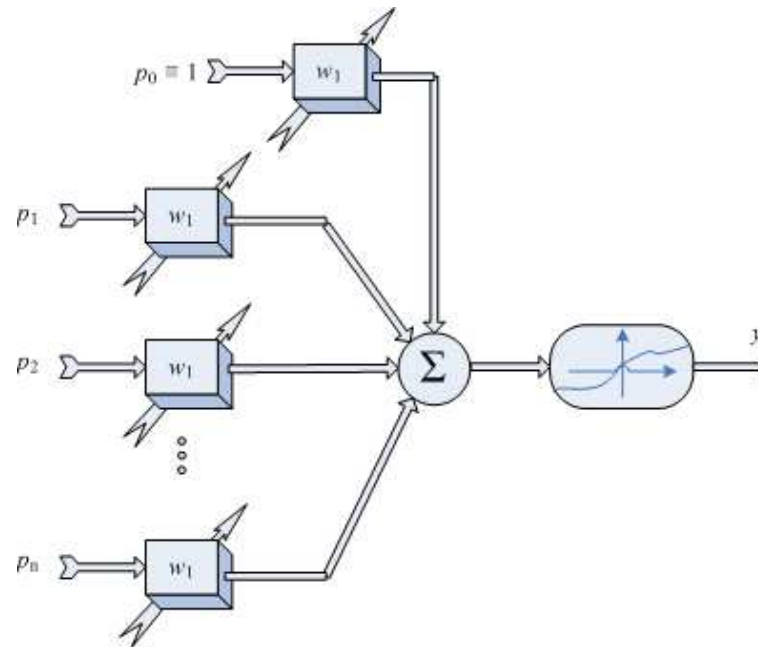
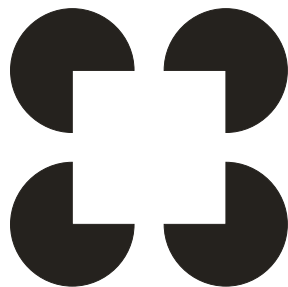


Soft Computing

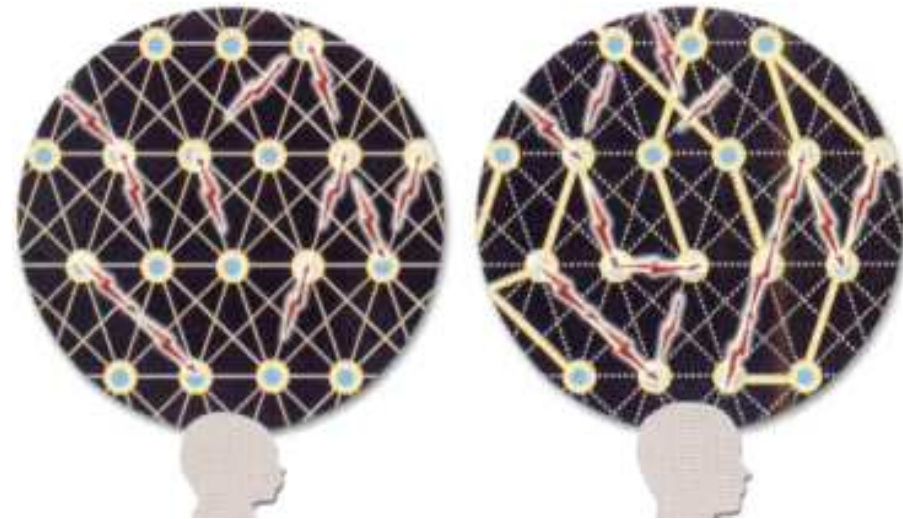
Neural Networks and Fuzzy Systems

Prof. Dr.-Ing. Adolfo Bauchspiess
Universidade de Brasília - Brazil



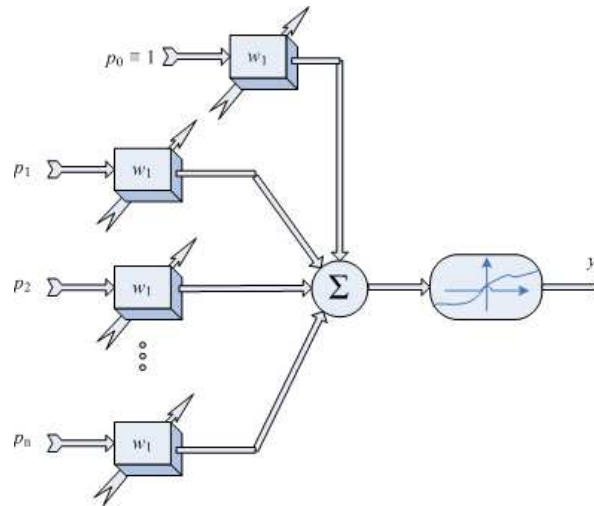
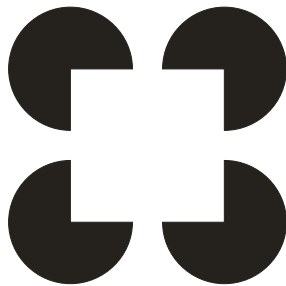
Summary

- 1 - Introduction – Connectionist Intelligent Systems
- 2 - Artificial Neural Networks
- 3 - Fuzzy Logic and Fuzzy Systems
- 4 - Examples and Applications
- 5 - Conclusions



