

**Blind and Visually Impaired  
Consumer Preferences for  
Consumer Electronic Device  
Interfaces**

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## Purpose of Study

This study was designed to collect opinions from the blind and visually impaired community to inform the design and implementation of the Personalized Audio Information Service (PAIS) service NPR Labs is developing in partnership with the IAAIS for NIDRR ([project number H133G070093](#)).

Specifically, this survey information will be used to help:

- **Define the feature-set of the PAIS service** – this survey addressed what previously available consumer electronic devices have done right and wrong in their accessible user interface designs. This information will help to define a PAIS service that builds on the successes of previously available devices, while avoiding their failures.
- **Define the profile input model** – A PAIS service will operate by filtering content received by a radio based on a listening profile. Visually impaired users will have to physically input their choices into a device - this survey addressed the preferred methods for this input.
- **Contribute to a visually impaired user interface model** – this survey addressed the design preferences for several fundamental components used to interact with interfaces.

## Methodology

### *Survey*

The survey consisted of specific and open-ended questions spread over the following categories:

- **Demographics**
- **Mainstream electronic device experience**
- **Accessible electronic device experience**
- **Successful and unsuccessful assistive device interfaces**
- **Successful and unsuccessful radios**
- **Audible feedback systems**
- **Accessible menu systems**

### *Survey Administration*

We administered the survey to visually impaired participants using several methods:

- **In-person** – NPR Labs staff attended the Washington Seminar hosted by the National Federation of the Blind where we were able to conduct the survey in-person;
- **Email** – after working with the NFB to develop a survey that could be read by screen readers, we accepted responses sent via computer;
- **Phone (NPR)** – NPR Labs set up a 1-800 number, allowing surveys to be collected

- in-house without burdening the respondents with long-distance phone charges; and
- **Phone (Towson)** - In partnership with Towson University and WTMD, an NPR member station, we enlisted graduate students to collect survey data using the radio station's pledge drive phones.

### *Survey Advertisement*

We solicited participants for the study using the following mechanisms:

- **Message Board Notification** - we put out notices on a variety of message boards for visually impaired people directing people to either complete an online version of the survey, or provide their phone number so we could collect their information over the phone;
- **Radio Reading Service (RRS) Advertisements** - in partnership with the International Association of Audio Information Services (IAAIS), we aired public service announcements on dozens of Radio Reading Services across the country
- **NFB Newsletter** – notice of the survey was included in an NFB monthly circular

# Results

## *Respondent Demographics*

Table 1 summarizes the demographic representation of our survey participants:

<b>Category</b>	<b>Item</b>	<b>Frequency</b>	<b>Percent</b>
Gender			
	Male	129	60%
	Female	86	40%
Age			
	18-29	23	11%
	30-39	22	10%
	40-49	40	19%
	50-59	81	38%
	60+	48	22%
Severity of Impairment			
	Completely Blind	129	61%
	Legally Blind	68	32%
	Visually Impaired	13	6%
Education			
	Graduate School	87	41%
	College	99	46%
	High School	26	12%
	Less than High School	2	1%
Income			
	< 20K	51	24%
	20-40 K	48	22%
	41-75 K	68	31%
	> 75K	49	23%
Employment Status			
	Work Full Time	82	41%
	Work Part Time	28	14%
	Work From Home	22	11%
	Retired	52	26%
	Student	17	8%
Technology Use			
	Tech. Enthusiast	86	40%
	Frequent Tech. User	117	54%
	Infrequent Tech. User	10	5%
	Never Use Tech.	2	1%

Braille Use			
	Use	158	73%
	Do Not Use	57	27%
<hr/>			
Frequency of Braille Use Among Users			
	Daily	120	76%
	Weekly	22	14%
	Monthly	15	10%

**Table 1 - Demographic Representation of Survey Respondents**

Despite casting a wide net for participants, as the data in Table 1 shows, our participants were more experienced with technology, better educated, and heavier users of Braille than is common with the visually impaired community at-large. While participant demographics are not consistent with the overall visually impaired community, it is consistent with past surveys that have been taken with blind consumers by numerous groups, and speaks to the problem of including older and less educated blind members in these sorts of efforts. However for our purposes, the respondents included in this survey will more likely be the early adopters of PAIS and thus can provide valuable information that guides product development.

