

LOCATING LUNA



Teacher's Guide

04-28-2020





YOU FOUND LUNA!



You can copy the Action Log
from your Oculus Go to a
computer and analyze your
game session.

PRESS ANY BUTTON TO RESTART

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Introduction



The Locating Luna virtual reality experience was specifically designed to assist in teaching Data Visualization concepts from the Computer Science Teachers' Association K-12 Computer Science Standards. The experience is optimized for the Oculus Go Headset with a single controller. The Oculus Go headset tracks rotational motion of the head and the controller, but not player movement through space. Game play for this experience requires only a place to sit that has space for some arm motion.

Targeted Standards

with bolded vocabulary terms

Data and Analysis

- Collect **data** using **computational tools** and **transform the data** to make it more useful and reliable.
- Refine **computational models** based on the data they have generated.
- Create **interactive data visualizations** using software tools to help others better understand **real-world phenomena**.
- Create computational models that represent the relationship among different elements of data collected from a phenomenon or process.
- Use **data analysis** tools and techniques to identify patterns in data representing **complex systems**.
- Select data collection tools and techniques to generate data sets that support a claim or communicate information.
- Evaluate the ability of **models** and **simulations** to test and support the refinement of **hypotheses**.

From: <http://www.csteachers.org/page/standards>

How to Play

Overview

- The player is in a dark swampy forest and must use their torch with surrounding landmarks to find their dog. The player can light standing torches to mark their path and climb a tower lookout to get a bird's eye view. Using the built-in microphone on the Oculus Go, the player can also call out to their dog and, if close by, they will hear a barking response in the direction of their dog. During the game, all player actions are recorded in an action log, which the user can download from the headset and analyze outside the game.
- Every time the app opens for the first time, the dog and environmental landmark locations are set. The environment and dog location remain the same between replays, but the player starting point will be different. Closing and opening the app sets a new environment and dog location.

In-game Screen Shots

Figure 1:
First view in the app.



Figure 2:
Second information screen.



In-game Screen Shots (continued)

Figure 3:
Final information screen to begin
the challenge.



Figure 4:
Looking up at the moon can
provide a sense of direction.



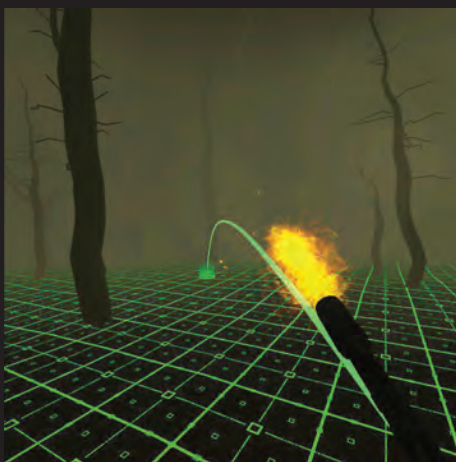
Figure 5:

Player must navigate the dark swamp area with only a torch.



Figure 6:

To teleport (move location), press down on the thumbpad and point. A green arc indicates you can move to that spot. Releasing will take you to the end of the arc.



In-game Screen Shots (continued)

Figure 7:

If the line for teleporting is red, move your controller to find a location you can move to as indicated by green. You cannot teleport into the swamp that runs through the environment.

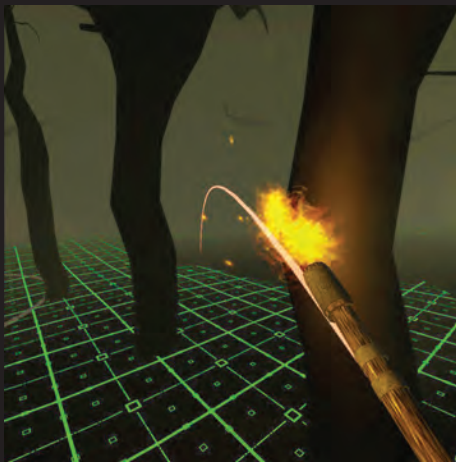


Figure 8:

Player will find standing torches throughout the game.



Figure 9:
Lift controller to light found
torches with your hand-held torch.



Figure 10:
There is a lookout tower that can
be climbed for a better view.



In-game Screen Shots (continued)

Figure 11:

Teleport into the blue circle to climb the lookout tower.