Part 1

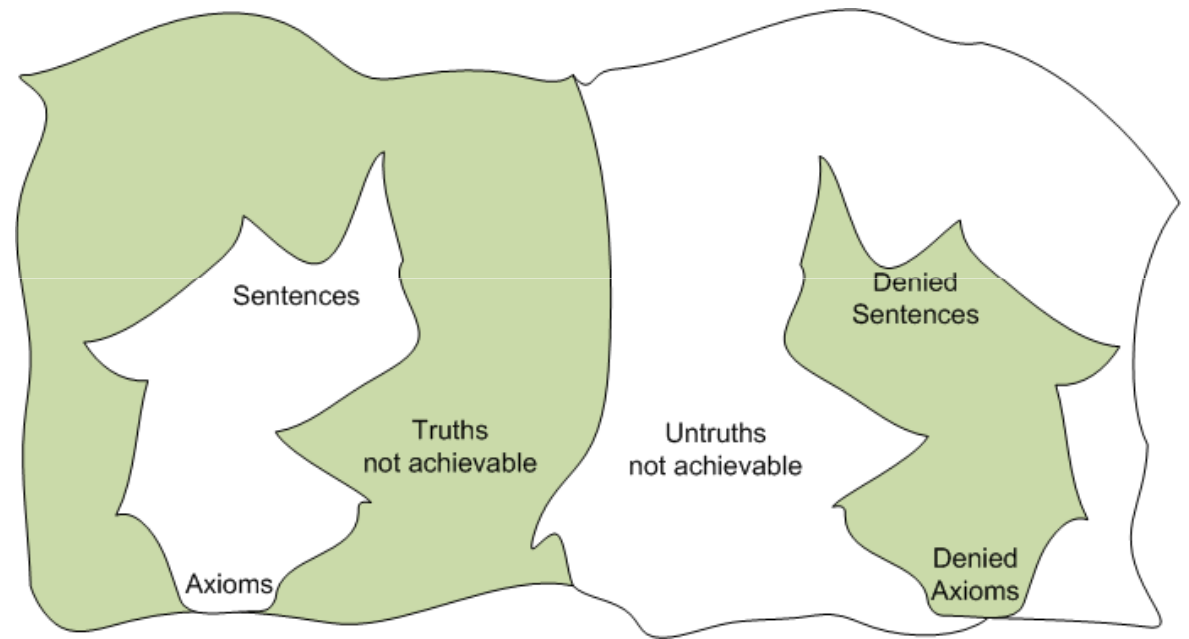
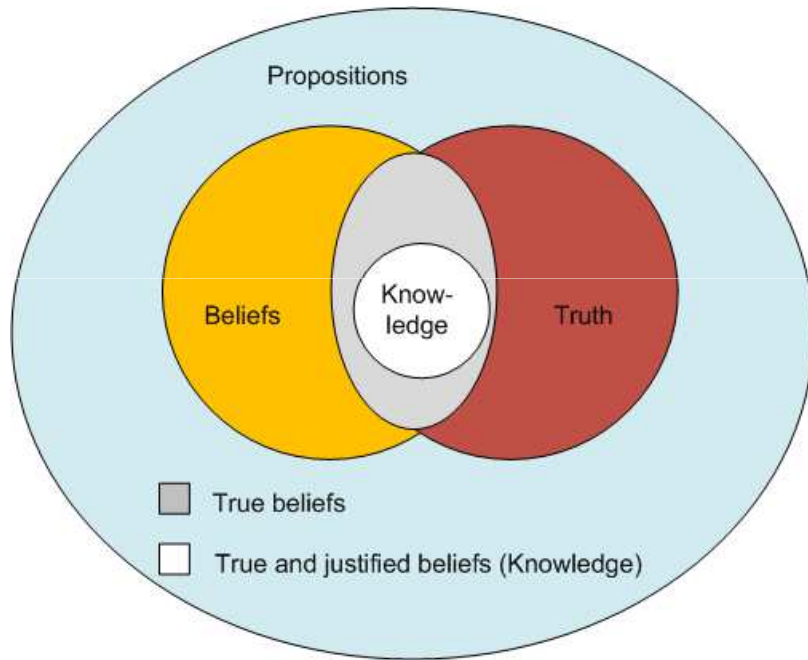
Introduction – Connectionist Intelligent Systems



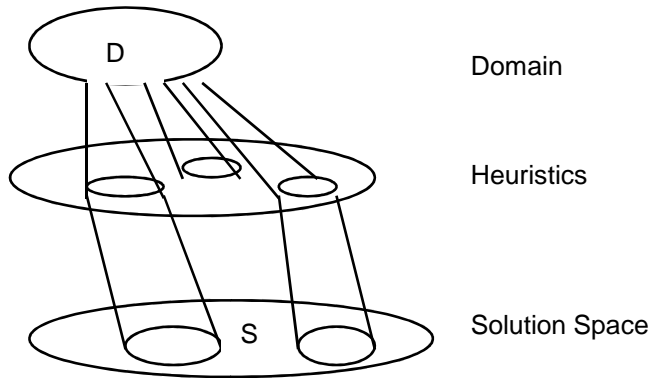
Some publications - Intelligent Systems

- Internacional Journals
 - Neural Networks, IEEE Transaction son
 - Fuzzy Systems, IEEE Transactions on
 - Intelligent Systems Engineering
 - Intelligent Systems, IEEE
 - Intelligent Transportation Systems, IEEE Transactions on
 -
- Conferences
 -

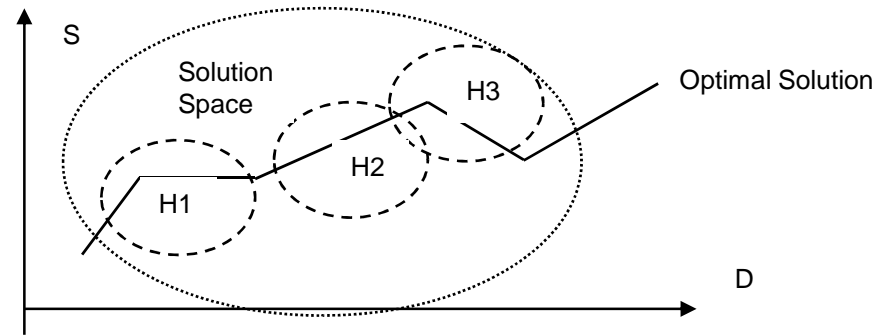
Epistemology – “Philosophy of Knowledge”



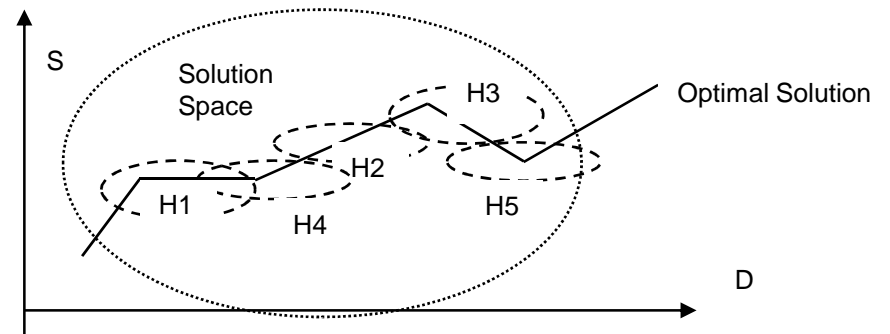
Heuristics



A heuristic rule leads from the domain space to the solution space



Heuristics give sub-optimal solutions.