*Radio Reading Service Use*

Table 2 summarizes the patterns of use and satisfaction our survey participants for radio reading services. Our respondents were not frequent users of radio reading services. Many users noted that RRS stations were either unavailable in their area, or didn't adequately serve their media needs. Some respondents noted that RRS stations were of decreasing relevance in the face of AM/FM radio, satellite radio, podcasting, and other computer audio delivery methods. Others responded that RRS stations were inconvenient to use because they were used to time-shifted programming.

<b>Category</b>	<b>Item</b>	<b>Frequency</b>	<b>Percent</b>
<hr/>			
Reading Service Radio Use			
	Use	57	27%
	Do not Use	157	73%
<hr/>			
Frequency of Reading Service Radio Use Among Users			
	Daily	25	44%
	Weekly	14	25%
	Monthly	18	32%
<hr/>			
Reported Satisfaction with Reading Service Radios Among Users			
	Satisfied	28	50%
	Neutral	10	18%
	Unsatisfied	18	32%

**Table 2 – Radio Reading Service Use Patterns and Satisfaction**

### *Consumer and Accessible Electronic Device Use*

Table 3 summarizes which mainstream and accessible technologies our survey participants used frequently. As the data shows, our respondents were heavy users of computers (95%) and associated screen readers (86%). It's interesting to note the slightly higher use of mainstream devices in general over accessible devices. Also, although 73% of our respondents were Braille users, just 32% used refreshable Braille displays. Respondents cited cost (refreshable Braille displays cost upwards of \$3000) as a major obstacle to owning a refreshable Braille displays.

<b>Category</b>	<b>Item</b>	<b>Percent</b>
<hr/>		
Mainstream Devices		
	Computer	95%
	TV	90%
	Table Top Radio	80%
	Music Player	70%
	Home Stereo	67%
	Car Radio	43%
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Accessible Devices		
	Screen Reader	86%
	Scanner	66%
	Daisy Player/Book Reader	48%
	Audio Recorder	47%
	Accessible PDA	39%
	Braille Display	32%
	Screen Magnifier	17%

**Table 3 – Specific technology use**

### *Audible and Tactile Feedback Systems*

Table 4 summarizes our participants' preferences for audible and tactile feedback systems. This data clearly suggests strongly held preferences for audible and tactile feedback systems across our respondents.

- Audible feedback systems should employ spoken prompts, not series of beeps
- These spoken prompts should have human sounding (not overly synthesized) voices
- Users should be able to change the speed of spoken prompts. This enables visually impaired users to navigate devices more quickly
- Users should have ultimate control, including the power to turn off spoken prompts
- Tactile feedback is highly desired.

<b>Category</b>	<b>Item</b>	<b>Frequency</b>	<b>Percent</b>
Preferred Audio Feedback System			
	Spoken Prompts	184	92%
	Series of Beeps	15	8%
Importance of Switching Between Different Sounding Voices			
	Important	67	33%
	Neutral	59	29%
	Not Important	77	38%
Importance of Having Human Sounding Voices			
	Important	113	56%
	Neutral	52	26%
	Not Important	37	18%
Importance of Changing the Speed of Voice			
	Important	161	79%
	Neutral	22	11%
	Not Important	20	10%
Importance of Having Ability to Turn Off the Voice Feedback			
	Important	112	56%
	Neutral	31	15%
	Not Important	59	29%
Importance of Having Tactile Feedback			
	Important	156	74%
	Neutral	40	19%
	Not Important	16	8%

**Table 4 - Audible and Tactile Feedback Preferences**

### *Menu Access Technique*

Table 5 summarizes our participants' preferred methods of accessing menus. This data shows there is a clear preference for using numbered keypads as input methods on electronic devices. Respondents noted that numbered keypads offered flexibility (including the ability to numerically enter in frequencies) and familiarity (it is similar to the dial pad on a telephone).

<b>Category</b>	<b>Item</b>	<b>Frequency</b>	<b>Percent</b>
Preferred Method to Access Menu			
	Numbered Keypad	147	71%
	Buttons	34	16%
	Knobs	15	7%
	Other	12	6%

**Table 5 - Preferred Method to Access Menus**

### *PAIS-specific features*

In addition to general interface accessibility questions, we asked a series of specific questions about how the PAIS service should be structured. Table 6 summarizes our participant's responses:

<b>Category</b>	<b>Item</b>	<b>Frequency</b>	<b>Percent</b>
Preferred Number of Hours to Record in a Day			
	2 hour or more	159	76%
	1 hour or less	49	24%
Preferred Length of Time to Keep Saved Programs			
	Indefinitely	85	41%
	One week	70	34%
	One month	40	19%
	One day	13	6%
Importance of Saving Programs onto a Computer			
	Important	148	71%
	Neutral	30	15%
	Not Important	30	15%
Preference for Being Able to Record in Real-Time			
	Prefer Feature	192	92%
	Does Not Prefer Feature	17	8%
Importance of Being Able to Pause Live Broadcasts			
	Important	135	65%
	Neutral	54	26%
	Not Important	19	9%
Preference for Having an Internal Speaker Included in Device			
	Prefer Feature	194	93%
	Does Not Prefer Feature	15	7%
Expected Time Required to Learn New Accessible Device			
	Under 30 mins.	97	45%
	30 min	73	34%
	More than 30 mins.	44	21%
Preferred Method Used to Learn New Accessible Device			
	Audio Manual	101	47%
	Braille manual	46	22%
	Trial and Error	35	17%
	Have someone teach you	32	15%

**Table 6 - PAIS-specific features**

This data suggests several trends:

- Visually impaired users want accessible services that operate flexibly in real-time.



For the PAIS service, this means including Pause/Catch-up functionality, and allowing users to record in real-time (by pressing a button when they hear content they want saved, as opposed to having all recorded streams depend on a listening profile).

- Internal speakers should be included in PAIS-enabled receivers
- Manuals should be distributed in audio format, with supplementary Braille manuals if the manufacturer so desires

## Impact on Design

The data suggests our survey participants share a near-consensus opinion for several different interface elements relevant to the design of the PAIS service:

- **Numbered keypads** are the preferred methods of input, and should be used for a variety of features in the PAIS service, including inputting frequencies and traversing decision trees
- Audible feedback systems should employ **human-sounding spoken prompts**, that can be sped up, slowed down, or turned off by the user
- The PAIS service should allow users **flexible, real-time access to recording systems**
- The PAIS service should **integrate with computers**, allowing users to store content
- **Manuals should be distributed in audio format**, with supplementary Braille manuals if the manufacturer so desires
- **Internal speakers** should be included in PAIS-enabled receivers
- **Tactile feedback** is highly desired.

# Appendices

## *Appendix 1 - Explanation of Terms*

- PAIS (Personalized Audio Information Service) – PAIS is a new method of delivering the content of audio information services. Users of PAIS set up a listening profile, noting the categories or specific shows they are interested in (e.g. sports, or grocery ads). The radio listens to content that is coming in, and if the topic of individual pieces of content matches a listener's profile, that content is stored so the user can listen to it at their convenience.
- Listening Profile – The listening profile is what filters incoming content to PAIS-enabled receivers. It is a listing of topics or specific shows a listener is interested in hearing
- Profile input process – The profile input process is the methods users enter their listening profile into a PAIS-enabled receiver. It will most likely take form as a decision tree users traverse linearly, gradually refining their profile.
- Time-shifting – Time-shifting is the act of storing content so it can be accessed at a later time.
- Audible Feedback – Audible feedback is a sonic cue triggered when a user performs an action on an electronic device (e.g. a button emits a beep when pressed).
- Tactile Feedback – Tactile feedback is a physical indication on a device that clarifies function (e.g. a raised dot on the '5' button on a phone's keypad)

*Appendix 2 – Survey Questions*

**Script for the PAIS Survey**

Name of Respondent: \_\_\_\_\_

Home Phone: \_\_\_\_\_

Cell Phone (if already provided): \_\_\_\_\_

Male

Female

**Hello. My name is \_\_\_\_\_ and I am calling on behalf of NPR (National Public Radio). You were previously in contact with someone from NPR about participating in a survey about media devices. Would you have about 15 or 20 minutes right now to complete the survey?**

**What type of visual impairment do you have?**

Completely blind

Legally blind

Visually impaired

Other (please specify) \_\_\_\_\_

**Which of the following age ranges would you fall into?**

18-29

30-39

40-49

50-59

60-69

70+

**Based on how much you use current technology, which of the following categories would you classify yourself as?**

Technology Enthusiast (Early adopter)

Frequent Technology User

Infrequent Technology User

I never touch the stuff

**In what range would your current household income fall under?**

Under 20,000

20,001-40,000

40,000-75,000

Over 75,000

**What is your level of education?**

Less than High School

High School

College

Graduate School

**How would you classify your current level of employment?**

Work full time

Work part time

Work in- home

Retired

Student

**Do you use Braille?**

Yes

No

(If yes) How often do you use it?

