

Learnings from deploying a voice-based social platform for people with disability

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ABSTRACT

For people with disability living in low-income neighborhoods, access to technology is compounded by inaccessible designs and relative isolation in poverty. To bring together this segment of population, an NGO in India built Enable Vaani, a voice-based social media platform designed for persons with disability living in rural areas without internet connectivity. This system has been in deployment since 2016 and has reached over 25,000 users. We present a mixed-methods analysis utilizing system logs and qualitative interviews, with the goal of understanding Enable Vaani's impact. We find that posts related to employment, education and government programs are the most listened to and shared. Content uploaded by the Enable Vaani team is listened and bookmarked more per post than any user-generated content, indicating the importance of an active role of platform managers. Besides providing useful information, people reported that the platform serves as a medium for social support. Our analysis also finds areas of improvement: people skip a lot of posts, very few people share, and a large fraction of newcomers leave after the first month. In response to these shortcomings, we suggest strategies that can be useful for voice-based systems: active contribution of content, customized content feed, special strategies for encouraging newcomers, and design changes to make sharing easier.

CCS CONCEPTS

- Human-centered computing~Social network analysis
- Human-centered computing~Accessibility technologies

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KEYWORDS

Voice-based social media; Impact evaluation; Accessibility

INTRODUCTION

The 2011 Indian census revealed that over 70% of persons with disabilities in India live in rural areas [16]. This segment of the population has relatively low access to modern networks including electricity and telecommunications, and are often deprived of access to livelihood opportunities and information [11,17]. To fill this gap in knowledge delivery, Enable India, an NGO that works with people with disability, launched a voice-based social media platform. Called Enable Vaani (*vaani* translates to “voice”), the platform is aimed at “facilitating the sharing of stories, opportunities, and ideas” [12] for persons with disabilities in rural India by leveraging India’s robust mobile phone coverage. Users connect to the platform by making a free phone call. Through an Interactive Voice Response (IVR) system, they receive a call back from the platform where they can listen, record, and share relevant opportunities and information with one another. Enable Vaani has been deployed since 2016 and has reached over 25,000 users through a total of over 300,000 calls.

In this paper, we conduct a mixed-methods, longitudinal study to understand its use and its related impact on the lives of persons with disability. The Enable Vaani team currently operates two systems based on language: Namma Vaani (NV) in Kannada for the state of Karnataka, and Hamari Vaani (HV) in Hindi for seventeen states that have Hindi speakers. We analyze usage logs of both systems over a six-month period from January 2018 to June 2018 comprising a total of over 9000 users and 165,000 calls. We also conduct qualitative interviews with a small sample of users of these systems.

Our analysis identifies features that work well, and learnings that can be used to improve the platform towards its goal of empowering people with disability. Overall, we find wide variation in usage of the platform. The median number of posts listened to on NV and HV is 53 and 17 posts respectively, per user. The mean number of posts listened by users, however, is much higher: 523 and 153 posts per user respectively, indicating the presence of “power users” of the platform. As a proxy for relevance of a post for a user, we analyze the fraction of posts where people listened for at least 90% of the post’s duration, which we call as *completed* posts. The median number of completed posts per user is 13 out of 53 for NV, and 5 out of 17 posts for HV, over a six-month period. In qualitative interviews, people stated that they found the platform useful, both in receiving relevant content and social support.

The most popular posts were associated with job opportunities, education, and special government programs that people with disability are eligible for. Often, people would post about positive impact that Enable Vaani had on their lives and these posts were one of the most popular. “*Impact*” was the top tag for Hamari Vaani and the sixth most popular tag for Namma Vaani. As with user activity, we find a big disparity in posts’ popularity: median number of bookmarks for a post is 1-2 while the 95% percentile posts are bookmarked (81.35, 27) times on NV and HV respectively.

People also appreciated the ability to bookmark posts and forward them to specific friends. On both platforms, out of the (2174, 2820) posts that were bookmarked, (85, 83) of them were shared at least once. Consistent with online social networks [8], most of the sharing chains were small: a common sharing pattern was the star pattern, where a single user shares to their friends. However, unlike online networks, we found that the sharing chains remained small even for the most popular posts, possibly because of absence of broadcast sharing and relative difficulty in entering friends’ phone numbers each time to forward a post.

To make the platform more engaging, the Enable Vaani team intervenes organic usage with additional content or new features. We study two interventions: creating additional “first-party” content, and awarding “star” status to active users. We find that posts generated by Enable Vaani are listened and bookmarked more on the platform, even after adjusting for a potential bias due to being listed in the “Main” channel. These results suggest that active content creation can be important for a mission-focused platform for the disabled like Enable Vaani, in contrast to general-purpose social platforms that depend entirely on user content. The second intervention awards status to highly active

users in a month through a “star user” badge. After the award, we find that star users post 16% more content for the next month but the difference is not statistically significant. At best, we find a weak effect of selecting star users on increasing user-generated content.