"Well-formed" Heuristics are close to the optimal solution.

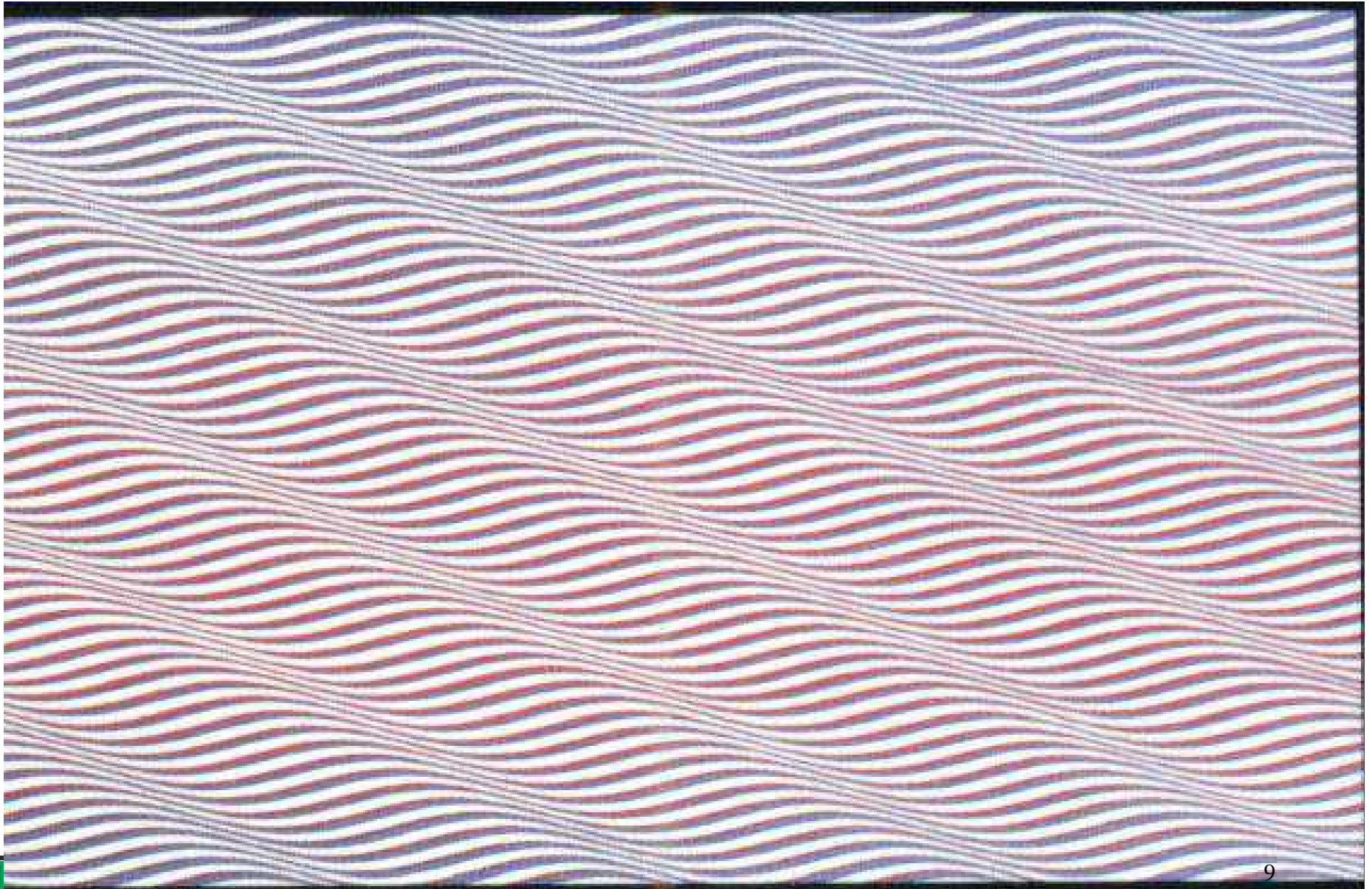
Dislexy?

I cnduo't bveleie taht I culod aulacly uesdtannrd waht I was rdnaieg. Unisg the icndeblire pweor of the hmuan mnid, aocdcrnig to rsecrah at Cmabrigde Uinervtisy, it dseno't mttær in waht oderr the lterets in a wrod are, the olny irpoamtnt tihng is taht the frsit and lsat ltteer be in the rhgit pclae. The rset can be a taotl mses and you can sitll raed it whoutit a pboerlm. Tihs is bucseae the huamn mnid deos not raed ervey ltteer by istlef, but the wrod as a wlohe. Aaznmig, huh? Yaeh and I awlyas tghhuot slelinpg was ipmorantt! See if yuor fdreins can raed tihs too.

Giant x 3D Illusion?



Waves?



Simpathic?



Antipathic?



