



Fueling equity in education with EdTech — a success story by BrainLeap and Tobii

About this success story

The digital transformation of manual assessment procedures and learning therapies into automated solutions has led to the creation of the EdTech sector, which is fueling equity in education. To stimulate the kind of digital transformation needed in education, the US government has allocated considerable funding for tech startups and small businesses looking to leverage research and scientific findings to build next-gen solutions that will not only have an impact on millions of people but will do so in a commercially viable manner.

In this success story, we cover the journey from research and innovation to commercialization of EdTech startup BrainLeap Technologies, and how they have leveraged scientific findings in their game-based attention training solution.

Why attention is important

Sustainable stability relies on a human race that can contribute, participate, work, go to school, learn, remain healthy, and develop innovative solutions for future generations. Quality education and learning are fundamental prerequisites for this kind of stability, which in turn relies on attention skills that enable people to retain and apply new information. According to [this study](#), there is a strong correlation between a child's attention skills at the age of 4 and college graduation by the age of 25.

Research carried out by two of BrainLeap's founders into the association between attention and eye movement led them to the conclusion that it is possible to train attention and related motor skills. They also believed that any child — not just those with specific attention-related disorders — can benefit from regular training.

EdTech

The digital transformation of assessment and learning through the introduction of innovative technologies and gamification that deliver engaging, inclusive, and individualized learning experiences in the classroom and the home.

About BrainLeap

BrainLeap is a tech startup based in San Diego, California. Born out of research into the association between attention and eye movement, the company is on a mission to unlock the potential of more than one million children with attention challenges — every year. With the help of government funding, they have successfully leveraged research findings, eye tracking, and gamification into a commercially viable EdTech solution.



The research

The initial research was carried out at the University of California, San Diego (UCSD) between 2012-2018 by Jeanne Townsend (professor in the Department of Neurosciences at UCSD) and Leanne Chukoskie who was the director of Power of NeuroGaming (PoNG) Center UCSD at the time (now associate professor at Northeastern University).

Because it is challenging to systematically assess attention through manual observation, Chukoskie and Townsend decided to measure saccades, the fast eye movements between fixations, to assess attention because these tiny yet frequent movements are a good indication of neural processing capacity. Figure 1, for example, shows the typical pattern of the fixations and saccades of a proficient and focused reader.

Fixations and saccades

Saccades are the rapid eye movements a person makes when they shift focus from one object to the next. Saccades are typically less than 100 msec and a person can move up to about 500° per second. Fixations are the points at which our eyes essentially stop scanning and hold focus to allow the visual system time to process information. The accuracy of modern eye tracking has enabled research into saccadic abnormalities and the connection between eye movements and neurological disorders.

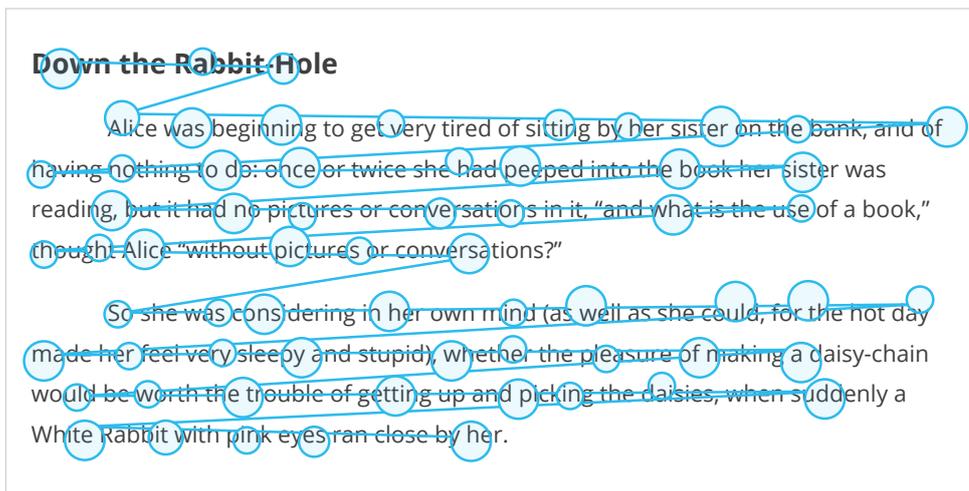


Figure 1: typical reading pattern comprising fixation (dots) and saccades (lines between the dots)

