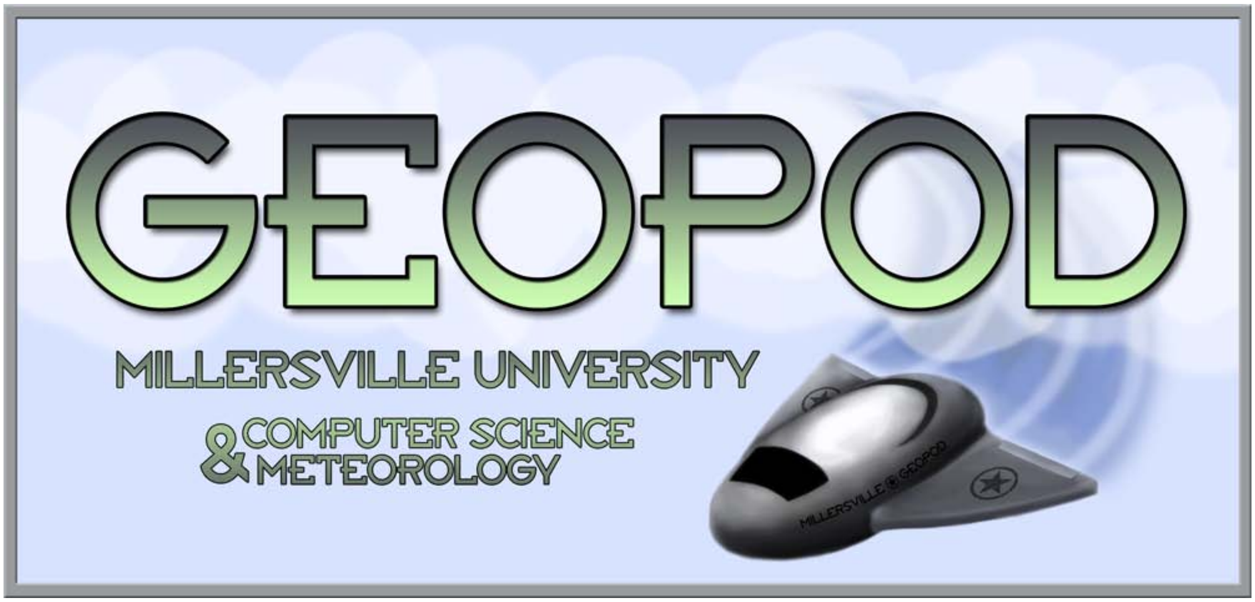

Geopod Project

Usability Study Analysis

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Overview

As noted in the Usability Test Plan, the study consisted of two main types: a usability study using 15 earth science students as participants, and an expert review. This report provides a summary of the data collected from these studies, and an analysis of the results.

Participants were timed while performing tasks during 4 trials designed to (1) exercise the system functionality and control interface and (2) mimic actual assignment tasks as the system would be used in a lab setting. In addition, participants provided basic demographic and attitudinal information about their experiences during the four trials on pre- and post-test surveys.

Demographics

Table 1 presents the pre-test data (see Appendix 1 for the actual instrument used). Eight participants were female and seven male. One participant used the mouse left-handed. Participants were between the ages of 18 and 26. When asked to rate their experience with applications that use 3D navigation, from 0 (no experience) to 5 (expert). The average response was 2.5, indicating a low experience level overall. Only 4 participants answered with a score of 4; no participants indicated a 5.

Participant	Q 1	Q 2	Q 3	Q 4
1	1	19	Right	F
2	3	20	Right	M
3	4	19	Right	F
4	2	21	Right	F
5	4	21	Right	M
6	3	22	Right	M
7	1	26	Right	F
8	3	20	Right	F
9	0	22	Right	F
10	4	19	Right	M
11	2	20	Right	F
12	3	20	Right	M
13	3	22	Right	M
14	4	22	Right	M
15	1	18	Left	F
AVG	**2.5**			
Male				7
Female				8

Table 1

Timings

Table 2 summarizes the timings for each participant on each trial – Participant 15 was not included in this analysis since she was asked to "think aloud," which had the potential to drastically lengthen the amount of time it would take to complete tasks. In addition, the table includes the times posted by the control expert user. A value of double the control time was used as a reference target time for the participants.