Our analysis also reveals several areas for improvement. First, because the IVR interface allows only sequential browsing, people skipped a large fraction of the posts after listening to them partially. Second, a majority of the people did not bookmark or forward any post, and most of the newcomers to the platform left within a month. We posit that an easier sharing interface, more first-party content, customized feed rankings, and special strategies for encouraging newcomers can help in sustaining engagement with the platform.

Finally, while we focus on Enable Vaani, we believe that our insights, such as patterns of sharing and the effect of content ranking on user activity, can be applicable broadly to other IVR-based platforms [13,15,26]. Interestingly, despite the differences in interface and target communities, we discuss how many of our findings are similar to past studies on online social networks.

Privacy and Ethics: All data analyzed was sourced (with license and consent) from Enable India. All personally identifiable information was removed from the data before analysis. In addition, all work was approved by our institution’s Institutional Review Board.

BACKGROUND AND RELATED WORK

Accessible design aims to create technologies that can be used by all. However, people with disability face challenges in accessing many popular technologies such as the internet and social media [6,7]. Especially for people in low and middle income countries, lack of access to technology is compounded since there are infrastructural and socio-economic factors such as internet connectivity that act as additional barriers [17,20]. In India, for example, 70% of people with disabilities live in rural areas and they do not have access to the Internet or social networking [16].

Given this setting, designing low-cost, accessible technology platforms that provide access to relevant information and social support can help in empowering people with disability. To this end, voice-based platforms can be a solution. This is supported by evidence from Vashistha et al. [23], who found that visually impaired people had high engagement with a voice-based platform where they could record and listen to audio content. Additionally, it is desirable that the platform can be accessed by inexpensive feature phones

for wide reach. Therefore, Enable Vaani is designed as a voice-based platform for disabled people based on the Interactive Voice Response (IVR) technology, following recent work on using IVR platforms in low-resource settings [22–24]. This paper builds on impact analyses of voice-based platforms and past work on online social media to evaluate the impact of Enable Vaani.

Impact Evaluation of Voice-based Social Platforms

Our work contributes to the growing literature of impact analysis of voice-based social platforms for low-income communities. Chakraborty et al. [3] analyzed an IVR-based content platform for behavior change campaign on maternal and child nutrition practices. Using system logs from their platform, they identified which items were listened completely or skipped by people and used these data to analyze popularity by content theme and gender. Overall, they found that facilitating IVR technology adoption, especially for women users, is difficult and that diversifying content beyond the core platform focus can be useful. Other work on analyzing voice-based platforms have focused on qualitative analysis, such as on CGNET Swara [13] or GramVaani [15]. In this paper, we take a mixed-methods approach that uses both quantitative and qualitative analysis towards the goal of understanding the impact of Enable Vaani. In addition, to help improve its utility for people, we study the impact of a few specific interventions that the Enable Vaani team introduced.

Analysis of Online Social Networks

Throughout, we draw from and compare our findings to results from similar analyses on online social media. There is a rich literature that looks at how online social platforms mediate and influence people’s behavior, including patterns of information diffusion within a social network [8,25], community growth and retention [5,18], importance of ranking or position bias [4,10,19]—higher ranked items are clicked on more—and the challenge of misinformation [14,27]. While voice-based platforms offer a limited interface in comparison and are often designed for a different goal, it is an interesting question to study how results from online media translate to IVR-based platforms.

THE ENABLE VAANI PLATFORM

The Enable Vaani platform focuses on a few key issues that impact lives of the disabled: education, employment, and social support [8,14]. In general, persons with disability face problems in getting access to information because they might be in a rural area or might be marginalized. Further,

many employment workshops and training programs happen in the cities, which are harder to travel to. The Enable Vaani platform aims to address these issues by delivering timely information to people irrespective of where they are.

The Enable Vaani platform is setup as an IVR system. To avoid call costs for users, people access the system using a “missed” call, where they call the advertised phone number and hang up. They then receive a callback from the Enable Vaani system. On the call, users get a menu of content that is organized on the basis of content channels. Through this phone-based information sharing service, users can listen and respond to recorded voice messages from the disability community regarding education and employment opportunities, workplace solutions, enhanced life skills, and more.

