

# **USER MANUAL GAZEPOINT REMOTE EYE TRACKING**

Rabab Alareifi, Kelly Gross, Kris Jacobson, Excell Lewis

**Northern Illinois University**

## INTRODUCTION

The ultimate goal of user experience (UX) research is to understand a user’s point of view. It assesses how people interact with technology (or documents or any of a number of things) regardless of the intent of the creator. In this sense, UX research bridges the purpose of a product with actual success in use.

Eye tracking has existed for well over 100 years and is an extremely valuable tool in UX research. Originally developed to analyze how people read and access information on a page, eye tracking is essentially the process of identifying where a person is focusing their eyes. More than a general direction where someone is “looking”, eye tracking pinpoints someone’s visual focus moment-to-moment. Because it allows researchers to see through the eyes of the user, it has a broad range of modern applications, from education and sports to medicine and technology.

### **Research Areas for the technology**

With the aid of eye-tracking research, teachers can better understand how students visualize material, coaches can see from the eyes of their top players, surgeons can operate instruments hands-free, and web designers can create applications that are truly user-friendly. Although not exhaustive, research areas for this technology include: website and application testing, human computer interaction (HCI), neuroscience and psychology, learning and education, sports, and marketing.

## Remote Eye Tracking

Remote eye tracking (RET) is a special application of eye tracking technology. RET involves hooking up an eye tracking device to a computer to enable live measurements. This user guide will focus on RET, including a breakdown of how to use the Gazeport RET technology.



## Brief Literature Review

RET is used in a variety of research settings to gain a deeper understanding of users' interactions with electronic resources. For instructional designers and researchers interested in human computer interaction, these tools have revolutionized the way in which researchers can assess the role of mental effort and the overall user experience in online environments.

In an exploration of user behavior in two online search engine interfaces, Gwidzka (2010) found that cognitive load differed at different stages of the online search and evaluation process; notably that formulating search queries and the process of tagging results required greater cognitive load on average than examining search results or retrieved pages. He also found that extraneous cognitive load could be mitigated by adding semantic information to search results lists in one of the interfaces. Other studies using eye tracking reveal that user information seeking behavior differs depending on the confidence of the user population. In a study of first year high school students, Walhout, Oomen, Jarodzka and Brand-Gruwel (2017) found that

novice users who lacked background knowledge on the topics they were searching spent more time gazing at retrieved results on a cause-effect topic but less time gazing at results lists on a more complex, controversial topic. This work suggests that students who lack the background to make effective judgments about the quality or search results are more likely to give up and disengage from the information seeking process. These findings have profound implications for both database and search engine designers as well as educators who instruct students in information search.

Recent studies using eye tracking have revealed information about learning and engagement that would otherwise more difficult to attain through other methods due to the users' age or disability. Liang and Wilkinson (2018) presented visual scene displays (a very common form of augmentative and alternative communication support) to three groups of participants, one group with autism, one with Down syndrome, and one of typically developing individuals. They found that the groups did not differ significantly in their attention and gaze patterns of photographic depictions of people engaged in activities, both when the people depicted were interacting together or not. Their findings suggest that visual scene displays using varied numbers of socially interacting people are appropriate for all populations. This has significant implications for educators, therapists and others who use these cards to communicate. In another recent study, Molina, Navarro, Ortega and Lacruz (2018) used eye tracking with primary school students to examine their engagement and cognitive load when interacting with a multimedia mathematics program. These authors note that eye tracking is especially helpful

for gaining insight into children’s preferences and interests, as they are more difficult to assess with traditional methods, such as surveys, given their age.

These uses of eye tracking in research are just a small sample that highlights the capacity of the technology to reveal information about users’ interactions with visual and interactive media on a much deeper, more nuanced level than would be possible using traditional assessments such as think aloud protocols and/or surveys.

### **User Audience**

The target audience for this user guide is students and faculty at Northern Illinois University (NIU) who are interested in learning more about eye tracking technology and potentially using the User Experience (UX) Lab. For the purposes of this user guide, we based the instructions upon a basic series of UX tasks and their analysis. The tasks were as follows:

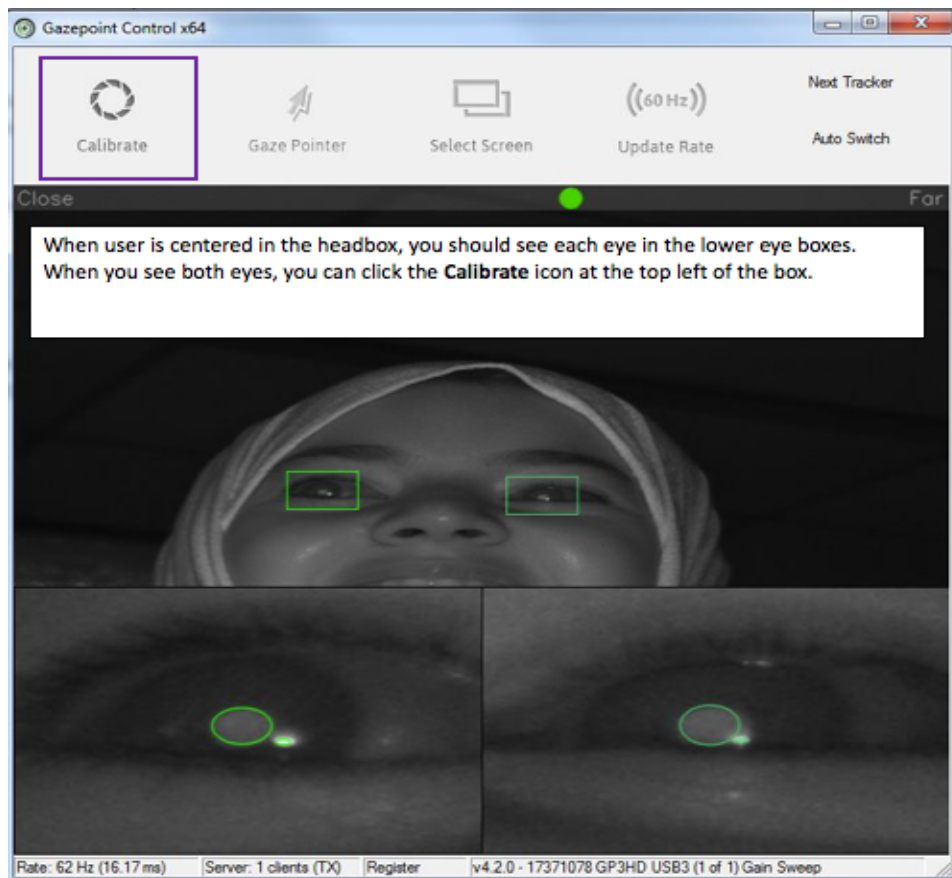
1. Please locate ETRA Department from NIU homepage
2. Please locate the application deadline
3. How many credits are required for the doctorate?

## STEP-BY-STEP GUIDE

### Getting Started

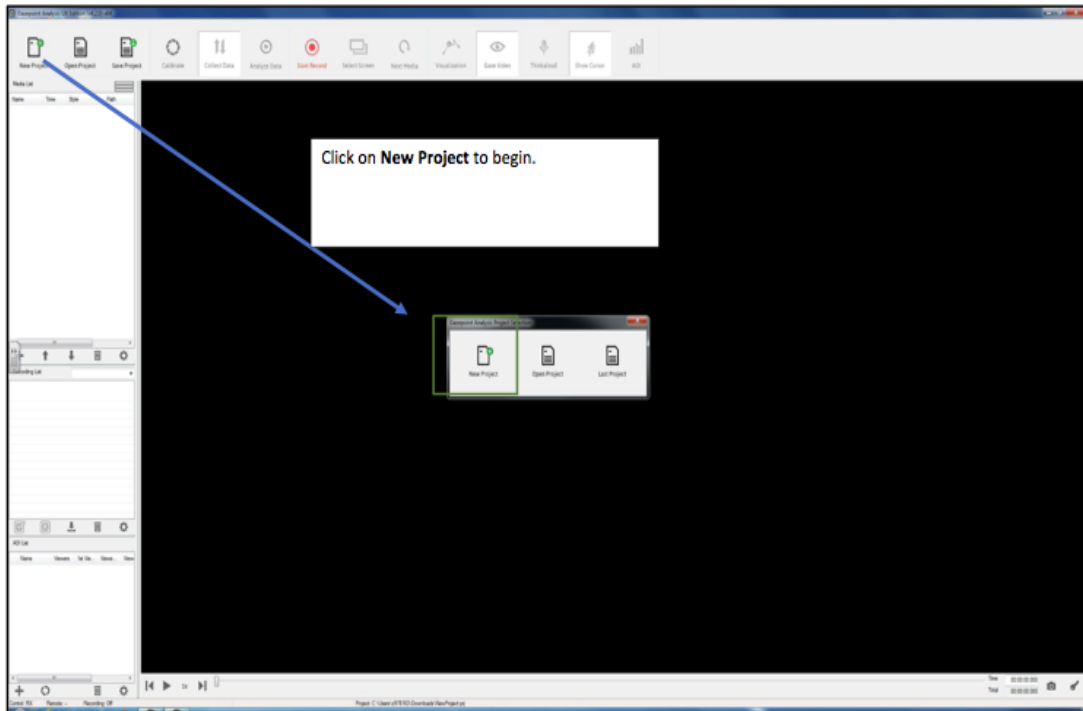
There are two Gazepoint RET devices in the ETRA Department UX Lab at NIU (Gabel Hall RM 212). They are on Windows machines (PCs).

1. Turn on the computer.
2. Locate and click on the Windows button in the lower left corner of the screen.
3. Type “Gazepoint” into the search bar .
4. Click on “Gazepoint Control”. A screen will open that looks like this:



5. Repeat STEPS 2 and 3 (click on the Windows button in the lower left corner and type “Gazepoint” into the search bar).

6. Click on “Gazepoint Analysis”. A screen will open that looks like this:

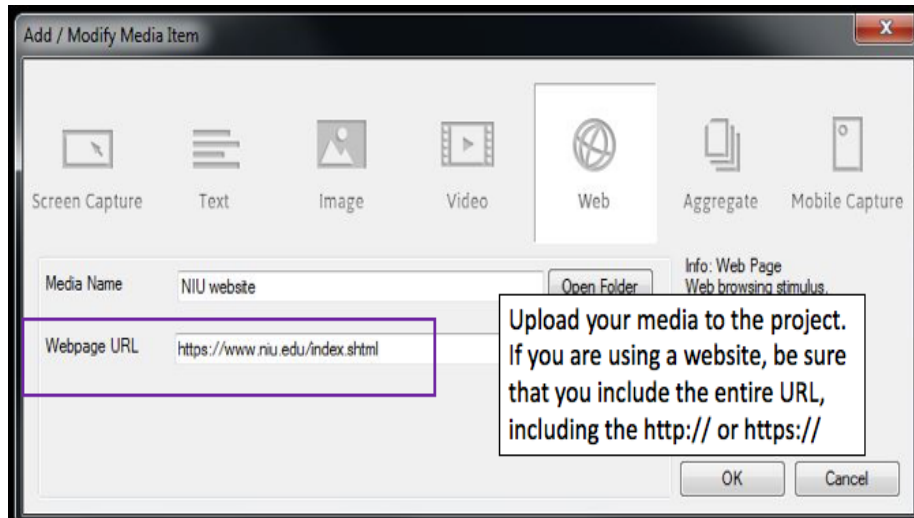


→ IMPORTANT NOTES:

- You must have both the **control** and the **analysis** applications open to use the program.
- It is recommended that you create a separate folder for each project rather than housing multiple projects in the same folder.
- If you are working on a project with other people, be sure to share it in a place that can be accessed by all of you; the default is the documents folder attached to the account of the person who is signed into the computer.

## Add Media

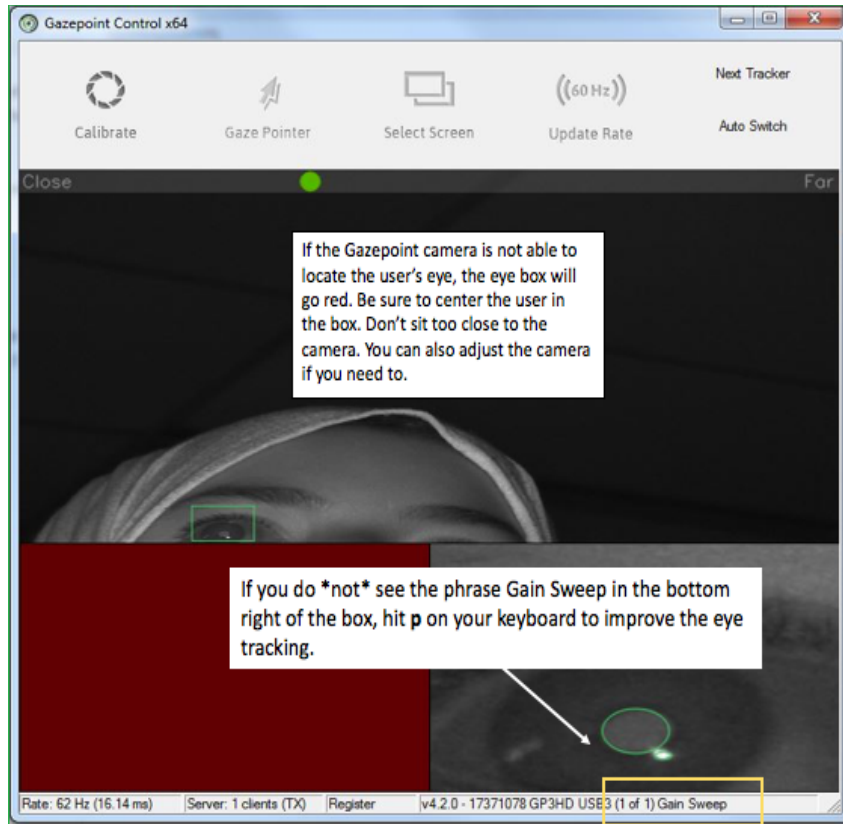
Open the **Analysis** application and import your media (image, video, web page) into the program. Be sure to get the full web address (including http:// or https://). You can test different media, such as screen captures, text, images, video & websites.



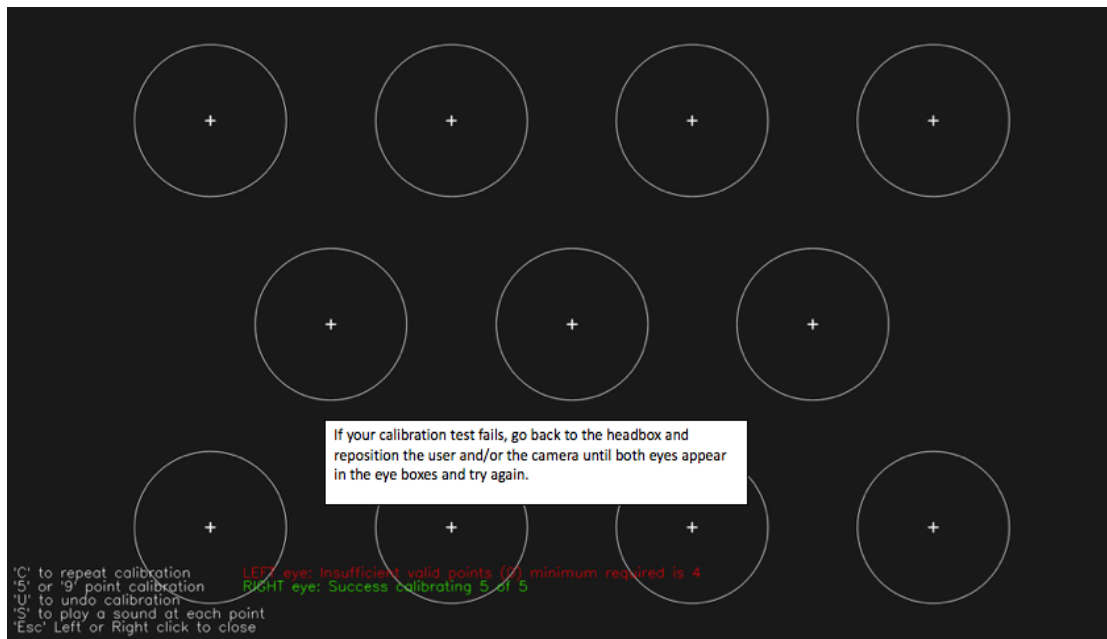
## Calibration

1. Inside the **Control** application, click on the Calibrate icon in the upper left corner of the dialog box.
2. Ensure your head is inside the **Headbox** (this is a virtual area inside which the GazePoint device can detect your eyes - if you are outside of this area, the device will not work)





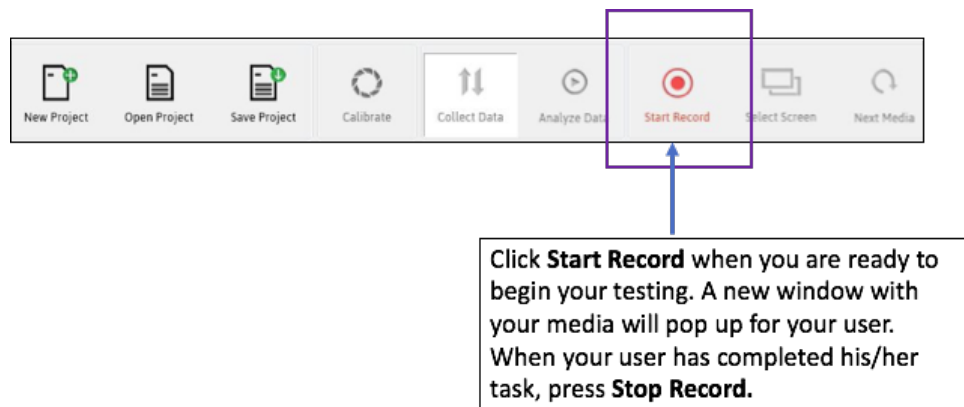
3. Follow the on-screen instructions (the program will take you through a series of automated calibrations where you will follow some dots across the screen.



4. Click **calibrate** and calibrate the camera by looking at the dot moving around the screen.
5. Your accuracy level must be 4/5 (ideally 5/5) for each eye in order to achieve an accurate reading. If you do not pass the calibration test, use the window in the control application and adjust the camera and make sure the user is centered in the top square and that each eye appears in the lower squares. You want to sit back a bit from the camera for the best readings; don't sit too close to it.
6. Once the user's gaze is calibrated, you are ready to begin collecting data.

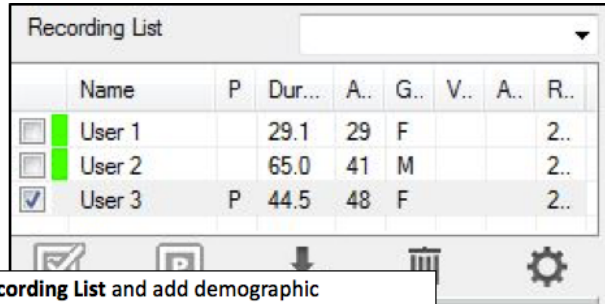
## Collecting Data

1. Go to the **Collect Data** button from the menu at the top of the box and Hit the record button on the menu banner.



2. A new window with your image/video/website will open and the user can begin his/her task(s). Minimize the window when done and hit stop recording to end the session.
3. You can add/edit users and their demographic information on your **recording list**. Add participants to the project by performing the calibration in the control application and simply hitting record.

4. The system will automatically generate a different color for representing different users' gazes.

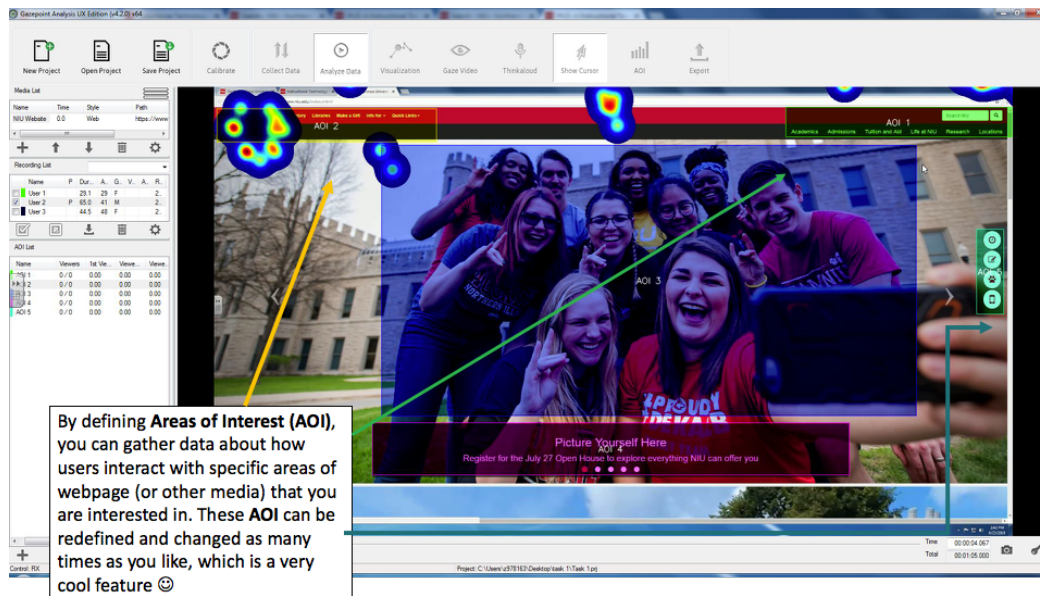


	Name	P	Dur...	A.	G.	V.	A.	R..
<input type="checkbox"/>	User 1		29.1	29	F			2..
<input type="checkbox"/>	User 2		65.0	41	M			2..
<input checked="" type="checkbox"/>	User 3	P	44.5	48	F			2..

Add Users to your **Recording List** and add demographic information to the cells for each user. This data will be synchronized to your recordings.

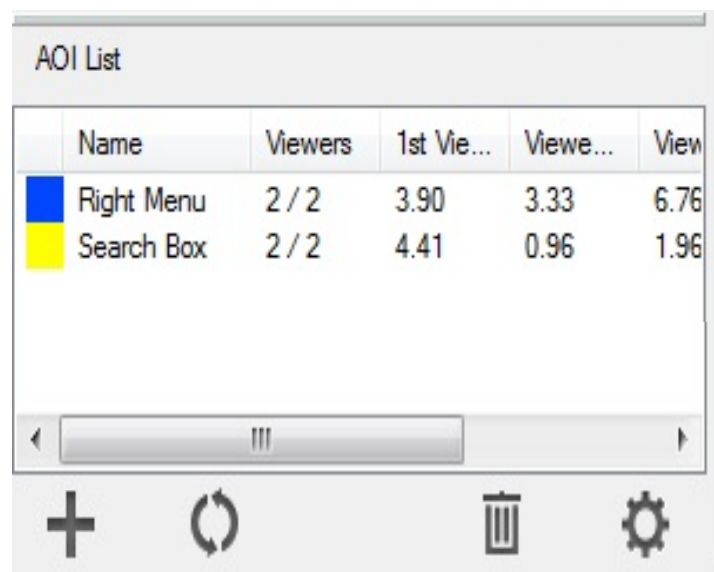
### Areas of Interest

1. You can define different **Areas of Interest (AOI)** on your media and see how your users interact with those areas.
2. Statistics will be gathered primarily based on the defined areas of interest. Luckily, you can change the AOIs as needed, so you are not locked into the first AOIs you define.



By defining **Areas of Interest (AOI)**, you can gather data about how users interact with specific areas of webpage (or other media) that you are interested in. These AOI can be redefined and changed as many times as you like, which is a very cool feature 😊

3. To add AOI, play the recording of your user interaction and hit the pause button to stop the recording where you want to add AOI and collect data on the user's interaction with those area(s).
4. You can add AOI by clicking the plus sign (+) and dragging your mouse over the area(s) you wish to explore. Be sure to name them clearly distinguishable names so that you can easily identify them in your dataset.

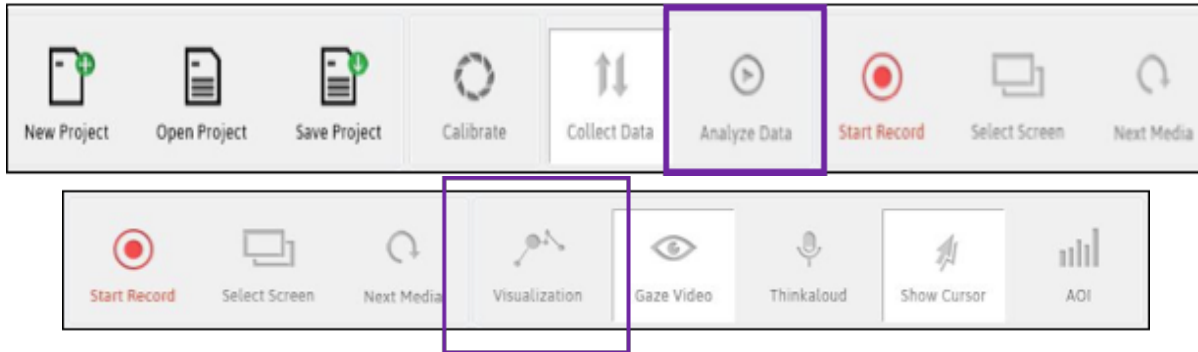


	Name	Viewers	1st Vie...	Viewe...	View
■	Right Menu	2 / 2	3.90	3.33	6.76
■	Search Box	2 / 2	4.41	0.96	1.96

## Visualization

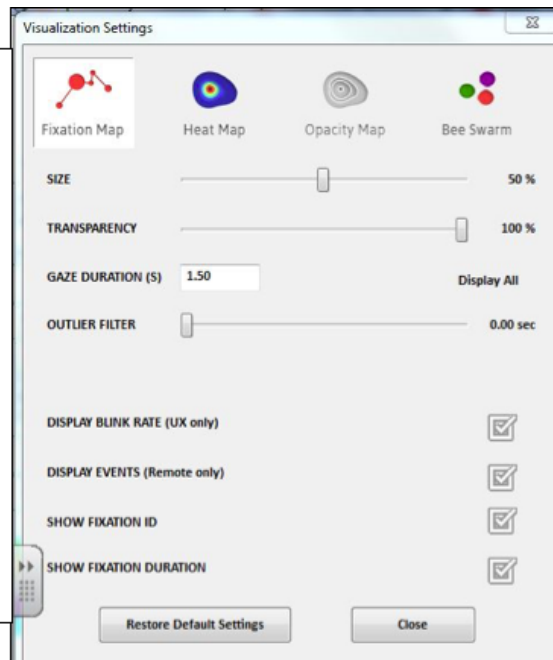
Visualization allows you to graphically see how your users interact with the media. Different methods of representation will provide different information, so your choice of how to represent the data will depend on your research question(s).

Click on **Analyze Data** to access the menu of Visualization options



To see visual representations of the users' gaze data, click on **Visualization** on the Navigation Bar.

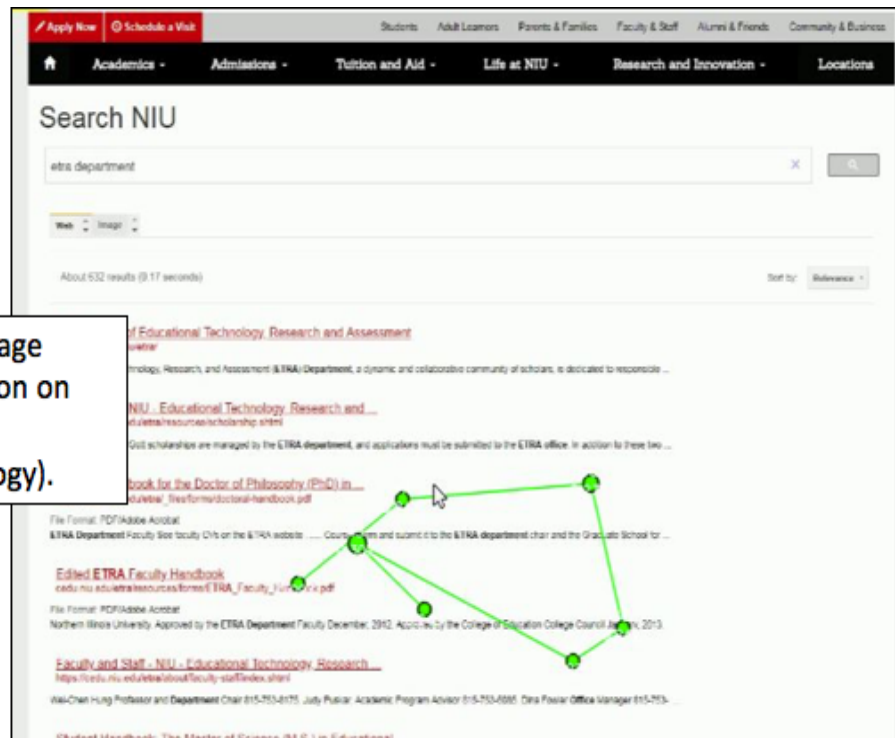
You can choose different methods of representing the data, each has different uses for research: the **Fixation Map** will show you the places users looked on the screen as well as the order in which they looked and the amount time spent looking at each point on the source media; a **Heat map** will show you the location(s) on the screen where your users focused their attention.



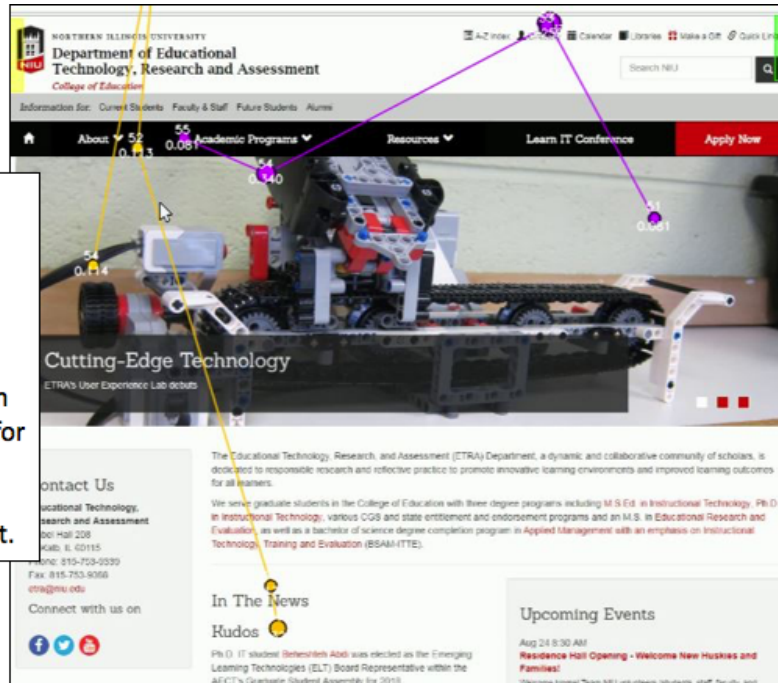
## Fixation

Fixation maps and data are especially helpful for gaining understanding of how users interact with the media; **time to first fixation** indicates the time elapsed (in seconds) from the beginning of when the user first began looking at the media/web page until the start of the first time he/she gazed at an Area Of Interest (AOI).

Fixation Areas on a page  
(looking for information on  
the PhD program in  
Instructional Technology).

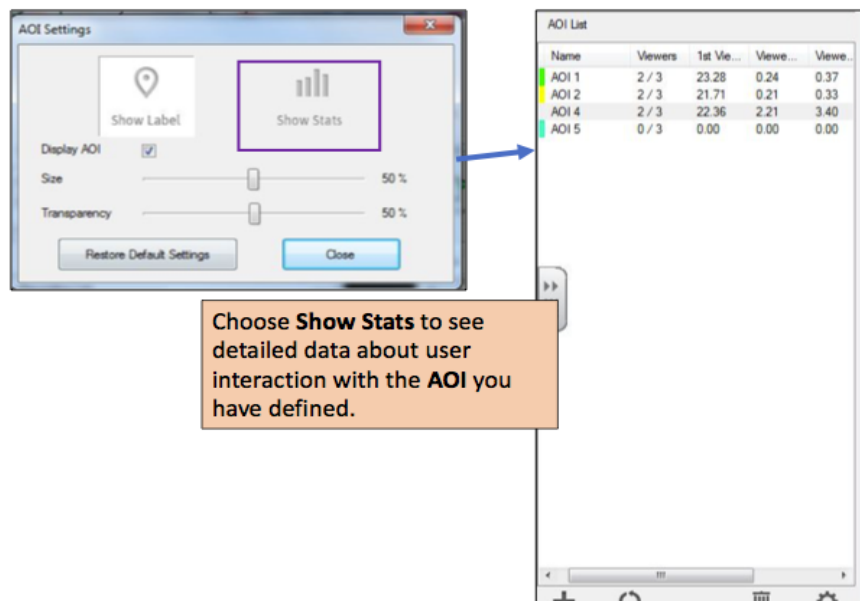


Fixation Areas from two users on a web page (looking for information on the PhD program in Instructional Technology). Fixation data can be helpful for understanding how individual users interact with content.



## Looking at Data

You can look at your statistical data by clicking on **show stats** on the taskbar. You will want to click the refresh button at the bottom of the AOI list before you export the data:



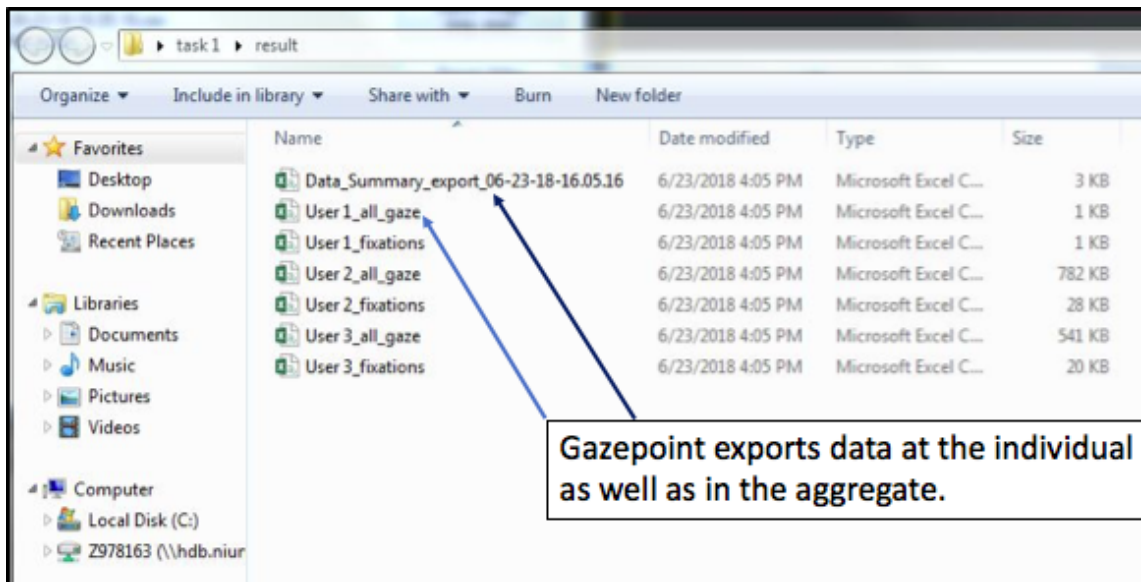
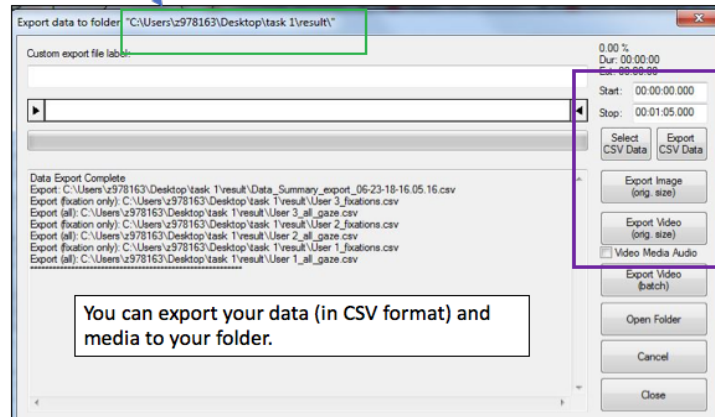
Choose **Show Stats** to see detailed data about user interaction with the AOI you have defined.



## Exporting Data

You can export the video and/or images as well as the CSV data. The default application for opening CSV files on the PCs in the lab is Excel.

Hint: If you are saving data on the PC, it will default to the account of the person who is logged into it. Be sure to make a backup of the data if you are not that person!



This dataset can show you lots of information about your users and you can make comparisons between them.



The screenshot shows an Excel spreadsheet titled 'Data\_Summary\_export\_06-23-18-16:05:16 - Excel'. The spreadsheet contains data for 'Gazepoint Analysis' and 'AOI Statistics (for each user)'. A callout box highlights the 'AOI Name' column, emphasizing the importance of clear labels for each AOI.