Participant	Trial 1	Trial 2	Trial 3	Trial 4
1	0:02:15	0:03:15	0:02:44	0:16:35
2	0:02:25	0:07:01	0:03:23	0:21:03
3	0:02:47	0:06:13	0:03:28	0:15:22
4	0:03:14	0:11:26	0:04:32	0:22:06
5	0:02:54	0:04:03	0:04:00	0:18:57
6	0:02:52	0:04:03	0:03:41	0:19:03
7	0:03:19	0:06:38	0:06:30	0:29:46
8	0:03:41	0:05:04	0:03:35	0:13:12
9	0:02:58	0:05:04	0:05:23	0:24:16
10	0:05:00	0:04:26	0:04:31	0:14:13
11	0:03:09	0:12:25	0:03:22	0:26:47
12	0:02:23	0:05:24	0:03:01	0:21:52
13	0:04:12	0:16:24	0:12:09	0:30:31
14	0:05:40	0:12:12	0:06:08	0:26:06
Average	0:03:21	0:07:24	0:04:45	0:21:25
Control	0:01:43	0:02:26	0:01:54	0:10:50
2 * Control	0:03:26	0:04:52	0:03:48	0:21:40

Table 2

What we see from this data is that in Trials 1 and 4, test participants met the goal of performing the tasks in no more than double the control times. This meets the stated performance targets.

In Trial 3, participants completed the tasks in 2.5 times the control time. This is slightly worse than the target. However, there was only one time (Participant 13) that was significantly worse than all others (nearly double the next longest time). If this time were eliminated from the average, the result is only slightly worse (0:04:11) than the target time.

In Trial 2, participants performed at 3 times the control time. There were 4 participants (#4, 11, 13, and 14) who took nearly twice as long as other participants. Eliminating these participants from the average produces a result of 0:05:07, just slightly worse than the target time.

Furthermore, it must be remembered that some of the tasks required in the trials were somewhat open-ended, such as asking the user to enter notes into the notebook without specifying the exact text of the notes to enter. Some participants took considerable time making such notes as realistically meaningful as possible, while others made minimal notes. This can account for a significant difference in times for participants.

Conclusion: the time required for the users to complete each trial is within acceptable limits of performance.

User Satisfaction

Table 3 summarizes the participants' responses to the post-test survey which asked attitudinal questions about their experiences with the Geopod system. See Appendix 2 for a list of the questions used for this survey.

Participant	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9	Q 10	Q 11
1	4	5	4	4	5	5	5	2	3	2	5
2	4	5	4	3	5	4	3	2	1	2	5
3	4	5	5	4	4	5	5	1	1	1	5
4	4	4	5	4	5	4	4	3	2	3	5
5	4	4	4	4	4	4	4	3	4	3	5
6	3	4	4	4	4	5	2	3	2	2	4
7	3	4	4	3	5	5	4	4	1	4	5
8	2	5	5	3	5	5	5	4	1	2	3
9	1	3	2	4	5	5	2	4	2	1	3
10	4	4	5	3	4	3	4	3	2	3	4
11	2	5	5	3	4	5	4	4	1	2	5
12	3	4	4	4	5	5	4	2	1	2	5
13	5	5	5	3	5	4	4	2	3	2	4
14	5	5	5	5	5	5	4	1	2	3	5
15	5	5	4	5	5	4	4	3	2	2	5
	3.53	**4.47**	**4.33**	**3.73**	**4.67**	**4.53**	**3.87**	**2.73**	**1.87**	**2.27**	**4.53**

Table 3

Questions 1 – 7 should result in agreement (at least a 4) from the user (with 5 being "Strongly Agree") if the user had a positive attitude toward the Geopod system. Four of the seven questions resulted in average responses better than 4 (very favorable). The remaining 3 indicators show slightly less favorable results, but still on the positive side of the scale.

Questions 8 – 10 should result in disagreement (a 2 or less) from the user (with 1 being "Strongly Disagree) if the user had a positive attitude toward the Geopod system. Only one of the three indicators was clearly within the target response area (Question 9), but the other two indicators are still on the side of the scale indicating disagreement.

