INTEGRATION OF EDUCATION IN WELFARE
A FOUR YEAR EXPERIENCE IN AN INCLUSIVE NURSERY IN FLANDERS

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Villa Clementina, www.villaclementina.be
PATIENTS AND METHODS

• January 2013 – June 2017
• 108 children in nursery
• 28 children with special needs (SN)
• 25 children in educational program, aged 2y6m – 6 y
• All SN children > 2y6m: individualized educational program (25-75% of attendance)
• Setting after leaving Villa Clementina
  ➢ Regular education
  ➢ Special education
  ➢ Day-care center
THE STORY OF S.

- Morquio disease
- Part of twins, 1 older sister
- 2.6y at start at VC; brother starts at same school as older sister; school refuses S
- Alternative: special school, bus – no option for the parents
- Starts in the educational program of VC, soon at level of a toddler
- Contacts with local school Zemst around age 3: teacher observes at VC
- S kan start for 1 hour a week at the school; has her own place at the class
- Gon starts: after a while she goes every day until noon, comes back than to VC
- At 5 years she integrates completely at school
- Now same program as children of her age
THE STORY OF S.

- Severe autism, global retardation
- Starts at VC 18m, no diagnosis
- No interaction, no interest in other children, no imitation
- Expection: day care centre
- Started at 2.6 in the educational program. Accent on interaction, communication, acceptance of structure – basic level
- Parents put S on waiting lists, also need for global support of the family because of difficult behaviour
- Can start at 4 at a type 2 school, not an approach for children with severe autism, no support of the family - Stays for this support and the educational program at VC – parents have no alternative
- This schoolyear: 6 years old and... good news!
THE STORY OF GW.

- Global developmental delay at first attributed to severe low vision problem
- Progress since correction vision but still great global developmental problem (IQ <55) after few years – advice type 2
- Started at VC at 24m; went already to a nursery but parents chose VC for the educational program
- Learns at a level of a child of 24m – 28m, likes social interaction with other children
- ‘together to school project’
- Started this year in the regular school of his sisters! After observation and team-meeting with new school, CLB, parents
THE STORY OF G.

• Severe form of autism, global delay, diagnose (OI <55) at very young age (<2y)

• Starts at age of 20m at VC: very sensitive, parents live isolated, has 1 younger brother, very selective eater

• Individual approach – ‘kitchen’, Bob Dylan; learns to accept other children – parents find a life again!

• Has splinter skills, expectance: school type 2

• Starts at 2.6 in the educational program: learns to work in a little group, sharing attention, getting less sensitive

• At 3.6: teacher can learn him educational skills of children of his age

• Retest: IQ 85!

• Can start this year at type 9!
RESULTS

• Age of children leaving the nursery
  ➢ TD children: 2y6m
  ➢ SN children: 4y7m

• All TD children started at regular schools
• SN children
  ➢ 12/21 children setting other than predicted
  ➢ 10/12 children enrolled a more challenging ‘academic’ setting
• Predicted: 8 children to day-care centre
  ➢ 1 child to regular school with integrated care
  ➢ 4 children started at specialized schools
  ➢ 3 children went to a day care centre BUT got a continuation of education!
• Predicted 3 SN children in regular schools
  ➢ 8 children attend regular schools (6/8 integrated care)
Qualitative result:

all parents and caregivers are convinced of the added value of the goal directed approach of education
CONCLUSIONS

• It is feasible to integrate education in a non-school environment (welfare sector)

• Education is an added value in the multidisciplinary approach of SN children

• Our educational project officially approved as a pilot project of the Flemish government in June 2016
IMPACT AND CONSIDERATIONS

• Educational project brings Unesco Salamanca Statement from theory into practice
• Example of a changing mindset towards inclusion in Flanders
• Education – as a part of multidisciplinary approach- optimizes development in critical period of brain plasticity
• In infants ans toddlers: be careful to make ‘definite’ and early referrals
• Education is feasible out of the school walls
• Positive contribution to M-decreete
• Impact of environmental enrichment in critical/sensitive period ?? Or…
Banneux en Beauraing

IIS IT A MIRACLE?
NO: IT’S ALL ABOUT NEURONS
Image showing the neural connections in the brain of a newborn, a 3 month old, a 15 month old and a two year old child.
BRAIN PLASTICITY

Result of result of interaction between genes and environment

• Definition:
  • changing of neurons, organization of their networks and their function by new experiences

• Genes guide initial steps of brain development
  ➢ Neural tube formation and subdivision in specific regions
  ➢ initial formation of neural connections and neural circuits

• Environmental factors (stress, diet, drugs, exercise, experience, pathogens)
  ➢ Influence development (e.g. Dendritic and synaptic creation, sprouting)
“If you don't know history, then you don't know anything. You are a leaf that doesn't know it is part of a tree.”