Daily

Weekly

Monthly

**The following questions are about your use with common media devices.**

**1. Do you use a computer, including laptops?**

Yes

No

(If Yes) How often do you use your computer?

Daily

Weekly

Monthly

**Where do you use this device?**

Primarily at home

Both outside the home and at home

Primarily outside of the home

**On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your computer.**

1      2      3      4      5

**2. Do you use a portable music player, including portable radios, mp3 players, iPods, etc?**

Yes

No

(If Yes) How often do you use your portable player?

Daily

Weekly

Monthly

**Where do you use this device?**

Primarily at home

Both outside the home and at home

Primarily outside of the home

**On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your portable player.**

1      2      3      4      5

**3. Do you use any reading service radios?**

Yes

No

(If Yes) How often do you use your reading service radios?

Daily

Weekly

Monthly

**Where do you use this device?**

Primarily at home

Both outside the home and at home

Primarily outside of the home

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your reading service radio.

1      2      3      4      5

**4. Do you use any tabletop radios, including alarm clock radios?**

Yes

No

(If Yes) How often do you use your tabletop radio?

Daily

Weekly

Monthly

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your tabletop radio.

1      2      3      4      5

**5. Do you use any car radios?**

Yes

No

(If Yes) How often do you use your car radio?

Daily

Weekly

Monthly

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your car radio.

1      2      3      4      5



**6. Do you use a component stereo system?**

Yes

No

(If Yes) How often do you use your component stereo system?

Daily

Weekly

Monthly

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your component stereo system.

1      2      3      4      5

**7. Do you use a TV?**

Yes

No

(If Yes) How often do you use your TV?

Daily

Weekly

Monthly

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your TV.

1      2      3      4      5

**8. Do you use any other similar devices that you would like to mention?**

Yes

No

(If yes, please name) \_\_\_\_\_

How often do you use this device?

Daily

Weekly

Monthly

Where do you use this device?

Primarily at home

Both outside the home and at home

Primarily outside of the home

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with this device.

1      2      3      4      5

**The following questions will be very similar to the questions which you just answered except that these will be based on your use with assistive devices.**

**1. Do you use any screen readers, such as JAWS or WindowEyes?**

Yes

No

(If Yes) How often do you use your screen reader?

Daily

Weekly

Monthly

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your screen reader.

1      2      3      4      5

**2. Do you use any screen magnifiers, such as ZoomText or MAGic?**

Yes

No

(If Yes) How often do you use your screen magnifier?

Daily

Weekly

Monthly

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your screen magnifier.

1      2      3      4      5

**3. Do you use a Daisy player?**

Yes

No

(If Yes) How often do you use your Daisy player?

Daily

Weekly

Monthly

Where do you use your Daisy player?

Primarily at home

Both outside the home and at home

Primarily outside of the home

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your screen magnifier.

1      2      3      4      5

**4. Do you use an accessible PDA, such as an Icon or TapMemo?**

(If yes) How often do you use your PDA?

- Daily
- Weekly
- Monthly

Where do you use your PDA?

- Primarily at home
- Both outside the home and at home
- Primarily outside of the home

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your accessible PDA.

1      2      3      4      5

**5. Do you use a refreshable Braille display?**

(If yes) How often do you use this display?

- Daily
- Weekly
- Monthly

Where do you use this display?

- Primarily at home
- Both outside the home and at home
- Primarily outside of the home

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your refreshable Braille display.

1      2      3      4      5

**6. Do you use a message or voice recorder, such as a tape deck.**

(If yes) How often do you use this recorder?

Daily

Weekly

Monthly

Where do you use your recorder?

Primarily at home

Both outside the home and at home

Primarily outside of the home

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your recorder.

1      2      3      4      5

**7. Do you use a scanning or CCTV system?**

(If yes) How often do you use this system?

Daily

Weekly

Monthly

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with your scanning or CCTV system.

1      2      3      4      5

**8. Do you use any other assistive devices that you would like to mention?**

(If yes, please name) \_\_\_\_\_

How often do you use this device?

Daily

Weekly

Monthly

Where do you use this device?

Primarily at home

Both outside the home and at home

Primarily outside of the home

On a scale of 1 to 5, with 5 being highly satisfied and 1 being highly unsatisfied, please rate your satisfaction with this device.

