BeautifulVoice

Early-stage Beautiful Voice product evaluation report

- Pilot Usability and Acceptability Study

Evaluation period: September – December 2022

Evaluation locations: Hobbs Rehabilitation clinic & Users' homes

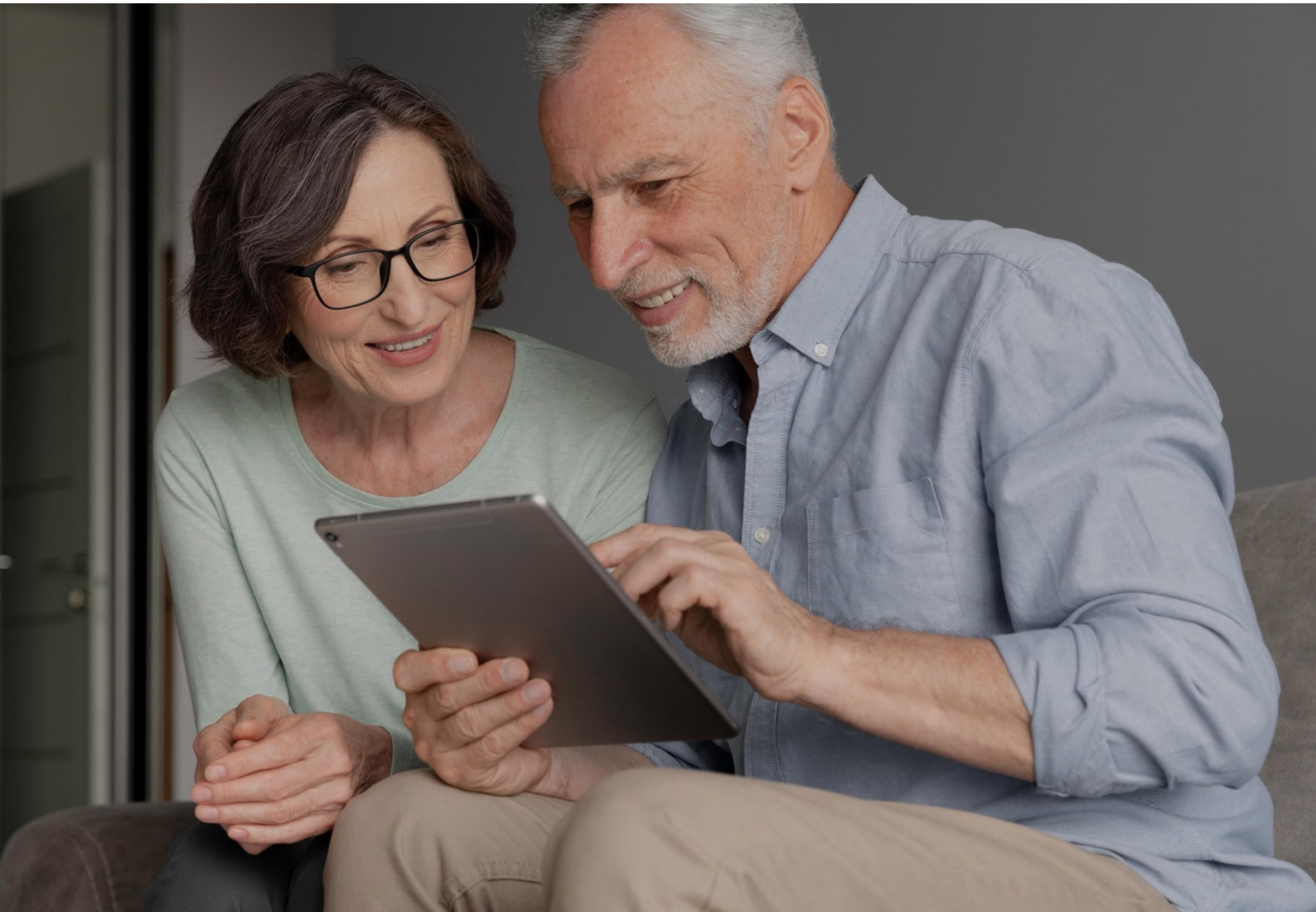
For further information: contact@beautifulvoice.co.uk

Beautiful Voice Limited is a company registered in England and Wales. Registered number: 13863314.
www.beautifulvoice.co.uk | contact@beautifulvoice.co.uk

Introduction

Beautiful Voice has developed a digital platform to assist on speech therapy delivery. It quantifies users' speech, voice and language qualities while providing evidence-based exercises, aiming to reduce workload for speech and language therapists (SLTs) while helping patients receive more speech and language therapy at home for better rehabilitation.

