

## Rett Syndrome research & eye tracking

### Customer

Rett Syndrome Center, Children's Hospital at Montefiore (CHAM), Albert Einstein College of Medicine

### Objectives

The study aimed to examine Rett Syndrome patients' cognitive abilities. Rett Syndrome patients' abilities to identify focal points within images were compared with non-Rett individuals'.

### Tools & methods

Tobii T120 Eye Tracker was used to present a total of eleven images to Rett Syndrome patients and non-Rett individuals. Data was analyzed qualitatively and quantitatively in Tobii Studio.

Since 2011, Rett Syndrome Center at Montefiore is using a Tobii TX300 Eye Tracker.

### Conclusions

Rett Syndrome patients appeared to demonstrate similar fixation patterns to non-Rett individuals and meaningful visual searching strategies. No significant differences were found. Both groups allotted the majority of their gaze to the same general areas and Rett patients observed the focal points of images in a similar way, as well.

## Eye tracking gives Rett Syndrome patients a voice

Without eye tracking, there would be few means to fairly examine Rett Syndrome patients' cognitive abilities. This study, in which patterns of visual processing in Rett Syndrome patients and non-Rett control subjects were compared, demonstrates the feasibility of using eye tracking technology in evaluations of patients with RTT.

### Background

Rett Syndrome is the most physically debilitating neurodevelopmental disorder on the Autism Spectrum and one of the leading genetic causes of severe impairments in females. Today, 45 years after the syndrome was identified, we still do not understand if, and how much girls and women with RTT understand, how much they remember, or how they process information. Profound impairments in their abilities to speak, walk, and use their hands (caused by apraxia and other movement disorders) severely limit the ways in which girls with RTT can express themselves and are understood. Motor difficulties and apraxia also limit the abilities of RTT girls to respond to questions during

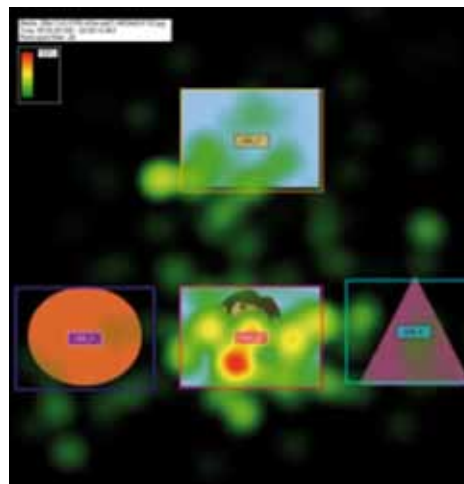
standardized neuropsychological testing, which may lead to underestimations of their cognitive abilities.

At the Rett Syndrome Center at Montefiore, NY, eye tracking technology was used in order to compare patterns of visual processing in Rett Syndrome patients and non-Rett control subjects.

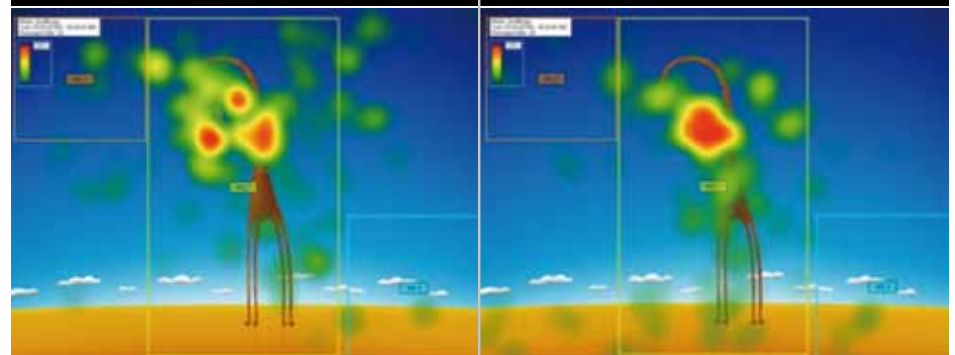
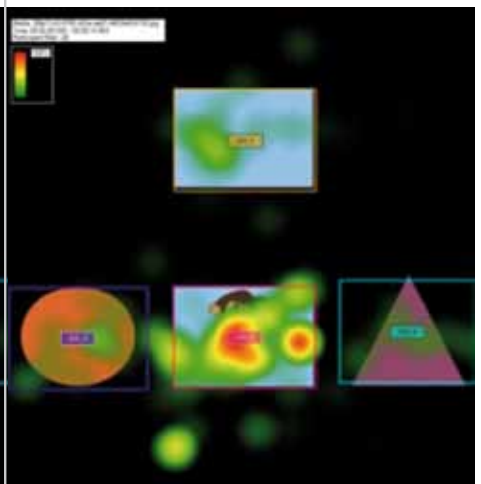
### Objectives