Question 11 asked the user directly to indicate whether they like using the Geopod system. An average response of 4.53 shows a strong affirmative for this question.

Conclusion: users were uniform in their positive attitude toward the Geopod system in general.

Likes and Dislikes

Participants were also asked to indicate what they liked most or least about the Geopod system (see Table 4). While there was a wide range of responses for both of these open-ended questions, there were two responses – one positive, one negative – that were repeated the most frequently.

Participant	Q 12	Q 13
1	Look up location, dropsonde	
2	navigation, views	focus error
3	wind tubes, visualization of surfaces	no auto-level on isosurface (incorrect statement)
4	particle imager, wind tubes	controls difficult at first
5	crystal structures	navigation at first
6	navigation, customizable display panel	controls different from Google Earth, focus error
7	user friendly	navigation
8	visualization of data	navigation
9	particle imager, gridpoints, notebook	navigation
10	Moving along isosurface	commenting on each spot
11	flight simulation	controls different from Google Earth
12	particle imager	
13	autopilot, visualization of data	parameter setup
14	user friendly, simplicity	focus error
15	particle imager	

Table 4

On the positive side, users noted the system's ease of use (user friendliness) as what they liked best about the system.

On the negative side, navigation was noted most frequently as something participants didn't like about the system. It should also be noted that although 4 users indicated navigation as a problem, 2 users indicated that navigation was what they liked best about the system. Two participants indicated that they thought the Geopod navigational controls differed from those used in the Google Earth system, which could make the Geopod system more difficult to learn for some students.

Conclusion: in general the participants liked the system and thought it was easy to use. It was clear not only from the user responses to the post-test survey but from analyzing video of the tests that navigation was a consistent problem for users. There is some indication, however, that such navigational difficulties may be temporary, as indicated both by one particular participant in the survey and from observing improved user navigational performance as the trials progressed.

Video Analysis

Tables 5 – 8 summarize the results of analyzing the recorded videos of the user trials. An "x" indicates that a particular user error or interface error occurred during a particular participant's run of the trial.

Table 9 provides a list of user errors that were observed during the trials. These are execution mistakes made by users, as opposed to "slips". The distinction is that mistakes are improperly formed intentions, whereas slips are instances where the user had the correct intentions but simply failed to execute that intention properly, e.g. by hitting the wrong button because of poor hand/eye coordination. Slips were not recorded for this study.

Table 10 gives a list of interface errors that were observed. These are problems with the interface itself. The identification of such errors derives primarily from interface guidelines developed by human-computer interaction experts Donald Norman and Ben Shneiderman.

Norman's principles are

1. Use both knowledge in the world and knowledge in the head.
2. Simplify the structure of tasks.
3. Make things visible.
4. Get the mappings right.
5. Exploit the power of constraints.
6. Design for error.
7. When all else fails, standardize.

Shneiderman's "Eight Golden Rules" are

1. Strive for consistency.
2. Cater to universal usability.
3. Offer informative feedback.
4. Design dialogs to yield closure.
5. Offer error prevention and simple error handling.
6. Permit easy reversal of actions.

7. Support internal locus of control.
8. Reduce short-term memory load.

These guidelines are also used during the expert evaluation described later in this document.

Participant	UE 1	UE 2	UE 3	UE 4	UE 5	UE 6	IE 1	IE 2	IE 3	IE 4	IE 5	IE 6	Help
1			x				x						
2	x		x										
3							x						
4													
5	x												
6	x	x					x	x					
7		x	x				x	x					
8	x		x				x						
9			x	x			x						1
10	x		x		x		x						
11		x	x		x				x				
12							x						
13							x						
14			x				x			x			1
15													

Table 5: Trial 1 Summary

Participant	UE 1	UE 2	UE 3	UE 4	UE 5	UE 6	IE 1	IE 2	IE 3	IE 4	IE 5	IE 6	Help
1			x										3
2					x								2
3			x										1
4													2
5			x	x		x							
6							x						1
7			x			x							2
8			x										
9													1
10			x										
11						x							1
12							x	x					1
13		x	x										3
14			x					x					2
15			x										