A product evaluation study has been conducted in partnership with the MiNT academy and Hobbs Rehabilitation to evaluate the usability and acceptability of the platform. 13 volunteers with voice, speech and language difficulties contributed to this study by using the platform in-clinic and at home over 2 months and providing their feedback. Their voice, speech and language data were collected and analysed throughout the period using the Beautiful Voice platform.



Participants

Test size: 13 volunteers (4 people with Parkinson's, 8 stroke survivors and 1 encephalitis survivor).

Demographics: 9 males, 4 females, aged between 30-80.

Recruitment: Voluntary participation.

Reported voice, speech and language issues: All participants have reported one or more voice, speech and language difficulties. The percentage of issues reported is shown below. Note that 30.7% of participants reported more than one difficulty.

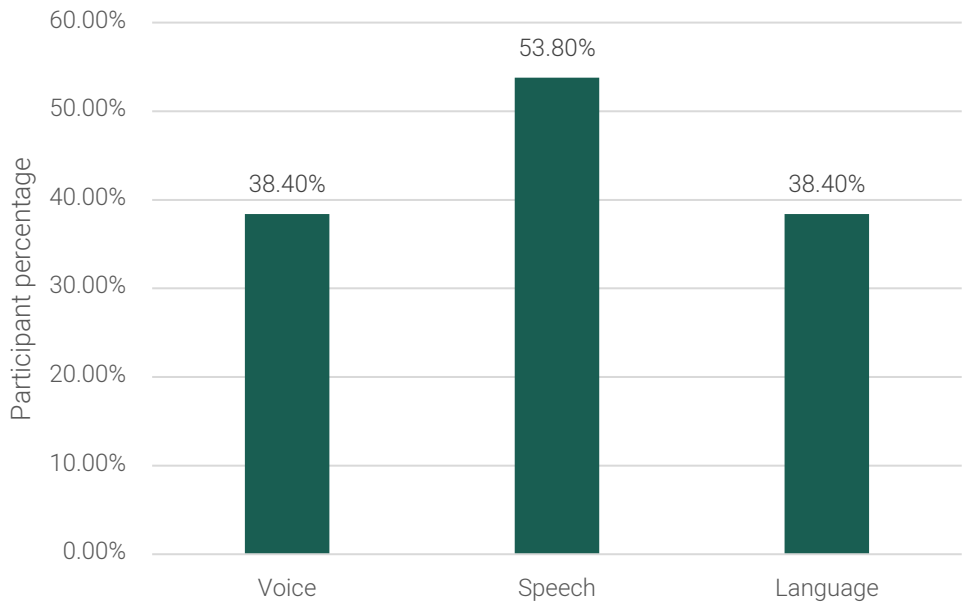
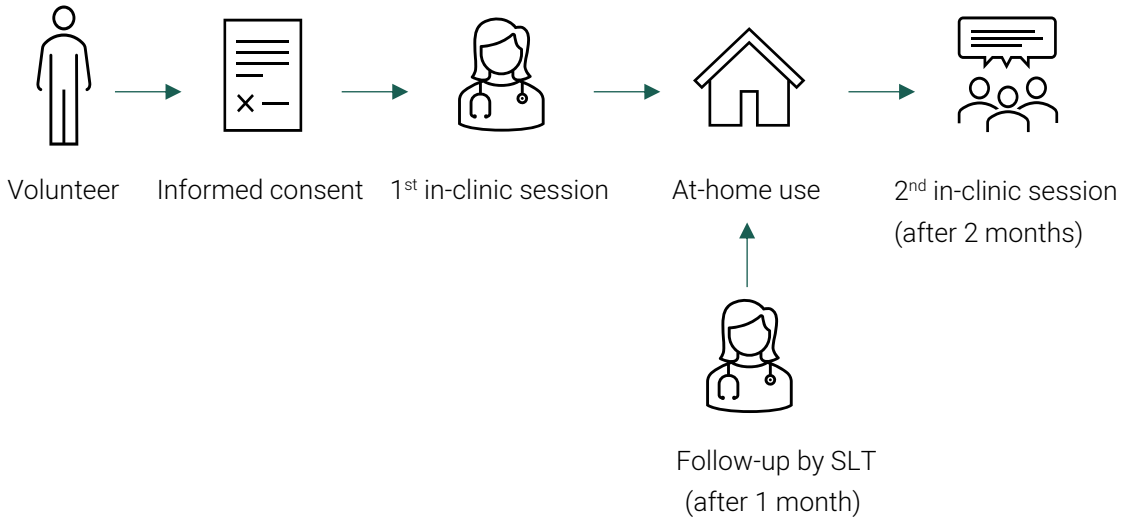


