

DAS – Students Model Neural Networks

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DAS: A Simulation Tool for Neural Networks

D	→ Diskret = Discrete	The program runs stepwise which results in sequences of discrete states
A	→ Allgemeine = General	Each kind of neuron can be simulated with DAS
S	→ Schwellen- elemente = “Threshold” Elements	Refers to Dertouzos (1965) who pointed out that neurons are nothing but a special kind of control elements

DAS – The Simulation Tool

The DAS-program (Gerdes & Dörner, 1988- 2000) is a simulation tool for modelling and visualizing neural networks.

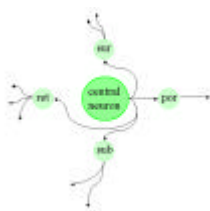
The basic elements used in DAS are **“theoretical neurons”**.

These neurons have four possible **inputs**:

- activating input (arrow)
- inhibiting input (⊥)
- associating input (empty circle)
- dissociating input (filled circle)



DAS includes not only the standard activatory and inhibitory neurons but also some special theoretical neurons like **Quads** (see Dörner et al. 2002). A Quad consists of a central neuron and four other neurons called sur, sub, por and ret



- sur:** bottom-up connection
→ part-whole relation
- sub:** top-down connection
→ whole-part relation
- por:** forward connection
→ time forward relation
- ret:** backward connection
→ time backward relation

Each neuron in DAS has **three parameters**:

- threshold: input must be stronger than the threshold to activate the neuron
- maximum activity
- enhancement factor: each input gets enhanced by this factor

The strength of any connection between two neurons is modelled by a **weight factor** (varies between 0 and 1).

- Weight = 1 → input is fully transmitted
- Weight = 0.5 → 50% of the input is transmitted

One neuron can activate one, two or more single neurons, but it also can activate a whole field of Quads.

References

- Dertouzos, M. L. (1965) Threshold Logic: A Synthesis Approach. Cambridge Mass: MIT Press.
 Dörner, D. et al. (2002). Die Mechanik des Seelenwagens. Bern: Huber.
 Gerdes, J. & Dörner, D. (1988-2000). DAS Diskret-Allgemeine Schwellenelemente – Ein Programm zur Konstruktion und Simulation neuronaler Netzwerke.
<http://giftppp.uni-bamberg.de/projekte/psi/das/index.html>

DAS – The Teaching Tool

At the University of Bamberg DAS is used for courses in modelling neural networks. Small groups of advanced psychology students learn about the theory of neural networks and how to work with neural networks and DAS.

Two main goals:

1. The students should get a proper look at a neural network simulation.
2. They have the possibility to acquire a deeper understanding of psychological processes on a neural level.

The students start with simple inhibitory processes and end up with complex cognitive, emotional or motivational processes.

Example: “Find the strongest neuron out of three neurons”



Problems and solutions in this example:

- Keeping the neuron active during the evaluation time
→ send activation in circles of three neurons
- Inhibiting the neurons step by step
→ use the principle of collateral inhibition
- Indicating the end of the process
→ sensor which shows that only one neuron is active

The evaluation of the course showed that the students especially liked that they could do things themselves instead of just having to listen to lectures.