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# LEARNING GUIDE

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## HUMAN BRAIN DEVELOPMENT: NATURE AND NURTURE

*With*

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**DAVIDSON** *films*

*Expanding the Mind's Eye since 1955*

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# INTRODUCTION

- No dichotomy between nature (genetic and other biological factors) and nurture (environment and experience) but an interplay between them.
- Brain not fully mature until 20 to 25 years after birth.
- Adult brain is highly differentiated; infant brain is not. Experience will shape it.

## PLASTICITY

- **Neuroplasticity:** The changing of the brain's neural connections as a result of experience.

Three profiles of plasticity:

- **Constrained**, not highly modifiable.  
Examples: Circuits that transmit discomfort and central vision.
- **Highly modifiable and dependent on experience, but only during certain sensitive periods.**
  - **Sensitive periods** are time windows, they vary between and even within systems.  
Examples: Visual acuity and depth perception, sound and grammar aspects of language.
- **Highly modifiable throughout life.**  
Examples: Many skills, knowledge, vocabulary.

**Pruning:** Loss of unused or redundant neural connections.

## Lab Based Research into Brain Plasticity

- **Empirical studies:** Experiments that test specific hypotheses, have stringent controls for other hypotheses and produce data that is carefully analyzed.

Methods used in this lab:

Psychometric assessments. Example: vocabulary tests

Non-invasive brain imaging:

Event Related Potentials: ERPs

Measure voltage fluctuations in response to stimuli.

Reveal time course of neural response.

Magnetic Resonance Imaging: MRIs

Spatial images of regions of brain where activity is taking place.

Studies of the vision of congenitally deaf vs. hearing people:

Central and color vision is the same (constrained plasticity): ventral pathway.

Deaf people had better motion perception, peripheral vision and attention: (system is modifiable):dorsal pathway.

Dorsal pathway more plastic: enhancements in deaf, vulnerable in developmental disorders.

- Language studies:

Language systems are within left hemisphere of brain.

**Phonology:** Sounds of language.

Highly modifiable and dependent on experience but only during certain sensitive periods.

**Grammar:** System of linking words together to make sense.

Highly modifiable and dependent on experience but only during certain sensitive periods.

**Semantics:** Words that refer to particular objects, descriptions and events, vocabulary.

Highly modifiable throughout life.

**Focalization:** Specialization; indicates more mature organization of the brain.

Adults and children with better language skills have more focalized brain responses to grammatical and semantic errors.

- Intervention Study

Head Start children, ages 3 to 5.

Studied the children before intervention:

Health and developmental histories.

Psychometric tests.

Attention skills.

Randomly assigned children to six groups for study:

Parenting classes.

Small group sessions:

Music.

Language.

Attention.

Small control group.

Large control group.

- Conclusion:

Attention can be modified.

Better attention skills improve performance in many spheres of life.

## **RELATED FILMS**

*Also available from Davidson Films*

***DISCOVERING THE HUMAN BRAIN: NEW PATHWAYS TO NEUROSCIENCE***

(2006) 29 minutes

***NOURISHING LANGUAGE DEVELOPMENT IN EARLY CHILDHOOD*** (1996) 31

minutes