



*...besser lernen mit ABA/VB*

## **Movement analysis in infancy may be useful for early diagnosis of autism**

(PHILIP TEITELBAUM\*†, OSNAT TEITELBAUM\*, JENNIFER NYE\*, JOSHUA FRYMAN\*, AND RALPH G. MAURER‡)

### **Introduction:**

The idea that movement disorders play a role in autism has been debated. For example Rimland has argued the majority of autistic individuals are relatively unimpaired with regard to their gross motor skills capabilities and finger dexterity. Contrary autistic individuals can be found to be particularly coordinated and dexterous. This has been especially noted in autistic children who build tower blocks higher than normal adults and can climb to extreme heights without falling. According to Rimland this dismisses the notion that autism is or involves a movement disorder.

However, Damasio, Maurer and Vilensky et al, found that autistic children aged between 3-10 walked more slowly with shorter steps than normal and walked like adults who suffered from Parkinson. In addition, Courchesne et al, found that certain areas of the cerebellar vermis are not fully developed in autistic children. This supports the view that movement disorders may play a role in autism.

The aim of the current study is to try to resolve the issue of whether movement disorder plays a role in autism or not. As movement disorders can be detected as early as the first few days after birth, a study investigating movement disorders in infancy may serve as an early indicator for diagnosing autism in children.

### **Method:**

Parents of children with autism (diagnosed via conventional methods before age three) were asked to send in videos of their children when they were infants. 17 infants were compared in their patterns of lying, righting from their back to their stomach, sitting, crawling, standing, and walking with 15 normal infants. Selected portions of these behaviors were transferred to



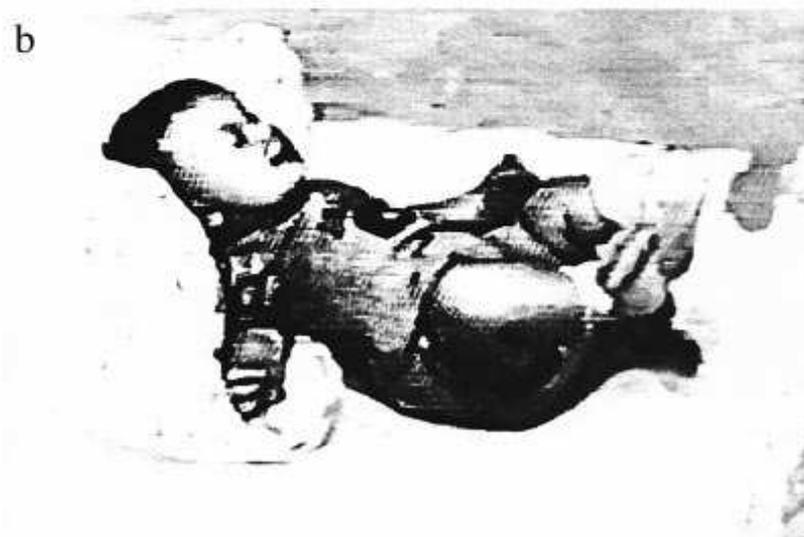
*...besser lernen mit ABA/VB*

rewriteable software for still analysis. The normal infants were filmed by the researchers at a stage when each pattern was just beginning.

### **Results:**

#### Lying:

Lying is an active posture displayed by all newborn babies from the first few days of life. Constant digression from normal patterns of lying can indicate abnormalities associated with autism. For example, one of the children when lying on his stomach always had his right arm caught under his chest. This was persistent through the first year of his life, causing him to fall to his right side when lying on his stomach, sitting, and even when he started to walk.





...besser lernen mit ABA/VB

An autistic child, '3 months old, lacking the ability to rotate around the body midline during righting (a), attempts to sit up by ventroflexing his body in the midline plane (b).

### Righting from spine to prone:

This is the ability to roll over from your back to stomach. This movement typically begins at age 3 months. The researchers of this study have found that in their experience impairments in righting are common in autistic children. From the 17 videos of autistic children that were analysed for this study only 3 of them had filmed the righting of autistic children. However the pattern of righting conveyed by these 3 infants was different from form shown by normal children. This abnormal pattern of righting was noted in the autistic children from age 3 months.



