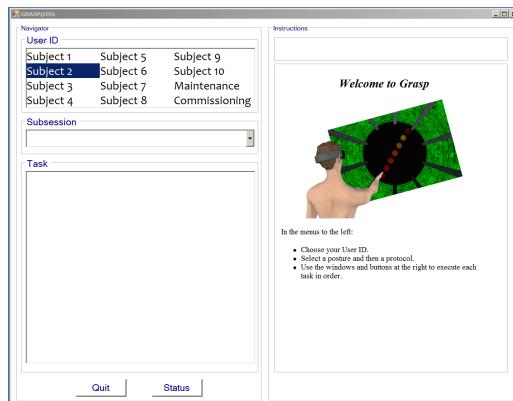
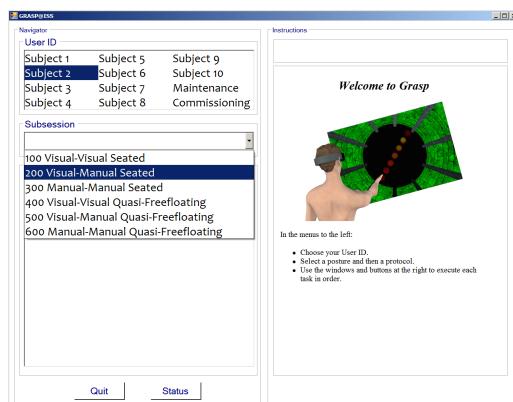


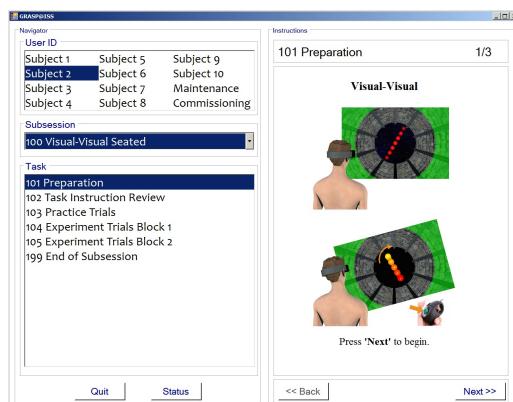
A user initiates Grasp activities by selecting his or her designated subject ID in the upper-left panel of GRASP@ISS:



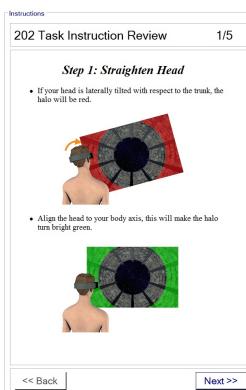
Using a pull-down menu, the protocol for the pending sub-session is selected:



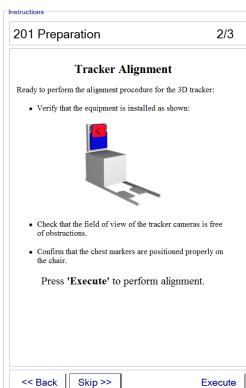
Selecting the subsession protocol brings up a list of tasks to be executed in the defined order (the first task is automatically selected):



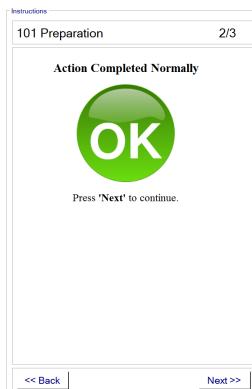
The panel on the right then guides the subject through the steps required by each task. The panel may take one of four different forms. First, the subject is presented with one or more pages of instructions. Once the instructions have been read the subject proceeds to the next step by pressing the 'Next' button. It is also possible to return to the previous step (except when at the first step) by pressing the 'Back' button.



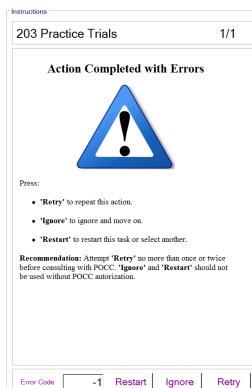
The subject may then be prompted to launch a particular action. In the example shown here, the system is ready to perform the tracker alignment. The subject presses the 'Execute' button to initiate the action. He or she may also press 'Back' to return to the previous action or instruction. In exceptional cases, the subject may be told by POCC to press 'Skip' to move on to the next step without performing the action.