Table 6: Trial 2 Summary

Participant	UE 1	UE 2	UE 3	UE 4	UE 5	UE 6	IE 1	IE 2	IE 3	IE 4	IE 5	IE 6	Help
1			x					x					
2													
3								x					
4								x					
5			x										
6			x				x	x					1
7			x					x					3
8			x										
9				x									2
10			x										
11													1
12							x	x					
13			x										1
14			x					x					1
15													

Table 7: Trial 3 Summary

Participant	UE 1	UE 2	UE 3	UE 4	UE 5	UE 6	IE 1	IE 2	IE 3	IE 4	IE 5	IE 6	Help
1	x	x	x			x		x				x	2
2			x					x					
3		x	x			x		x					
4								x					
5		x	x			x		x					
6		x						x					
7		x	x			x		x					1
8			x			x							
9		x	x					x					2
10		x	x					x					
11		x	x			x		x					
12			x										
13			x										
14			x			x		x			x	x	
15			x					x					

Table 8: Trial 4 Summary

1.	User didn't hit "Enter" to set grid points to 50 (T1-7).
2.	User became disoriented (e.g. T1-12).
3.	Failed to successfully complete at least one step.
4.	User selects wrong operation.
5.	User moved cursor to upper right corner of a window in search of a close button.
6.	User used a manual process rather than an available automated one

Table 9: User Errors

1.	Problems with highlighting (selection) in data fields (latitude, longitude, altitude, gridpoints) (T1-1).
2.	Focus remained in data entry field (T1-2).
3.	Insufficient feedback to user.
4.	User has difficulty selecting a point on the grid
5.	Overlapping windows obscuring important information
6.	Calculator does not remain visible while using notebook

Table 10: Interface Errors

User errors can be caused by a number of factors, not the least of which is simply inexperience with the system. User Errors 1 and 2 in particular can be accounted for by this. Such problems can usually be effectively eliminated through longer and/or more thorough training.

That being said, however, there are other issues related to user disorientation (UE 2) – a pervasive problem during the trials – including a lack of adequate feedback related to the pod's orientation. This lack is discussed during the expert evaluation section below.

Another indicator of concern is User Error 3, indicating a failure to complete at least one step during the trial. Usually this is because the user skipped a step, though sometimes it is because they did not perform the correct actions in order to successfully complete a step. Users who noticed their error and corrected their mistake were not flagged with this error, however.

Some of these failures can be attributed to issues not related to the system's interface. One, certainly, is thorough training. Another is that the phrasing of task statements may not have been adequately understood by some participants. Examples include phrases such as "note the location" or "parallel to the isosurface." A later section of this report explores some of the phrases that are possible problems. These problems can be overcome when designing assignments using the Geopod system through a combination of training and changes in wording for certain tasks.

The most frequent interface error encountered is a focus problem related to the data entry fields (latitude, longitude, altitude, gridpoints). As a consequence to this problem, users frequently ended up accidently entering command keystrokes into these data fields. While in all instances the users noticed the problem and were able to correctly fix it, this is still a significant problem of the interface.

The second significant problem users had was in selecting the current values in these data fields prior to modifying the fields. It is not clear whether anything can be done about the current awkwardness of this interaction.

Expert Evaluation

In addition to the usability study discussed above, the Geopod was reviewed by this report's author while using the system to complete the same set of trials given to the study participants.

The same interface guidelines as discussed above were also used as a basis of the expert review. Some additional elements of the evaluation include properties derived from gestalt theory: proximity, similarity, symmetry, and closure. These principles guide issues related to the look of the interface.

Finally, it should be noted that this review does not include issues related to users with disabilities. This will require an additional review effort.

Concerns and Recommendations

Following are concerns raised from the usability study and/or expert review, in no particular order.

(1) There is a difference in pod orientation between setting the coordinates and the altitude and then flying the pod versus setting the coordinates and flying the pod, then setting the altitude.

- This is not intuitive for users. This is not necessarily an indication that something in the system needs to be changed, but at the least instructions to users must be very precise in how they are worded so that users will all tend to perform those instructions in the exact same way.
- **Recommendation:** it may not be practical to change this behavior. If that is the case, make this a training concern.

(2) There is a lack of feedback for the buttons, in terms of showing that buttons have been activated.

- Users expect buttons to behave certain ways based on their (already considerable) user of computer technology.

- **Recommendation:** all buttons should follow typical interface style.

(3) There is a non-standard and inconsistent use of "close" buttons for pop-up windows.

- Most windows include a button labeled "Close" at the bottom of the window. However, the calculator window has the close button in the upper right corner.

- **Recommendation:** It would be best for such buttons to follow the standard for the operating system (Windows), with an x button in the upper right corner of the window.

(4) Some forms of feedback are unclear.

- "No Particle Formation Image": does this mean there's no particle at that location, or that there is no image on file?
    - **Recommendation:** something like "No Particle Present" would be clearer.

- "No Address Found": why? What is this supposed to indicate to the user?
    - **Recommendation:** If this is used to indicate that the pod's current location is outside of the loaded volume, a better message would be "Current location is outside of volume."

(5) Lack of consistency of use of keyboard commands versus buttons.

- Some controls have keyboard equivalents as well as buttons on the control panel, others have only buttons or only keyboard commands. This lack of consistency creates confusion for the user (is there a meaning implied by one interaction form over another?), as well as memory problems. For example, what is the difference between the "Lock on Isosurface" control function (which has both a button for control and a keyboard command) and activating the particle imager (which has only a button)?

- **Recommendation:** all operations (perhaps excepting navigational operations) should have both buttons and keyboard commands.

(6) Notebook automatic entry format need visual separator.

- Once the user enters multiple automatic notes into the notebook, the text visually runs together, making it difficult to easily identify individual entries.

- **Recommendation:** include a visual separator between notes, e.g. a line of dashes.

(7) User must type location into notebook.

- When an instruction asks the user to "look up" their location and enter it into the notebook, the user is required to retype the data that is already displayed in the location field. This is exacerbated because the notebook window partially obscures the location field.

- **Recommendation:** provide a button or command to transfer the location field to the notebook.

(8) Insufficient feedback when dropsonde has been launched.

- Only indications are changes to labeling of dropsonde (the longitude and latitude) or, possibly, to the graph that is displayed.
- **Recommendation**: add visual and/or audio cue of launch

(9) Difficult to distinguish one dropsonde from another

- Only indication is differences in latitude/longitude labels for each dropsonde
- **Recommendation**: add a unique identifier for each dropsonde

(10) Being "locked on isosurface" is difficult to determine, regardless of message in upper left of screen.

- It is not easily determined by the total visual display that the pod is actually locked onto the isosurface…the only ongoing indication is a changing altitude as the pod is navigated. The user does not appear able to comprehend what "locked onto isosurface" actually means from the visual information, since there may not be any actual visual evidence of the lock (other than the displayed message).
- **Recommendation**: any time the user begins to navigate with the lock on, reorient the visual display so that the isosurface is displayed across the center of the screen.

(11) The "locked on isosurface" indicator does not follow standard use of state icons.

- The icon shows an open lock, which could be interpreted as the lock's state; state is instead indicated by the presence of a special notice displayed with a pop-up in the upper left corner of the display.
- The location of the "locked" state message is on the opposite side of the screen from the button. This violates proximity principles of design.
- **Recommendation**: use the button icon to indicate state.

(12) Halting history playback leaves the display at the position last shown during the playback, rather than the position of the pod before the playback started.

- This violates principles of predictability and locus of control, in that users would not be able to predict that playing back history could potentially change the pod's current position, and they would feel a lack of control in terms of being able to set the position of the pod themselves.

- **Recommendation**: playback should have no impact on the pod's position; it should remain at the same position it was in before playback was begun. One way of making this clear to the user is to show the playback within a separate window rather than using the entire display to do so. However, if the purpose of the playback tool is to allow the user to go back to a previous position, then one additional control to return to the pod's position prior to playback might solve the problem (perhaps a "return to previous position" operation).

(13) Using autopilot to change just the pod's altitude can change pod's latitude/longitude.

- This violates principles of predictability and locus of control, as demonstrated by several participants during the usability studies.
- **Recommendation**: when the only change to navigation fields is in the altitude, move the pod without changing its orientation, in a straight line.