Media ID	Media Na	Media Du	AOI ID	AOI Name	AOI Start	AOI Durat	Viewers	Total View	Ave Time	Ave Time	Ave Fixat	Revisits	Average f		
1	NIU Webi	U	5	left men	1.32	U	2	3	21.713	0.211	0.325	2	1	2	
8	1	NIU Webi	U	7	picture us	2.365	U	2	3	22.36	2.208	3.398	10.5	2	8
9	1	NIU Webi	U	9	Tool bar	2.365	U	0	3	0	0	0	0	0	0
10	1	NIU Webi	U	11	Right nav	2.915	U	2	3	19.893	0.816	1.256	2.5	2	2
11	1	NIU Webi	U	12	search ba	2.915	U	1	3	35.825	0.113	0.174	1	0	0

Media ID	Media Na	Media Du	AOI ID	AOI Name	AOI Start	AOI Durat	User ID	User Nam	User Gen	User Age	Time to 1	Time View	Time View	Fixations	Revisits	
15	1	NIU Webi	U	5	left men	1.32	U	1	User 1	F	29	-1	0	0	0	
16	1	NIU Webi	U	5	left men	1.32	U	2	User 2	M	41	2.685	0.375	0.576	3	2
17	1	NIU Webi	U	5	left men	1.32	U	3	User 3	F	48	40.741	0.048	0.074	1	0
18	1	NIU Webi	U	7	picture us	2.365	U	1	User 1	F	29	-1	0	0	0	
19	1	NIU Webi	U	7	picture us	2.365	U	2	User 2	M	41	26.573	1.165	1.792	6	5
20	1	NIU Webi	U	7	picture us	2.365	U	3	User 3	F	48	18.147	3.252	5.004	15	11
21	1	NIU Webi	U	9	Tool bar	2.365	U	1	User 1	F	29	-1	0	0	0	
22	1	NIU Webi	U	9	Tool bar	2.365	U	2	User 2	M	41	-1	0	0	0	
23	1	NIU Webi	U	9	Tool bar	2.365	U	3	User 3	F	48	-1	0	0	0	
24	1	NIU Webi	U	11	Right nav	2.915	U	1	User 1	F	29	-1	0	0	0	
25	1	NIU Webi	U	11	Right nav	2.915	U	2	User 2	M	41	35.905	0.13	0.2	2	1
26	1	NIU Webi	U	11	Right nav	2.915	U	3	User 3	F	48	3.882	1.503	2.312	3	3
27	1	NIU Webi	U	12	search ba	2.915	U	1	User 1	F	29	-1	0	0	0	
28	1	NIU Webi	U	12	search ba	2.915	U	2	User 2	M	41	35.825	0.113	0.174	1	0
29	1	NIU Webi	U	12	search ba	2.915	U	3	User 3	F	48	-1	0	0	0	

## Advantages

RET provides a lot of data about users' interactions and can be used with many types of media.

The technology is a very unobtrusive method of collecting information; the user interacts with the screen naturally as the data is collected with nothing to distract them. RET can provide more greater insight into user behavior than surveys or think aloud protocols.

## Disadvantages and Limitations

Although RET allows you to measure the amount of time someone is gazing at an AOI, it does not detail why they are looking there, what they're thinking about, or their psychological state. However, it is worth noting that RET programs can record changes in pupil size over the course of a task, which is a reliable indicator of cognitive load (see Gwidzka (2010) for a good example of how this data can be used).

Some important limitations of the Gazepoint device itself is that the user *\*must\** save at every step. There is no autosave function, so without doing so, the risk of data loss is high. This does happen with some frequency, especially when considering that the device can overheat. When it is overheated, the device may stop working (freeze). In those moments, even restarting will not improve function.

The final limitation in relation to RET is that it is limited to the desktop; it will not record where a user looks anywhere besides the screen.

## TROUBLESHOOTING

- The grayed-out control panel in the **Analysis** application is somewhat confusing and one can easily click a different option and not realize they have chosen a different function because the ribbon of options on the taskbar doesn't change much when move between functions (unlike, say, the ribbon in Microsoft Office applications). Be sure to double check to make sure you are in the correct menu if something suddenly disappears from your ribbon of options.
- If the program becomes unresponsive, it is best to exit and reopen it. Note that after long periods of use, it may continue to be unresponsive. So, it's a good idea to **save early and often** to make sure your data is preserved.
- The device is prone to overheating after extended use (5+ hours). If restarting does not help, then it is best to shut the system down for a while to let it cool off.

## REFERENCES

- Gwizdka, J. (2010), Distribution of cognitive load in Web search. *J. Am. Soc. Inf. Sci.*, 61: 2167–2187. doi:10.1002/asi.21385
- Liang, J. and Wilkinson, K. (2018). Gaze toward naturalistic social scenes by individuals with intellectual and developmental disabilities: Implications for augmentative and alternative communication designs. *J Speech Lang Hear Res*, 61(5), 1157-1170. doi: 10.1044/2018\_JSLHR-L-17-0331
- Molina, A.I Navarro, O. Ortega, M. and Lacruz, M. (2018). Evaluating multimedia learning materials in primary education using eye tracking,” *Computer Standards & Interfaces*, 59 , 45-60. 2018 <https://doi.org/10.1016/j.csi.2018.02.004>
- Walhout, J., Oomen, P., Jarodzka, H. and Brand-Gruwel, S. (2017). Effects of task complexity on online search behavior of adolescents. *Journal of the Association for Information Science and Technology*, 68, 1449–1461. doi:10.1002/asi.23782