Figure 1: Participant groups segmented by different communication difficulties. Speech difficulties include slurred speech and difficulty in moving jaw, lips or tongue. Voice difficulties include hoarse, quiet, breathy voices. Language difficulties include difficulty in understanding words.

Study Overview



At the beginning of the first in-clinic session, participants gave Beautiful Voice their written content to collect and use their feedback, video/audio footage of the sessions and speech data collected through the platform for research and development purposes.

1st in-clinic session

The in-clinic session included baseline measurement by a speech and language therapist (SLT) from the Hobbs Rehabilitation and platform evaluation by participants.

Baseline measurement

Various aspects of participants' communication issues were measured by SLTs using the Beautiful Voice platform. Specific measures were chosen at the SLT's discretion depending on the difficulties experienced by participants. In general, the measures chosen were the following:

For voice conditions (e.g., people with Parkinson's):

- Intelligibility and loudness measurements

For speech conditions (e.g., dysarthria due to stroke or encephalitis):

- DDK rate and intelligibility measurements

For language conditions (e.g., aphasia due to stroke):

- Token assessment

Platform evaluation

To evaluate the platform usability, volunteers were asked to perform several tasks on the Beautiful Voice platform under the supervision of the Hobbs SLT. The tasks represent typical actions involved in using the platform, such as registering an account, configuring platform settings for personalised use, performing exercises and monitoring progress etc. Issues identified during the process were recorded for analysis.

Throughout the session participants were able to provide their thoughts on the platform which were recorded by the Beautiful Voice team. At the end of the session a Modified System Usability questionnaire was conducted to obtain quantitative feedback of the platform usability.

At-home use

Participants were invited to use the platform at home by themselves for two months. They were encouraged to perform the exercises assigned by the SLT as homework in the platform, but they were also able to freely explore other exercises available in the platform. While using the platform, the user's speech data was analysed and quantitative feedback was given to the user to guide them through their exercise activities.

By the end of month 1, the SLT followed up with the participants to update their homework, provide assistance for use if needed and obtain any feedback on the platform.

2nd in-clinic session

The same measurement performed in the 1st clinic session on participants' communication issues were conducted again in the 2nd clinic session. In addition to this, participants reviewed their progress with the SLT based on the data collected by the platform during the 2-month period. Participants' feedback and the Modified System Usability questionnaire on using the platform at home by themselves were recorded and analysed.

Results analysis

Platform use profile

On average, each participant accessed the platform 15.3 times over the 2 months of study, performing 8.5 hours of self-training. This indicates an increase in speech and language therapy training of over 1 hour a week per participant on top of their usual daily routine.

Use profiles varied greatly among participants. As shown on the graph below, about 62% of the participants used the platform regularly, over 1.5 times a week. Whereas 23% were infrequent users and didn't access it every week. The infrequent users have all reported that they require a carer to help use the platform, hence the low access time.