(14) After changing display parameters, a "Loading Finished" message appears in a pop-up window, requiring the user to manually close the window.

- In addition to interrupting the user's workflow, the message itself confuses users since they must determine whether this is some sort of error message, or something requiring a decision or action on their part.
- **Recommendation**: if there are some parameters that require time to load, use a "percentage of completion" indicator that disappears automatically when loading is complete.

(15) No indicator for pod orientation.

- Users are frequently confused as to the current orientation of the pod, since the only possible indication is the visual display. As a consequence, users become so disoriented that they can't navigate effectively.
- **Recommendation**: provide a pod orientation indicator, perhaps like those used in airplane control panels

(16) Insufficient feedback for the current speed.

- Users cannot determine current speed except by observation during navigation. This violates predictability and locus of control principles.
- **Recommendation**: provide a speed indicator, with a finite number of discrete speed settings (e.g. 10 possible settings).

(17) Using autopilot with gridpoints was sometimes confusing for users.

- Once user selects a point and begins navigating (by clicking on the "Go" button), it is impossible for user to determine progress toward the selected position, because the selected point is changed back to its "non-selected" color.
- **Recommendations**: the color of the selected point should not change back to its unselected color until the end of the navigation, rather than the beginning. In addition, it would be helpful for the user's ability to understand the progress of the navigation if the point would "grow" as it is approached.

(18) Add Note operation focus is not initially in the comment text entry field, so user has to click in the field in order to enter a comment.

- This violates the predictability principle.
- **Recommendation**: set the focus automatically to within the comment field.

(19) Buttons don't "react", i.e. change on mouse-down and mouse-up.

- This violates the standard way buttons operate on most system. This lack of consistency makes it difficult for users to confidently user controls.
- **Recommendation**: button icons should have distinctive mouse-down and mouse-up visual cues.

(20) Altitude unit of measure not specified.

- This resulted in various users indicting the altitude in either feet or meters when making notes.
- **Recommendation**: provide units in the display.

(21) Gridpoints are very small targets.

- This requires users to take extra time in trying to get the mouse hot-spot within the target in order to select it prior to using the autopilot. Users are clearly sometimes confused as to whether they have successfully selected a point.
- **Recommendation**: the "click zone" of a button should exceed the actual visual size of the gridpoints, making for a larger perceived target.

(22) No "undo" facility.

- Users frequently issue unintended commands, for a variety of reasons. With no undo facility, users must attempt to restore a state previous to issuing the errant command manually.
  Sometimes this is not even possible. This violates a fundamental principle for user interfaces.
- **Recommendation**: provide an undo operation.

(23) Inconsistent notation between latitude/longitude fields and the dropsonde window labels.

- While the latitude/longitude fields show a negative number, the dropsonde label is based on 360° value. Such inconsistency can be confusing to users.
- **Recommendation**: use consistent labeling.

(24) Confusing labeling of Geocode field.

- The field displays two similar messages when the current latitude/longitude does not match up with a specific city: "No Address Found" and "?, ?, United States". The distinction between these is unclear. The purpose of this first message is unclear, but may be displayed only while the pod is still outside the isosurface volume.
- **Recommendation**: eliminate the "No Address Found" message entirely – just leave the field blank instead.

(25) Calculator functionality concerns.

- Whenever the user sets the focus to the notebook, the calculator disappears. This requires the user to remember the last value displayed on the keyboard in order to enter that value into the notebook.
- **Recommendation**: either keep the calculator visible even while the notebook is visible, or provide a button on the calculator to copy its current value to the notebook.

(26) Pop-up labels obscure data entry fields.

- The roll-over pop-up labels obscure the data entry fields for latitude, longitude, and altitude.
- **Recommendation**: move labels to ensure clarity of fields.

(27) The Add Note operation provides insufficient feedback.

- The pop-up window indicates only that the user can enter a comment into the notebook, when in fact the current values of all display parameters are copied into the notebook at the same time. Users frequently misunderstood this and redundantly entered display parameter values into the comment field manually.
- **Recommendation**: the pop-up window should display the entire note that will be added to the notebook.

(28) "Saved" status of notebook confusing.