Introduction

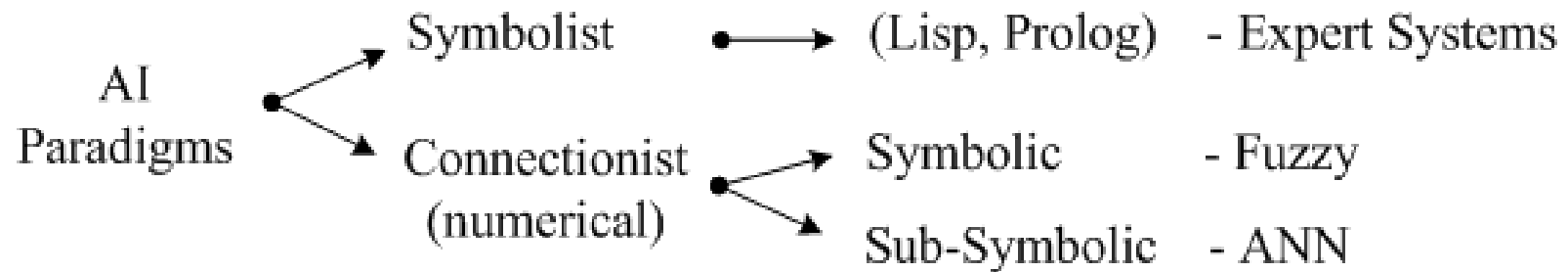
- Connectionist Intelligent Systems

Artificial Intelligence

Science field that studies **paradigms**
that aims to explain how
intelligent behaviour
can **emerge**
from artificial implementations, in computers.

Intelligence:
learning, adaptation, comprehension

IA Paradigms



Intelligence :
learning, adaptation, comprehension

Connectionist Paradigm

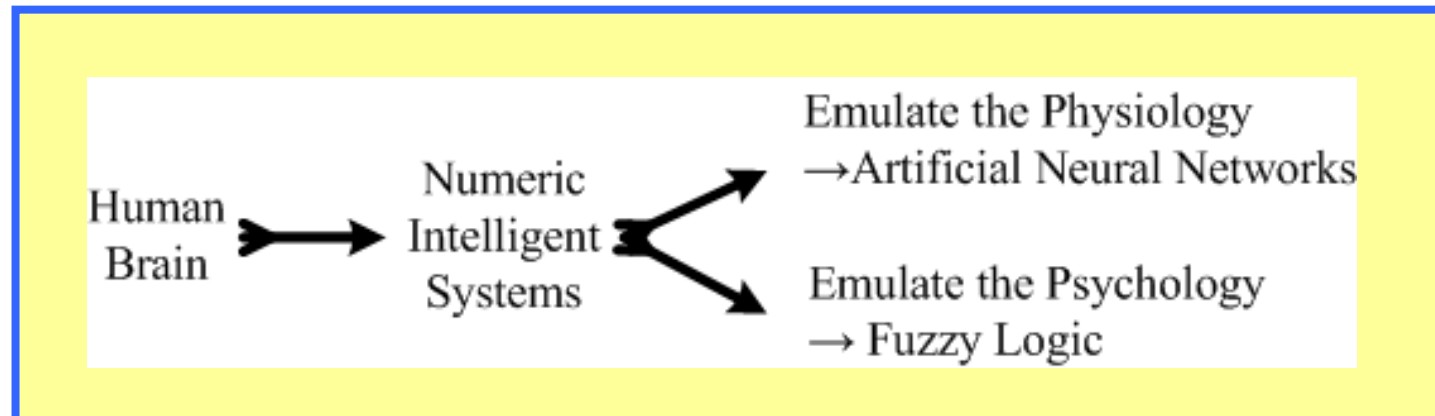
Considers to be virtually impossible to
transform in algorithms -

i.e., to reduce to a sequence of logical and arithmetic steps
many tasks that the human mind performs with ease and speed,
for example:

- Face Recognition,
- Comprehend and translate natural languages,
- Memory evocation by association,
- Games...

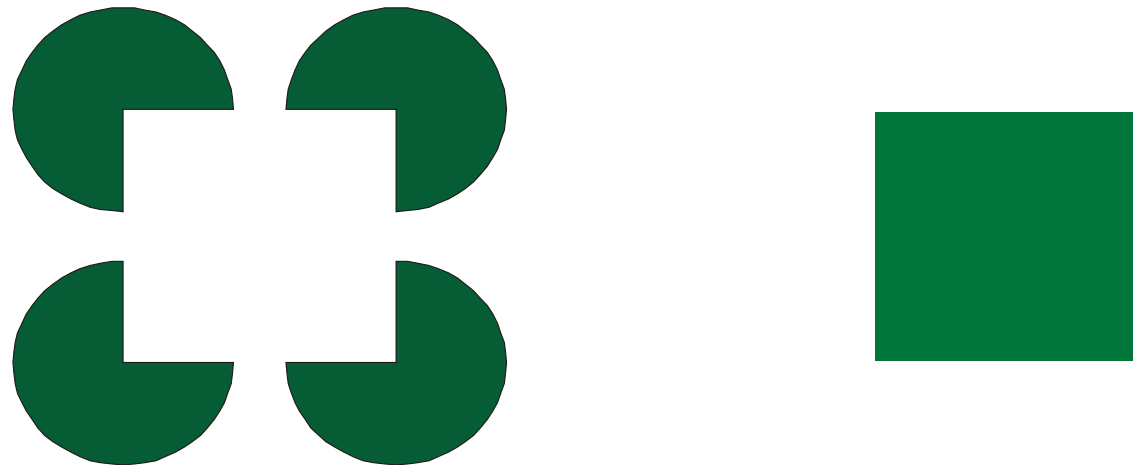
Connectionist Paradigm

The computational process have to mimic
the brain capacity of self-organization → **learn!**