An autistic baby, '5 months old, cannot right by rotation. Instead, he arches the head and pelvis sideways upward, moves the top leg forward, and topples over *en bloc*, without the sequential segmental rotation in the righting movement characteristic of normal children.

### Sitting:

From about age 6 months babies can sit in an upright position. Typically, autistic children are unable to maintain a stable sitting position. This study found that because an autistic child had an inability to distribute his/her weight equally on both sides the child falls over when reaching for objects.

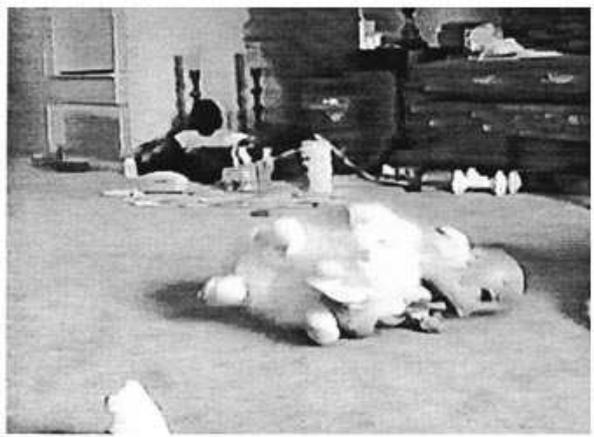
**a**



**b**



**c**



**d**

An autistic girl, 8.5 months old, shows no allied protective reflexes when falling (e.g., extending the arms and hands out to protect herself from striking her head when falling toward the ground).

*Crawling on hands and knees:*

Most babies begin to crawl about the same time they begin to sit. There are different types of crawling including creeping and crawling. This study examined crawling on hands and knees. When crawling forward on hands and knees, the arms and thighs move parallel to the midline axis of the body. That means that the arms stay shoulder width apart, and so do the thighs.



A normal baby, '6 months old, shows good support in the arms and legs while crawling forward.

Some autistic children show digression from the normal patterns on crawling. One of the infants (3 months old) examined for this study supported himself on his forearms rather than his hands. With this particular child one arm was crossed in front of the other meaning that his base of support on his arms are very narrow, therefore making the right arm weaker than the left. Reaching was done with the left arm as the right arm was caught under the body. At age 6 months the child's arms had developed support so the kegs could be used for crawling. However, the child exhibited a right side deficiency in the use of his legs for crawling; the left leg moved in the usual way, but the right leg did not move actively. This pattern was also noted in another autistic child in the videos.



*...besser lernen mit ABA/VB*



An autistic baby, '5 months old, is unable to support himself on his hands and is unable to bring his knees toward his chest to crawl forward, so he lifts his rump up while trying to crawl but cannot move forward from the spot.

*Standing:*

Typical developing infants begin to pull them self up to stand for a few minutes at about 8-10 months old. One autistic girl in the video about 8-10 months old was seen standing in one place leaning against a piece of furniture for periods as long as 15 minutes. Such relative akinesia may signal abnormality.



*...besser lernen mit ABA/VB*



Typical child standing at 10 months: holds his arms up at shoulder level as he is just beginning to learn to walk.

### Walking:

When a baby starts to walk, his walking pattern develops through fixed stages which is controlled by different segments of the leg, with more control from the hip and the pelvis. The thigh is the first to make active movements. There are three stages involved when a child begins to walk; waddling, intermediate stage and final stage. These three stages can be observed in all children when they begin to walk. However, the amount of time children spend in each stage varies greatly from a few days to a few weeks. The walking pattern of autistic children differs from that of typical developing children. For example in typical developing children the arms and legs are symmetrical, in the autistic children these movements are asymmetrical.