Goal 1: Qualitatively compare the abilities of Rett Syndrome patients to identify focal points within images. Basically, answer the question: Can Rett Syndrome patients differentiate between the more important and less important aspects of an image by giving more attention to the relevant (focal) stimuli?

### Rett Patients



### Non-Rett Patient



Above are two examples in which Rett and non-Rett individuals focused the majority of their gaze (indicated by the red regions) on the same area – the focal point of the image.

*"Eye gaze technology allowed us to give Rett Syndrome patients a voice – a way to communicate their perception of what they see. This is of immeasurable value because most of these patients have no other way to communicate their knowledge or understanding due to extreme physical disabilities."*

**Dr. Aleksandra Djukic, Rett Syndrome Center, Children's Hospital at Montefiore, Albert Einstein College of Medicine**

## About the Rett Syndrome Center Children's Hospital at Montefiore (CHAM), Albert Einstein College of Medicine

**Web:** [www.montekids.org/services/leadership/neurology/rett-syndrome](http://www.montekids.org/services/leadership/neurology/rett-syndrome)  
**Location:** Montefiore, US  
**Industry:** Medical center

The **Rett Syndrome Center** at Montefiore, directed by Dr. Aleksandra Djukic, is one of the highly specialized services offered by the Division of Child Neurology at the Children's Hospital at Montefiore (CHAM). This is the only center for Rett syndrome in the Tri-State area. Their mission is to provide state-of-the-art services for patients with Rett Syndrome through intervention, education, and research aimed at effective treatments and cures.

This portion of the study was presented by Kathleen Mavrommatis, a junior attending Yorktown High School, at the Westchester Science and Engineering Fair. This project won second place in the behavioral category, and Kathleen won the George D. Yancopoulos Young Scientist Award.

**Goal 2:** Quantitatively compare the abilities of Rett and non-Rett individuals to visually identify the focal points within images by finding any significant differences between the following values:

- 1) How long it takes Rett/non-Rett individuals to look at the focal point of an image.
- 2) How long the first fixation on the focal point lasts.
- 3) How long the individuals spend looking at the focal point.
- 4) How many times the individuals looked at the focal point.

### Tools & methods

31 girls with Rett Syndrome were involved as test participants in the study. The control group consisted of hospital personnel, research team members, and parents.

A total of eleven images were presented to the test participants via the Tobii T120 Eye

Tracker. These images consisted of photographs of real situations, faces, shapes and cartoons.

Viewing time was 5 seconds. To minimize confounding effects of language processing, verbal requests were limited to: "Look at the screen".

### Data analysis

Heat map visualization in Tobii Studio of the eye tracking data was used to analyze data qualitatively. A Student's T-Test was then used to compare the mean values of the four values listed above (Time to first fixation, First fixation duration, Total fixation duration, and Fixation count—all standard metrics in Tobii Studio) for Rett and non-Rett individuals for the focal points of 5 images. This yielded twenty Rett to non-Rett comparisons.

### Results and conclusions

Rett Syndrome patients appeared to demonstrate similar fixation patterns compared to Non-Rett individuals and meaningful visual searching strategies.

