of 45% of the requests were solved within one day (24 hours), increasing to 50% by 34 hours. However 25% of the resolvable requests required more than a week.

5.2 Requests from Users

Our requests came not only from the request mechanisms in the Access Tool but also from a mailing list, from interviews, and from our work in experimental sessions, so it is difficult to estimate the exact number of requests addressed by the supporters. In this section, we focus on deeper analysis of the requests submitted via the tool, a total of 323 as of 1 May 2009. Many users, especially novices, used the simple guest account, which prevents us from doing a deeper user-oriented analysis.

Table 2 shows a classification of the requests as reported by the users. For example, if a user misunderstood a DHTML problem as being a problem with a missing heading, then the request is categorized as “Request for heading tags” as perceived by the user. The largest numbers of requests were reported as problems with alternative texts for images or for non-textual objects ($124/323 = 38.4\%$), followed by requests for heading tags (24.8%). This was an expected result, since these are major problems on the Web and since our service was especially designed to target these two kinds of problems.

Beyond that, some non-obvious items appear. The third most-common item (4.6%) is problems related to Flash. Based on our previous work, around 50% of the Flash content is hidden from screen reader users [1]. This means that typical users are not even aware of half of the Flash-related problems. In spite of that, the users were still often aware of the existence of inaccessible Flash content. This may reflect the popularity of multimedia content on the Web.

Metadata Type	Count
Alttext	11,969 (65%)
h+ (h1-6)	6,069 (33%)
Landmark	122 (1%)
h-	119 (1%)
Others	17 (0%)
Total	18,296 (100%)

Table 1. Ratio of Metadata Types

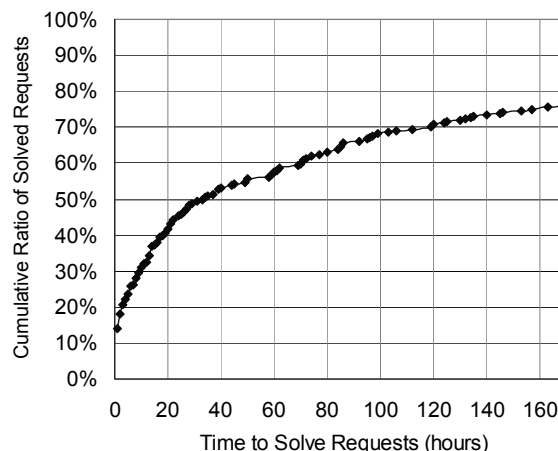


Figure 4. Ratio of Time for Solving Requests (from 0 hour to 1 week)

Collectively, questions were a large category. When a user was unsure of the exact nature of a problem, they would send questions to the service. There were several types of questions, such as asking why something couldn’t be done (e.g. “Why can’t I edit the reply message?”), whether a certain object existed (e.g. “Where is the list of links?”), or if there was any workaround for a problem (e.g. “How can I move to the next page?”). A wide-variety of websites were involved in the requests, such as public services, online-shopping, e-learning sites, news sites, sport event sites, video sharing services, social networking site and others. The list of target websites was fairly representative of the variety to be found on the Internet.

5.3 Sustainability

Figure 5 shows a historical metadata authoring activities. The horizontal axis shows the time and the vertical axis shows the cumulative amount of metadata created for each category of participants. The development team members tried to reduce their activities over time to encourage the participants. Most of the activities were metadata authoring by the supporters after the page-map release. Some of the activity was authoring activities for landmarks and alternative texts added by the users themselves. Most of the participants worked for brief periods, though a few supporters were contributing for longer periods, such as one supporter who answered many requests from the Japanese community.

6. Findings and Challenges

This section considers the statistics in the previous section to clarify the essential and common challenges for collaborative accessibility improvement services. Solutions are discussed in Section 7.

6.1 Time Effectiveness

Can supporters fix the requested problems in a timely manner? What types of metadata can supporters create?

Before starting the project, we expected that encouraging the activities of the supporters might be the most important challenge for the project. However, the supporters worked much more effectively than we had anticipated. The results (Figure 4) show that almost half (45%) of the requests were resolved within only 1 day (24 hours). Giving the gap between the resolution work and the decision making (mentioned in Section 3), many the users actually benefited even more quickly.

Compared to the existing source-code modification approaches, the time effectiveness of the approach is clear. Those approaches will involve at least one iteration of the development process, possibly two weeks but typically much longer. Our service allows users to access the improved sites within a few days. This is clearly a huge leap beyond the previous methodology.

The productivity of the metadata authoring tool was a key success factor for the supporters' work. The new page map function was released in November 2008 (20 weeks), and the supporters' activities increased dramatically (Figure 5). Also, the participants who joined after the new tool became available were much more likely to continue contributing to the service. They evidently felt that working with the service was valuable as a use of their time.