Michael Crichton
2 Dec 2012, 7:33 pm
SOME HISTORY...

• 1802 – English poet William Wordsworth: ‘the child is the father of the man’: dichotomy between Nature and Nurture

• 1890 – American psychologist William James
• 1906 – Maria Montessori – theory of sensitive periods
• 1930 - Konrad Lorenz
  • first scientist to popularize the notion of a developmental critical period
  • Imprinting: 1973 Nobel prize.
• **1960-1970 – Hubel and Wiesel**
  - first scientists to explore the neural basis of a critical period
  - pioneering work on cat visual cortex
  - showed that *environment could influence the brain*
  - effects on monocular deprivation in kittens

• **Around 1960 – Harry Harlow**
  - effects of maternal and social deprivation on rhesus monkey infants
  - *importance of social stimulation* for cognitive and emotional outcome
About critical and sensitive periods...

- **Critical period:**
  - Time window when environmental input is required for proper development of a particular brain circuit
  - If unstimulated: brain function permanently compromised, development is ‘fixated’
  - Qualitative difference

- **Sensitive period: less stringent**
  - Time when environmental experiences have greatest impact on brain circuitry
  - Circuits can be shaped by experiences later in life but a lesser degree
  - Quantitative difference
  - Period of increased sensitivity to both positive (EE) and negative stimuli (deprivation, stress)
  - Most vulnerable: period of rapid growth, associated with differentiation plasticity
Some other examples ...

- **Birdsong:**
  - sensory acquisition phase: young birds first memorize song of a tutor
  - Sensorimotor practice
  - Finally: crystallization when note structure and sequence become stereotyped
  - Raised in isolation (no tutor) or deafened (no auditory feedback)
    - Abnormal vocalisations as adult birds

- **Human language**
  - Full term neonates: already left hemisphere dominance for speech and sound
  - 6 months: perceptual map is refined to eliminate nonnative phoneme distinctions (like ‘r’ from ‘l’ in Japanese)
  - At age 12: cumulative critical period for language ends:
    - ability to properly discriminate subtle grammatical errors
  - Other features as semantics: can be learned throughout life
Neural Circuits are Wired in a Bottom-Up Sequence

- Substance exposure
- Maternal infection
- Malnutrition
- Stress
- Air Pollution
- Poverty

*in utero*  \[\rightarrow\]  genes  \[\rightarrow\]  critical periods  \[\rightarrow\]  behavior

*environment*  \[\rightarrow\]  adulthood

Plasticity:
- Birth
- Sensory
- Motor / Language
- Higher Cognition

Development:
(Hensch & Bilimoria, Cerebrum 2012)
• 1947 - Hebb:
  ➢ Concept of environmental enrichment
  ➢ rats raised as pets performed better on problem solving tests than rats raised in cages
  ➢ ‘Hebbian theory’ but no standardized research

• 1960 – Rosenzweig: standardized research on environmental enrichment
  ➢ Combination of complex inanimate and social stimulation
    • Wide attractive cages ‘Disney land’
    • large social groups
    • Variety of stimulating objects, regularly changed
    • Essential: voluntary physical exercise
• Large number of animal studies:
  
  • **EE modifies behavior**
    - Sensitive improvement of cognitive functions
    - Positively affecting emotional and stress reactivity
  
  • **Anatomical level**
    - Increments in cortical thickness and weight
    - Modifications of neuronal morphology
  
  • **Molecular level**

![Diagram showing morphological and molecular effects of EE](image)
✓ Hypothesis on EE

• Multifactorial

• Reducing intracerebral inhibition

• Increasing histone acetylation

• Enhancing neurotrophin expression
  
  ➢ Delaying progression
  ➢ Ameliorating symptoms of disorders in which neuronal plasticity is compromised