In seven of the eleven images, the areas of greatest fixation duration (red regions) were similar in both Rett and non-Rett heat maps. Also, only six out of twenty Rett to non-Rett metric value comparisons revealed significant differences between Rett and non-Rett values, indicating that they observe image focal points in a similar way. In four out of five images with obvious focal points, Rett Syndrome patients did focus the majority of their gaze on the focal point.

### Why eye tracking?

"Without eye-gaze technology, there would be few means to fairly examine Rett Syndrome patients' cognitive abilities. Most conventional cognitive exams require physical tasks, which these patients cannot coordinate because they are so physically impaired. Vision and cognition are closely related, making eye gaze technology a fair way to examine how Rett Syndrome patients see the world around them, which may be an indication of how they understand the world around them.

"This research was prompted by numerous observations in literature that girls with RTT have strong eye gaze, eye contact, visual tracking, and almost uniform reports by parents and caretakers that these girls use eye gaze to greet, point, request, and refuse. It is possible that some of these girls may be spending lives in isolation; "lived in" their

apraxic bodies but aware. Their apparent attempts to communicate haunt caretakers and clinicians.

"The results of this study are extremely encouraging, and demonstrate the feasibility of using eye tracking technology in evaluations of patients with RTT. This is necessary, because any intellectual ability they do possess needs to be exercised and strengthened as if they were a typically developing child.

"Eye tracking can be used to define cognitive phenotype and natural history. It can help us develop more appropriate educational programs and be used as outcome measurements for upcoming treatment trials for this disease, which is potentially curable in the future," says Dr. Aleksandra Djukic, Rett Syndrome Center at Montefiore.

### Why Tobii?

"These eye tracking systems have enhanced our abilities to monitor and record eye motion and track related eye data - especially in patients with Rett Syndrome who often have short attention spans or jerky head movements. The technology helps us calibrate easily, allowing us to proceed from one step to the next quickly.

"Collecting gaze data at 300Hz, lets us study eye movements in more detail. For instance, we are now able to record more data of the smooth pursuit and calculate the real gain of the pursuit.

"Visualization features are clear and reflect data in a way that is easy to understand, analyze and draw conclusions from," says Dr. Aleksandra Djukic.

**To find out how eye tracking can improve your research, please visit [www.tobii.com](http://www.tobii.com) or contact one of our offices.**

**EMEA**  
 Tobii Technology AB  
 Karlsrovägen 2D  
 S-182 53 Danderyd  
 Sweden  
 +46 8 663 69 90 Phone  
 +46 8 30 14 00 Fax  
[sales@tobii.com](mailto:sales@tobii.com)

**NORTH AMERICA**  
 Tobii Technology, Inc.  
 510 N. Washington Street  
 Suite 200 - Falls Church,  
 VA 22046 - USA  
 +1-703-738-1300 Phone  
 +1-888-898-6244 Phone  
 +1-703-738-1313 Fax  
[sales.us@tobii.com](mailto:sales.us@tobii.com)

**CENTRAL EUROPE**  
 Tobii Technology GmbH  
 Niedenu 45  
 D-60325 Frankfurt am Main  
 Germany  
 +49 69 24 75 03 40 Phone  
 +49 69 24 75 03 429 Fax  
[sales.de@tobii.com](mailto:sales.de@tobii.com)

**JAPAN**  
 Tobii Technology, Ltd.  
 3-4-13 Takanawa, Minato-ku  
 Tokyo 108-0074  
 Japan  
 +81-3-5793-3316 Phone  
 +81-3-5793-3317 Fax  
[sales.jp@tobii.com](mailto:sales.jp@tobii.com)

**CHINA**  
 Tobii Electronics Technology  
 Suzhou Co., Ltd.  
 No. 678, Fengting avenue,  
 Land industrial Park  
 Weiting, Suzhou  
 Post code: 215122  
 China  
 +86 13585980539 Phone  
[sales.cn@tobii.com](mailto:sales.cn@tobii.com)

**tobii**  
[www.tobii.com](http://www.tobii.com)