- The concept of the notebook being "saved" is difficult to understand, since closing the notebook closes the window but retains its current entries – which can be interpreted as being "saved." In addition, there is no indication in the notebook window of whether the contents have or have not been saved. Users frequently had difficulty determining status of notebook content.

- **Recommendations**: include a "saved" or "needs saved" status indicator to the notebook window. Also, system should not be allowed to be shut down without offering the user an opportunity to save the notebook.

Vocabulary Issues

One issue that is independent from the actual interface but had a noticeable impact on the performance of students was the use of vocabulary and particular phases within the instructions of the test trials. Some careful thought must be given to how these phrases are used, what implied semantics are derived by the student, and what semantics were actually intended by the instructor.

The most problematic term throughout the study was "note." In some instances, e.g. "note the location," the intent of the instructor was to get the user to add an automatic note to the notebook. In other instances, e.g. "note the layer," it appears that the instructor is simply asking the user to pay attention to something. These different uses clearly confused a number of study participants. Coupled at times with a lack of knowledge about the available controls, this resulted in a number of participants entering information into the notebook manually instead of using the auto-note facility or abandoning attempts to complete a task.

Other phrases that confused participants were

- "at the entrance (to a wind tube)"
- "upon exiting (a wind tube)"
- "restore your position"
- "navigate the isosurface"
- "parallel to the isosurface"
- "holding your altitude steady"
- "fly around the perimeter"
- "level the pod"
- "reverse your direction"
- "base of the trough"
- "on the ridge"
- "comment on"

Recommendation: special phrases that are going to be used to indicate a specific meaning must be covered in training, and should also be included in the help file. Phrasing in missions should either use a small set of standard phrases for specifically intended actions, or must be self-explanatory.

Anomalies

During the trials and expert review of the system, a few situations arose for which there appeared to be no explanation for the behavior the system exhibited. These are being referred to here as anomalies. These may or may not be bugs or unexpected (and undesirable) behavior. If not, then the situations that could produce these anomalies should be discussed during training. The anomalies 3 – 6 can be reviewed using the video files.

(1) It appears that when the user has locked onto an isosurface that they can't open the parameter selector.

(2) The user is able to navigate below the earth's surface (negative altitude).

(3) Trial 2, Participant 4: appears to have trouble getting the system to recognize clicking on the "Enter" button for the "Add Note" operation.

(4) Trial 3, Step 5, Participant 7: system did not display a particle when it should have.

(5) Trial 3, Step 4, Participant 11: system suddenly allowed the Windows desktop to show through the Geopod window.

(6) Trial 4, Step B4, Participant 9: image appears to "jump" for no clear reason.

Conclusions

Although the list of concerns above appears lengthy, overall the Geopod system is actually quite good. Not only did participants enjoy using the system, they were clearly able to perform at an adequate level with only minimal training.

Appendix 1

Pre-Test Survey

1. ______ On a scale from 0 to 5, rate yourself on your experience with applications or games that use 3D navigation (e.g. Google Earth, World of Warcraft, Halo, Call of Duty, any flight simulator), where 0 indicates no experience and 5 indicates an expert: ________

2. ______ What is your age?

3. With which hand do you use a computer mouse?: ☐ Left ☐ Right

4. What is your gender?: ☐ Male ☐ Female

Appendix 2

Post-Test Survey

Please indicate your level of agreement/disagreement with the following statements, using the scale:

5: Strongly Agree
4: Agree
3: Neither Agree nor Disagree
2: Disagree
1: Strongly Disagree
0: Not Applicable or No Opinion

Score

	1. The navigation controls are intuitive to use.
	2. The navigation controls are easy to learn.
	3. The interface is visually appealing.
	4. The overall interface is simple and easy to use.
	5. The button icons clearly convey the purpose of the button.
	6. Any textual content is presented in an easy-to-read format.
	7. The Geopod devices acted in a predictable way (e.g. the action of each control you use matches your expectation of what would occur).
	8. The navigation controls were difficult to use.
	9. Locating the specific device needed for a particular task was difficult.
	10. I had trouble understanding the written directions for the tasks.
	11. I liked using the Geopod system.

12. What was your favorite part of the system?

13. What part of the system did you not like (if any)?