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# Adding Voices to Support Web Navigation Among a Low Digital Literacy Group

## Aakash Gautam

Virginia Tech  
Blacksburg, VA 24060, USA  
aakashg@vt.edu

## Deborah Tatar

Virginia Tech  
Blacksburg, VA 24060, USA  
dtatar@cs.vt.edu

## Steve Harrison

Virginia Tech  
Blacksburg, VA 24060, USA  
srh@cs.vt.edu

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## Abstract

This paper presents our initial experiences introducing and refining a voice-annotated web application to a group of people who have limited experience with technology. We conducted a two-week training program for a group of sex-trafficking survivors in Nepal to help them sell their handi-crafts on an online marketplace. We incorporate voices in two senses: by providing naturalistic, extended voice annotation with colloquial phrasing and intonation and by using the survivors' words and images in the interface. The colloquial phrases helped in use and we saw the survivors adopting the phrases to explain the system. We contemplate design approaches to make web applications accessible to people with limited digital fluency.

## Author Keywords

voice annotation; audio interface; digital divide; digital literacy; illiterate users; user study; HCI4D

## CCS Concepts

•**Human-centered computing** → **Empirical studies in interaction design**; **Auditory feedback**; *User studies*;

## Introduction

Our research work involves anti-trafficking organizations (NGOs) and sex-trafficking survivors in Nepal. One of our goals is to locate opportunities to support the survivors by

	In school?	Can read basic Nepali?	Used a computer before?
S1	N	Y	Y
S2	N	N	N
S3	Y	Y	N
S4	Y	Y	N
S5	Y	Y	Y
S6	Y	Y	Y
S7	N	Y	N
S8	N	Y	N
S9	N	Y	N

**Table 1:** Demographic information of the participants

Day 1	General introduction; IRB consent request
Day 2	Further discussion on their crafting and computing interests
Day 3	Introducing laptops and the Internet; Drawing on the HTML canvas
Day 4	Continuing drawing; Creating details of crafts
Day 5	Sharing drawings and crafts
Day 6	Adding and editing details of their crafts
Day 7	Watching experts' work and commenting on it
Day 8	Looking at shared work and commenting on it
Day 9	Hearing comments; Sharing new design ideas with each other
Day 10	Explaining the system to a staff-member

**Table 2:** Overview of major activities in the sessions

designing technologies that help them achieve “dignified reintegration”, a phrase used by the NGOs. Reintegration is a long-term, complex process which involves programs towards social and economic empowerment. For the latter, the NGOs provide training in creating handicrafts. However, an earlier study reported survivors’ concern about a perceived decline in handicraft sales, their major source of livelihood, in the local market [2].

We came to the space to see if we could help by widening the survivor’s access to markets using technology. However, the design of any technology for their use is not straightforward. A typical technology interface assumes some level of familiarity with text but an estimated 85.9% of the survivors in Nepal have never been to school [7] and in an ethnographic probe, only four of nine survivors reported sufficient familiarity with text to be able to read an SMS [2]. Similarly, survivors have been reported to have limited digital fluency. In an earlier study, only two of the nine survivors had ever owned a mobile phone [2]. While they had heard or seen others use Facebook, they had limited experience using computers or accessing web pages. A prior group had reported being overwhelmed when the NGO had tried introducing photo-editing software [2]. This limitation has motivated us to explore ways to make technology more accessible to low digital literacy groups such as these.

To that end, we created a web application that supported a group of survivors in posting their crafts for online sale. We follow design guidelines posited by earlier work on supporting low-literacy populations (e.g. [3, 4, 5]) which includes avoiding text but not numbers, using semi-abstract images, and placing help buttons in consistent locations. We also added voice to the interface, as has been explored in earlier work (e.g. [4, 6]). But we add voice in a different way — by seeking out words and images, whether written or aural,

that have meaning to the population.

The design proposition was that naturalistic, extended, voice annotation with colloquial phrasing and intonations on visual navigational elements such as links would make the application sufficiently easy to approach and use so as to hold promise for actual use *in situ* in the future.

### Methodology

In January 2019, the first author, a native of Nepal, conducted a two-week training program for a group of sex-trafficking survivors<sup>1</sup> to learn basic operations of a computer and in using a web application called “Hamrokala” (“Our Crafts”). Nine sister-survivors participated in 10 sessions of around two hours each. Four laptops were shared (in 3 groups of two and a group of three).

#### *Hamrokala: The Web Application*

The NGO did not allow the sister-survivors to use mobile phones. So, we chose to provide a web application as a medium to explore possibilities of using technology.