To assess attention, the researchers developed a suite of specialized computer games. Chukoskie and Townsend leveraged eye tracking in the solution because it is the most accurate means of measuring saccades. But they also used the technology as an input modality, forcing students to control game action with their eye movements — a crucial feature that helps the student train focus. And because eye tracking devices can be placed unobtrusively at the bottom of



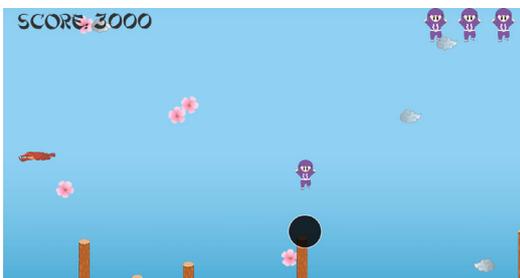
a computer screen, this technology is non-invasive. Consequently, eye tracking can be used in scientific research because it can measure behavior without influencing it, resulting in unbiased findings.

In 2016, a trial with 23 participants took place during a 12-week period, the results of which you can read below.

The innovation — the Attention Arcade™

Following the trial and subsequent funding, BrainLeap was formed to develop the initial research into a commercial solution. The result is a suite of attention-training games for children aged between 7 and 14, including assessment tests for monitoring progress, as well as a reporting tool for parents and teachers to see how much the child trains and how their skills improve.

Each game trains specific aspects of attention such as inhibitory control, anticipatory focus, steady focus, and visual search as well as executive planning functions. The child trains by using their eyes to interact with the game. Controlling the game with eye movements is an essential element of the BrainLeap solution because it forces the child to focus on what they are doing — if they look elsewhere, or get distracted, they will fail. To incite play, the games become progressively harder as the child advances.



Factors for commercialization

The trial showed that depending on the level and complexity of a child's attention challenges, improvement requires a couple months of training, with regular sessions of about 20 minutes each. A digital solution facilitating such a level of commitment needed to be practical, accessible, and affordable.

To address the practical aspect, BrainLeap targeted their solution toward schools and homes, places where children already spend a lot of time and where basic computer equipment, and internet access are often established.

To raise equity, reaching as many children as possible, BrainLeap focused on training attention skills that can benefit students irrespective of a medical diagnosis. The desire to help a child or student improve their attention skills is reason enough to use the solution.

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To create an affordable commercial solution, the requirements include:

- A lightweight application running on a local computer
- Minimum performance requirements for the computer running the application
- Standard internet connection
- Accurate eye tracking that is easy to ship and set up

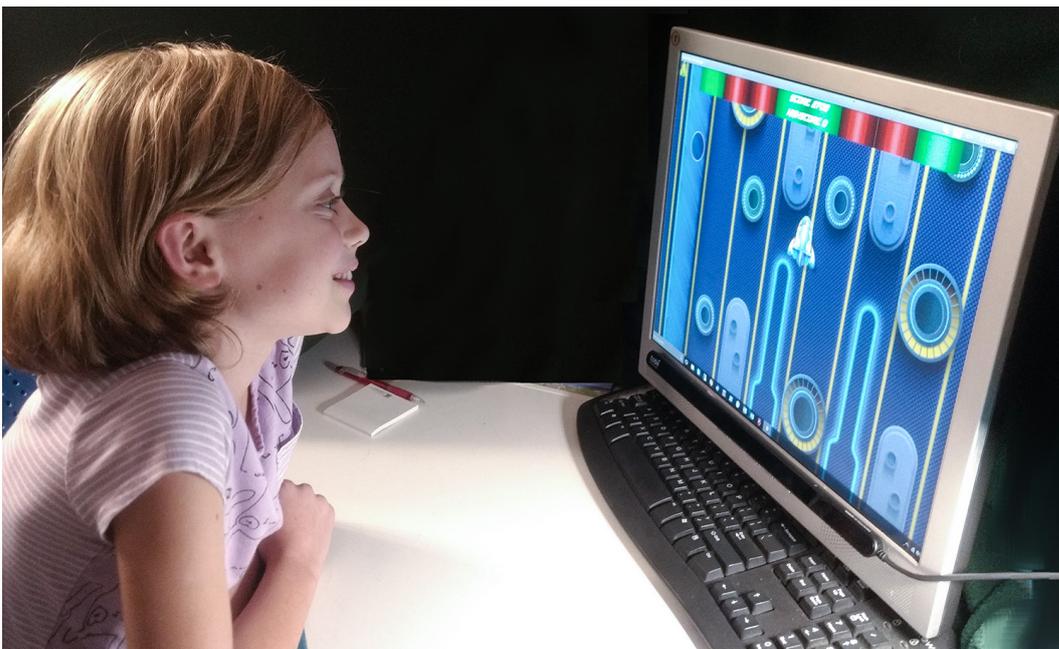


The commercial solution

Most modern computers, will live up to these basic performance requirements. To deliver the eye tracking solution BrainLeap started out with the Tobii Eye Tracker 4L, moving to the Tobii Eye Tracker 5L. Both solutions provide the accuracy required for real-time gamification, at an acceptable price point. And because they are lightweight plug-and-play USB peripherals, the solution is easy to ship and set up. In addition, Tobii's eye trackers are designed to carry out image processing locally, upholding user integrity, ensuring no additional load on the host system, and meets the everyone, everywhere, every device principle.



During research and development, BrainLeap tested a variety of different eye tracking solutions, including webcams, but only Tobii's eye trackers deliver the accuracy required for real-time game control at an affordable price point. The games are delivered on a monthly subscription basis and customers can either rent or buy an eye tracker. As Tobii eye trackers are designed to carry out the heavy computational load of triangulation and image processing, it is possible to run the Attention Arcade on lower-end Windows and macOS computers typically found in schools.



The results

The initial UCSD study showed significant improvements. Participants with attention challenges saw an average improvement of 30% for focus and of 55% for inhibitory control — the ability to remain undistracted by bright shining objects or sounds while working on a task. Fast attention shifts rose on average by 68%. Fast and accurate shifts of attention enable a person to interpret facial expressions and social cues when engaged in a conversation with several people.

Using the suite of attention training games and assessments, an independent researcher at the University of Florida, Gainesville ran a study in an after-school program on participants with reading and attention challenges. The study showed an average improvement of 35% for fast gaze and shifts, 65% for inhibitory control, and 32% for fast and accurate shifts of attention.

A few examples of individual outcomes from the hundreds of children who have played the Attention Arcade, include Jack, who transformed from struggling reader owing to attention challenges to reading the Harry Potter series (4,000+ pages) in one summer. After training for several months, Joey started thriving in school, getting assignments in on time and staying on task. And Brooklyn became a more confident reader and began reading for pleasure.

The next step — scale

While the BrainLeap team are encouraged by the progress they have made, they are constantly searching for ways to scale and help ever more children. In a partnership with Lexplore — a Tobii customer who have transformed time-consuming reading assessment into an eye tracking based digital solution — BrainLeap is collecting data that will reveal the connection between attention skills and reading abilities. Armed with this information, BrainLeap aims to raise adoption of attention training in schools. To increase the number of students that can play simultaneously in a classroom, BrainLeap has begun the development of a browser-based solution for Chromebooks, which are common in US schools.

There are many ways in which BrainLeap could evolve their novel solution to increase its impact. For example, the level of immersion could be raised by migrating the solution to VR or encourage teamwork through interactive online gaming. Whatever next step BrainLeap takes, Tobii will be there to help make it a success.



About Tobii

Tobii is the global leader in eye tracking and pioneer of attention computing. We are on a mission to improve the world with technology that understands human attention and intent. Creating tech for a better future, our technologies and solutions apply to areas such as scientific studies and research, healthcare, assistive devices, education and training, gaming, extended reality, and automotive. Tobii's eye tracking is used by thousands of enterprises, universities, and research institutes around the globe. With headquarters in Sweden, Tobii is listed on NASDAQ Stockholm (TOBI). For more information, visit: www.tobii.com.
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