Users can also post content. In fact, a majority of the content comes from the users themselves. As a result, every piece of content on the platform needs to be moderated before it goes onto the platform. So, when a user calls and uploads a piece of content, it is first stored on a *moderation* platform. Next, a team of moderators listens to the content and segregates it into three categories: ‘Yes’, ‘No’ and ‘Archive’. When an audio post gets a ‘Yes’, moderators assign one or more tags to the post to signal the theme of the post and publish it under an appropriate channel (see *Content Channels* below). If the audio post receives a ‘No’, it can be rejected for various reasons such as incomplete or inappropriate information, or bad quality of the recorded audio. In such cases, a moderator calls the user and provides inputs on how the audio post can be improved. Based on this call, if the user uploads a post that meets the requirements of the platform, it is assigned the ‘Yes’ category. The third category, i.e. ‘Archive’, is for audio posts containing information that is valid but not helpful for others. These posts are not published on the IVR platform and are simply archived on a public web portal. Due to the high volume of content, published audio posts remain on the platform for three days, after which they are archived. Thus, all published content is moderated by the Enable Vaani team to verify audio quality and avoid misuse of the platform. We discuss the three salient features of the platform—content channels, content sharing, and platform interventions—below.

Content Channels

In order to disseminate information on the platform effectively, Namma Vaani and Hamari Vaani have a fixed number of channels. While planning the platform, channels such as *Wage Employment* and *Self-Employment* were created based on the basic needs of people and the platform’s

focus on livelihoods. Further, since Enable Vaani was created for persons with disabilities to feel connected to a larger community and get more exposure, channels were also determined based on the initial users' activity and the extent to which the community would be able to contribute content by themselves. For instance, a case study on a low-cost solution for bed sores discovered by a person with spinal cord injury triggered the idea of having a channel dedicated to solutions and assistive aids.

Thus, in Namma Vaani, there are 5 channels: *Main*, *Self-Employment*, *Wage Employment*, *Opportunities*, and *Solutions*. The Main channel contains important information chosen by the Namma Vaani moderators. Other channels consist of informational posts, queries and responses related to each topic. Similarly, in Hamari Vaani, there are 5 channels: *Main*, *Self-Employment*, *Wage Employment*, *Solutions*, and *Other*. The '*Other*' channel has information on assistive aids, general information, competitions, and so on. Users can select a channel by pressing the associated number key on their phone and then browse through the posts in sequence. A user may listen fully to each audio post until it ends, or may skip posts by pressing a specific key on their phone. They may also "bookmark" posts that they find relevant. All bookmarked posts can be accessed later as *Bookmarked items*.

Given these different channels and themes on which people post content, we would like to understand what kinds of posts are most useful to people. This leads to our first research question.

RQ1: What do people find the most useful about Enable Vaani?

Content Sharing

In addition to posting and listening to content, the Enable Vaani platform allows people to forward specific posts to their social connections. To forward a post, a user presses the designated button on their phone and enters the phone number of each recipient that they wish to forward the post to. Each recipient receives a phone call from the Enable Vaani system where they can listen to the forwarded post. Thus, the system allows *directed sharing* [21], in contrast to broadcast sharing common on online social media.

The use of social sharing provides a way for users to connect with others on the platform, besides simply consuming content. We would like to understand how it affects people's usage of the platform, and what it can tell us about the social networks of people with disability.

RQ2: How does social sharing affect use of the platform?

Platform Interventions

Enable Vaani is an evolving platform. Since its launch, the team continues to make changes to enhance its utility and encourage adoption. With the benefit of hindsight, we would like to study some of these interventions to evaluate their impact and whether they helped in their intended goals. We study two interventions: introduction of content created by the Enable Vaani team to bolster usage of the platform; and awarding "star" user badges to highly active users to encourage them to contribute more content.

"First-party" content: In the initial stages of the platform, the Enable Vaani team contributed content posts to set a precedent on how the platform needs to function. We call these posts as "first-party" content or *system-generated content* (SGC) to distinguish them from *user-generated content* (UGC). Examples of first-party posts are English grammar classes to help users in finding jobs that require English, awareness posts about the Rights of Persons with Disabilities Act in India, or inspirational stories of persons with disabilities. As the platform grew, both Namma Vaani and Hamari Vaani have transitioned to having more of user-generated content, in order for persons with disabilities to have a sense of ownership over the platform. Today, over 99% of the content on Namma Vaani and 93% of the content on Hamari Vaani is generated by users. We would like to understand how this content is received by users of the platform, and whether both systems should continue to have first-party content.

"Star" users: Another interesting feature about the platform is the recognition of highly active users as "star" users. Namma Vaani introduced this feature in December 2016 and Hamari Vaani introduced it in August 2017. Star Users are individuals who have contributed positively to the platform and typically have listened, forwarded or created a substantial number of posts. By promoting information with others out of their sheer goodwill, these users expand the reach of the platform in a significant way. To acknowledge their efforts and to promote more engagement with the platform, moderators select top 5-6 star users every month. They are thanked in a post on the *Main* channel to give them public recognition and for other users to be inspired by their actions. To encourage more female Star Users, moderators select 4 men and at least 1 woman each month. Thus, our third question is to evaluate the effect of these interventions on user engagement.

RQ3: What is the impact of past interventions on usage of the platform and how can we improve utility of the platform for users?