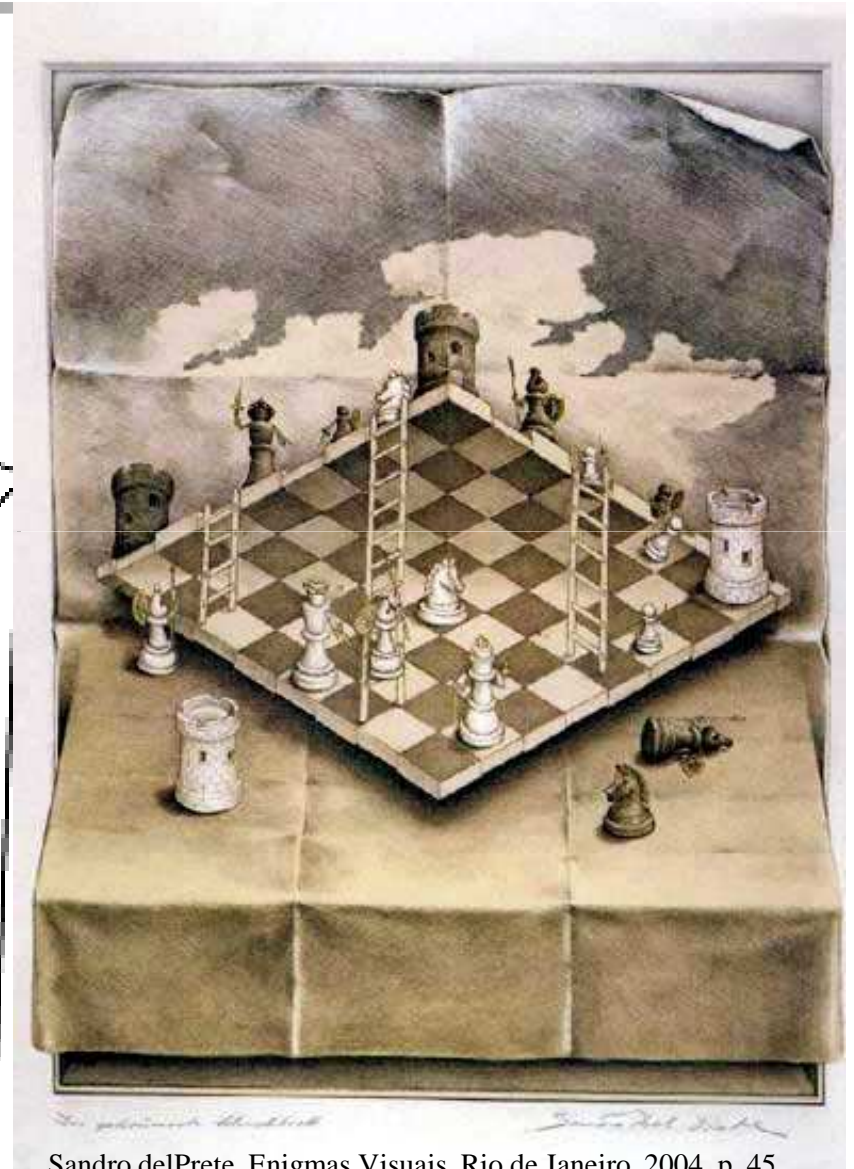
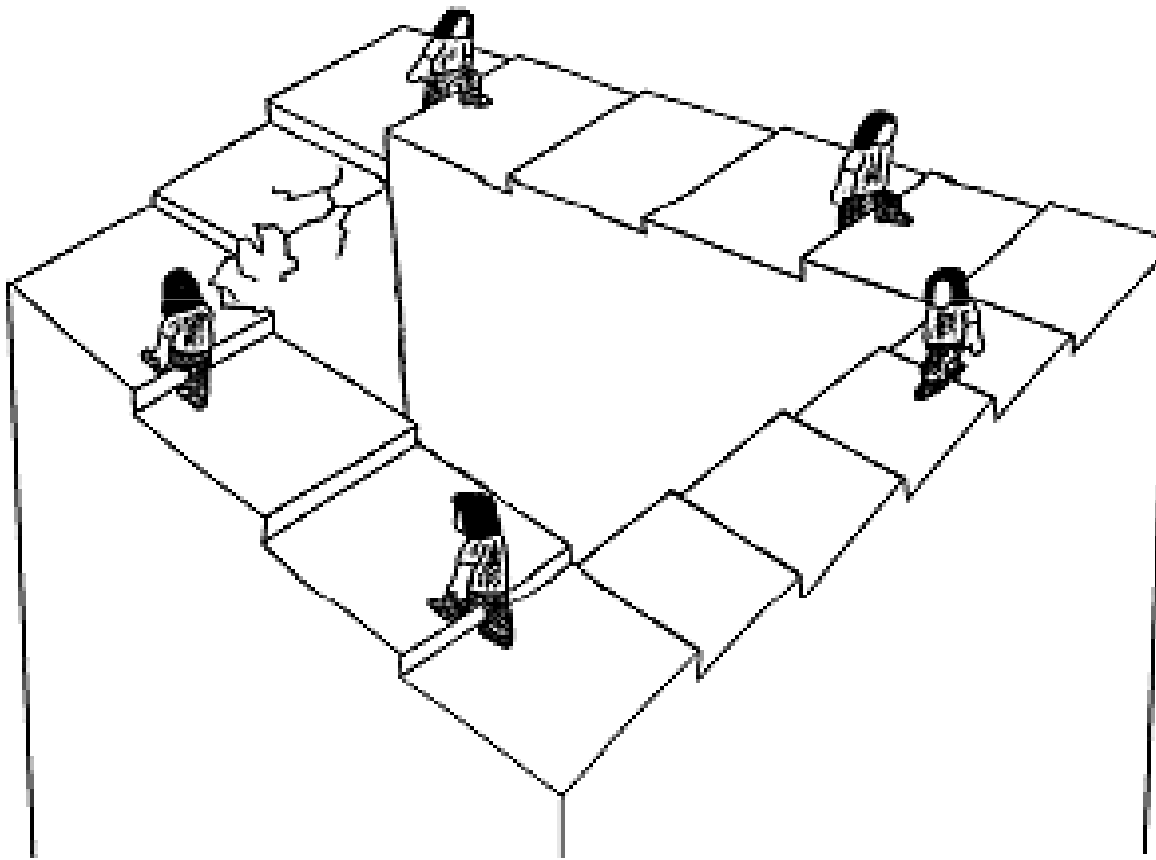
Symbolist versus Connectionist Paradigm