The page-map approach dramatically lowered the required skill for the metadata authoring. Looking at the metadata that was created, it appears that many of the supporters had some knowledge about Web accessibility. They seemed to understand the basic rules for alternative texts and how users would use the heading tags for navigation. These two skills may be the minimum required knowledge for supporters using the current page-map tool. To further reduce the required skills, new authoring technologies may be required.

It took more than 1 week (168 hours) for 25% of requests. One of the reasons is that the current mechanism for status changes did not work very well because of supporters' reservations about their own solutions. Status changes can be made by the supporter who worked on a request, but sometimes the supporter hesitated to change status to "resolved" because of uncertainty about the quality of their solution.

6.2 Request-first Model

How can users report their problems to the service? What types of requests users were reported and for what types of sites?

One of our findings is that "challenges exist on the user side." In our process model, the starting point of each collaboration is always a request (Figure 2), and this proved to be a challenge. We found that making requests was more difficult than we had expected. In this section, we consider three of the major reasons revealed by analysis of our results and in interviews and discussions with participants. Among these issues, the issue of the lack of awareness is crucial and severe for the blind community.

Request types	Count
Request for alternative texts	124
Request for heading tags	80
Questions	43
Request for making Flash accessible	15
Request for alternative texts and headings	13
Report for Form related issues	12
Request for removing repetitive information	9
Request for landmarks	7
Others (color-related, CAPTCHA, DHTML, etc.)	20
Total	323

Table 2. Classification of User Requests

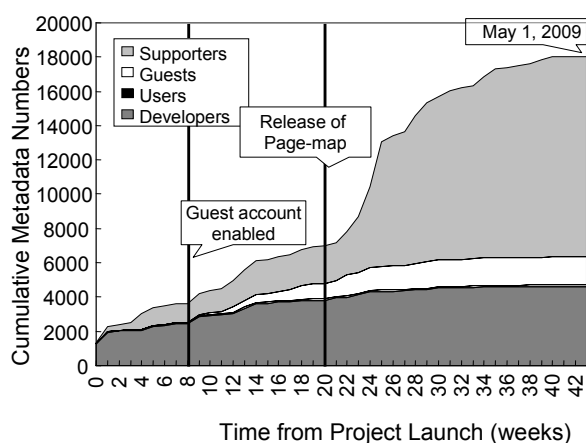


Figure 5. History of Supporters' Activities

6.2.1 Users' unawareness of problems - "They don't know what they don't know."

One of most important findings of the service was the high ratio of users who are not aware of the nature of the problems they are facing. Skilled and experienced users are aware of their problems, and they can easily report them. However, we were surprised by how many users were unaware of the real causes of their difficulties. Patrie et al. reported on the awareness issue in their investigation on remote usability evaluation [18] and we also described such problems in an analysis of voice browsing behavior [24]. However, the severity of this problem looms larger the more we study it.

About 30 blind computer users joined a seminar-style discussion that we organized. However, most of them were not actively accessing the Web, but only accessing certain "selected special sites for the blind". Many had tried to access general websites, but they found such websites "totally confusing and time consuming", and most of them soon quit trying. In other words, they gave up on the wider Web without even knowing much about the world's information and services. Some of the users that we interviewed mentioned that this phenomenon is "a major concern for the visually impaired community." Without wider public awareness of the real problems, this situation will not change.

Another awareness problem involves the major screen readers that silently skip certain objects, such as unlinked images without alternative texts or Flash movies with the opaque setting. In such cases the users are quite unaware of the objects regardless of their importance. A related example involves inappropriate or misleading headings. If such a heading tag appears near the bottom of a page, most users will jump directly to the heading, and thus miss most of the actual content of the page. As long as something is found after the heading the user will usually report that the page has “no problem”, as a result of being misled about the true content of the page.

This raises an epistemological question: *How can users report problems that they cannot recognize?* They may be able to infer the existence of problems through from other content, and we found some examples of this among the actual requests we received. For example, one request said that an instruction should appear on the page, but complained that there was no readable information there. In this case, the user was able to report the problem because the missing information was obvious and easy to infer, but such situations seem relatively unusual.

6.2.2 Too many basic problems

The interview sessions revealed that another factor that discouraged users from submitting any request was finding too many problems on a page. The most common requests were basic accessibility errors, such as missing alternative texts and missing headings (Section 5.2). That is why so much of the supporters’ work was devoted to such basic and repetitive improvements (Sections 4.1 and 4.2). In addition, such problems often appear repeatedly on a website that uses pages with a similar layout. For example, if an article does not have a heading tag, all pages with a similar layout may lack heading tags. As a result, many users feel uncertain about when to send requests. This phenomenon is consistent with the results reported by Monkoff et al [16] in their investigation for thoroughness of detected errors by blind experts.