DATA AND METHODS

We now describe the data we use for our analysis. We consider a six-month period from January to June 2018 and collect system log data on people’s activity on the platform. We also obtain qualitative data by conducting interviews with a sample of Namma Vaani and Hamari Vaani users.

Quantitative Log Data

The Enable Vaani team provided us anonymized usage logs from both Hamari Vaani and Namma Vaani for a six-month period from January to June 2018. These logs contained details about each call that was made to the two platforms. All data was de-identified before conducting the analysis.

Each call log contained an anonymous user ID and the interactions the user had with the system. This includes any content that was recorded and posted by the user, and IDs of content that were listened to, bookmarked, or forwarded by the user. If a user listens to at least 90% of a post’s duration, we consider it as a *completed* listen. Otherwise, if a user presses the “skip” button without listening to at least 25% of the post, we consider it a *skipped* listen, following the definition in Chakraborty et al. [3]. Additionally, for each post uploaded on the Enable Vaani platform, a group of moderators transcribe it and assign it relevant tags. We also accessed the tags for each post.

Table 1 shows the summary statistics for users and posts on both platforms. In total, there were 3788 and 5348 users on NV and HV platforms that listened to at least one post. Out of these, more than half did not contribute any post on the platform; median uploads per user is zero. On Hamari Vaani, for example, only 522 (10%) users uploaded a post to the platform. The top 2 percentile of users contributed 63% of the posts, as expected in user-generated content where majority of the posts came from a small fraction of the users [9]. During the six-month period, a median user listened to over 50 posts on NV, and over 17 posts on HV. The mean is much higher, due to higher activity by some individuals. One user listened to over 25,000 posts, translating to over 4000 posts a month (most of them were skipped posts). Figure 1 shows the distribution of number of posts listened to and uploaded by a user.

However, not all of these posts were listened to completely. Compared to the median of 53 posts listened by NV users, the median number of posts that are completed is only 13. Similarly, compared to the 17 posts listened by a median HV user, the median number of posts completed is 5. People skipped many posts, possibly due to IVR interface limitations that did not allow browsing posts without listening to the previous ones in a channel. This was the most

prominent in Namma Vaani, where a median user skipped 13 posts, almost one-fourth the median number of listened posts. On Hamari Vaani, the median number of skipped posts was 1. In comparison, bookmarks and forwards were rare. The median for both is zero, indicating that more than half of the users never bookmarked or shared a post. As with listening activity, we find that a few users were doing the bulk of these activities: maximum bookmarks and shares per user were 900 and 930 respectively.

In contrast, distribution of activity on posts was less skewed. Half of the posts received at least 483 listens on NV, and 219 on HV (Table 1). The median number of bookmarks and forwards was 1-2, indicating that more than half of the posts were liked by the users at least once. Still, a substantial fraction of posts listened to were skipped. Figure 1 (third panel) shows the distribution of listens for each post.

	Namma Vaani	Hamari Vaani
Number of users	3788	5348
Number of posts	3437	1944
USE R		
Posts/user	(0, 0, 0.8, 141)	(0, 0, 0.3, 43)
Listens/user	(1, 53, 523, 26283)	(1, 17, 153, 8637)
Completed/user	(0, 13, 101, 7500)	(0, 5, 40, 2465)
Skips/user	(0, 13, 252.9, 21867)	(0, 1, 60.6, 3635)
Bookmarks/user	(0, 0, 4.0, 900)	(0, 0, 4.8, 981)
Forwards/user	(0, 0, 3.2, 930)	(0, 0, 3.8, 914)
POST		
Listens/post	(1,483, 576, 31686)	(1, 219, 422, 9247)
Bookmarks/post	(0, 1, 4.3, 186)	(0, 2, 11.7, 700)
Skips/post	(0, 183, 278.7, 21703)	(0, 58, 166.7, 5289)
Forwards/post	(0, 1, 3.2, 154)	(0, 1, 10.7, 587)

Table 1: Summary statistics for Namma Vaani and Hamari Vaani. Numbers are reported as (minimum, median, mean, maximum). We report per user and per post statistics for listening, bookmarking, skipping and forwarding activity.

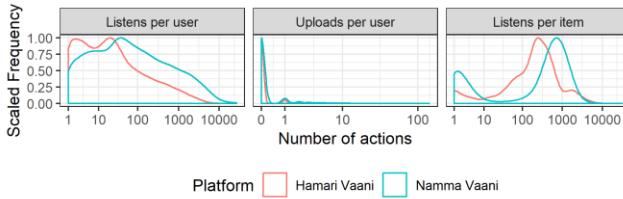


Figure 1: Distribution of listens per user, uploads per user, and listens per item for Namma Vaani and Hamari Vaani. Uploads per user are highly skewed; very few users upload content.