Pressing 'Execute' typically causes a new program to execute, which will activate specific popup windows outside the GRASP@ISS main window. When execution of the task terminates, focus will return to the GRASP@ISS main window and the termination status of the task is displayed. If the task was successful, the subject will typically see the following message allowing them to confirm and move on to the following step (by pressing 'Next') or to return and repeat the task (by pressing 'Back').



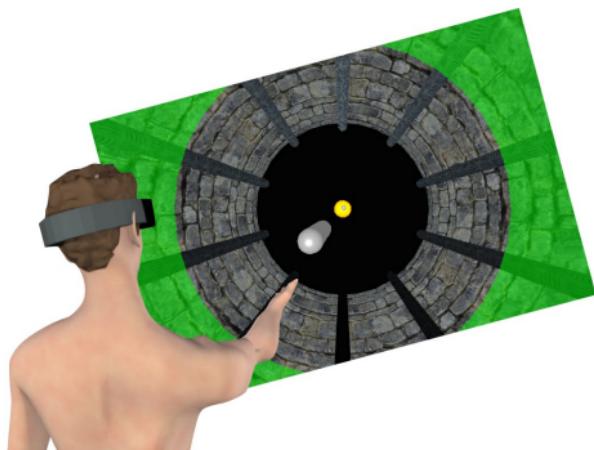
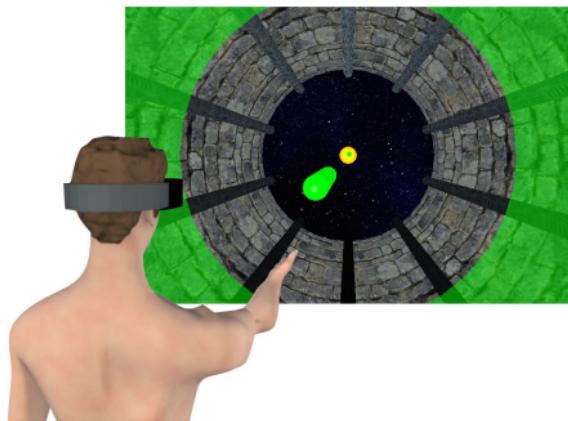
If the task did not complete successfully, an alert will be displayed that shows the error return code (in the 'Error Code' box) and that typically includes a graphical or text explanation of the error. Shown here is the generic message that may be used for any error condition, but more specific error messages may also be displayed.



In these circumstances, the subject is invited to repeat the task by pressing 'Retry'. If a second attempt also fails, the subject has the option to move on to the next step anyway, by pressing 'Ignore' or to repeat the entire task from the beginning by pressing 'Restart'.

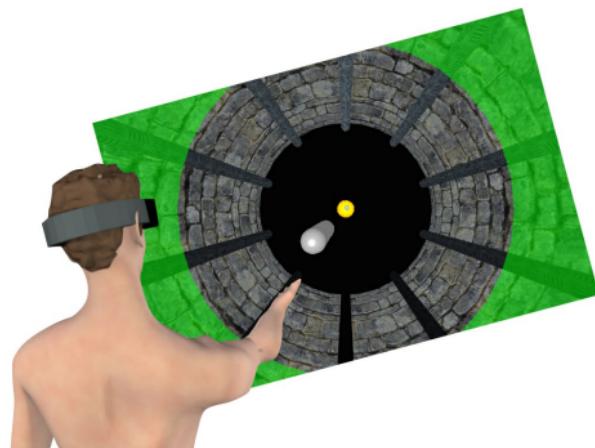
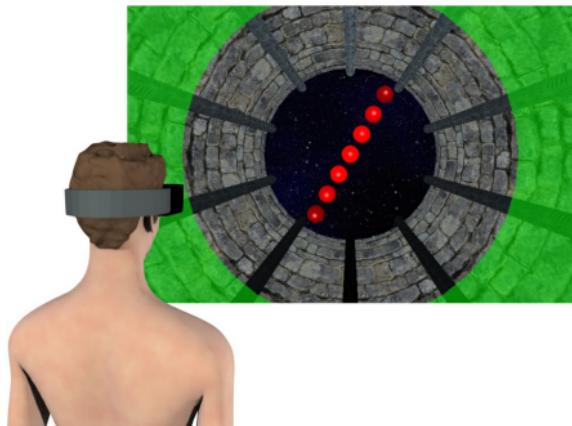
The full set of possible instruction, status and alert screens are included in the following sections.

## Manual-Manual



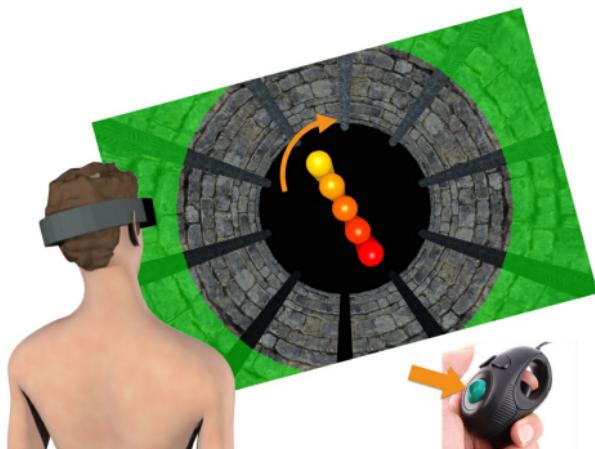
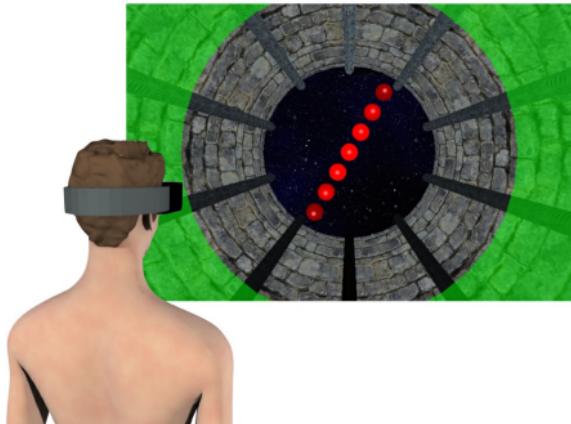
Press '**Next**' to continue.

## Visual-Manual



Press '**Next**' to begin.

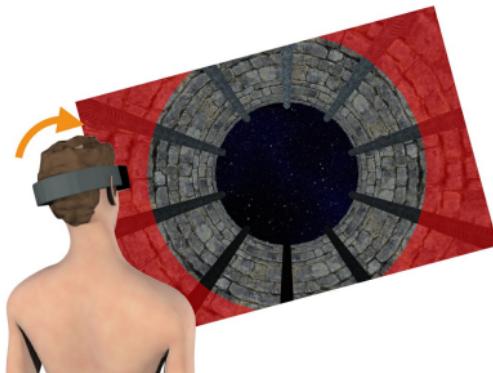
## Visual-Visual



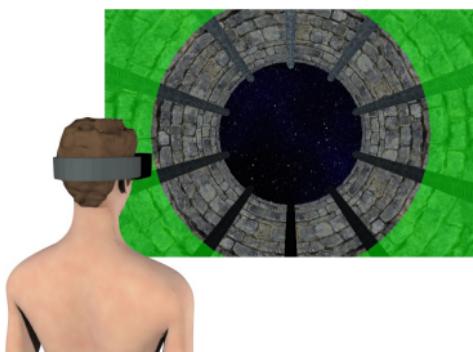
Press 'Next' to begin.

## ***Step 1: Straighten Head***

- If your head is laterally tilted with respect to the trunk, the halo will be red.

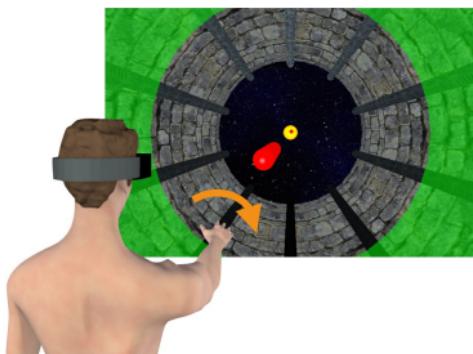


- Align the head to your body axis, this will make the halo turn bright green.