EE as endogene pharmacotherapy in rehabilitation?
Promising animal studies

- **Rett syndrome**
  - Mice models: abnl in motor coordination, social interaction and cognition
  - EE: increasing BDNF in cerebellum
    - motor coordination and cognitive decline reversed
- **Down syndrome**
  - Murine models: impaired neurogenesis and dendritic branching
  - EE: increased exploratory behavior and enhanced spatio learning
- **FMR Mice model**
  - rescue of hyperactivity and social and cognitive deficits
- **Autism and EE**
  - reducing time spent in repetitive behaviors
  - Decreased anxiety
  - Enhanced exploratory activity
QUESTION: ANIMAL VERSUS HUMANS?

• Most humans do experience ‘EE’

• But levels of cognitive, social and physical stimulation vary among individuals
Studies outcome adverse early life experiences (maternal depression, malnutrition, abuse)

• Neuro-imaging studies in orphanages: reduction in metabolic activity in frontal gyrus, amygdala, hippocampus, lateral temporal cortex
• **Environmental enrichment therapy for autism** – E. Aronoff 2016  
  o 1002 children (3-13 yrs) daily Sensory Enrichment therapy  
  o Overall gains e.g. learning, memory, anxiety, attention, motor skills...

• **Massage therapy in healthy preterms** – A. Guzzetta  
  o 30-33 weeks  
  o changes in EEG, increased IGF-1  
  o Underlines role of environmental stimulation

• **Effect of quality parent-infant interaction!**  
  o EI programs in NICU (Kangooroo)  
  o Post hospital programs (home guiding)
Promising...

• 1995 – Rauschecker
  ➢ Visually deprived (also adult) animals can localize sounds with greater precision
  ➢ Neurons in visual cortex now activated by sound
  ➢ Compensatory plasticity

• Late adoption studies
  • from deprived to enriched environment
• Re-opening windows – Hensch

- About pedals and brakes
  - Brakes
    - Nature
    - Nurture
  - Pedal
    - Nature
    - Nurture

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**Plasticity**

- Myelination
- Glia, Astrocytes
- Perineuronal nets, Parvalbumin Interneu

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The brain’s **ability to change** in response to experiences

The **amount of effort** such change requires

**AGE**

Center on the Developing Child | HARVARD UNIVERSITY

Source: Levitt (2009)

www.developingchild.harvard.edu
The diagram illustrates the development of inhibitory mechanisms in the brain across different postnatal ages. Overinhibition is represented at the top, followed by high inhibition (mature brain) and low inhibition (juvenile brain). Pathological states in the developing brain are connected to specific interventions, such as environmental enrichment and drug treatments targeting GABA-A and GABA-B receptor inhibitors. The diagram also highlights the importance of plasticity in the developing brain, with interventions like environmental enrichment, diet, and drug treatments, including fluoxetine and chondroitinase, used to enhance or manipulate this process.
PEDAL : MIRROR NEURONS

http://developingchild.harvard.edu/science/key-concepts/serve-and-return/

Video mirror neurons
- Rizolatti and Galleze – Parma – 1990 ies
  - Mirror neuron fires BOTH
    - When an animal execute a task
    - When the animal observes the same action performed by another

!! Role of mirror neurons in imitation/learning and action understanding

Role in social cognition: understanding other people’s actions and emotions
  - Mirror neurons in autism, problems with imitation
Mirror neurons in rehabilitation

- Empathy fostering program in autism: movement therapy research
- Action-observation therapy (AOT) in stroke

"We gain more from observation if we bring with us some familiarity with the movements being watched."

SOURCE: Action Observation and Acquired Motor Skills: An fMRI Study with Expert Dancers, Cerebral Cortex Journal
Take home messages

• Nature versus nurture—but nature and nurture

• Brain plasticity life-long

• Brakes

• Pedals
  ➢ Environmental enrichment
  ➢ Mirror neuron system

Is this the answer ???
Is this the answer ??

We think it is a puzzle piece but ... we know so little...

Wisdom is knowing how little we know.
~ Socrates

Hensch – Harvard University (2012)
Clearly, there is a need for greater respect, funding, and focus on early childhood education and well-timed interventions
So... all about neurons and ... no miracle ???

Life is a series of tiny little miracles. Notice them.
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