6.3 Sustainability

How can we create a self-sustaining service with active participation?

There are two sides of sustainability. One is motivating the supporters to continue helping users. As described in Section 4.3, a few supporters contributed frequently for months. Their activities were sufficient to respond to the current numbers of requests from users.

The other side of sustainability is the ongoing participation of the end users. We found significant challenges on this side. In order to sustain ongoing participation, we need organizations to educate and encourage the users as they address the problems. The problems will be there, but the users need the skills to imagine the improved Web environment resulting from the solution of these accessibility problems. The collaboration approach is a method to make this goal more achievable, but special skills are required to reach the goals.

To encourage the users, collaboration with existing organizations seems to be the most promising approach. We have already been contacted by nonprofit organizations worldwide who hope to offer such service for more accessible content for their blind communities. If they can fill the roles of educating and encouraging users, the situation will be dramatically improved.

7. Next Steps

As described in the previous section, the most important challenges are on the user side, and therefore we need to consider sustainable social mechanisms and technologies to support those mechanisms. This section discusses some of the most promising technical and organizational extensions and improvements for the service.

7.1 Site-wide Metadata Authoring

As introduced in Section 3, some of users explicitly and most of the users implicitly requested improvements not only for specific pages but also for other pages on the target site. To address those requests, some supporters worked tirelessly on surrounding pages to cover as many pages as possible, thus encouraging users to access the entire website, not just the original target pages.

Therefore, **site-wide metadata authoring** support would dramatically improve the effectiveness of the service. Site-wide metadata can cover thousands of suitable pages on a site, for example by adding heading tags to pages with similar layouts [20]. The current Accessibility Commons database is capable of site-wide metadata [13], but it is technically difficult to make the site-wide authoring tool easy-to-use for a broad community of supporters. New technologies should be invented to make site-wide metadata easier to create, more robust, and more practical.

Our team has been working toward these goals. Our **site-wide annotation inference algorithm** and its integration into our authoring tool is one of these efforts. The algorithm is capable of presenting possibly applicable metadata for a new page by analyzing the similarity between the new page and the pages with existing metadata. If a supporter creates a set of metadata for one page and opens another page with a similar layout on the same website, then a list of recommendations will be presented. If the supporter accepts a recommendation, that metadata will be generalized to cover all of the similar pages, perhaps thousands, by generalizing the matching patterns for the URI and the description that selects an element (using Xpath).

Creating site-wide metadata is generally considered to be tedious and time-consuming, but that is not an intrinsic limitation. From our experiences, we have found ways that site-wide authoring technologies can reduce the work of supporters. This is evident when we see similar metadata created for many pages on a website. We have estimated the potential workload reductions by analyzing the created metadata. The results show that 4,667 metadata records out of the total of 11,969 alternative texts and 1,206 metadata records among the 6,388 headings seem to be redundant. Beyond the saved work, the coverage of websites can be dramatically broadened.

Once site-wide authoring technologies have been developed, new process models are possible by integrating the site-wide authoring phase before the request phase. Figure 6 shows the new process flow. The point is basic accessibility improvement “in advance.” The new process starts with the selection of a target site. The site can be selected in various ways, such from users’ requests for site-wide improvement, through discussions among end users and supporters, or in collaboration with a site owner who is eager to make a site accessible.

7.2 Activating the End Users

In order to encourage active participation by users beyond the challenges summarized in Section 6.2, three types of technologies should be created. First is a method for a **site request**, a request to improve the basic accessibility of a target site. This is already partially addressed in the previous section, but there should be a special focus on users who have given up their hopes of accessing the Web. We believe that a site-based service could help lure back some of these users.

Second would be an **accessibility checking functions** for end users. This would be a relatively small but important function to help users be aware of the problems they are facing. Some of the existing screen readers have functions to give an overview of the accessibility by announcing statistics for the content when the page is loaded, such as the number of links. With improvements, using intuitive and non-intrusive functions to present the accessibility problems, users will be more aware and more motivated to address their problems.

Another required feature would involve functions for **user-side metadata authoring**. In our interviews we found that expert users are eager to improve the accessibility by themselves and to contribute to other users. Actually user-side “labeling” of images is one of the major functions of leading screen readers [12] and of some existing collaboration services [19][25].