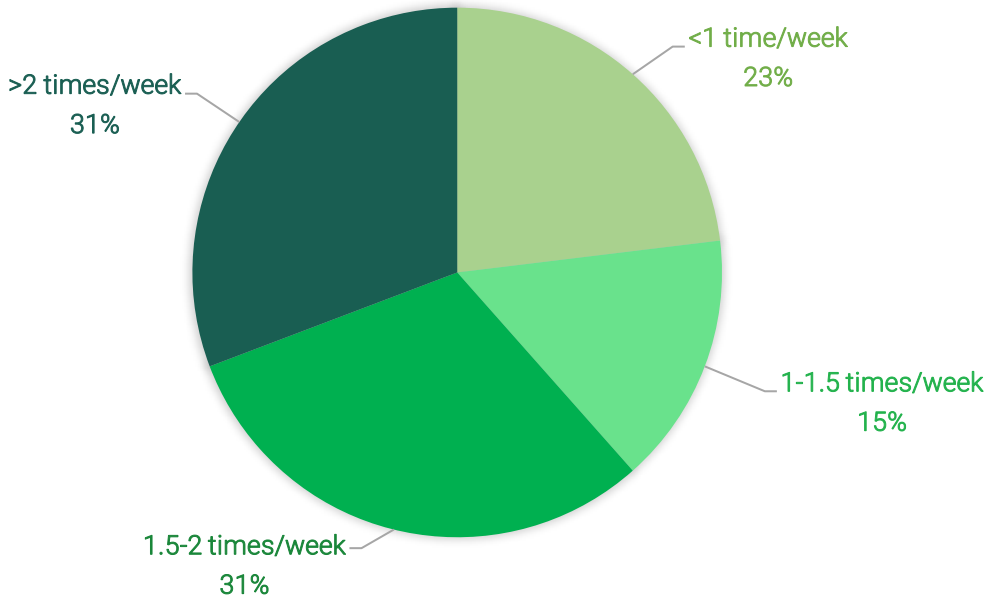


Figure 2: Participant groups segmented by number of platform accesses per week.

The participants were also asked to evaluate whether the platform is ready for them to use as a voice, speech and language training tool at home. Overall, about 40% of the participants felt that the platform was ready to use. 30% felt it needed some minor improvements (such as font size, button locations) and another 30% felt it needed

major improvements for them. Major improvements were in its majority regarding usability improvements needed for people with cognitive and physical/dexterity difficulties so that these users could operate the platform by themselves with no or minimal assistance of their carers/families.

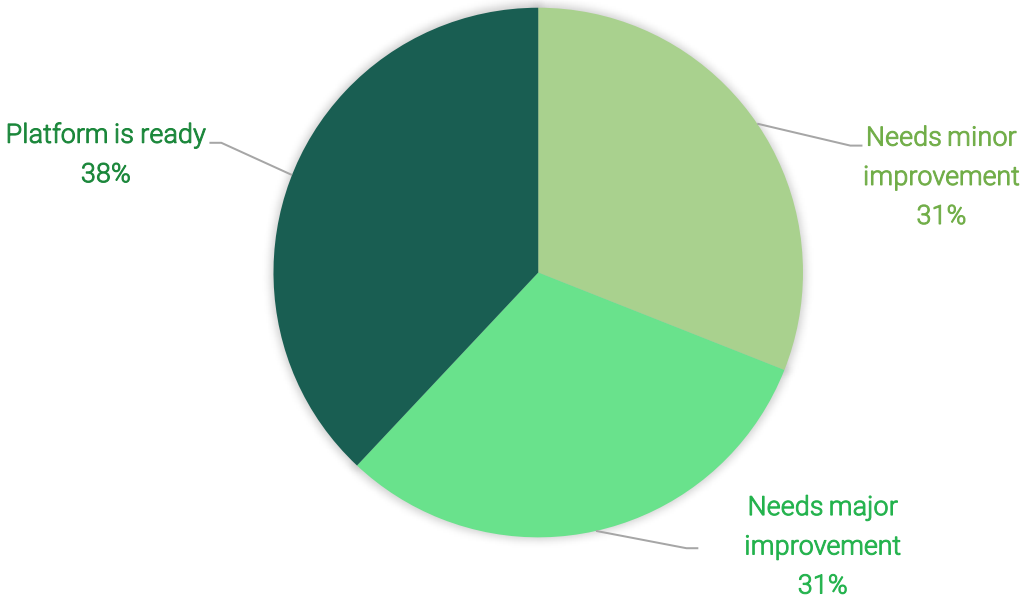


Figure 3: Platform readiness according to the study participants.

Participants were also asked whether they would want to purchase and continue using the platform in the future. All participants but one said they would want to purchase the platform and continue using it. The participant who was not willing to purchase felt that the platform was too challenging for her, not only the control/operation of the platform but also the exercises themselves, where she would require the assistance of a carer at home.

Figure 4: Participants' willingness for platform purchase.