-Perception



The Kanizsa square, 1976

“Local Coherency – Global Paradox”



Sandro delPrete. Enigmas Visuais. Rio de Janeiro, 2004, p. 45

M.C. Escher



“Positive Truth X Negative Truth”

*“Up stairs
X
Down stairs”*



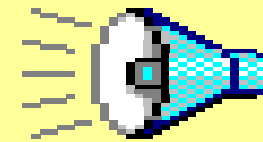
Paradigma Symbolista versus Conexionista

- J.S. Bach

“Coerência Local - Paradoxo Global”

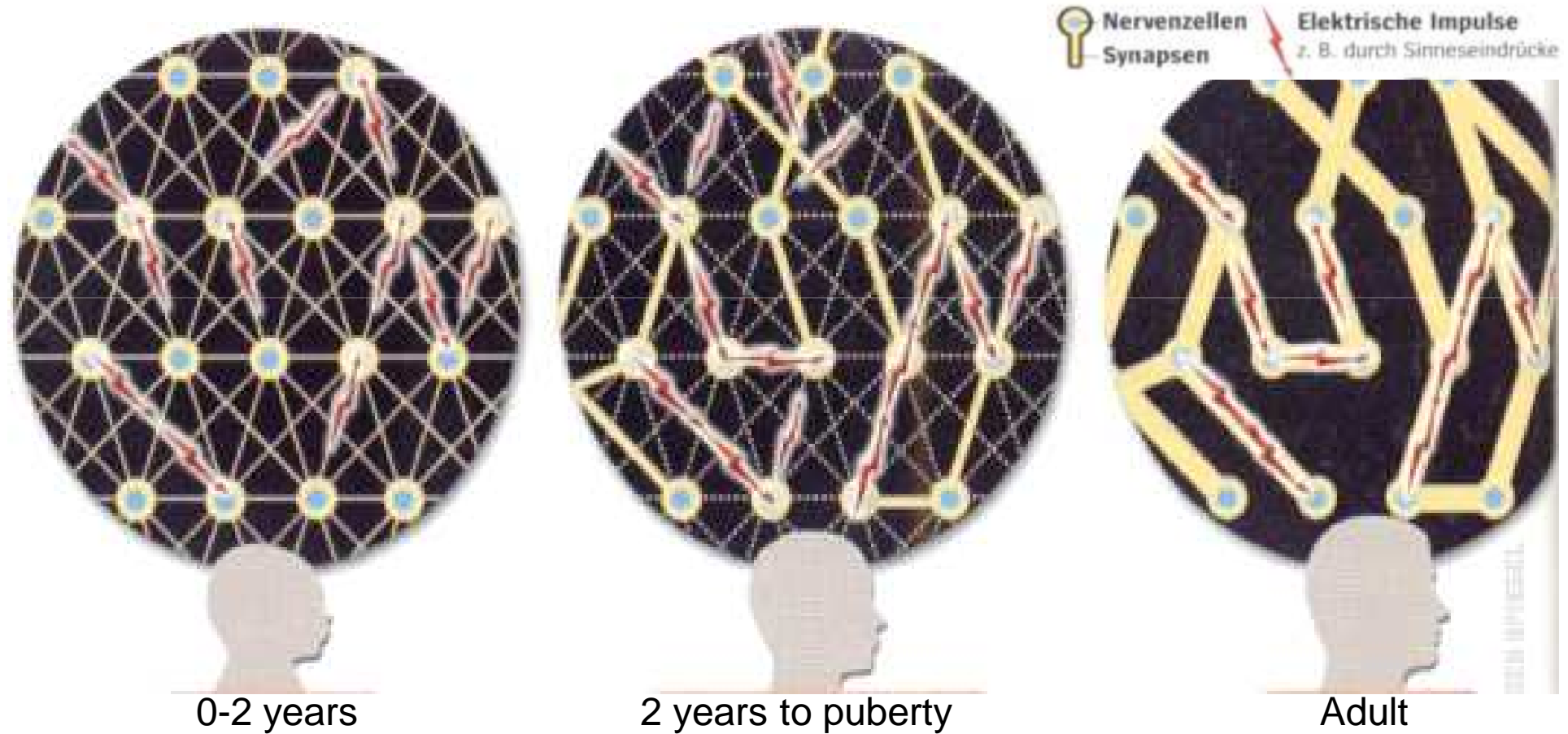
The image shows a musical score for J.S. Bach's piece. It consists of three systems of three staves each. The first system is labeled 'c-moll' and the third system is labeled 'd-moll'. The notation includes treble and bass clefs, a common time signature, and various musical symbols such as notes, rests, and accidentals. The piece is characterized by its complex, chromatic structure and the use of a pseudo-rising scale.