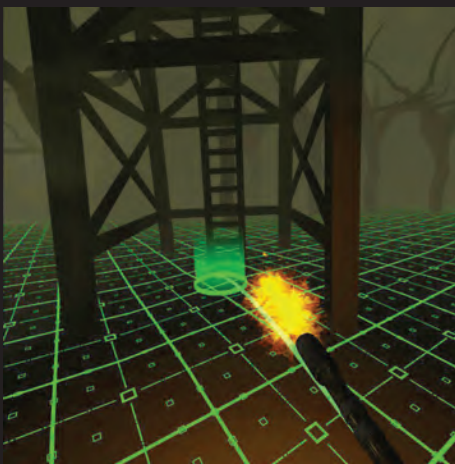


Figure 12:

View from the top of the lookout tower.

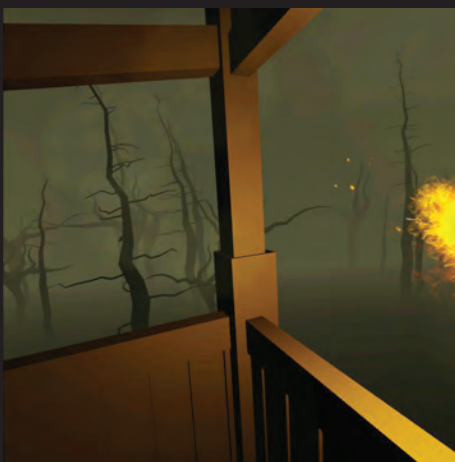


Figure 13:
Player may also discover a cave.



Figure 14:
There is a shack located in
the game.



In-game Screen Shots (continued)

Figure 15:

When you see Luna, teleport into her circle to complete the game.



Figure 16:

The map on the final screen illustrates your journey to Luna.

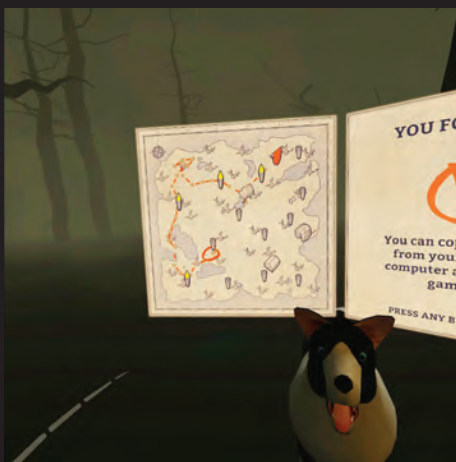


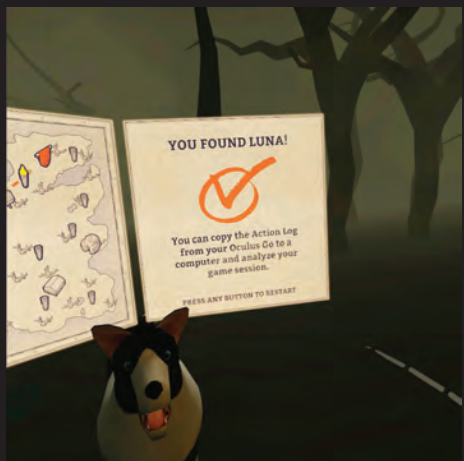
Figure 17:

This is the view when you teleport into Luna's circle.



Figure 18:

All player's actions have been logged. You can download the data and use Excel or another program to analyze the data, comparing with other players or considering another search strategy.



Take Screenshots in the Game

App users may take screenshots within the game. This can be helpful for comparing the map produced at the end with the downloaded data as plotted on an x-y grid. To take a screen shot while in the app, take the following steps:

- Press the Oculus button on the controller once. This will pause the app and offer the options to Quit, Resume, or Take Photo.
- Use the controller to point and click on Take Photo. The app will resume, and a red dot will blink in the upper right portion of the user's viewing area.
- Look directly at the object to be captured in the photo and wait until the red dot becomes solid and then disappears completely. See the next section for how to access the photo.

Download Screenshots and Action Logs of Data

- With the headset powered on, use the USB charging cord (remove the plug) to connect the headset to a computer.
- Look in the headset and use the controller to accept access to the headset by the computer.
- Find the VR-Headset storage space on the list of available hard drives shown on the computer and click.

- To download the Action Log with your session data, follow the path **VR-Headset > Internal shared storage > Android > com.PNNL.LocatingLuna > files > Luna_ActionLog_####.csv**. File date and time can be used to determine the file for the session of interest.

Note that the data for multiple sessions played on the same map (without restarting the app) will be recorded in a single Action Log.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	Session Started																				
2	Action	Time	Location																		
3	Dog	4.55	(-16.2, 0.2, -15.9)																		
4	Watchtower	4.55	(6.3, 0.1, 16.9)																		
5	Cabin	4.55	(20.3, 0.3, -22.7)																		
6	Cave	4.55	(18.7, 0.3, -5.6)																		
7	Player Sta	4.55	(24.3, 0.4, 16.9)																		
8	Teleporter	50.76	(17.6, 0.2, 29.8)																		
9	Teleporter	51.2	(18.0, 0.3, 27.9)																		
10	Torch Lit	53.76	(15.5, 0.2, 27.9)																		
11	Teleporter	65.2	(15.5, 0.3, 27.6)																		
12	Teleporter	71.97	(15.5, 0.3, 27.6)																		
13	Teleporter	78.79	(8.1, 0.2, 21.9)																		
14	Teleporter	81.23	(3.8, 0.4, 16.9)																		
15	Called out	88.89	(3.8, 0.4, 16.9)																		
16	Teleporter	90.49	(16.1, 0.2, 32.4)																		
17	Teleporter	108.31	(5.8, 0.3, 16.2)																		
18	Teleporter	127.03	(-0.5, 0.4, 21.5)																		
19	Teleporter	130.72	(-7.3, 0.3, 24.4)																		
20	Teleporter	148.68	(4.3, 0.3, 25.0)																		
21	Torch Lit	144.72	(8.4, 0.3, 25.3)																		
22	Teleporter	156.61	(-13.1, 0.3, 25.2)																		
23	Called out	159.99	(-13.1, 0.3, 25.2)																		
24	Teleporter	160.37	(-19.0, 0.2, 24.7)																		
25	Teleporter	181.99	(-25.2, 0.3, 23.2)																		
26	Called out	182.44	(-35.2, 0.3, 23.2)																		
27	Teleporter	183.58	(-30.8, 0.4, 26.8)																		
28	Teleporter	185.84	(-31.6, 0.3, 36.2)																		
29	Teleporter	188.91	(-35.3, 0.3, 34.3)																		
30	Teleporter	172.32	(-30.1, 0.3, 37.2)																		
31	Teleporter	174.58	(-34.1, 0.2, 37.8)																		
32	Teleporter	177.87	(-27.4, 0.4, 33.6)																		
33	Teleporter	181.46	(-29.1, 0.3, 35.1)																		
34	Teleporter	192.84	(-34.1, 0.4, 29.8)																		
35	Teleporter	195.09	(-37.6, 0.4, 23.1)																		

Figure 19:

The raw data as downloaded from the headset after gameplay.

- To download any photos/screen shots taken, follow the path **VR-Headset > Internal shared storage > Oculus > Screenshots**.

Vocabulary Terms with Definitions

Complex System – Various related elements arranged together in such a way that forms interconnections and relationships. Examples include social media interactions, shopping patterns, traffic patterns, and feeding habits of animals in an ecosystem.

Computational Models – Mathematical models used to study complex systems by using computation to simulate the models. One example is a programmed simulation of events or a representation of how various data is related.

Computational Tools – Computing programs or devices that make the work of scientists and others easier through the automation of processes like collection and transformation of information.

Data – Information collected and used for analysis or reference whether digital or non-digital.

Data Analysis – The process of examining, manipulating, transforming, and modeling data (information) in order to discover useful information for decision making or drawing conclusions.

Hypothesis – A proposed explanation based on limited evidence and prior knowledge that enables further experimentation.

Interactive Data Visualizations – Graphical representations of information that allow direct actions on their plot to change elements and links so that the audience may better see and understand trends, outliers, and patterns.

Models – A reasonable, and often physical, representation of what something looks like or how it works.

Real-World Phenomenon – Experiences that can occur in daily life and that provide an opportunity to make sense of more complex ideas and concepts. In Locating Luna, searching for something that is lost is the real-world phenomenon.

Simulations – A reasonable imitation of the way a process or system works over time.

Teleport – To be transported across a distance instantly.

Transform Data – A way to make appropriate changes to the data to remove errors, highlight or expose relationships, and/or enable processing by computers.

Resources for Lessons to Accompany the Experience

code.org lessons on data and data visualization

🔗 <https://curriculum.code.org/csp-1718/unit2/>

🔗 <https://curriculum.code.org/csp-19/unit4/>

Introduction lessons and homework

🔗 <https://www.dwrl.utexas.edu/2016/10/31/teaching-data-visualization-an-introduction/>

Video demonstrating power of data visualizations

🔗 <https://www.youtube.com/watch?v=jbkSRLYSojo>

Teaching data visualization to younger students

🔗 <https://policyviz.com/2018/11/19/teaching-data-visualization-to-kids/>

Tool to help grades 5-14 summarize, visualize, and interpret data

🔗 <https://codap.concord.org/for-educators/>

Collection of charts and graphs, categorized by function

🔗 <https://datavizcatalogue.com/>

A fun data visualization project

🔗 <http://www.dear-data.com/theproject>

A data visualization tool

🔗 <https://vega.github.io/voyager2/>

Data resources and tools from NOAA

🔗 <http://oceansofdata.org/our-work/teacher-resources>

🔗 <http://oceansofdata.org/topic/data-visualizations>

Data visualization tools for educators

🔗 <https://oedb.org/ilibrarian/9-data-visualization-tools-for-librarians-and-educators/>

🔗 <https://www.teachthought.com/technology/5-free-data-visualization-tools-you-can-use-in-the-classroom/>

Videos to learn Google Sheets

🔗 <https://www.youtube.com/channel/UC8p19gUXJYTsUPEpusHgteQ>

Working with the Data

The Action Log file can be opened in Microsoft Excel, Google Sheets, or a similar program for use with .csv files. The raw data will need some transformations before graphs and charts may be generated. For a tutorial and lesson plan on creating some basic charts and graphs from the Action logs, please visit: <https://www.pnnl.gov/projects/stemvr>.

	A	B	C	D	E
1	Action	Time	X location	Y location	Z location
2	Dog	4.55	-16.2	-15.9	0.2
3	Watchtower	4.55	6.3	16.9	0.1
4	Cabin	4.55	20.3	-22.7	0.3
5	Cave	4.55	38.7	-5.6	0.3
6	Player Start	4.55	24.3	36.9	0.4
7	Teleported	50.74	17.6	29.8	0.2
8	Teleported	53.2	16	27.9	0.3
9	Torch Lit	53.78	15.5	27.9	0.2
10	Teleported	65.2	15.5	27.6	0.3
11	Teleported	71.07	15.5	27.4	0.3
12	Teleported	78.78	8.3	21.9	0.2
13	Teleported	81.23	3.8	16.9	0.4
14	Called out to Dog	86.69	3.8	16.9	0.4
15	Teleported	90.49	6.1	12.4	0.2
16	Teleported	108.31	5.9	16.2	5
17	Teleported	127.03	-3.5	21.5	0.4
18	Teleported	130.72	-7.5	24.4	0.3
19	Teleported	143.68	-8.3	25	0.3
20	Torch Lit	144.72	-8.4	25.5	0.3
21	Teleported	156.61	-13.1	25.2	0.3
22	Called out to Dog	159.89	-13.1	25.2	0.3
23	Teleported	160.37	-19	24.7	0.2
24	Teleported	161.99	-25.2	23.2	0.3
25	Called out to Dog	162.44	-25.2	23.2	0.3
26	Teleported	163.95	-30.8	28.8	0.4
27	Teleported	165.84	-31.6	36.2	0.3
28	Teleported	168.91	-35.3	34.3	0.3
29	Teleported	172.32	-30.1	37.2	0.3
30	Teleported	174.38	-24.1	37.8	0.2
31	Teleported	177.87	-27.4	33.6	0.4
32	Teleported	181.46	-29.1	35.1	0.3
33	Teleported	192.84	-34.1	29	0.4
34	Teleported	195.09	-37.6	23.1	0.2
35	Teleported	197.67	-34.9	16.1	0.3

Figure 20:

An example of transformed data that can be used to generate data visualizations.

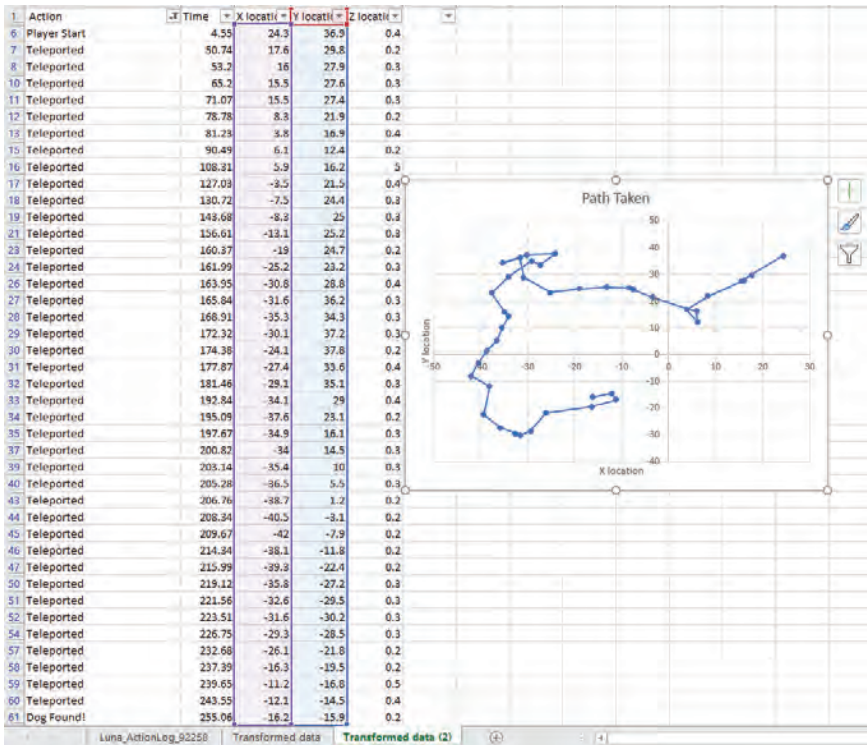


Figure 21:

An example of the x-y location data visualized in order to better understand the search path taken.

Example Discussion Questions

- What were you doing in the game? How does it connect to computer science concepts?
- Can you use the data you collected to improve your search strategy?
- What else might you do with this data?
- What tools can you use to help analyze the data?
- What real life scenarios might this connect to (rescue searches, searching for items, clues in a crime)?
- What other tools would you want to have to process and analyze the data?
- What other data would you like to have collected in this scenario?

Oculus Go

[Set Up and Help](#) 



Tips and tricks for classroom use:

- Screen Cast can be used to see live student game play.
- Students can take a video or screenshot while playing the game. This can be downloaded from the headset as evidence of student progress.
- Students can work on other tasks while they take turns with the app. After all students have played the game, a full classroom discussion, reinforcing activities, or a formative assessment is recommended.
- Almost no students experience nausea or have trouble seeing clearly. Should a student experience nausea or be unable to adjust the headset to see clearly, have them take off the headset and participate through a screen cast experience.
- Glasses can be worn with the headset—put the headset up to the face over the glasses and then pull the head straps over the head to secure.
- Make sure students place the controller safety strap on their wrist to prevent the controller from falling.

Pacific Northwest National Laboratory

Pacific Northwest National Laboratory (PNNL) advances the frontiers of knowledge, taking on some of the world's greatest science and technology challenges. Distinctive strengths in chemistry, earth sciences, and data analytics are the heart of our science mission, laying a foundation for innovations that improve America's energy resiliency and enhance our national security.

Visual Analytics



Many challenging problems are characterized by incomplete, disparate, conflicting, and uncertain data that cannot be addressed easily through automated approaches—they need human insight. An early pioneer of visual analytics,

PNNL continues to create capabilities that combine interactive visualizations with advanced automated data analysis techniques, enabling users to gain deeper insights from their data.

Our information visualization research leads to tools and capabilities that create powerful partnerships between users and their systems. Our visualizations display meaningful and easy-to-interpret patterns of real-time operations center data to support decision-making and enable insight into emergent conditions.

Immersive Computing

Immersive environments use digital technology to simulate real-world conditions, which is particularly valuable where hands-on activities are unsafe, too expensive, or impractical—such as national security, training, and healthcare.



PNNL creates novel, immersive experiences that work with a variety of devices and platforms. We apply and develop emerging user-interface technologies to create more engaging experiences and seamless workflows. We are developing multi-sensory interfaces that support collaboration, where users can immerse themselves in information to explore, discover, and analyze.



This Teacher's Guide is provided as an instructional companion to the Locating Luna virtual reality game, developed by computer scientists at Pacific Northwest National Laboratory. An interactive .PDF version of the Teacher's Guide is needed to access the additional information available from the hyperlinks inside, and can be freely downloaded from:

<http://www.pnnl.gov/STEM/>



Locating Luna can be downloaded for FREE — find it under the Education category within the Oculus App.



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