

## Developmental Psychology

*“We have collected large volumes of very high quality data using our Tobii systems. This has enabled us to obtain research results in infant studies that would have been time-consuming or even impossible using traditional eye tracking systems”*

**Claes von Hofsten, Professor of Psychology, Uppsala University**

**Eye tracking is used in developmental psychology to explain infants’ growth and transformation in cognitive, social and emotional abilities.**

**At the Department of Psychology’s Babylab at Uppsala University in Sweden, Claes von Hofsten and his fellow researches use Tobii Eye Trackers to measure development of infant object representation and study the differences in social interactions in normal children and children with autism.**

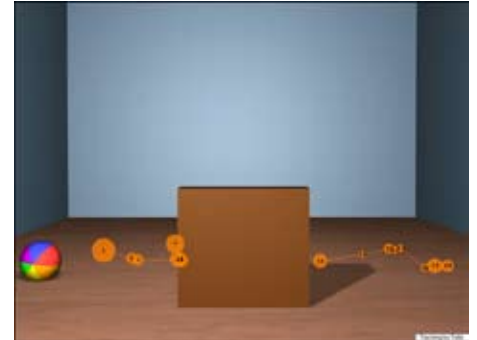
### Infant object representation

The ability to remember (represent) temporarily occluded objects is an important milestone in early infancy. This ability helps the child relate to things other than what is directly perceivable. In addition, infants’ enhanced object representations help them increase their ability to relate to the external world, predict future events and successfully interact with their surroundings. Uppsala University’s Babylab uses eye tracking to investigate how this ability develops during the infants’ first year of life.

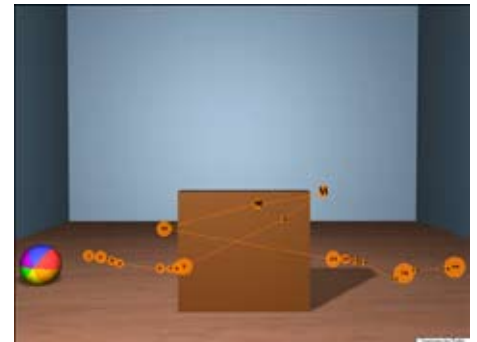
Participating infants are for instance shown different movies in which a ball rolls toward and disappears behind a screen. After an interval that corresponds to the time it takes for the object to move to the other side of the screen, the ball reappears on the other side. As infants watch these events a Tobii T120 Eye Tracker is used to measure where they look.

The question asked is when do infants move their eyes from the location where the ball disappears to the location where the ball reappears. If the infants move their eyes to the reappearing location before the ball emerges this is interpreted as an indication that infants expect the ball to emerge at this location and that infants have the ability to represent the ball behind the screen.

Using this method, the researchers have been able to demonstrate that infants can represent temporarily occluded objects from the age of four months. In addition, they can demonstrate that six-month old infants can represent occluded objects for up to four seconds. At this age infants also possess the ability to learn novel events after only a few presentations and remember these events for at least 24 hours.



5-month old infants can represent temporarily occluded objects.



7-month old infants assume that occluded objects will continue.

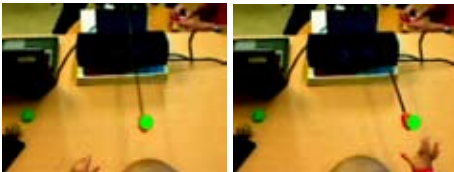
### Infant control of action

Motor performance often relies on a complex relationship between motivation, perception, planning and motion, and is not just a question of control over muscles. Even in newborn children movements are not just simple reflexes. For example, the way infants reach for an object is related to how they plan to use it—throwing the object or placing it in a box. Also, infants tend to imitate the purpose of an action rather than the structure of the movement itself and will only reproduce it if the outcome of the action was interesting enough for them. Thus early in their lives children seem to be able to act

as agents in their environment and to anticipate what will happen next. These findings raise interesting questions about infants' motor and cognitive development:

- How do infants acquire the knowledge about rules and processes that govern events? How do they acquire the ability to extract future-oriented information from their senses?
- What motivates them to explore and learn about objects and events in the world?
- How do perception and action integrate to provide a flexible movement control system to attain the desired goals?

A Tobii X120 Eye Tracker is used at the Babylab to study infant action motor development.



These images from a video shows the gaze behavior of an infant when performing a reaching task. Before gripping, the child always looks at the part of the object that will make contact with the hand, i.e. fixates "the goal" as opposed to just detecting the object and reaching out for it.

### Social interactions in normal children and children with autism

Autism is characterized by severe and pervasive impairments in several important areas of development, reciprocal social interaction and communication as well as behavior and imagination. Since late diagnosis hinders good treatment and prognosis, research into the early and identifying markers of autism is crucial. Early and intensive interventions improve chances that children with autism and their families will get adequate help and support.

The Babylab uses eye tracking in studies of autistic children to understand more about their strengths and weaknesses.



Autism prediction: A normal, and an autistic, child's perception of social interaction.

### Why Tobii?

"We have spent a lot of time setting up different eye trackers to work with babies in our lab. Tobii remote eye trackers provide several advantages compared to other systems. They offer large freedom of head movement and non-intrusiveness, which is mandatory for baby testing. Calibration and recording is also much more straight-forward than anything else we have seen.

It is easy to set up attention-grabbing stimuli using video and audio, calibration routines are quick, easy and specifically designed for babies, and eye tracking is fully automatic.

Recently we upgraded our old Tobii 1750 eye tracking systems to the new Tobii T120 Eye Trackers. The new hardware allows for twice as much head movement and the eye tracking data is even more accurate. It also provides automatic bright and dark pupil optimization", says Claes von Hofsten, Professor of Psychology at Uppsala University.



An infant in front of a Tobii T120 Eye Tracker at the Babylab at Uppsala University.

### About The Babylab at Uppsala University

The Babylab conducts basic research primarily to determine how human infants develop their abilities to perceive, act, and reflect on the world. One applied goal is to find better methods for the early diagnosis of handicaps. [www.babylab.se](http://www.babylab.se)

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