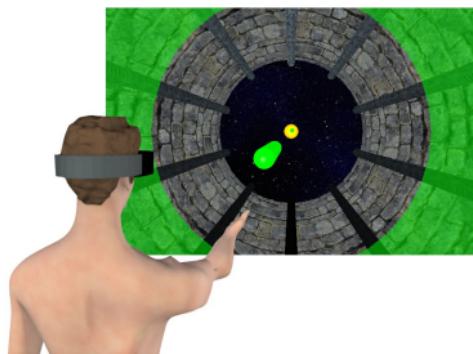


## ***Step 2: Acquire Target***

- Once your head is aligned with your body, a disk-shaped target will appear. Raise your arm and point until the laser-pointer falls on the target.



- Rotate your hand in a rolling motion around the axis of your arm until the pointer and the tool turn bright green. Memorise the corresponding hand orientation.

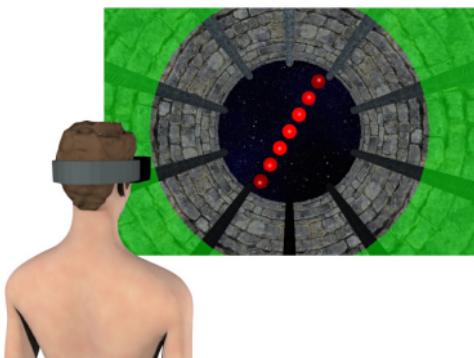


- When the target disappears, lower your arm to your side.



## ***Step 2: Acquire Target***

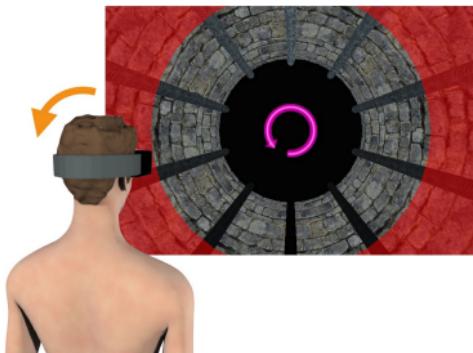
- Once your head is aligned with your body (i.e. when the halo is bright green), a line of balls will appear at the end of the tunnel, representing the target orientation.



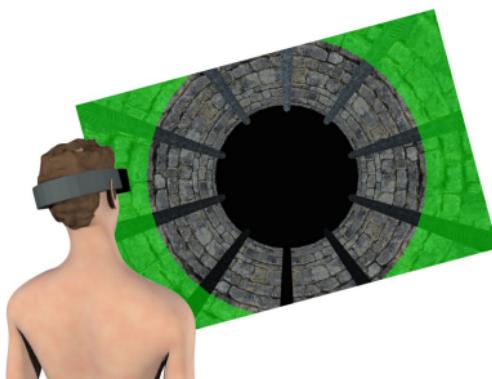
- Memorise the target orientation.

### ***Step 3: Tilt the Head***

- If the tunnel turns red, you must tilt your head to a new orientation. If an arrow appears, it tells you which way to rotate the head.



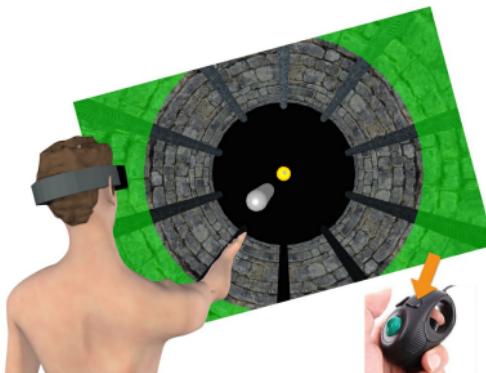
- Roll your head from side to side until the tunnel turns green.



- Hold this position.

### ***Step 4: Align to Target***

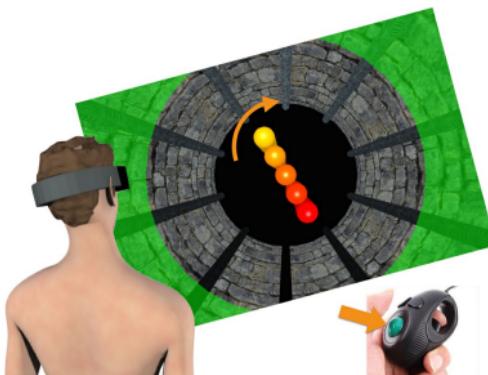
- When the orange disk reappears, raise your arm and aim until the laser pointer falls on the disk.
- Rotate your hand in a rolling motion around the axis of your arm to the remembered target orientation. The hand will not change color.



- Click on the top right mouse button to validate your response once you think your hand is aligned with the memorised target.

### ***Step 4: Align to Target***

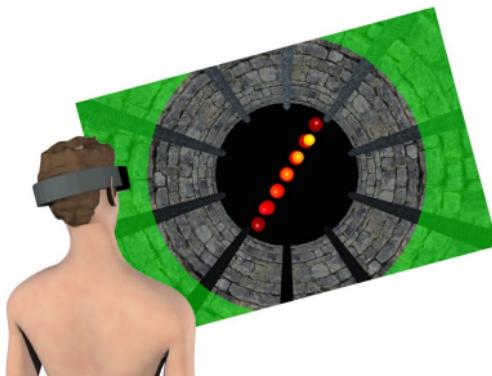
- Use the mouse trackball to align the tool to the memorised target (trackball movements to the left and right produce counterclockwise and clockwise rotations of the tool, respectively).



- Click on the right mouse button to validate your response once you think that your hand is aligned with the memorised target.

### ***Step 5: Check Response***

- In some of the trials a line of target balls will be projected from your hand towards the targets, allowing you to verify whether or not you correctly aligned your hand.

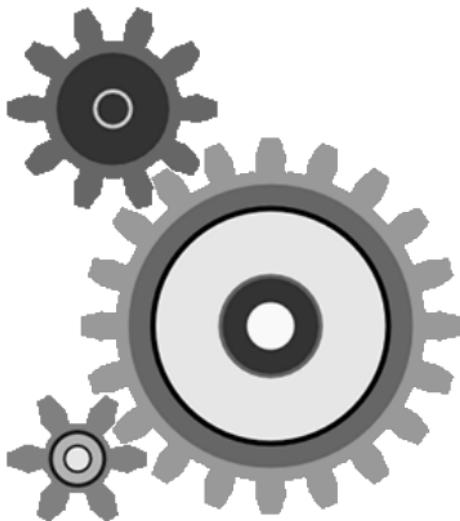


## **Subsession Terminated**



Press '**Next**' to exit.

## Application Running



## Task Terminated

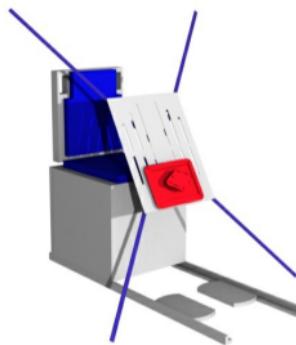


Press '**Next**' to proceed.

## Tracker Alignment

Ready to perform the alignment procedure for the 3D tracker:

- Verify that the equipment is installed as shown:



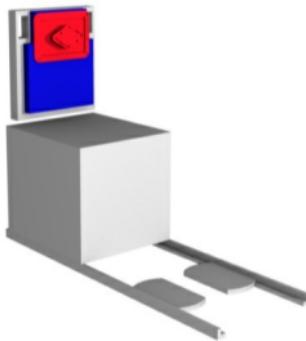
- Check that the field of view of the tracker cameras is free of obstructions.
- Confirm that the chest markers are positioned properly on the chair.

Press '**Execute**' to perform alignment.

## Tracker Alignment

Ready to perform the alignment procedure for the 3D tracker:

- Verify that the equipment is installed as shown:



- Check that the field of view of the tracker cameras is free of obstructions.
- Confirm that the chest markers are positioned properly on the chair.

Press '**Execute**' to perform alignment.

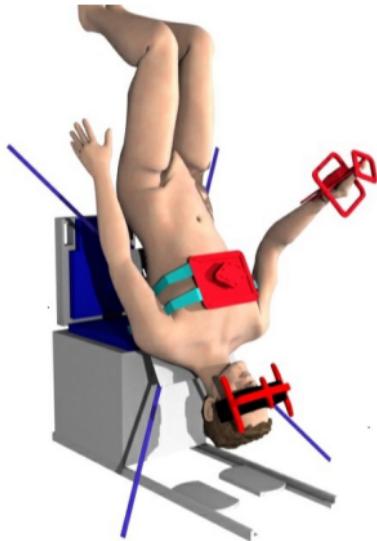
## Ready to Start



Press '**Execute**' to continue.

## Ready to Start

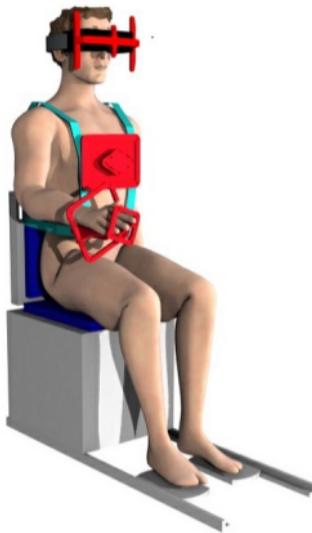
Adopt the quasi-freefloating posture with chest and hand markers attached and the HMD ready.



Press '**Execute**' then don HMD and start trials.

## Ready to Start

Adopt the seated posture with chest and hand markers attached and the HMD ready.



Press '**Execute**' then don HMD and start trials.

## Action Completed with Errors



Press:

- '**Retry**' to repeat this action.
- '**Ignore**' to ignore and move on.
- '**Restart**' to restart this task or select another.

**Recommendation:** Attempt '**Retry**' no more than once or twice before consulting with POCC. '**Ignore**' and '**Restart**' should not be used without POCC authorization.

## Action Terminated



If normal exit:

- 'Next' to continue to next step.

If error exit:

- 'Retry' to repeat this action.
- 'Ignore' to ignore error and move on.
- 'Restart' to re-initiate this task or select another.

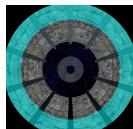
**Recommendation:** Attempt 'Retry' no more than once or twice before consulting with POCC. 'Ignore' and 'Restart' should not be used without POCC authorization.

## Action Completed Normally

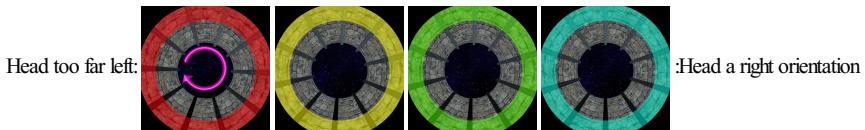


Press '**Next**' to continue.

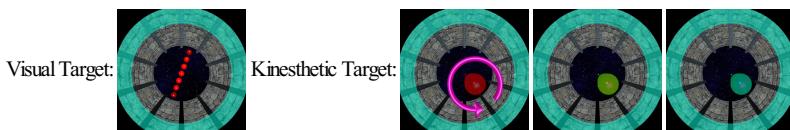
The actual Grasp scientific task starts with a welcome screen that prompts the subject to press a button in order to start a block of trials:



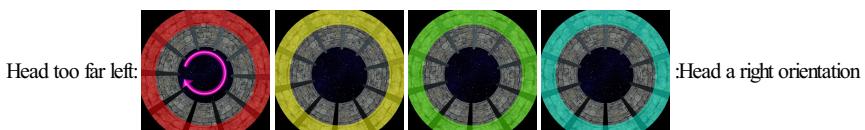
He or she is then guided to bring the head to an upright position with respect to the shoulders. The halo around the subject's view into the virtual world changes color, from red when the head is tilted far from the upright position through yellow and green until it turns bright cyan to indicate that the head is at the proper orientation. A circular arrow may appear when the head is far from the desired posture, giving the subject an indication of which way to tilt the head.



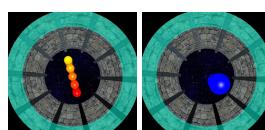
A target orientation is then presented to the subject. This can be visual, in the form of a line of balls presented at the end of the tunnel. Or the target orientation can be presented kinesthetically, by guiding the outstretched hand to the desired orientation by changing the color of a virtual tool.



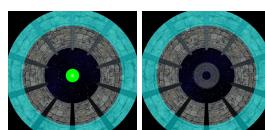
The target disappears and the subject is prompted to tilt the head to a new orientation through the same system of halo colors and direction arrows as described previously.



The subject then reproduces the remembered target orientation, with or without visual feedback about the hand's orientation.



The subject presses a button to validate the trial. A green sphere pops up to indicate that the trial was completed successfully, or a message appears to indicate that the block of trials has been completed.



Note that a circular prompt with text instructions may appear at different times in response to different conditions. For instance, a message will be generated if the subject does not maintain the head in the specified tilted position. All possible messages are shown in Appendix II.