Our Access Tool has been gradually improved in the direction of integrating checking and authoring functions. The function to list and navigate among images without alternative texts allows users to be aware of problems without disrupting their daily use of the Internet. A natural extension of this function would be an alternative text authoring function. If a user is aware of an appropriate alternative text for an image, the user could create and submit the alternative text for the image. AccessMonkey [3] is an example with a combination of accessibility checking and authoring functions for inappropriate alternative texts for blind end users. Integration and convergence with these technologies will be a clear future direction, and the core database of Social Accessibility is originally designed to enable such integration [13].

The Flash-access function also allows users to be aware of the existence of opaque Flash movies. Beyond awareness, the tool converts such Flash movies into non-opaque movies and allows the users to access their content. In addition, users can add appropriate labels to the buttons in the content.

These recently added functions are small steps, but they increase the power of users to be aware of their own problems while allowing them to resolve more problems by themselves. However, it is clear that new technologies to empower blind users could allow them to access various types of content and help them discover the gaps between visual and non-visual information.

7.3 Collaboration with Site Owners

The collaborative model is often seen as a competing approach to the compliance-oriented model, but we feel this is an overly limited perspective. One of the reasons is that collaboration between “supporters” and “users” can be regarded as an approach to crowd-sourcing. In reality, the special advantages of external metadata, timeliness and adaptivity, can also contribute value to the site owners. The collaborative model will also accelerate the process of compliance by helping to connect with the stakeholders

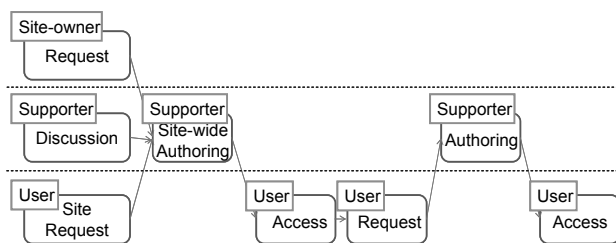


Figure 6. Process of the New Site-wide First Model

on the site-owner side, such as the designers, developers, content authors, and system vendors.

The **back-stage model** will enable site owners to integrate external metadata into their pages. This is a simple mechanism for applying metadata inside of webpages without any external tools. With support from the site owners, a special HTML tag could be inserted into the page templates. Then the tag (script) can automatically access the database, acquire the metadata, and apply it to the page. Users may not even notice the existence of the metadata mechanism. End users could access accessible content without installing any tools. The process could be done behind the scenes. This approach would also improve the compliance of the website, since the improvement is a part of the similar webpages as handled by the general JavaScript libraries. The dynamic improvement approach by using a JavaScript library is already used by Google with AxsJAX technology [6].

The combination of the **back-stage model** with **site-wide metadata authoring** will be a new approach to make websites not only compliant but also adaptive for end users. For example, one of our preliminary experiments, one supporter needed only an hour to fix an existing government agency website with 3,500 accessibility validation errors in 82 pages. This involved creating 142 metadata records.

If a site owner is actively working to improve the accessibility of a website and wants to promise end users that requests will be addressed quickly, then **request redirection** may be the best way to contribute. This method redirects the submitted requests to a specific channel provided by the site's owner. In this case the collaboration system will work as a hub for gathering users' requests. The **portal for site owners** would be a channel for improving websites by providing summary metadata and requests as a set of objective instructions. The requests can be regarded as a set of results of real-world usability testing, and the metadata can be regarded as examples to improve the website. Currently, the information is hidden inside the database. Therefore, we are now planning to create portals for site owners so they can see the summarized information about their websites.

The collaboration approach or technologies in collaboration services have great possibilities to reduce the work for compliance and to improve accessibility. We, the research community, should consider ways to work with site owners and new technologies to support them.

8. Conclusion

In this paper, we summarized the 10 months of an experimental service, Social Accessibility, and tried to foresee future directions to make collaborative accessibility improvements into a mainstream approach. Three topic areas for the end users, the

volunteers (supporters), and for the sustainability of the approach were presented to clarify the challenges of the approach. We reviewed our work, summarized examples and the statistics of the experimental service, and considered some of the technical innovations included as this new service evolved. We found that the supporters were surprisingly productive, but that users were often unsure what to ask for. We also considered some of the features and technologies that seem most promising as next steps, with special focus on site-wide tools and approaches.

The experiment is still continuing. We are planning to publish more about the technologies introduced in this paper, especially for site-wide authoring tools and accessories. More importantly, we have been discussing with various organizations around the world about how we can integrate these approaches and technologies into their ongoing activities. For example, the system could be utilized by a public agency to address the accessibility issues on their websites based on users' actual requests. In their situation, the new metadata will be created by official metadata authors. In school, the system can be utilized as a part of education course for information accessibility based on real user difficulties. Also, research institutes can utilize the system as part of their searches for future collaborative methodologies. We hope that these efforts will collectively create new services in the near future to help those users who find themselves on the edges of our information society.

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