The web application allowed users to post details about their handicrafts. It also permitted them to participate in an online communal space by sharing their crafts, giving and receiving comments on those shared crafts, drawing craft design ideas on an HTML canvas, and drawing on photos of their crafts to further express themselves.

The theory of change that we explored was that to be successful, the system had to be approachable. Voice annotation would help – but rather than the standard, abrupt and efficient HTML annotations commonly used, our site and the annotations needed to offer their own kind of invitation

<sup>1</sup>The survivors addressed each other as “sisters” so to match their nomenclature, we shall henceforth call them “sister-survivors”.

**Count of Digital Artifacts**  
 Video clips created: 47  
 Entries posted for sale: 32  
 Entries shared with the group: 24  
 Audio comments created: 45  
 Audio comments shared: 33  
 Drawings created: 38



**Figure 1:** To login, users had to click on an image that they had chosen instead of writing a username.



**Figure 2:** Example of a list of crafts shared with the group and a comment being added about a shared craft.

to participate. To this end, the information needed to be extended and sufficient, and words needed to be naturalistic in phrasing and, when played back, intonation.

*Presenting Naturalistic Voice Annotation*  
 Each navigational element had an attribute called “data-audio” that stored the MP3 file containing the corresponding voice recording. It was played whenever a user hovered over the element. To ensure that complete information was conveyed, we played the audio file until the end unless the user hovered over another element or navigated away.

*Data Collection and Analysis*  
 On the first day, we read out the IRB consent form and asked for verbal consent. At the beginning of every session, we asked for their permission to record audio. The data presented here are drawn from audio recorded during the training sessions. Further, on the final day of the training, after obtaining permission, video was recorded as sister-survivors were paired with a staff member to whom they explained the web application. The analysis here uses a critical incident approach [1].

**Findings**  
 We focus on critical incidents that display the sister-survivors’ adoption and use of the technology and illuminate design directions.

*Finding Metaphors to Clarify Actions*  
 Nepali websites commonly use words like “website” and “login” but we learned that these words held little meaning to the sister-survivors; therefore, we introduced metaphors in both written and recorded forms. Because the actions afforded by log in and log out buttons were difficult, we used the more colloquial and metaphoric phrases “to go inside” and “to go outside”. During the training we further explained that login is “similar to how you come inside the workshop

to work on crafts”, and logout is “similar to how you leave the workshop after your work is done”. During the final day, all nine participants used these metaphors to explain login and logout. Similarly, we used the metaphor of pressing a shirt button (a popper snap button) to explain the action that could be performed on the HTML buttons.

The sister-survivors also used their own metaphors to explain the system. One of the sister-survivors had used the word “password” at the login page (see Figure 1). S3, in turn, perceived the page in terms of the similar sounding word “passport” and built on it to explain the photo-selection mechanism on the login page: “This is our passport, similar to how you put a photo in a passport, we have it here.”

*Elaborated Wording to Clarify Actions*  
 While metaphors were helpful in clarifying some elements, other elements with literal Nepali translation were harder to comprehend and required elaborate explanation. For example, we initially used the translation of “comment” (*tippani*) to signify an action that allowed users leave audio comments (see Figure 2). The sister-survivors were puzzled. They speculated that *tippani* meant, “all the materials that are required to make it”, “the estimated price”, “the main things related to the craft”, and “what is good about it”. This led S9 to exclaim, in frustration, “I have not even heard these words [before] so don’t know what to do.”

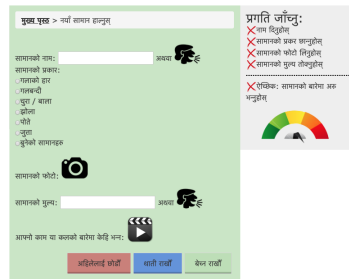
Therefore, we pointed out that this word was physically next to particular craft items on the screen and asked them “What else could be said about a craft?” This led the sister-survivors to connect “comment” to “saying what is nice or not nice”. Following this, we changed the interface. We also noticed that this phrase was used by the sister-survivors when explaining the system.

Examples of elaborated phrases used in Hamrokala:

- login: **to go in**
- logout: **to go out**
- download: **to keep it with you**
- inventory: **all items that you have created so far**

Choosing colloquial phrases (selected ones are in bold):

- to enter vs **to go in**
- edit vs **make correction**
- establish price vs **fix price**
- review vs **see all**
- discard vs throw vs **remove**



**Figure 3:** Users had to complete a list of tasks to post their item for sale. To reduce the reliance on text, users could speak to record name and price. They could either discard their work, save it as a draft, or if the tasks were complete, post it for sale.

*Perceived System Value to Interpret Actions*

S1 understood that the web application helped her post items for sale; in contrast, S7 thought it was about “sending object [craft] information from one place to another”. Both of these understandings were correct but partial. They denoted different ways of appreciating the system. These differences influenced how the sister-survivors interpreted other functions, particularly, “Save as Draft” and “Edit Draft”. Starting with a focus on selling the goods, S1 interpreted the notion of a “draft” as a limitation put by the system on what kinds of things were appropriate to sell or not sell at all, as in “that there is something insufficient [about the craft] and we can’t put it up for sale”. S7 thought “Save as Draft” meant “that we save the object on the computer”, that is the description of the crafting item is kept locally as opposed to sending it away to be seen by others. Similarly, S7 interpreted “Edit Draft” as a function that allowed her to further save descriptions of new items on the local computer. Like S1, S3 focused on how the application was meant to sell the crafts online and so she interpreted “draft” as saying “let’s not sell but just keep it here”.

*System Influencing Their Perceived Role*

Further, we noticed that some of the phrases that we had used in the voice annotation became part of the sister-survivors’ parlance. For example, during the final session, a staff member asked a sister-survivor (S1) where one could see “the comments that you have received”. The focus was on the sister-survivor being the actor who receives comments. S1 started her explanation saying, “The ones that we got” but stopped and changed her sentence to “... comments that others have given us can be seen here” making others the actors who have given her comments. The change was parallel to the voice-over phrase that the sister-survivors had encountered in the system.

*Receding Use of Voice Annotation*

The sister-survivors repeatedly played the audio files without taking any action during the initial introduction, often mimicking the voice. However, as the training progressed, we found that they stopped relying on the voice, having familiarized themselves with the different actions they could perform. They used voice only when they couldn’t perform a certain action such as reach a particular page. Even then, they did not play the audio file completely but just to the point that they remembered the page section.

**Discussion and Conclusion**

We presented a voice-annotated web application to a group of sex-trafficking survivors who had limited experiences with technology. The web application was a probe to understand the possibility of using technology to support the survivors during their reintegration journey.

We went in with an intuitive proposition to use colloquial, naturalistic voice annotation. To make the technology more inviting, we built on the survivors’ phrases and presented elaborated explanations in the voice annotation. We noticed that the survivors were also creating elaborations and metaphors to explain the system.

The survivors’ varied interpretations, explanations, and adoption suggest this approach to voice annotation might be a more general co-design strategy for making approachable systems. We are contemplating adding a feature that allows the survivors to replace the voice annotations with their own explanation such that other survivors can learn from fellow survivors. Also, further work is needed to see whether the survivors can continue to use the application and introduce it to others on their own and whether the learning from the application improves their practice while using other web applications.

## References

- [1] John C Flanagan. 1954. The critical incident technique. *Psychological bulletin* 51, 4 (1954), 327.
- [2] Aakash Gautam, Chandani Shrestha, Deborah Tatar, and Steve Harrison. 2018. Social Photo-Elicitation: The Use of Communal Production of Meaning to Hear a Vulnerable Population. *Proceedings of the ACM on Human-Computer Interaction* 2, CSCW (2018), 56.
- [3] Matthew P Huenerfauth. 2002. Developing design recommendations for computer interfaces accessible to illiterate users. *University College Dublin* (2002).
- [4] Indrani Medhi, Archana Prasad, and Kentaro Toyama. 2007. Optimal audio-visual representations for illiterate users of computers. In *Proceedings of the 16th international conference on World Wide Web*. ACM, 873–882.
- [5] Indrani Medhi, Aman Sagar, and Kentaro Toyama. 2006. Text-free user interfaces for illiterate and semi-literate users. In *Information and Communication Technologies and Development, 2006. ICTD'06. International Conference on*. IEEE, 72–82.
- [6] Indrani Medhi-Thies, Pedro Ferreira, Nakull Gupta, Jacki O'Neill, and Edward Cutrell. 2015. KrishiPustak: A social networking system for low-literate farmers. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing*. ACM, 1670–1681.
- [7] Kamal Thapa Kshetri, Yesoda Banjade, and Govind Subedi. 2018. *Trafficking in Persons National Report*. Technical Report. National Human Rights Commission Nepal. [http://www.nhrcnepal.org/nhrc\\_new/doc/newsletter/NHRC\\_National\\_Report\\_TIP\\_in\\_Nepal\\_September\\_2018.pdf](http://www.nhrcnepal.org/nhrc_new/doc/newsletter/NHRC_National_Report_TIP_in_Nepal_September_2018.pdf)