	Namma Vaani	Hamari Vaani
No. of users	19	19
Disability	Vision Impairment (13), Physical Disability (5), Cerebral Palsy (1)	Vision Impairment (18), Non-disabled (1)
No. of Men	14	17
Highest Education	Graduate (5), 12 th (4), 10 th (4), Others (6)	Graduate (9), 12 th (4), School (3), Others (3)
Employment status	Employed (10), Seeking a job (6), Studying (3)	Employed (8), Seeking a job (5), Studying (6)

Table 2: Demographics of qualitative interviewees.

Qualitative Interview Data

Besides log data, we conducted phone-based interviews with a sample of 19 users each from Namma Vaani and Hamari Vaani platforms who had used the platform at least once during the same six-month period. We constructed the sample such that there was adequate representation of different levels of a user’s activity on the platform, and of different genders, locations and type of disability. Out of the 38 users, there were 31 men and 7 women. The interviewees spanned different levels of education from graduate degree to middle school. The most common job status was employed. Others were either looking for a job or studying. Table 2 summarizes the demographics of the sample. One of the users for Hamari Vaani was not disabled; they were using the platform since their spouse and child were persons with disability.

DO USERS FIND ENABLE VAANI USEFUL?

Here we address our first research question by looking at the different types of content and how people interacted with them. We use each post’s tags to represent its content.

Skipping versus Bookmarking Posts

For each user, we first look at the fraction of posts that they listen completely or skip, as an implicit signal of relevance

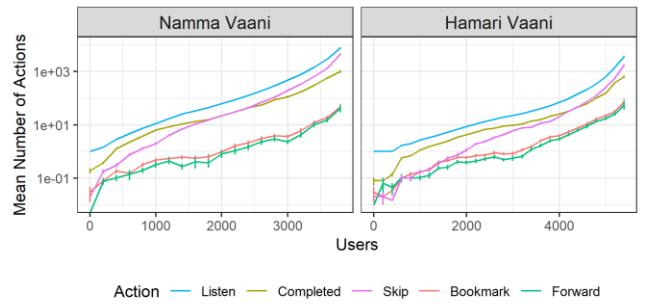


Figure 2: Number of listened posts that are skipped, bookmarked, or forwarded. A high fraction of the posts are skipped, and the fraction increases for “power” users who listen to more posts.

or utility. Figure 2 shows that as we consider users that listen to more posts, their fraction of completed posts decreases and fraction of skipped posts increases. For users with less than 100 total listens, fraction of listened posts that were completed is nearly 40% for both NV and HV. In contrast, for users with more than 100 total listens, fraction of completed posts drops to 25% for HV and 18% for NV.

Considering bookmarks as an explicit marker of utility, we find a mixed result: most people do not bookmark (median number of bookmarks per person is 0), but some bookmark a lot (Table 1). Over the six-month period, the top 95 percentile of users bookmark 59 and 68 posts on average on NV and HV respectively (medians=29 and 45).

In terms of content, on Namma Vaani, the *Main* channel is the most popular, with the greatest number of listens and completed listens. *Wage Employment* and *Opportunities* are the second and third most popular channels. For Hamari Vaani, the channel with the most posts and listening activity is the *Other* channel; *Main* and *Wage Employment* are the other two popular channels. Looking at the tags assigned to each post, we find that posts focused on impact, educational information and government schemes were the most listened to. Table 3 shows the five most popular tags by the number of posts that were associated with them. Queries about these topics were also popular, especially on government schemes and jobs. Apart from these, music information and queries were popular as well.

General Utility of the Platform

People’s responses confirmed the utility of Enable Vaani. A majority of the sampled users (11 for NV and 10 for HV) stated that they found useful information on the platform. Names are changed to protect users’ privacy.

For Pankaj, a student, Hamari Vaani is a platform that enables him to connect and share information with visually

Tags	Completed Listens/Post	Bookmarks/Post
Namma Vaani		
Impact	163.4	4.1
Education Info.	137.7	5.2
General Info.	154.0	6.2
Government Documents	172.8	4.6
Government Schemes	156.6	5.09
Hamari Vaani		
Disability	110.5	13.6
Employment	103.8	11.97
Education	127.6	27.04
Impact	81.4	6.63
Training	93.5	5.52

Table 3: Popularity of tags in terms of completed listens and bookmarks per post.

impaired persons for them to come out of their shell. In the case of Manoj, a user who is searching for a job,

“Hamari Vaani is very helpful for [the] disabled as it helps us to connect with each other and also provides a lot of useful information on employment.”

Geeta, who works part time at a Disabled People’s Organisation [DPO] listens to the platform with other people.

“...we all sit and listen in the DPO and because of that, I know lots of people and their problems.”

In another example, Gautam, who is a Village Rehabilitation Worker [VRW]¹ uses the platform by posting relevant information and helping others by placing them in jobs, hostels, schools and hospitals. In Sanjay’s case, who is also a VRW, the platform has supported him in becoming a VRW.

“For [the] blind, there was [a] rule that VRW should not be given to [the] blind. We had given VRW in [our] Kolar district and we were allowed to give VRW in other districts. I fought for it and Namma Vaani [supported me] ...I feel very proud about this.”

For Mahesh, a student, Namma Vaani is a source of content that motivates him.

“See, the point is, I did not know that this all could be done by VIs only. I go to a college where there are very few [visually impaired students]. But, Namma Vaani people post about encouragement all the time, so why can’t I do this too? I thank [the] Namma Vaani team for that.”

Areas for Improvement

Overall, interviews and the completion rates for listening to posts suggest that people find Enable Vaani useful. Most of the popular content was about practical queries or information related to people’s livelihoods such as jobs, finance or government welfare information, conforming to the intended aims of the platform to support livelihoods of people with disability. That said, users also voiced shortcomings of the platform. Three users spoke about the need for new information categories, such as recreation, examples of disabled entrepreneurs along with those engaged in self-employment, educational and work opportunities for those with higher qualifications such as an MBA, and motivational stories related to jobs and education. Users also asked for content customization and improvements to the IVR interface. Two users asked for information to be relevant in order for it to suit their age demographic and vernacular language. A user based in Assam stated that since a lot of the information was specific to the state of Uttar Pradesh, it was not applicable to him. Lastly, one user asked for ease of access to important information while looking for answers on the platform.

Other areas of improvement were highlighted as well. For instance, two users shared personal criticism about the platform such as their information not getting published, information being kept on the platform for a long time, and a bias involved in choosing star users. In terms of feedback for the platform as a whole, one user asked if notification about results could be provided on the platform. For example, if a job opening for persons with vision impairments was advertised on the platform, he felt it would be useful to know how many applied and were selected for the job to give the advertisement a sense of closure.

HOW DOES SOCIAL SHARING AFFECT USAGE?

Enable Vaani facilitates social sharing by allowing people to explicitly forward a post to their contacts. However, such forwarding or *sharing* was done by a fraction of all users. Only about 30% of users forwarded a post to any of their contacts on NV and HV. As in online social platforms with user-contributed content [2,9], forwarding activity follows a skewed distribution towards “power” users. The top 5% of users account for 50% of all the forwarding activity done on these platforms. These power users’ forwarding activity also ensures that more than half of the posts are forwarded at least once (Table 1). On Namma Vaani, 58.89% of listened

¹ A Village Rehabilitation Worker is hired on a contract basis by the state government of Karnataka to conduct outreach activities for persons with disabilities.

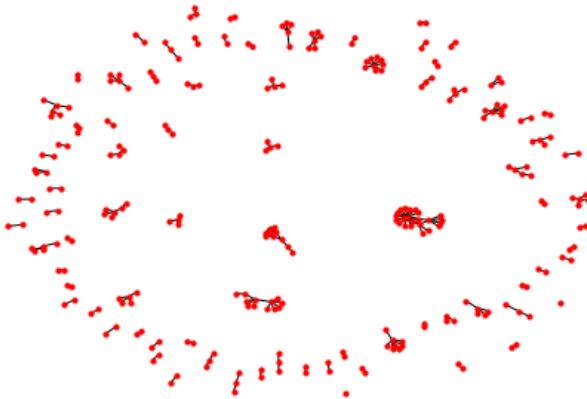


Figure 3: Forwarding network of a post in Hamari Vaani.

posts were shared at least once, and on Hamari Vaani, 58.85% of listened posts were shared. On average, a post was shared 14 times on the two platforms. Across the two platforms, the most popular post received 587 forwards, coming from 52 users.

Similar to recent research on online social networks that shows that vast majority of diffusion cascades end at the sharer or his/her immediate social connections [8], we find that most of the forwarding chains are one-hop or *star-shaped*. However, unlike online networks, the forwarding chains are short even for the most shared posts, possibly due to low global connectivity in the NV and HV networks. As an example, Figure 3 shows a forwarding network with many unconnected star components, typical of the forwarding network of a popular post on Enable Vaani. Maximum chain length was 4-5 for different posts. In terms of content, we find a similar pattern to listening activity: most forwarded posts had tags related to impact, education, government-related information and employment.

In interviews, users described Enable Vaani as a source of social support and connection. They described how it helped expand their social circle and how the stories of other users served as a source of motivation for them.

EVALUATING THE IMPACT OF INTERVENTIONS

We now turn to evaluating features of the platform that can be considered as interventions to the organic use of the platform. We look at two interventions: introduction of first-party content, and a star user incentive.

Content Uploaded by Enable Vaani

Comparing *first party* system-generated content (SGC) and user-generated content (UGC), we find that first-party content posts are much fewer. On Namma Vaani, 23 out of 3437

posts are first-party, and on Hamari Vaani, 132 out of 1944 posts are first-party. However, per post popularity is higher than user-generated posts. On Namma Vaani, mean number of completed listens for SGC posts is 155.5 ($sd=90.8$, median=165), while that for UGC posts is 111.2 ($sd=152.0$, median=98). On Hamari Vaani, mean number of completed listens for SGC posts is 483.2 ($sd=337.2$, median=415), while that for UGC posts is 83.3 ($sd=112.9$, median=59). These differences are statistically significant using a t-test: $NV(t(21)=2.26, p=0.03)$, $HV(t(133)=13.6, p<10^{-16})$.

However, the higher number of completely listened posts may be due to the affordances of the IVR system, since posts play in sequence and the people typically start listening from the first channel. Since SGC content are more likely to be in the first channel (*Main*), the observed effect may be simply due to content ordering or *position bias* [4,10,19]. To disentangle ordering effects, we compare how users react to a post once they listen to it. We look at the *bookmark-rate*, the fraction of completed listens that were also bookmarked. Bookmarks provide an explicit positive signal for relevance of content. On Namma Vaani, we find that 1.1% of completely listened SGC posts are bookmarked compared to 0.4% of UGC posts. Similarly, on Hamari Vaani, 2.8% of listened SGC posts are bookmarked compared to 1.3% of UGC posts.

Still, looking at only completed posts ignores the rate at which posts are skipped which may also provide a valuable signal. Therefore, we compare the fraction of posts that were skipped by users out of all the posts that users started listened to. As before, the skip-rate is the fraction of listened posts on which the user presses the skip button before they have listened to at least 25% of the post. We find that the skip-rate is higher for SGC posts. On Namma Vaani, 50% of SGC posts that users started listening to are skipped compared to 48% of UGC posts. On Hamari Vaani, the corresponding percentages are 48% and 35% respectively for SGC and UGC posts.

The above results indicate that users listen to and bookmark SGC posts at a higher rate than UGC posts, but also skip SGC posts more. While bookmarking conveys an explicit signal of utility, the skipping rate may be partly due to the length of a post and due to navigational needs of repeat users who intend to see other posts in a channel. In terms of post length, we find that SGC posts are longer than UGC posts: mean duration of an SGC post is 112 seconds compared to 58 for UGC. Further, when we restrict analysis to activity on the first time a user listens to a post, we find that the difference between skip-rates decreases: 31% for SGC versus 30% for UGC on NV, and 26% for SGC versus

21% for UGC on HV. This reveals the interplay between position bias and relevance for SGC and UGC posts on Enable Vaani, similar to the results on online search and recommendation systems [4,10,19]. However, in the case of IVR systems, the interplay is further complicated by different levels of technological familiarity of users with accessing buttons for skipping and bookmarking actions, as noted in Chakraborty et al. [3]. On balance, though, these data suggest that people find SGC content more relevant.

Thus, while the Enable Vaani team has been gradually moving away from posting SGC posts, it might be beneficial to keep contributing SGC posts. Qualitative interviews revealed a possible reason for the continued relevance of SGC posts: lack of verification of information in UGC posts. Three users spoke about how information inauthenticity was a concern by touching upon issues such as accessing information that is not confirmed, the presence of inaccurate job postings, and instances of job posters not responding after uploading advertisements.

Awarding “Star” User Status

To encourage sharing, moderators on the platform identify 5-6 “star users” each month. Here we look at the impact of receiving a star status on the person’s activity in the subsequent month. The Enable Vaani team shared with us the star users for each month that they announced on both platforms. For each star user, we compare their activity in the subsequent month to their activity in the month for which they were awarded the “star” status. We compare the following activity metrics: number of posts uploaded by the star user; number of users who listened to the star user’s posts; and number of posts listened to, bookmarked and forwarded by the star user.

For Hamari Vaani star users, we find that the mean uploads per user is higher in the subsequent month after they are declared as a “star” user (mean change in number of posts=1.33). This difference is not statistically significant using a t-test (mean=1.33, sd=5.75, p=0.5). On average, star users upload 7.8 posts, so the public recognition leads to an increase of 16%. However, we find no significant increases in other activity metrics. In fact, number of posts listened decreases slightly in the subsequent month. Results for Namma Vaani are similar. To see if public recognition motivated others to engage more with the platform, we compared the same activity metrics for a comparable set of high-activity users who were not announced as star users. We did not find any significant increases in their activities for the subsequent month. In summary, our results show a

weak effect of awarding star user status on increasing engagement with the platform.

User Retention

Finally, another way to evaluate the impact of interventions collectively is to look at aggregate data on user retention. A high user retention can be a proxy for continued value derived from the platform. To measure retention, we look at the number of *repeat* users—those that have called before—and new users for each month. Table 4 shows that both NV and HV receive new users every month. However, most of these new users do not translate into repeat users for the platform. Throughout the six months, repeat users of the platforms increase only slightly. Compared to a mean of 297 new users each month for NV, the mean rate of growth of repeat users is 16 per month. For Hamari Vaani, the growth is faster but many new users are still leaving after their first month: 662 new users on an average with an additional 70 repeat users per month.

Looking into the call records, we find that this effect is largely due to new users abandoning the platform after the first month. About 65-70% of the new users do not use the platforms in their second month. Among these, over three-fourths of the users do not use the platform beyond a day and thus likely leave the platform after their first use. It may be possible that providing in-person trainings or personalized calls as in [3] may be useful to prevent these users from churning; we leave this question for future work.

Month	<i>Namma Vaani</i>		<i>Hamari Vaani</i>	
	Repeat Users	New Users	Repeat Users	New Users
Jan	1,075	316	562	772
Feb	1,102	287	664	541
Mar	1,095	310	637	793
Apr	1,101	281	834	657
May	1,113	267	882	515
June	1,155	326	915	694

Table 4: Repeat versus new users on Namma Vaani and Hamari Vaani platforms.

DISCUSSION

Through analysis of activity data and qualitative interviews, we found that users find content on the EV platform useful (RQ1). On RQ2 and RQ3, we find mixed results. Most people do not share but there are a few “power” users due to which some posts were shared hundreds of times (RQ2). For RQ3, we found benefits of contributing first-party content and announcing star users, but could not fully rule out other factors that may have led to the same data. In this section, we describe areas for improvement that can make

the platform more useful, and comment on similarities of our findings with online social networks.

Impact Analysis and Design Implications

Content creation. We found that first-party content (SGC) is more popular than UGC. People also were concerned about the veracity of information posted on the platform. This suggests a stronger role for platform moderators, in contrast to the current trend where the Enable Vaani team is progressively reducing the share of SGC. Thus, unlike general online social media platforms, for a mission-focused platform like Enable Vaani for the disabled, our results suggest that there should be more investment in developing SGC content. For instance, given the interest in job openings voiced by several participants, the Enable Vaani team could solicit and verify job information from other NGOs and post them as first-party content.

Content customization. Currently, every user sees the same content and the same ranking in each channel. From Figure 2, we saw that users, especially power users of the platform, had to skip a lot of posts while browsing the platform. In addition, the Hamari Vaani platform reaches a wide area covering many states and some users want to see more local content.

To alleviate these issues, we suggest customization through a mix of moderation and content ranking. For locality-based customization, moderators can add an additional tag to each post, indicating whether it is locally relevant or a universal post. Locally relevant posts can then be ranked lower for people in other localities. In addition, we can customize the content ranking on the platform based on popularity of posts, both globally and locally. This could be added as a new “popular posts” channel. Further, given that the users of EV are in different life-stages (e.g., student versus employed), it may also be beneficial to consider customized feeds for these sub-populations. These ideas may be equally applicable to IVR platforms such as CGNET Swara [13], to the extent that customization is needed.

Ease of bookmarking and sharing. Overall, the number of bookmarks and forwards is low. Even for the posts that are shared, the diffusion chain length does not go beyond 2-3 users on average. We hypothesize that this may be due to difficulties in bookmarking and forwarding content in the current IVR interface.

To aid bookmarking, we suggest asking the user explicitly if they would like to bookmark a post after a completed listen, possibly at random with a low probability to both ex-

pose users to this feature and to avoid fatigue. For forwarding, low usage could be possibly due to the requirement of entering the full phone number each time a user wants to share a post. Here we suggest exploring if a user would like to save friends’ phone numbers when they share content, so that they can retrieve them for sharing later.

User retention. Finally, attracting new users is important to ensure viability of the platform. Our work finds that while the number of users is slowly increasing, a large fraction of the new users leave the platform after their first interaction. Devising specific strategies to retain new users, such as exposing them to some of the best past content or showing them the system’s features, will be useful.

Comparison with Online Social Networks

More generally, our analysis shows the following salient features of the Enable Vaani platform: a significant ranking and position bias that influences people’s activity, majority of the activity by a few power users, short diffusion chains for most posts, and the problem of misinformation even with moderation. As we discussed, these findings are consistent with literature on online social media [2,10,8,27]. At the same time, we find contrasting evidence on the importance of first-party content and the extent of sharing and bookmarking, possibly due to the difference in platform goals, technological sophistication of users, and the limitations of the IVR interface.

CONCLUSION

Our analysis presents the impact and shortcomings of a deployed social platform for people with disability, Enable Vaani. These findings will be used in designing the next iteration of the platform and also for launching similar platforms in other geographic areas. While we found that many people found the platform useful, our conclusions are limited by the data we could access. In reality, these platforms exist in a socio-economic context, and more work to integrate with on-the-ground reality will be useful. One of the participants of our study asked a pertinent question, “...if we do [a] recording, will the problems of the disabled get solved?” This question serves as a poignant reminder of the challenges the disabled face, and to contextualize the impact of these platforms.

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