Shepard's scale

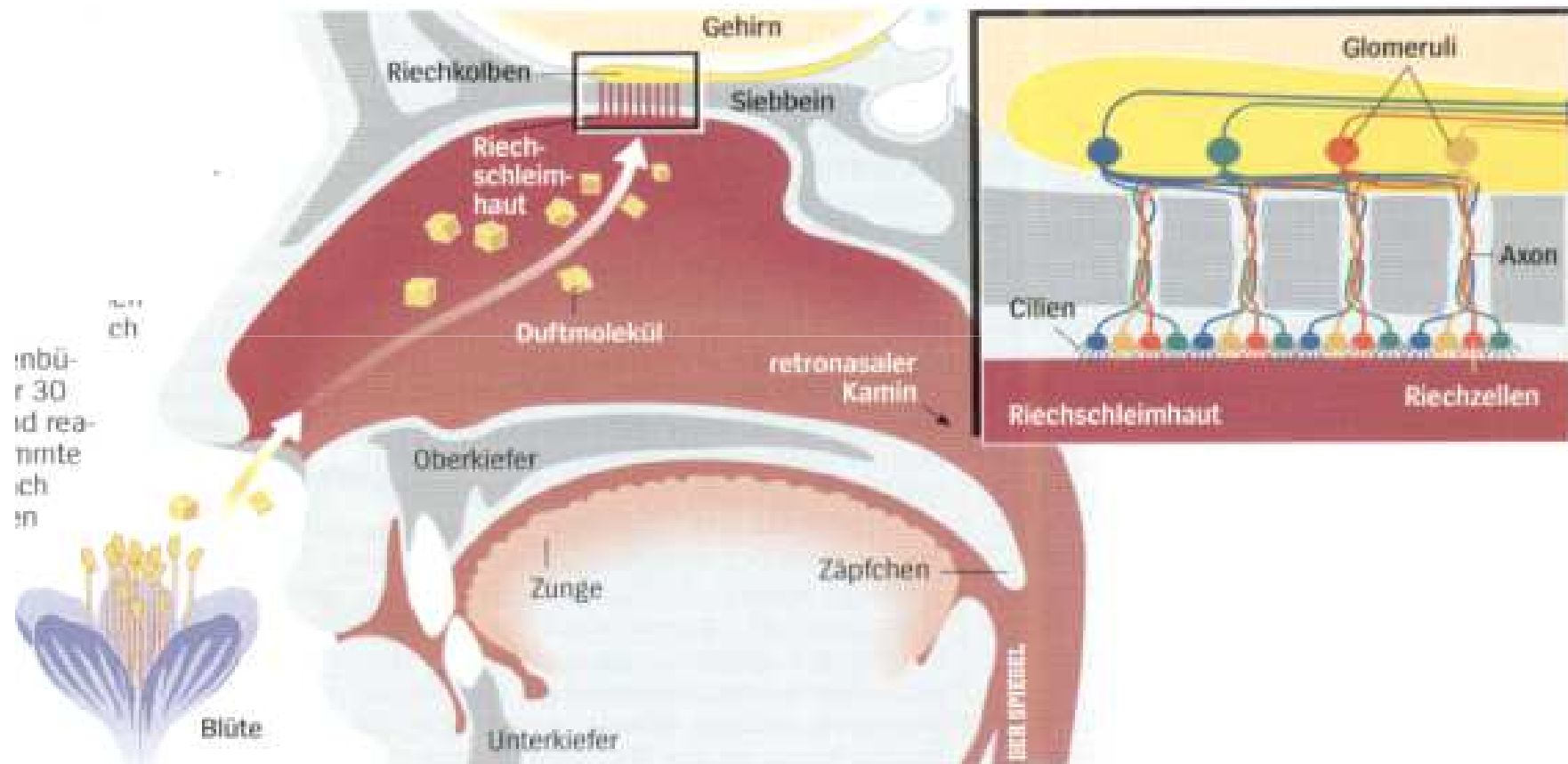


Pseudo-rising scale
played on a vibraphone

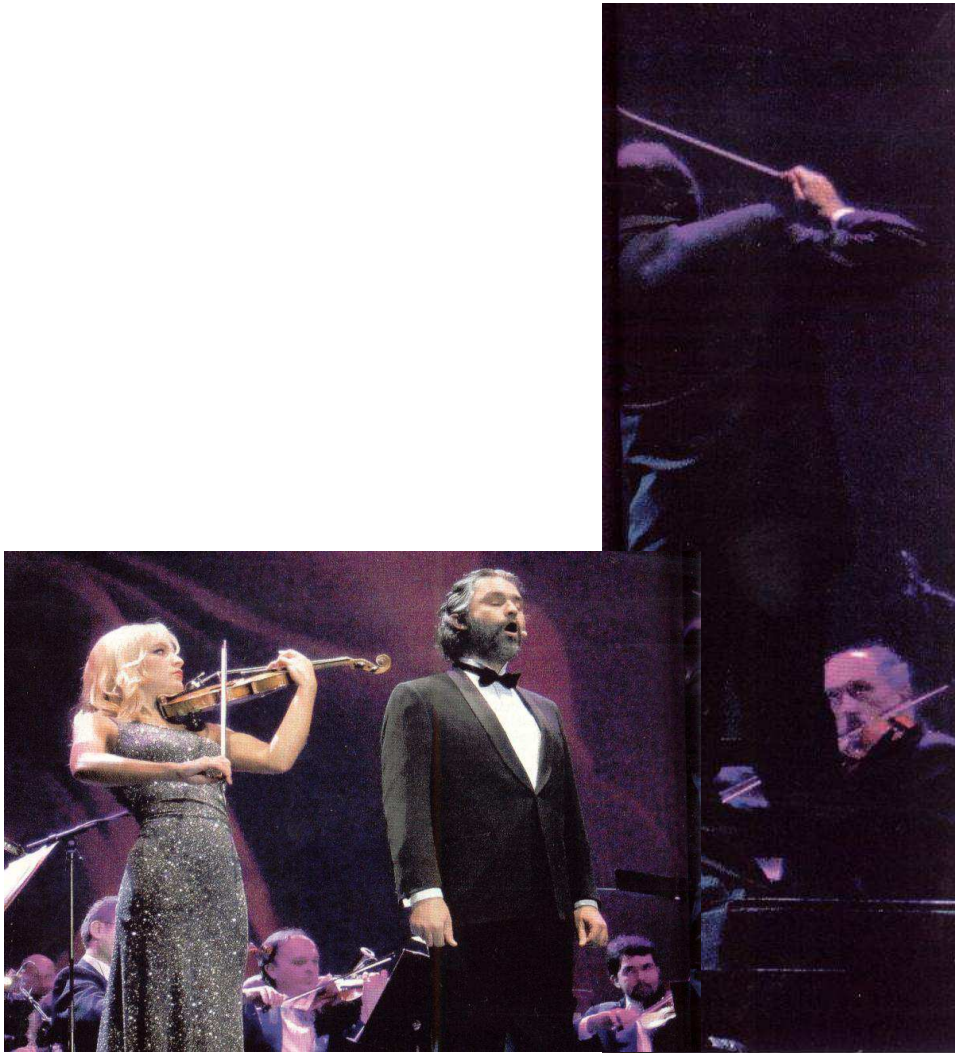
Synapses Formation



Olfative Information Processing



Auditive Information Processing



GEFÜHLE

Klangwelten im Kopf Wege der Musik durch das Gehirn

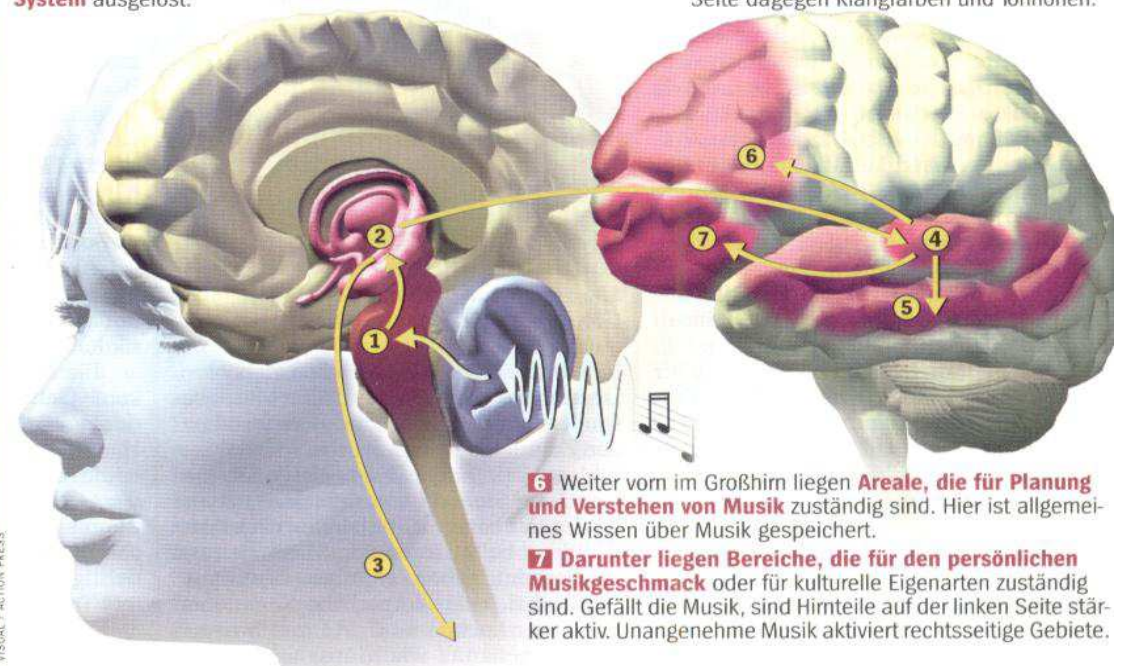
1 Der Hörnerv leitet Klanginformationen an den **Hirnstamm** weiter.

2 Einige Signale erreichen das so genannte **limbische System**, das eine wichtige Rolle in der Verarbeitung von Gefühlen spielt. Schöne Musik stimuliert jene Bereiche, die auch beim Sex oder beim Schokoladeessen aktiv sind.

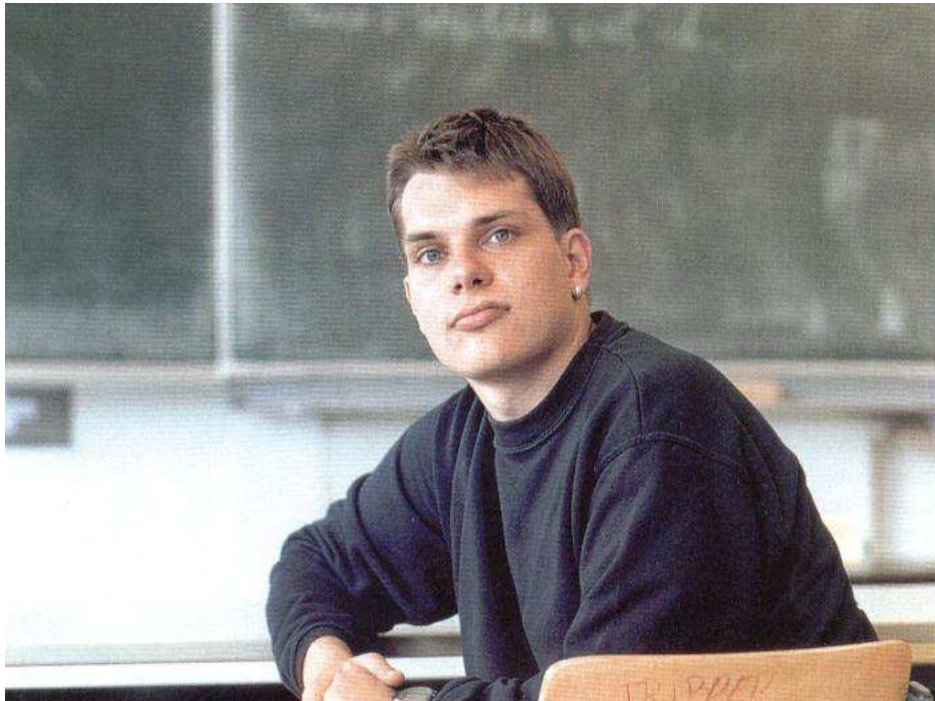
3 Auch körperliche Reaktionen auf Musik wie Weinen, Magendrücken oder Gänsehaut werden im **limbischen System** ausgelöst.

4 Die Informationen gelangen in die **primäre Hörrinde** im Großhirn, die Schaltzentrale des Hörens.

5 Umliegend finden sich die **sekundären Hörareale**. In der linken Hirnhälfte werden eher Rhythmen verarbeitet, auf der rechten Seite dagegen Klangfarben und Tonhöhen.



Epilepsy Patient – without left brain hemisphere since 12 years age



Leben ohne links

Seit zwölf Jahren lebt Philipp Dörr mit einem halben Großhirn. Trotzdem spielt er Schach, liest Goethe und taucht – ein verblüffendes Beispiel für die Wandlungsfähigkeit des Denkorgans.

A neuron over a Chip.