At the age of two or older the walking patterns of autistic children are delayed in comparison to their typically developing peers. At the age of five abnormal patterns of walking could still be noted in one of the children in the video. In typical developing children the shift of weight usually occurs at the same time that the thigh and lower leg and the foot actively move

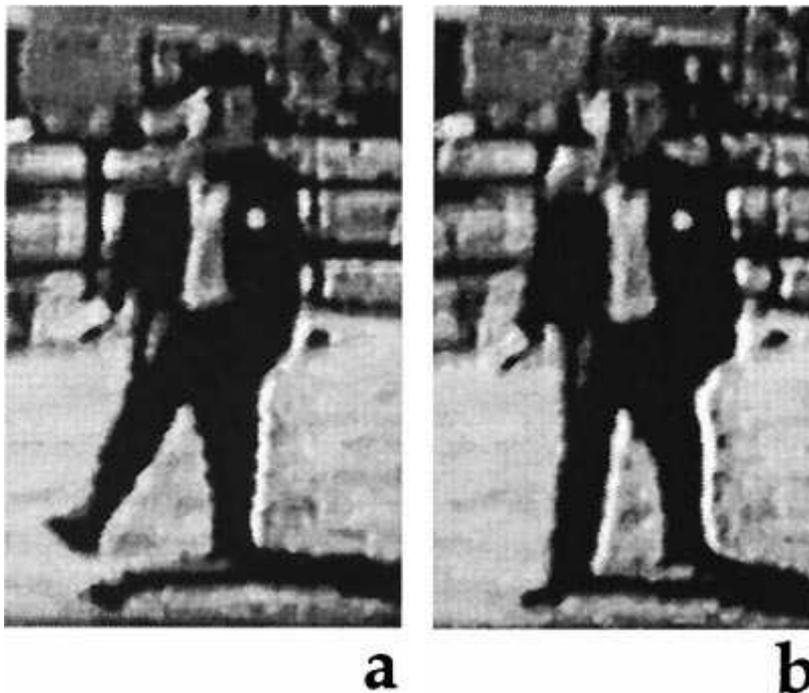


*...besser lernen mit ABA/VB*

forward. However, in the image of the autistic child this shift in weight occurred after the active movement forward of the thigh, lower leg and foot.

The position of the arm can serve as an important milestone along the course of normal development. For example, in a study conducted by Vilensky, Damasio, and Maurer, several autistic children (ages 3–10) exhibited more infantile positions of the arms while walking: the forearm often was held parallel to the ground, pointing forward.

Arm and hand flapping can also be noted in autistic children. This can also be noted in typically developing children but it disappears after a few months. However, if this persists for a sustained period of time (2 years or more) the arm and hand flapping may be an indication of autism.



(a) A 5-year-old autistic boy has a fully developed step gesture. All three segments of the leg move actively (see text), but his body weight does not shift at the same time, resulting in a form of goose-step. (b) The body weight only then is shifted so that the boy falls on to the outstretched leg at each step. This is a form of sequencing rather than superimposition of one movement on the other.

### **Discussion:**

Autism is usually diagnosed at age three when particular social skills fail to develop in children. However, social skills are not evident in the infancy stage, as the child largely relates to himself at this early stage. Although, the mother is usually aware during the early stages that something may be wrong, she cannot specify behaviors that are socially relevant for a diagnosis to be provided. As research has shown that almost all autistic children at later stages have movement abnormalities, these researchers in this study reasoned that such



*...besser lernen mit ABA/VB*

movement abnormalities will be evident from early infancy. The findings in this paper highlight the importance of detecting abnormalities in an infant's movements from the early stages of life. If, as noted in this study and other studies, that children with movement abnormalities go on to be diagnosed with autism, it may be crucial for the purpose of early intervention that abnormalities in movement are considered as an important indicator of autism. This study also noted that these abnormalities were typically noted to occur on the right side of the body. An awareness of the abnormal movements as noted in this study should be of particular importance to paediatricians who can fail to detect these early signs of autism.

**Copyright: PNAS permissions 200826**

**Please note that every effort has been made to condense and provide a broad overview of this research, however in order not to lose the key information some of the information in this summary has been copied directly from the original article. All credits of the summary whether directly worded or re-worded are solely given to the researchers.**

*For the summary great thanks to: Miss Georgiana Elizabeth Barzey.*