Usability questionnaire scores

At the end of both in-clinic sessions, the participants underwent a modified usability questionnaire. 10 questions were asked on a 5-point scale from Strongly Agree (1) to Strongly Disagree (5). The overall results are shown below:

Statements	Average Results
I think I would like to use this platform more often	1.5 (Agree)
I think the platform looks complex/overwhelming	3.4 (Neutral)
I think the platform was simple and easy to use	2.1 (Agree)
I would need help from someone else to use this platform at home	3.1 (Neutral)
I found the platform working smoothly, i.e., no big errors	2.4 (Agree)
There are some parts of the platform that I would want them to work differently	2.8 (Neutral)
I think most people can learn to use this platform quickly	2.3 (Agree)
I think it was hard to learn how to use this platform	3.9 (Disagree)
I feel I knew what I was doing when using the platform	2.1 (Agree)
I think there are a lot of things to learn before I can start using this platform	3.7 (Disagree)

Table 1: Average results of the Modified System Usability Scores.

The main findings from this usability questionnaire were the desire of the participants to use the platform and that they didn't believe it was hard to learn using the platform. However, on average, the participants were neutral about the platform complexity and assistance requirement, thus indicating that more work is needed to make the solution more user-friendly and intuitive for users who are less independent.

Speech, voice and language results

Participants' voice, speech and language metrics were collected throughout the platform use and analysed to evaluate changes over the course of the study.

Loudness improvement

Voice metrics were captured for users who indicated to have quiet, hoarse or breathy voice issues, often associated with Parkinson's disease. On average, these participants (n=5) observed an increase in sound pressure level (loudness) from 54dB to 59dB, indicating an improvement of over 7%.

Articulation and speech clarity improvement

For people with speech issues, such as dysarthria or dyspraxia (n=7), the diadochokinetic (DDK) rate and intelligibility metrics were evaluated.

The DDK rate showed a considerable improvement (19% increase in single syllable repetition and 25.6% increase in multi-syllable repetitions). For one of the participants, this improvement in articulatory ability was independently noticed by his personal speech and language therapist.

Intelligibility was computed both at word level (for single word assessments) and sentence level (for sentence assessments). The overall intelligibility of the users went from 73% intelligible to 78% over the course of two months.

Improvement in token and memory test

For people with language issues, often associated with aphasia caused by a stroke (n=5), a standard token assessment and a memory test were used to track their progress.

For the token assessment where participants were asked to pick up an object based on instructions, a large improvement was observed (from 61% to 72.5% of correct answers). However, throughout the study, improvements were implemented dynamically to the token assessment module in the platform based on user feedback. Therefore, better usability and instructions may have contributed to this 18% of improvement.

For the memory test, where participants were asked to identify the images from the names given and remember them among the 5-8 options, there was a slight increase from 88% to 91% of correct answers.

Conclusions

This study evaluated the usability and acceptability of the Beautiful Voice as a method to deliver voice, speech and language training at home for stroke survivors and people with Parkinson's. The findings of this study indicate that there is a great desire for these populations to use this type of platform and that such platform can provide users with regular/increased amount of speech, voice and language training at home. Key results indicate that a large proportion of participants has been using the platform regularly, greatly increasing the amount of therapy they receive when compared to their usual care/routine. Moreover, despite being a pilot study, indications of improvements have been discovered in participants' voice, speech and language conditions, particularly among the participants who have been using the platform regularly and frequently.

Nonetheless, through this study it was also important to identify relevant gaps and flaws within the platform. Most noticeably, usability was found inadequate for users with more accentuated language problems. Other key usability issues identified were with respect to font size, consistency of button locations and colours, and wording/instruction simplicity of the exercises.

Next steps include incorporating user feedback to improve the usability of the platform. An expert product design company has been contracted to redesign the Beautiful Voice platform interface, making it more accessible and user-friendly. Meanwhile, Beautiful Voice is working with Lab4Living from Sheffield Hallam

University on a series of co-design workshops with stroke survivors to identify new opportunities for home speech therapy, to further motivate users and increase the adherence of the platform.

Acknowledgements

We thank the study participants for giving up their time to take part in this research. We thank Lauren Cooper and Rachel Charles from Hobbs Rehabilitation for assistance in conducting the study and analysis. We also thank the staff at the Hobbs Rehabilitation and MiNT Academy for their help and support whilst running the study sessions.