1      2      3      4      5

**The next couple of questions will be more open-ended about your experiences with assistive devices.**

**Do you own or use any assistive devices that you feel are difficult to use?**

**1. (If yes, please name)** \_\_\_\_\_

Please tell me if any of the following reasons make the device difficult to use.

Poor user interface

Difficult to learn

Features missing

Features too complicated for what I need

Are there any other reasons you would like to mention that make the device difficult to us?

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**2. (If yes, please name)** \_\_\_\_\_

Please tell me if any of the following reasons make the device difficult to use.

- Poor user interface
- Difficult to learn
- Features missing
- Features too complicated for what I need

Are there any other reasons you would like to mention that make the device difficult to us?

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**Do you own or use any assistive devices that you feel are easy and simple to use?**

**1. (If yes, please name)** \_\_\_\_\_

Please tell me if any of the following reasons make the device easy to use.

- Easy to navigate
- Easy to learn
- Helpful manual
- Stable product – upgrades follow same patterns as older versions
- Follows conventions
- Interacts well with other products

Are there any other reasons that you would like to mention that make the device easy and simple to use?

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**2. (If yes, please name)** \_\_\_\_\_

Please tell me if any of the following reasons make the device easy to use.

- Easy to navigate
- Easy to learn
- Helpful manual
- Stable product – upgrades follow same patterns as older versions
- Follows conventions
- Interacts well with other products

Are there any other reasons that you would like to mention that make the device easy and simple to use?

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**Have you used or owned any radios that are well designed and easily accessible?**

- Yes
- No

(If yes) What features did you like or find useful?

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**Have you used or owned any radios that are not well designed or accessible?**

- Yes
- No

(If yes) What features made this radio inaccessible?

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**The following questions will be about audible feedback systems.**

**Do you use devices with an audible feedback system other than a screen reader?**

Yes

No

(If yes, please name) \_\_\_\_\_

Do you like the way it works?

Yes

No

Why? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(name of device 2) \_\_\_\_\_

Do you like the way it works?

Yes

No

Why? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**In an audible feedback system, which of the following would you prefer?**

Spoken prompts with a human sounding voice

Series of beeps or sounds

**Please rate the following items on a scale of 1 to 5, with 5 being very important and 1 being not important.**

The ability to switch between different sounding voices

1      2      3      4      5

The ability to change the speed of voice

1      2      3      4      5

Human or lifelike sounding voices

1      2      3      4      5

The ability to turn off the voice feedback system

1      2      3      4      5

**The following questions will be about various aspects of a user interface system.**

**Which of the following ways do you prefer to access a menu system?**

- Numbered keypad
- Knobs
- Buttons
- Others: Please List \_\_\_\_\_

**How important to you is tactile feedback in a physical interface?**

- Very important
- Important
- Somewhat important
- Somewhat not important
- Not Important

**When you first get an assistive device, how long do you think it should take to be able to use your device?**

- Immediately
- Within 15 minutes
- Within 30 minutes
- Longer than 30 minutes

**How do you prefer to learn to use your assistive devices?**

- Listening to an audio manual
- Trial and Error
- Having someone teach you
- Using a Braille manual

**Do you have a favored brand of assistive devices because they have good interfaces?**

- Yes
- No

(If yes) Please list: \_\_\_\_\_

What we are envisioning, here at NPR, is a new audio information service that would allow radios to save stories from reading services that are interesting to you automatically, allowing you to listen to it at your convenience (like TiVO, but for the radio). First you would set up a profile of what programs you like, either through a computer or through the radio itself. Then the radio would capture those programs, so that they would be ready for you to listen to at your convenience.

**If you were using this system, how many hours do you think you would like to record in a day?**

- Under an hour
- 1 hour
- 2 hours
- More than 2 hours

**How long would you like to keep your recorded programs?**

1 day

1 week

1 month

Indefinitely

**On a scale of 1 to 5, with 5 being very important and 1 being not important, how important is it to be able to pause live broadcasts?**

1      2      3      4      5

**On a scale of 1 to 5, with 5 being very important and 1 being not important, how important would it be to be able to save programs onto a computer?**

1      2      3      4      5

**Would you like the ability to record in real-time, meaning you hear something that you like and you press a button to record?**

Yes

No

**Would you like an internal speaker included in this device?**

Yes

No

**Are there any other features that you think should be included?**

Comment:

**Is there anybody else you know who is visually impaired and might like to take this survey?**

Names and phone numbers: