BrainPort® V100-T Device

Trainer Manual

BrainPort® Technologies
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General Description

The BrainPort V100-T is a non-surgical assistive device intended for orientation, mobility, object identification, and spot reading by individuals who are blind. It translates digital information from a video camera to gentle electrical stimulation patterns on the surface of the tongue. Users describe the experience as streaming images drawn on their tongue with small bubbles. With training, users are able to interpret the shape, size, location, and motion of objects in their environment. The BrainPort V100-T is intended to augment, rather than replace, other assistive technologies such as the white cane or guide dog.

Using this Manual

This manual is intended for use by individuals who instruct end users on the proper and safe use of the BrainPort V100-T device. **The manual is to be used in conjunction with BrainPort V100, Model V100-T and the *BrainPort V100 Device User Manual* (DR-000801, User Manual, V100) which contains additional important information**.

- Chapter 1 describes the BrainPort V100-T and the vRemote software.

- Chapter 2 explains how to begin training with the BrainPort V100-T.

- Chapter 3 includes troubleshooting procedures to use in the event of problems with the BrainPort V100-T or vRemote software.

- Chapter 4 lists user training activities and curriculum.

	Attention, consult accompanying documents
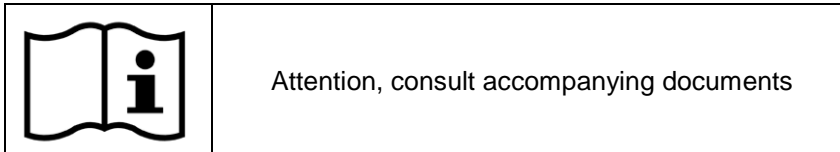
This label is a reminder for you to consult this manual or other material you received with the device for important safety information.

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CHAPTER 1
General Information

Indications for Use (Purpose of Device)

The BrainPort V100-T is intended for use as an electronic assistive device for individuals who are profoundly blind. It is specifically indicated for use as an aid in orientation, mobility, object recognition, and spot reading.

Description of BrainPort® V100-T

Headset

A digital video camera is mounted on a pair of sunglasses at the nose bridge. The camera is capable of working indoors and outdoors in typical lighting conditions. The camera's field of view is user-controlled and varies from narrow to wide angle views. There are two cables permanently attached to the left ear piece: The IOD assembly and the headset cable.

Intra Oral Device (IOD)

The IOD (tongue electrode array) contains electrodes that act as "pixels" for the tongue. The flat side with the electrodes should be in contact with the front top surface of the tongue. The user should close their lips around the thin stem, maximizing tongue contact with the electrodes. The stimulus pattern on the electrode array corresponds to the scene captured by the camera. There is one cable exiting the thin stem of the IOD that is permanently attached to the ear piece of the headset.

Controller

The Controller contains the battery as well as the user control features for the BrainPort V100-T. An antenna provides wireless connection capabilities. The Controller is generally handheld. A belt clip is provided for hands free operation.

Battery Charger (not displayed)

A battery charger with factory instructions is included with each BrainPort V100-T. All batteries included with the system should be fully charged prior to initial use.

vRemote

The vRemote software program (Figure 1) executes on a personal computer (Windows 7). It provides information to the trainer about stimulation intensity, zoom, exposure, tilt, and inversion settings of the BrainPort V100-T device. The CAMERA VIEW represents a generally higher resolution view of the scene detected by the camera. The yellow box in the CAMERA VIEW represents the region of interest (zoom/field of view) that the user has chosen. The IOD VIEW presents a visual representation of the information being sent to the IOD (derived from the region of interest).

Note: The personal computer used for training must be able to establish a Wi-Fi connection (minimum 802.11 a/b) with the BrainPort V100-T device.
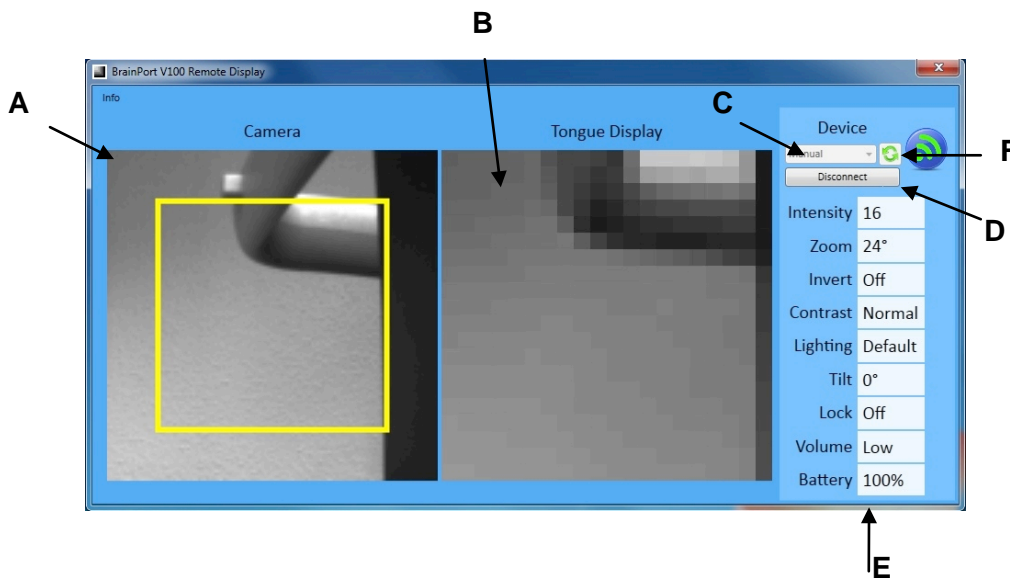

Figure 1. vRemote Program

    A. Camera View
    B. IOD View
    C. Device Name (Serial No.)
    D. Connect/Disconnect Button
    E. Device Status Panel
    F. Refresh Button

Contraindications

A user with any of the following conditions should not use the BrainPort V100-T device:

- Numbness or lack of feeling of the tongue.
- History of injury to the tongue resulting in impaired sensation or use of the tongue.
- Any neurological condition that causes impaired sensitivity to the tongue or loss of consciousness.

General Warnings

- *Personal Computer*. When using a personal computer with vRemote:

  o Do not allow the user to touch the personal computer;

  o Do not touch the personal computer and the user at the same time;

  o Instruct the user to hold the Controller such that the antenna is at least 20 cm (8 in) away from his body;

  o Do not allow the user to come into direct or indirect contact with any device plugged into a wall circuit;

  o Do not use a power strip or extension cord to power the personal computer;

  o The personal computer used to run vRemote is an accessory that is used only by trainers and is not a medical device when operated standalone. It becomes part of a medical device system when used for training and the precautions listed inside the *BrainPort V100 Device User Manual* must be followed to insure client safety.

Adverse Events

If a user experiences an adverse event or effect and the BrainPort device is suspected to be a contributory cause, please contact Wicab immediately.

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Product and Package Labeling

The labels on the back of the BrainPort V100-T controller and on its packaging provide important information. Please refer to the *BrainPort V100 Device User Manual* for descriptions of the symbols.

CHAPTER 2
Using the BrainPort V100-T Device

This chapter explains how to set up and use the BrainPort V100-T device.

Using procedures other than those specified in this manual may damage the BrainPort V100-T, increase risk of injury, and decrease benefits of use.

Before EACH use, tactilely inspect the device for damage, for example, anything rough or loose on the IOD, disconnected cables, etc. If you find any of these problems, contact Customer Support and DO NOT use the device.

Quick Start: Beginning a Training Session with the BrainPort V100-T Device

(Letters in parentheses refer to Figure 1: vRemote Program).

1. Wicab recommends that the trainer disinfect the IOD before allowing a user to use the device. See "Care and Maintenance" for detailed instructions on how to disinfect the IOD.

2. Please refer to the *BrainPort V100 Device User Manual* for instructions to start-up the device.

3. If you will be using the personal computer with vRemote software, power-on the personal computer and wait for the operating system to boot.

    A. Open the vRemote program and click the Refresh button.

    B. Each unit is configured with an Ad Hoc network corresponding to its serial number. From the drop-down menu in vRemote, choose the wireless network that matches the numeric portion of the device serial number of the user's device. For instance if the device serial number is SN000079, select wireless network BPV-000079. Press the Connect button to connect to the Wi-Fi network. The device will announce "Wi-Fi connect" and the camera image will appear inside vRemote.

    C. A Camera View **(A)** and IOD View image **(B)** should appear in vRemote on the personal computer. Note: If the Camera View **(A)** does not show an image, disconnect and reconnect the Headset to the Controller.

        Reminder: Review *Personal Computer* under General Warnings.

    D. To turn off the system, turn off both the BrainPort V100-T device and the personal computer; order is not important.
        a. Exit the vRemote application and power down the personal computer.

Care and Maintenance

Disinfection Procedure Between Individual Users

Wicab recommends that you follow the proper disinfection procedures provided in the *BrainPort V100 Device User Manual*. In the event that local regulations require high level disinfection between multiple BrainPort users, contact Wicab for additional information.

Care and Maintenance for a Single User

- Disinfect the IOD per instructions in the *BrainPort V100 Device User Manual* before using it for the first time.

- Rinse the IOD with tap water and air-dry it after each use. DO NOT use a hair dryer or the like to force dry the IOD. The IOD may need to be rinsed with tap water as needed to remove contaminants. It may be used immediately following such a rinse.

- Disinfect the IOD once a week. Use the disinfectant listed in Appendix A on a cotton ball or cotton swab to gently wipe the surfaces of the IOD. DO NOT SCRUB! DO NOT USE CLEANERS! Thoroughly rinse the IOD with tap water to remove any residual disinfectant and allow it to air-dry. DO NOT use a hair dryer or the like to force dry the IOD.

General Care and Maintenance

- As needed, use a cloth slightly damp with water to wipe the exterior of the controller, headset, and battery charger. DO NOT use cleaners! DO NOT rinse or immerse the controller, headset, or the battery charger. After cleaning, allow the controller, headset, and battery charger to dry completely before use.

- See the *BrainPort V100 Device User Manual* for Storage and Transportation conditions.

- DO NOT bend, fold, or crush the IOD cable as this may permanently damage the IOD.

- Always protect the IOD. To avoid damaging the IOD, follow these instructions:

  o Do not drag the IOD electrode surface across an object;

  o Do not strike the IOD against a hard object;

  o Do not allow the IOD to come in contact with other electrical equipment such as cell phones, cell phone chargers, portable music players, etc.

CHAPTER 3
Troubleshooting

There are no user serviceable parts in the BrainPort V100-T device. Routine adjustment or calibration of the device is not required. If you suspect there is a problem with the BrainPort V100-T device, follow the trouble shooting procedure contained in the *BrainPort V100 Device User Manual.*

If you suspect there is a problem with the vRemote software, check the following:

- Delayed camera image
    - ☐ Due to Wi-Fi limitations an occasional delay in the camera image may occur.
    - ☐ To minimize delay the distance between the personal computer and Controller should be less than 6 meters (20 feet).
    - ☐ Adjust the image quality of the camera mode by right clicking on the screen.

- No stimulation with Wi-Fi enabled
    - ☐ Follow "Quick Start: Beginning a Training Session with the BrainPort V100-T Device" to connect.

- Intermittent connection problems
    - ☐ Replace the battery with a fully charged battery in the Controller**.**
    - ☐ Follow "Quick Start: Beginning a Training Session with the BrainPort V100-T Device".

- No camera image
    - ☐ Unplug the headset cable connector from the receptacle at the base of the Controller near the Power On/Off button.
    - ☐ Re-connect the headset cable connector into the receptacle at the base of the Controller**.**

- Device serial number not listed in "Wireless Connection" dialog on the personal computer
    - ☐ Replace the battery with a fully charged battery in the Controller**.**
    - ☐ Follow "Quick Start: Beginning a Training Session with the BrainPort V100-T Device".

If you continue to experience difficulties with the device or the vRemote software, contact Wicab for assistance.

CHAPTER 4
User Training

Orientation Phase

During orientation, allow the user to experience hands-on familiarization with the physical components of BrainPort V100-T device. Instruct the user on device assembly and controls such as signal intensity control, positioning of the camera, control of camera zoom, and control of stimulus contrast inversion. Allow the user to perform the basic activity of bar orientation. Have the user hold the Styrofoam bar in his hand against the black background, and allow the user to feel the range of stimulation on the tongue as he moves over the line, back and forth.

Individualization of Training

☐ Use your professional expertise and experience with the device to decide what level of training is appropriate and effective for each user.

☐ Users will progress at different rates. Some may not progress within a training session. That is okay. Users should be challenged, but not frustrated, by the level of difficulty of the task performed at each training session.

☐ The training rate should be individualized for each user as needed. Take the user's physical conditioning, fatigue, concentration level, etc. into consideration when training.

☐ Each individual finds different tasks easier/harder. Be sure to spend time training on a variety of tasks enabling cross-situational learning/generalization to occur and to minimize boredom, loss of focus, etc.

Training Philosophy

☐ As a trainer, your role is to facilitate the user's self-discovery of linking BrainPort-derived perception with his lifetime of multi-sensory experiences.

☐ Where possible, let the user directly experience the situation rather than providing explicit verbal translational cues. Instead of telling him the mapping of the array to the world (up=back of tongue; down=front of tongue; left=left of tongue; right=right of tongue), give him an activity (e.g. training modules below) where he is in control of the viewed object's position in space. Have the user move the object to known locations, and observe how and where he feels the stimulation move on his tongue.

☐ Provide training activities where the user can explore the situation in his typical manner (by reaching, touching, listening, etc.) and then observing how that same situation is represented by the BrainPort V100-T device. If the user's handling of the object is not enough to identify the object, provide the object a name ("you are looking at an X") so that the user can make some context links between his existing knowledge of an object and BrainPort V100-T device perception.

☐ Ask the user to describe the stimulation pattern that he perceives on his tongue before coaching him about what he is feeling on the IOD. For example, if looking at two objects, the user may describe one a small and strong round blob of stimulation on the left, the other object a larger, more angular and less intense stimulation on the right. After receiving the user's description, then as trainer, link the noticed features with the identity of the object(s). Invite him to explore the situation again with his other senses to confirm the translation between perceived features and the real world.

☐ Train users on a variety of tasks in a variety of contexts. This will encourage generalized BrainPort V100-T device learning rather than entrenching strategies specific for one task. Changing training tasks every 20-30 minutes reduces fatigue, possible frustration for difficult tasks, and keeps users engaged. Repeat exercises from session to session to reinforce the learning.

Training Progression

The training protocol requires that a user progress from simple to increasingly more difficult tasks. The trainer should accompany the user in close proximity (but not touch the user while in contact with the personal computer) and monitor the BrainPort V100-T device output representation on the personal computer. This visualization gives the trainer an idea of which aspects of a scene are readily discernible with the BrainPort V100-T device and enables the trainer to provide strategy coaching to the BrainPort V100-T device user.

Training Modules and Procedures

The following lesson plans refer to suggested training equipment such as a black table cloth, 1 inch diameter Styrofoam bar, foam lines, foam shapes, household objects, etc.

Basic BrainPort Skills

Learning objectives:	New Exercises:
- Introduction to device assembly and wear - Introduction to device controls and their functions - Introduction to changing the battery - Introduction to basic orientation	- Bar Orientation - Basic Lines

Bar Orientation
1. Against the black wall, explore the field of view dimensions with the Styrofoam bar using a mid-range field of view (zoom) position.
2. Have the user hold the Styrofoam bar horizontally in his hand at arms distance, and move the bar up and down experiencing how the top and bottom dimensions translate to the Tongue Display (tip of tongue is bottom of visual field, back of the tongue is top of the visual display).
3. Have the user hold the bar vertically and explore left and right dimensions.

Basic Foam Line
1. Affix a light colored line to the black felt wall for users to explore. Users are encouraged to explore how to point the camera at the stimulus, using their hands for biofeedback.
2. Place the line in various positions (up, down, left, right) and in various orientations. Ask users to define the direction of the line.

* Challenge: Ask the user to find the line stimulus on a white or black background without the benefit of tactile assistance.

Head Movement Skills and Spatial Relationships

Learning objectives:	Review Exercises:
• Mastery of device assembly and maintenance • Mastery of device controls and their functions • Mastery of basic orientation • Introduction to advanced orientation and zoom • Introduction to object differentiation	• Basic Lines/ Bar Orientation New Exercises: • Advanced Lines • Locating Lines • Balls in Space

Advanced Foam Line
1. Affix the lines to the black wall. Instruct the user to locate the line starting with a mid-range field of view (zoom) position.
2. Point out that the stimulation gets stronger and larger as the line gets closer to the camera, and smaller and weaker as the line is moved further away.
3. The user can then explore how adjusting the zoom in and out changes the stimulation size on the tongue. Mention that using zoom on a static line is similar to moving the line closer or farther away from the camera.

Locating Lines
1. Place the Styrofoam bar and line on the black felt tabletop or against the black background about 10 inches (25.4cm) apart.
2. Allow the user to explore the tabletop and locate the objects. Ask the user to point to or describe the orientation of each linear object.
3. Vary the distance between the Styrofoam bar and lines, as well as their orientations (ex. parallel, T-formation, L-formation, etc). Repeat Step 2. Allow users to reach out feel the space between the objects for biofeedback purposes.

*Challenge: Ask the user to locate the trainer and/or various parts of their own body.

Balls in Space
1. Place a ball on the black table cloth. Have the user reach out and grab the ball. Repeat with the ball placed in different areas on the table to build up tongue-hand coordination.
2. Have the user place the ball close to him, and then far away, and reinforce the observation that when close, the ball size is larger and maybe stronger stimulation feeling.
3. In addition, suggest that he incorporate what he knows about his head position, for example, when the ball is close, he has to bend his head downward. When the ball is farther away, he may need to tilt his head up.
4. Suggest that these are basic cues of depth, even without stereo vision.
5. Place two balls (i.e. softball, baseball, or ping pong ball) on a black table cloth, with one ball far away from the user and the other closer to the user. Have the user reach out and grab a designated ball. Repeat with the balls placed in different areas on the table and varying distances apart from one another.

*Challenge: Increase the difficulty by adding more balls with varying sizes (e.g. ping pong ball and baseball). Ask the user to discriminate between the objects. "Which is bigger?" "Which is closer?" "Which one is not like the other?"

Shape Identification

Learning objectives:	Review Exercises:
- Mastery of advanced orientation and zoom feature - Mastery of object differentiation - Mastery of object localization - Introduction to basic shapes - Introduction to the effects of shadows	- Locating Lines Challenge - Balls in Space Challenge New Exercises: - Shapes - Object ID

Foam shapes
1. Affix the light colored shapes (i.e. letters C, E, T, 2 lines) on the black wall for the user to explore. Encourage the user to change head position in order to find the object as well as adjust zoom to get the best view of the object.
2. Have the user seated close enough, so that if necessary, the user can get additional feedback by touching the object.
3. If the user does not interpret the shape correctly, encourage him to touch the object, and then reanalyze the stimulation pattern.
4. In early training, it is fine to coach the user in head position cueing the user to use features such as zoom.
5. Ask the user to describe what he feels on his tongue. Ask probing questions like "Is it vertical or horizontal?" "Is it big or is it small?" "Is it angular or blob-like?" etc.

* Challenge: Position the shapes in abnormal orientations (ex. upside-down T, backwards E, etc.) and ask the user to identify the general shape and/or its orientation.

Object ID
1. Place 1 object on the black tabletop. Allow the user to practice locating the objects.
2. Instruct the user to confirm the location of each object by reaching out and picking up each object. Encourage the user to hold the object in his hand and to re-analyze the stimulation pattern created to build a link between hand-tactile knowledge and the newly developing tongue-tactile knowledge.
3. Place 2 objects on the black tabletop. Repeat Step 2.
4. Place 3 or more objects on the black tabletop. Repeat Step 2.

*Challenge: Ask the user to place objects next to or inside one another (ex. ping pong ball into the coffee mug) to facilitate associations between multiple objects.

Complex Shapes, Letters, and Numbers, Larger Environments

Learning objectives:	Review Exercises:
• Mastery of basic shapes/ shadow effects • Introduction to perception, recognition and categorization of shapes/symbols/large objects while stationary	• Shapes Challenge • Object ID Challenge New Exercises: • Flash Cards • Room ID

Flash Cards
1. Start by giving a flashcard to the user and having them explore the boundaries of the card shape from the background. User can be shown how the zoom and invert functions can provide additional details as necessary.
2. Then give the user a "vocabulary" of different shapes (letters/numbers etc).
3. Point out the distinguishing features to help discriminate shapes, such as the pointy top of the letter "A", etc.
4. Then have the user categorize into increasingly difficult groups. Perhaps first sort round objects from angular objects, then later, sort into distinct shapes or sort by size, etc.
5. Users can then try to identify the letters and words on the cards or even on a computer screen.
6. Do not focus all the training on flash card and computerized exercises. These exercises are ideal for learning to detect features and use of the zoom function, but they do not provide three-dimensional and interactive learning, which is more applicable for activities of daily living.

Room ID
1. To expand the benefit of this exercise to everyday living, move beyond activities on the stationary black felt tabletop. Encourage the user to identify or describe objects/furniture throughout the room. Doorways and windows are larger items which can more easily be distinguished by new users.
2. Use features of the training environment (ex. exit signs, elevator call buttons, bathroom signs, etc.) as well as the signs provided in the training kit to allow users to explore and identify useful identification techniques. Provide instruction on features such as "invert", "zoom" and "contrast" which may be helpful in differentiating signs/objects in everyday situations.

Mobility and Wayfinding*

Learning objectives:	Review Exercises:
• Mastery of perception, recognition and categorization while stationary • Introduction to indoor wayfinding • Identification of objects while mobile • Introduction to outdoor wayfinding (optional)	• Flash Cards • Room ID New Exercises: • Indoor Ambulation Part1/2 • Mobile Object Identification

*During this module, the trainer must provide close supervision of the user to prevent possible injury or accident.

Indoor Ambulation Part 1
1. Have the user point to areas of stimulation within a room, and then have him describe it. For example, door jams are often experienced as a very prominent vertical line or intersection. Once the user has described the experience, give him a label for it.
2. Allow the user to continue exploration of the types of stimulation felt on the tongue while moving, without pressure to actually identify specific objects or features. This exercise is meant to introduce optic flow resulting from self-motion.
3. Suggest using the "invert" feature when the environment displayed is predominantly white/light stimulating or when an object or feature of interest is dark or not stimulating.

*Challenge: Place two large objects (i.e. chairs) and instruct the user to navigate around the obstacles. Provide close supervision to prevent injury.

Indoor Ambulation Part 2
1. Start with a mid-range zoom position for ambulatory tasks.
2. In hallways and rooms, point out floor to wall intersections that have contrast readily discernible with the BrainPort V100-T device.
3. As a trainer, you may wish to stop and show the user a particular object in the environment. Have the user stop walking, then coach him into pointing the camera in the proper direction and slowly zooming into the object you have in mind. Query the user as to what features he is experiencing. After receiving a description, identify the object for him. Have the user look at the situation again, inviting him to explore the object with zoom for more detail, or by walking closer to and/or touching the object of interest.
4. While moving, instruct the user to bring the zoom field of view back to a mid-zoom. Demonstrate how having too much zoom restricts the field of view (like looking through a small straw) and can lead to disorientation. If this should occur, have the individual stop, zoom out, and recognize the environmental context before proceeding.

*Challenge: Outdoors, instruct the user to explore the edges of sidewalks, lines in an empty parking lot, etc. Allow the user to feel the differences in sensation on the tongue as a result of the different terrain.

<u>Mobile Object Identification</u>
1. Begin with a mid-zoom position for ambulatory tasks.
2. Allow the user to explore how the zoom field of view feature works in ambulatory situations as it behaves similarly to walking closer to an object. Start by having the user use a mid-range zoom looking at an object from a couple feet away. Then without adjusting the zoom, have the user slowly walk backwards, observing how the object/feature gets smaller and weaker on the tongue. Then from a distance, you can have the user experience the "reverse" sensation by using the zoom control while standing in place.
3. Instruct the user to find the center of the hallway by using the stimulation of the walls as a guide. Ask the user to also locate and identify objects in a room such as chairs, tables, people, and doorways.

*Challenge: Encourage users to identify and locate smaller areas of interest such as elevator call buttons, light switches, door handles, etc.

Measures of Training Success

Upon successful training, a BrainPort V100-T device user should be able to demonstrate mastery with skill areas such as object recognition and orientation and mobility.

As always, your professional judgment is the final determination in deciding whether a user is competent with the device.

Potential Training Issues

User is not feeling what is expected

First, confirm that his head is pointing to the object/feature of interest and that it is being presented on the vRemote software. If not, direct the user to change his head movements to point toward the object/feature of interest. Next, have the user describe the pattern of stimulation he is experiencing. Ask where on the tongue he is feeling the stimulation – is it horizontal, vertical, square-like, blob-like, etc.? After reporting his perception, you can then provide a commentary on what each feature noticed represents. If possible, have the user physically touch the object of interest, then return to observing the same object with the BrainPort V100-T device, trying to coordinate BrainPort V100-T device information with his pre-existing knowledge.

If the user reports feeling something entirely different than expected, take the following steps to confirm proper device performance: (1) have the user point the camera at a black/white surface and adjust image inversion to display a "Blank" area to the user, in which there should be no stimulation. Confirm with the user that no stimulation is perceived; (2) Display a simple stimulus, such as a vertical and/or horizontal bar. Confirm that the user's perception matches the visual display. If user's perception and the Display Unit are incongruous, there may be a problem with the system; contact Wicab, Inc. for more support.

User is having difficulty determining how far away an object is

If the object is within reachable distance, have the user look down to his hands or his feet as reference points. If the object and the reference are within the field of view together, the object is probably close and you can instruct the user to slowly move his hand/foot toward the object, noticing how the two objects move closer to one another. If the object is further away, have the user take advantage of body movement cues. For example, have the user look up from his hand/foot to find the object of interest, noticing how much body or head movement was required. Again, instruct the user to move closer to the object, recognizing that the amount of head/body bending required is reduced as the object gets closer.

User feels lost and cannot find expected objects

Sometimes beginning BrainPort V100-T device users are stuck in an over zoomed/magnified position (a narrow field of view) causing disorientation and difficulty locating an object of interest. Instruct the user to slowly zoom out to a wider field of view, providing a known context (room, door, table, card, computer, etc). In some situations it is helpful to return the camera zoom to a known "home position" for distance reference. Then, using deliberate and slow scanning head movements, have the user locate the object with the Tongue Display, and then zoom in slowly while correcting head position to keep the object centered. If the object is lost during this process, repeat.

User is having difficulty with the concept of zoom and field of view

As the user is exploring a vertical bar in the outstretched hand (Module *Basic BrainPort Skills*), have him bring the bar closer to the camera and have him notice that the size on the tongue increases. As he moves the bar away from the camera, the thickness of the line decreases. Then have him keep the bar stationary and engage the zoom feature. Call attention to the same features getting larger and smaller on his tongue, despite not moving the bar. Describe the zoom feature as a substitute for walking closer or father away from an object.

In a mobile situation, zoom can be demonstrated along with distance perception in an activity. Show the person a relatively large object on the wall that can be recognized at a given zoom level. Then have him take two large steps backward without changing the zoom level. Have the user notice how the object size and features may appear smaller and weaker. Continue having him step backwards a few steps at a time until the object is lost. Then you can demonstrate zoom by doing the same exercise in reverse. From a distance, have the user slowly zoom in until he is focusing on the known object. Reiterate to the user that he knows the distance from the object has not changed, but he can make a faraway object feel "closer' by the zoom/magnification feature. Point out that as one uses the zoom (magnification); it comes at a cost of the field of view. When zooming into an object from across the room, the user will not be able to see all the objects on the wall at the same time – the field of view is smaller. A similar exercise can be done stationary at a table. Have the user use a mid- to wide-field of view to begin.

The size of a pie/pizza wedge angle can be used as a metaphor for explaining field of view: the larger the slice, the larger the angle, the more field covered. Another useful metaphor uses pipes or straws. A large field of view is like looking at the world through a wide pipe, while a narrow view is like looking through a straw. Since the Tongue Display is of a fixed resolution, there needs to be more data compression for the wide field of view, so details in the image are often averaged out. When the field of view is narrow, the details are able to be presented on the tongue, but at a cost of only being able to display one small aspect at a time.

Contact Information

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Website: http://www.wicab.com/	

Appendix A: Disinfectants

Disinfect the IOD once per week using the disinfectant listed in the table below. Wet a cotton ball or cotton swab and gently wipe the surfaces of the IOD. DO NOT SCRUB! DO NOT USE CLEANERS! Thoroughly rinse the IOD with tap water to remove any residual disinfectant and allow it to air-dry. DO NOT use a hair dryer or the like to force dry the IOD.

The disinfectant listed below have been tested and shown to be compatible with the IOD. Follow the manufacturer's directions regarding safe use and disposal for the disinfectant.

Please visit our website for the most recent list of approved disinfectants. Disinfectants are added to the list as they are tested and shown to be compatible with the IOD.

Disinfectant	Source
70% isopropyl alcohol (rubbing alcohol)	Over the Counter (local pharmacy)