

Internationaler Kongress für Kinderphilosophie

Pluralismus und interdisziplinäre Perspektiven-

Philosophische Untersuchungen in einer sich rasch verändernden Welt

15.-18. November 2018 in Graz/Osterreich



Austrian Center of Philosophy with Children and Youth
Institut für Kinder- und Jugendphilosophie

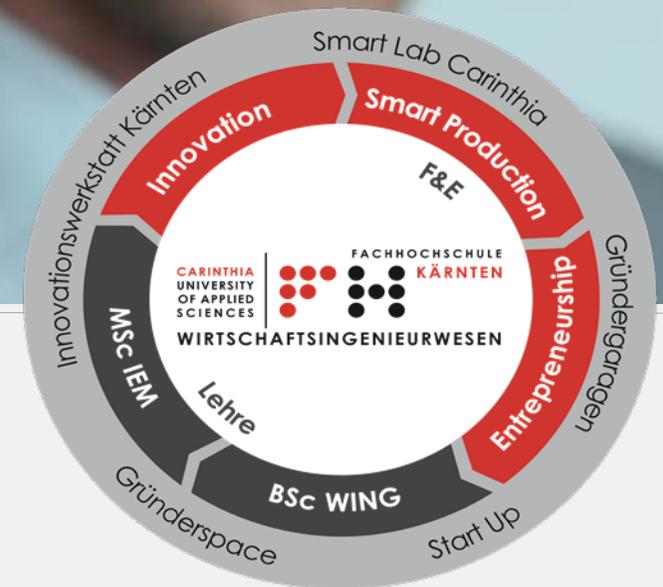


Interdisciplinarity as an Approach of Unifying Science

Universal Methodology, Practical Technical Education and Children Philosophy Implications

Autor: Bernhard Heiden

Ort und Zeit: Graz, Meerscheinschlössl 17.11.2018 16h00-16h30



„Menschen, die miteinander arbeiten, addieren ihre Potenziale.
Menschen, die füreinander arbeiten, multiplizieren ihre Potenziale“

Steffen Kirchner



FH-Prof. Mag. DI Dr. Bernhard Heiden, MBA
Professor for
Production Engineering



FH-Prof. DI Dr. Roland Willmann
Professor for
Industrial Management



FH-Prof. DI Dr. Erich Hartlieb
Degree programm leader
Industrial Engineering
Professor für Innovation- und
Technologymanagement



Mag. Dr. Petra Hössl
Senior Researcher
Start Up Initiative



FH-Prof. Dr. Joachim Werner
Professor for Business
Administration

FH-Kärnten
Wirtschaftsingenieurwesen
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DI Dr. Josef Tuppinger
Senior Researcher



DI (FH), Mag. (FH) Michael Roth
Scientific Employee



Mag. (FH) Thomas Saier
Scientific Employee



DI Reinhard Tober
Laboratory Engineer
Smartlab



Alexandra Reithofer
Administration



Joris Löschnig
Student Staff Member
Smartlab



Monika Decleva, BSc
Scientific Employee



Tamara Penker
Administration



Innovationswerkstatt KÄRNTEN

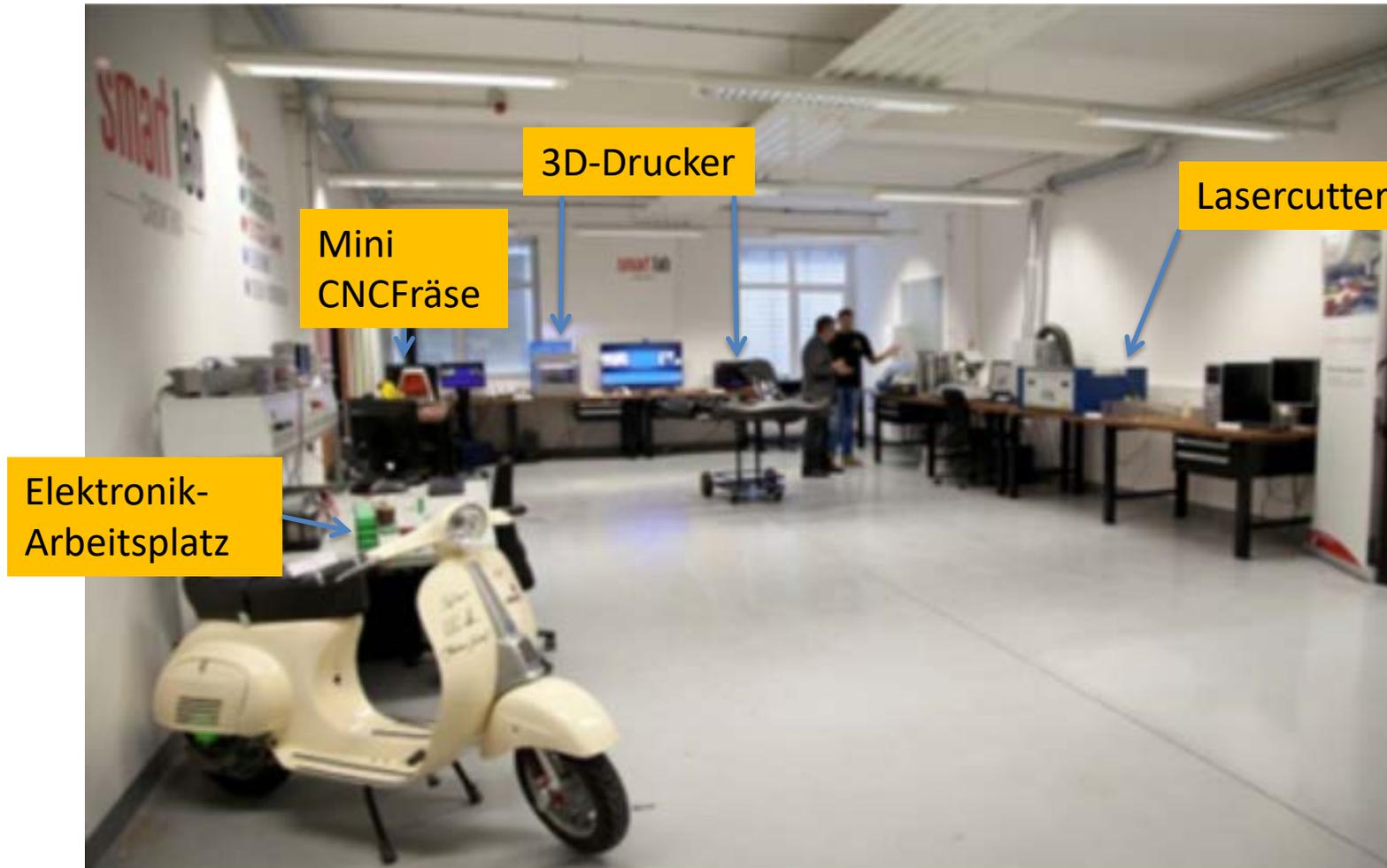


smart lab
— CARINTHIA —

Prototyping & Industrie 4.0

- CNC
- LASER CUTTER
- SCHNEIDPLOTTER
- 3D-DRUCK / SCANNING
- ELEKTRONIK
- DESIGN / KONSTRUKTION







Maschinentypologien

Biologische
Luftreinigung

Free place option

Interdisciplinarity as an Approach of Unifying Science

1. Methodology
2. Praxis
 - Practical Technical Education and Children Philosophy
 - Generalized Montessori Principle
 - Tulip Mathematics
3. Conclusion and Outlook

(1) General Methodology of Interdisciplinarity

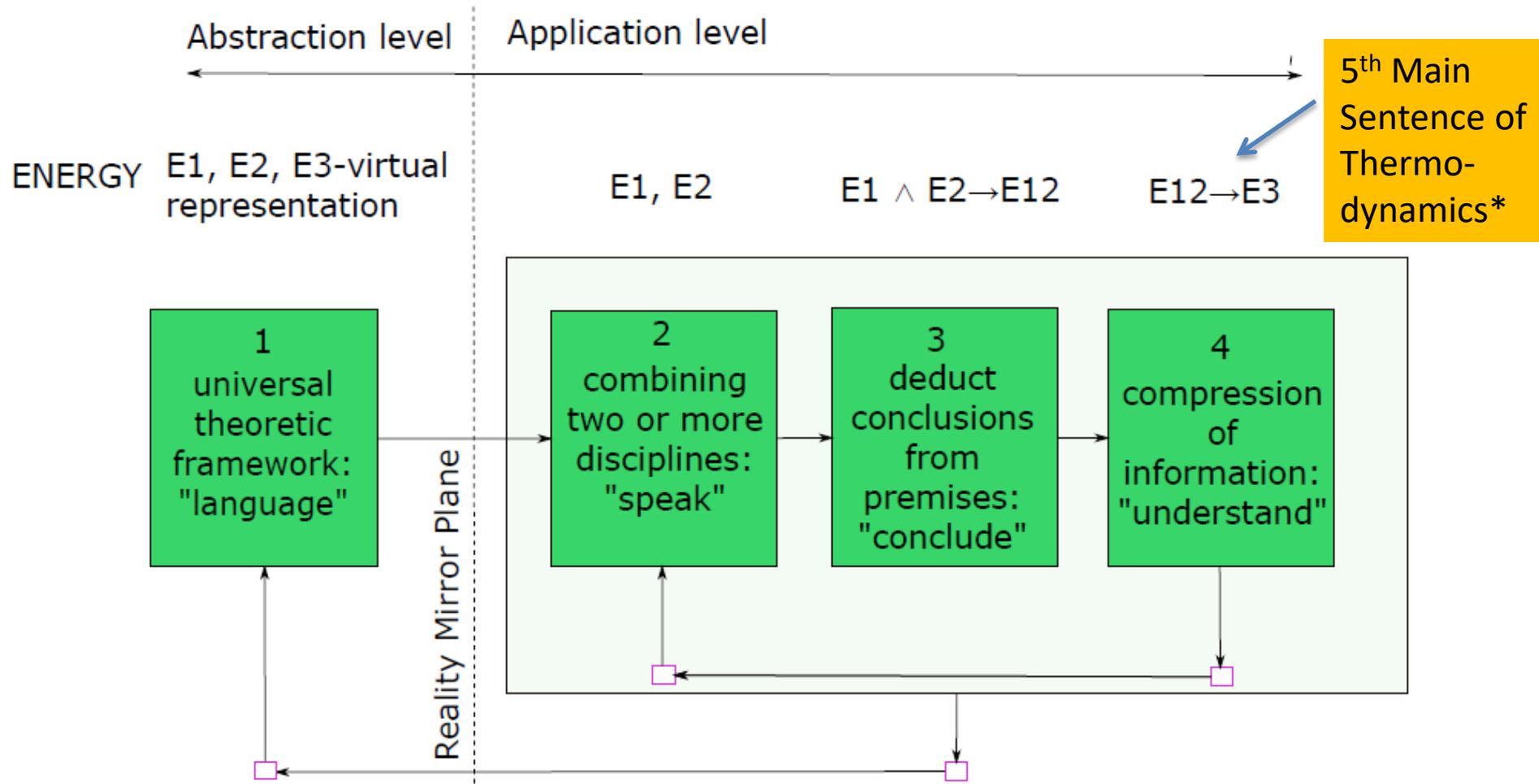


Fig. 1: Interdisciplinary methodology and theoretic framework of evolution

*[HeB18b]

4th Main Sentence of Thermodynamics:

Energy Forms have different orders:

→ more ordered Energy Forms can more broadly be used

$$S(dE_{i+1}) < S(dE_i) \quad i: 1 \dots n$$

Fig. 2: 4th Main Sentence of Thermodynamics*

*[HeB18b]

5th Main Sentence of Thermodynamics:

Increased Structured Application of Energy
Ordering Process itself (can) increase Order
→ more ordered Energy Forms are built from
less ordered Forms successively

$$S(dE_{i+1})_{\leftarrow i} < S(dE_i)_{\leftarrow i} \quad i: 1 \dots n$$

Fig. 3: 5th Main Sentence of Thermodynamics*

*[HeB18b]

(1) Markov Chains

- Markov Chain*: Each state has a certain probability to transit to a next state
- All natural processes can be regarded as Markov Chains
- Order can be regarded as long term connection
 - long in space
 - long in time

→ **long term trajectory**

* see also [WuG00]

→ Interdisciplinarity → leads to democratisation

→ Education → leads to democratisation

→ Democracy can lead to **higher order**
and **empowerment of children**

Several information channels are
representing the same information
differently

(1) Natural vs. Artificial Perception

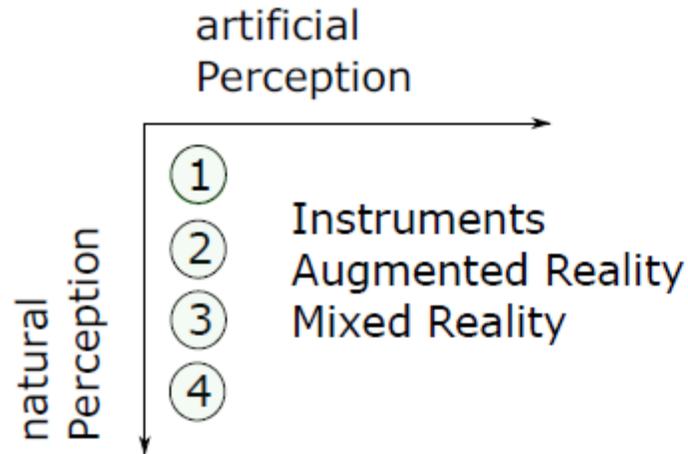


Fig. 2 Dimensions of perception eg. (1) Text (2) Picture (3) Video (4) Sensomotoric (Heiden and Oberlercher 2018)

[FeS17]



Bildquelle: <https://svgsilh.com/de/image/2518989.html> 17.11.2018

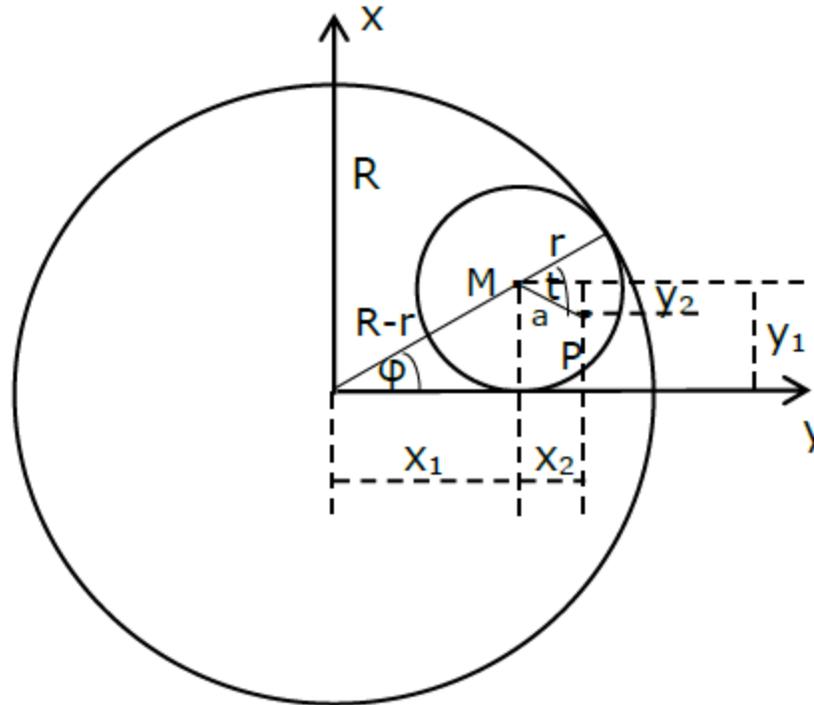


Abbildung 26: Abrollen des Hypozykloiden Kreises (Eigene Darstellung)

[FeS17]

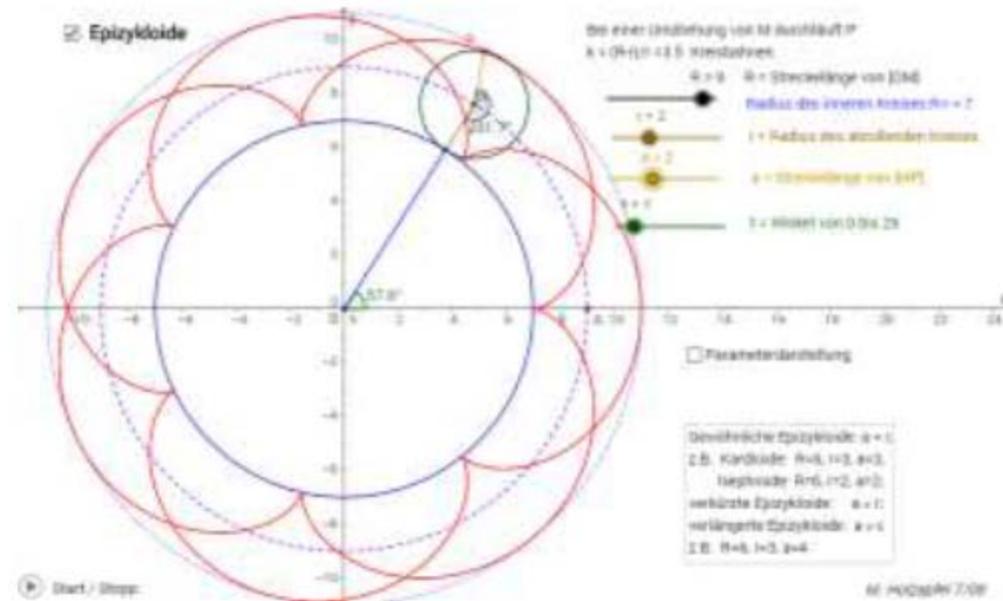


Abbildung 28: Gewöhnliche Epizykloide (Eigene Darstellung mit GeoGebra)

[FeS17]

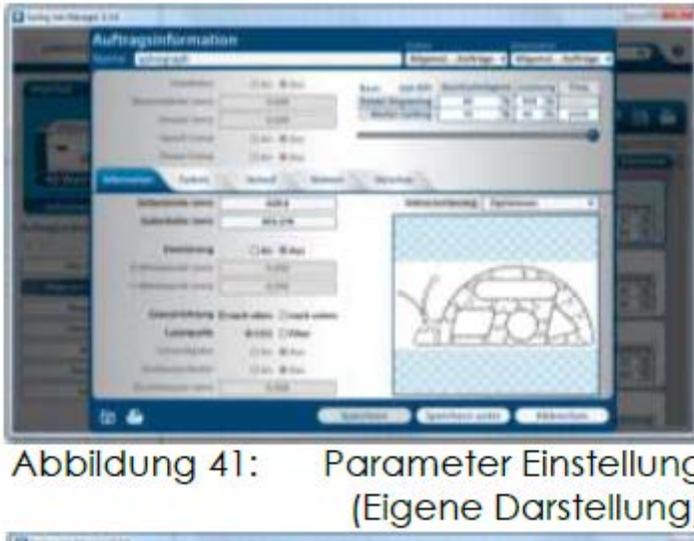


Abbildung 41: Parameter Einstellung (Eigene Darstellung)

Epilog Zing Laser Cutter

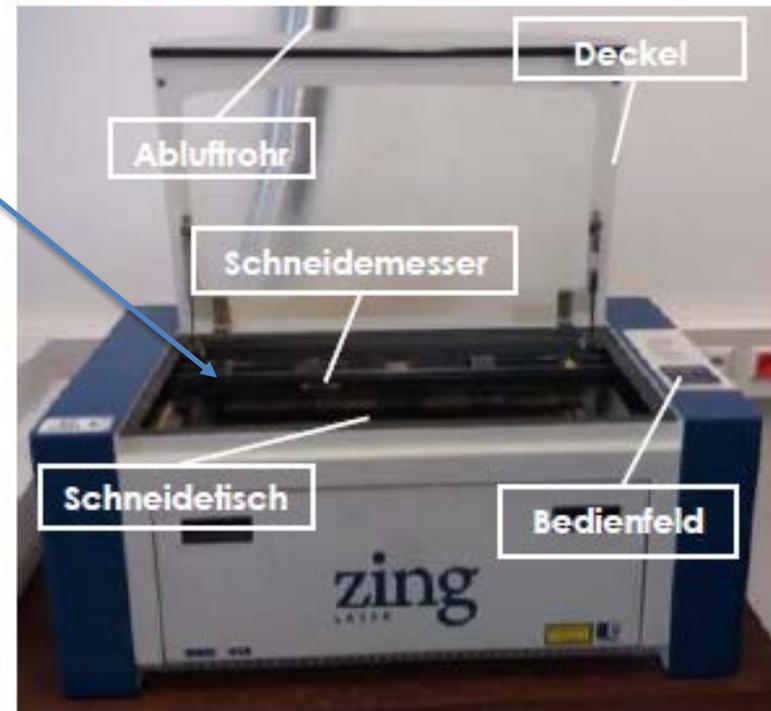


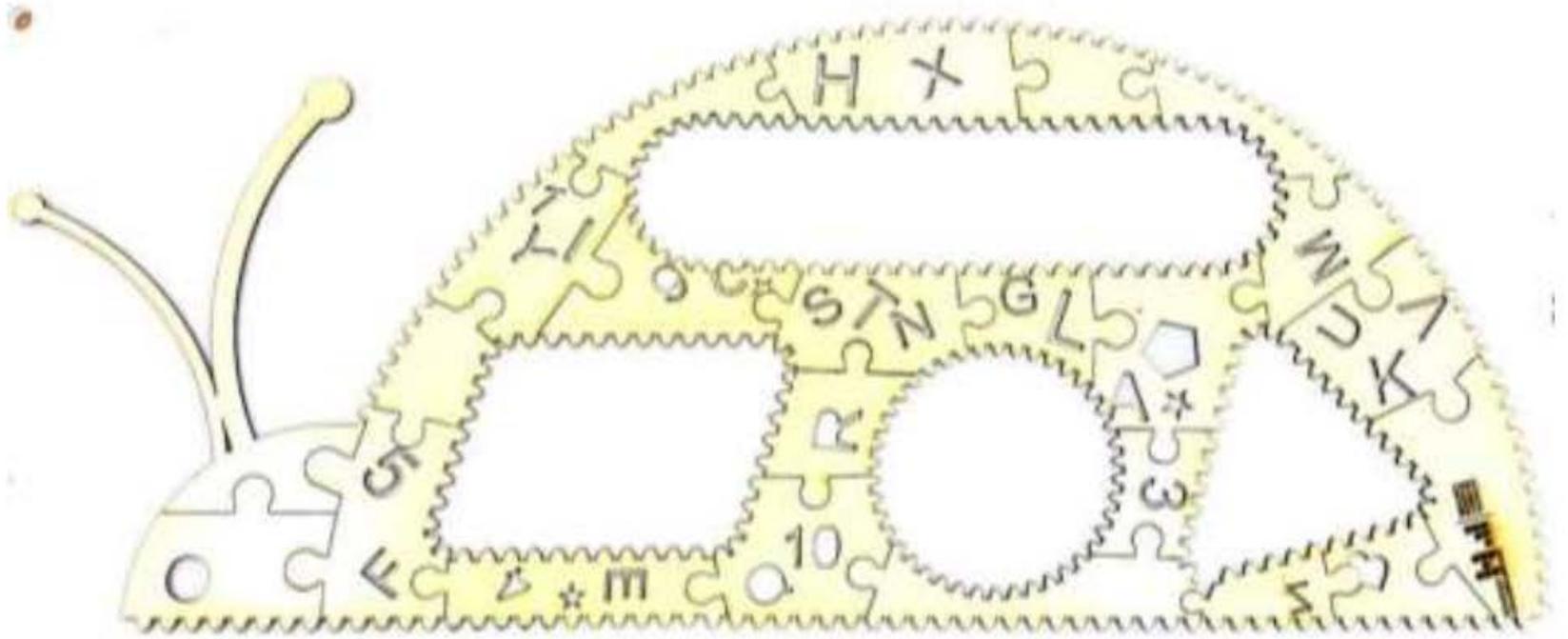
Abbildung 14: Zing Lasercutter Vorderseite (Eigene Darstellung)

[FeS17]

(2) Application 1 – Product

4.1.1.3 Kooperative Spirograph

Der kooperative Spirograph basiert auf den Hypozykloiden und Epizykloiden.



[FeS17]

Abbildung 52: Kooperativer Spirograph mit Lasercutter geschneidert
(Eigene Darstellung)

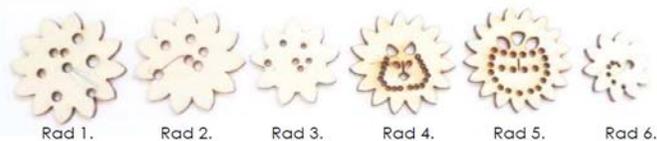


Abbildung 53: Räder für den Spirograph (Eigene Darstellung)

Hier sind ein paar Beispiele der Sprografen-Muster.

Kreisförmiger Zahnkranz:

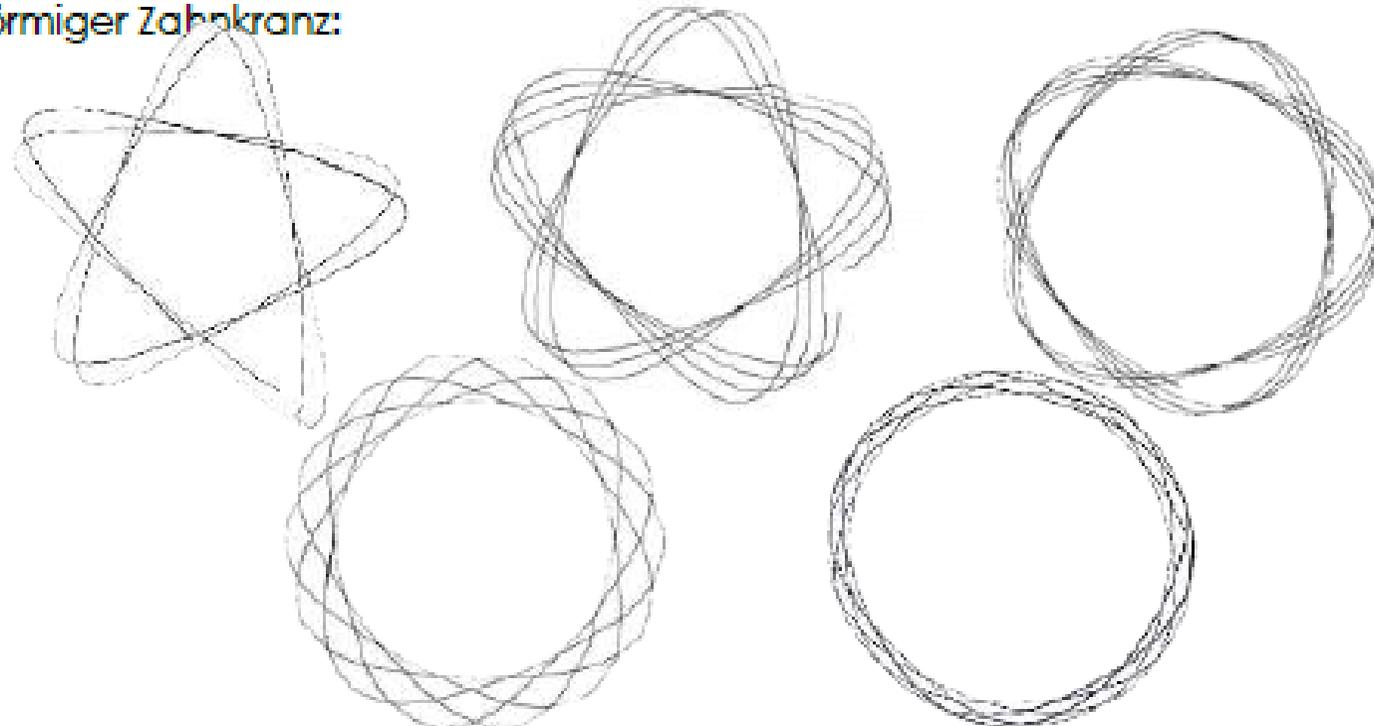


Abbildung 54: Spirograph mit Rad 5 und Rad 4 (Eigene Darstellung)

[FeS17]

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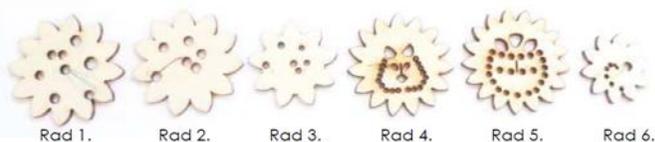


Abbildung 53: Räder für den Spirograph (Eigene Darstellung)



Abbildung 67: Erklärungen über den kooperativen Spirographen (Eigene Darstellung)

[FeS17]



Abbildung 59: Zeichnen mit dem Spirograph und gegenseitiges Helfen im Sunrise Kindergarten(a) (Eigene Darstellung)

[FeS17]

(2) Application 1 – Childrens Results 1



Abbildung 77: Fertige Zeichnung mit dem Spirographen in der Motessori-Schule(Stern)(Eigene Darstellung)

Abbildung 78: Fertige Zeichnung mit dem Spirographen in der Motessori-Schule(Parallelogramm)(Eigene Darstellung)

[FeS17]

(2) Application 1 – Childrens Results 2



[FeS17]





Fig. 4 Cooperative building together of the spirograph in the first class of the Montessori school in Villach Land (Sheng [2017](#))

[FeS17]



Take some disciplinary regularity e.g. laws, of mathematics, physics or of any discipline, and combine the core of the law in a material that contains the law available to different perception channels according to Fig. 2.

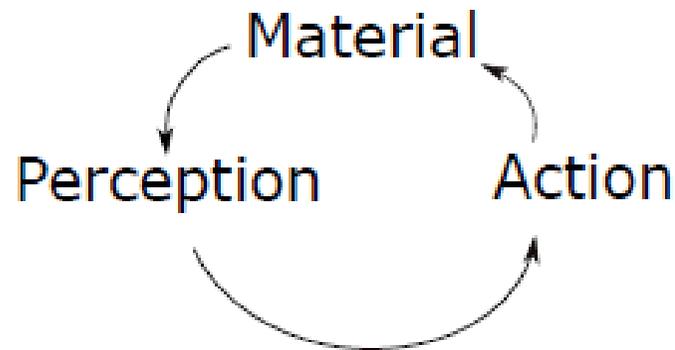
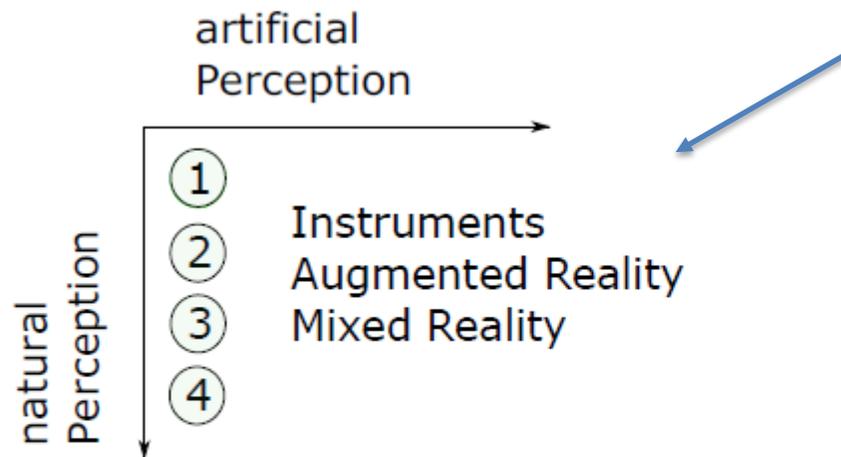


Fig. 3 Biocybernetics feedback cycle



THEORETIC FRAMEWORK:

- (0) Framework of System-Theory [LuJ08], Perception theory, Montessori Pedagogic [MoM67] , [MoM07] , 5th Main Sentence Thermodynamics [HeB18b], Information Theory
- (1) Sensory Perception channels „speak“ with each other (translation)
- (2) New rules can be observed by practical implementation (using senses)
- (3) Compression of information by means of generalization rules → semantic density forming

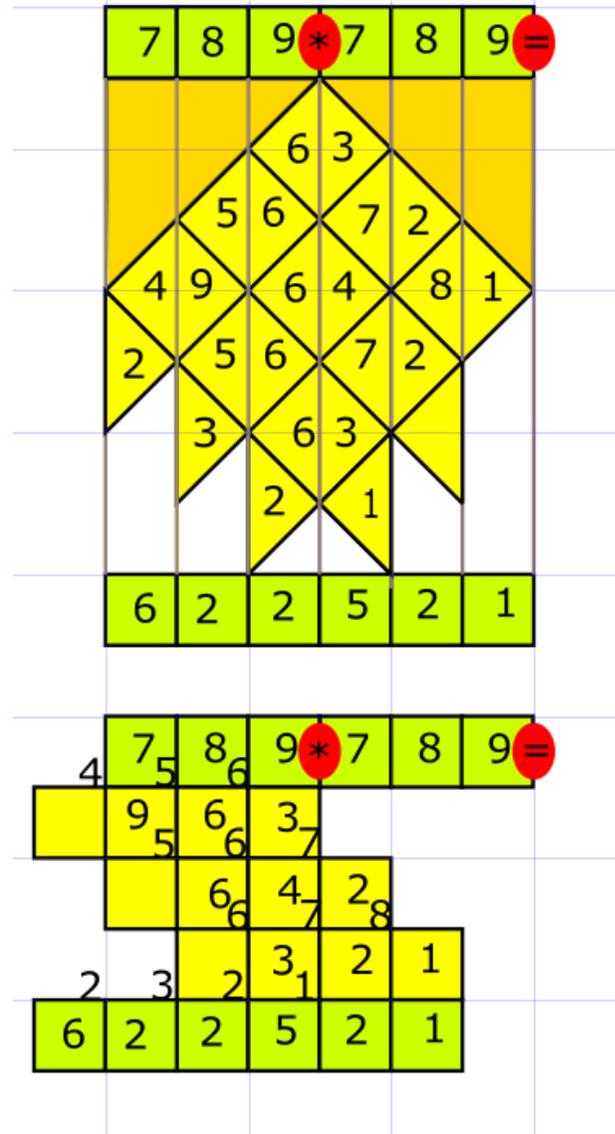
Fig. 2 Dimensions of perception eg. (1) Text (2) Picture (3) Video (4) Sensomotoric (Heiden and Oberlercher 2018) *

*Figure according to [HeB18a]

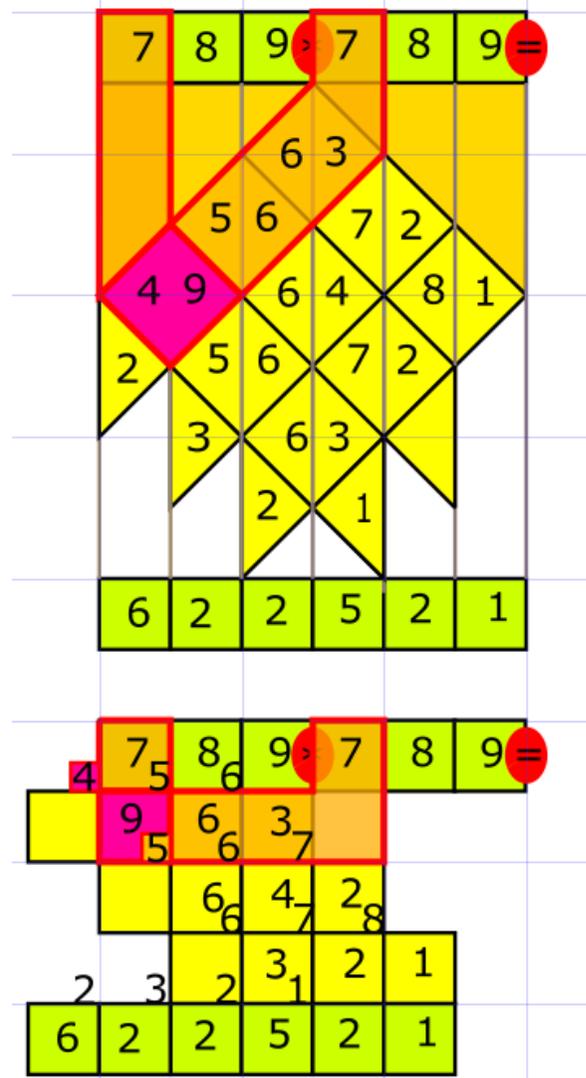
(2) Application 3 - Tulip Mathematics

- Example: $789 \cdot 789$

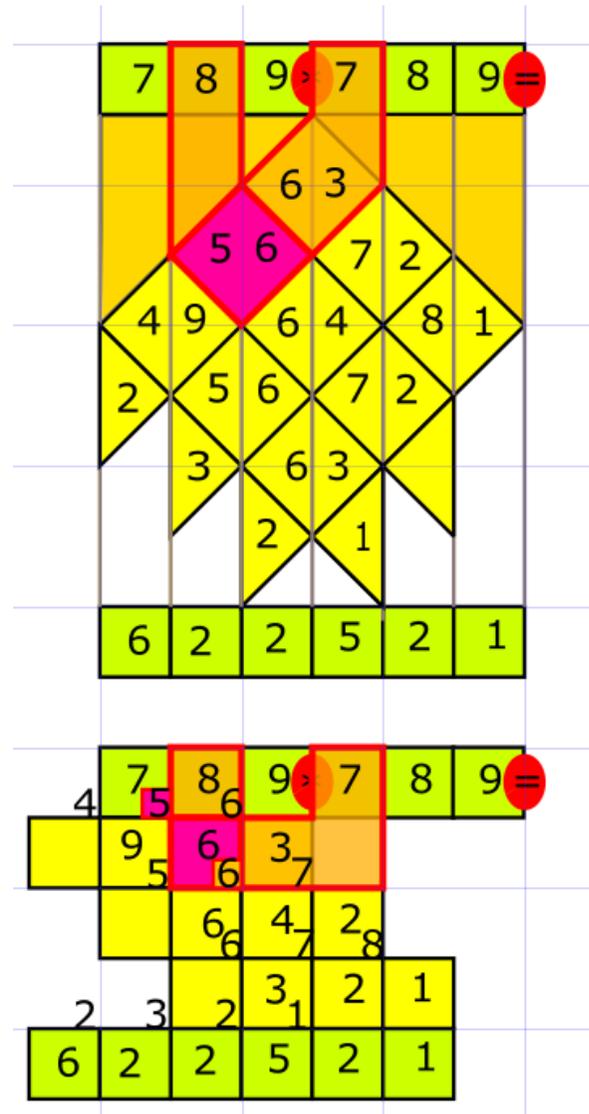
(2) Application 3 - Tulip Mathematics



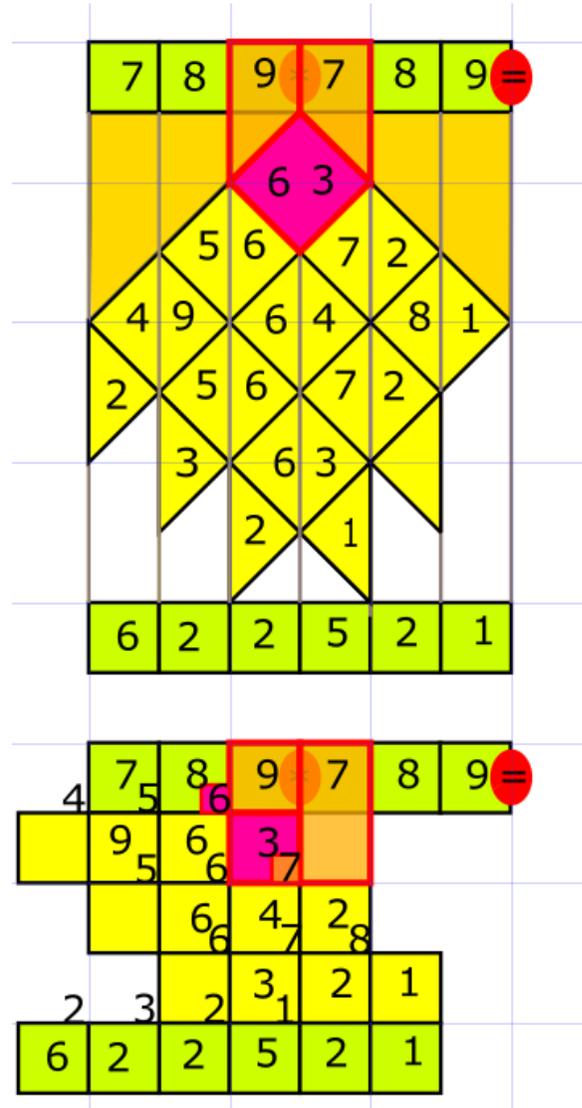
(2) Application 3 - Tulip Mathematics



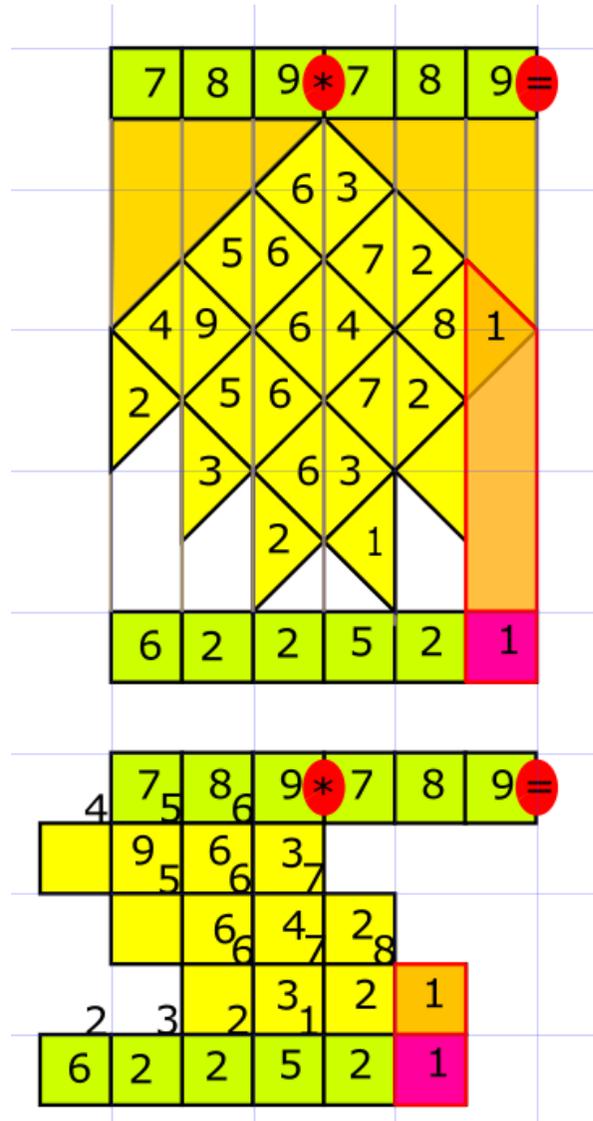
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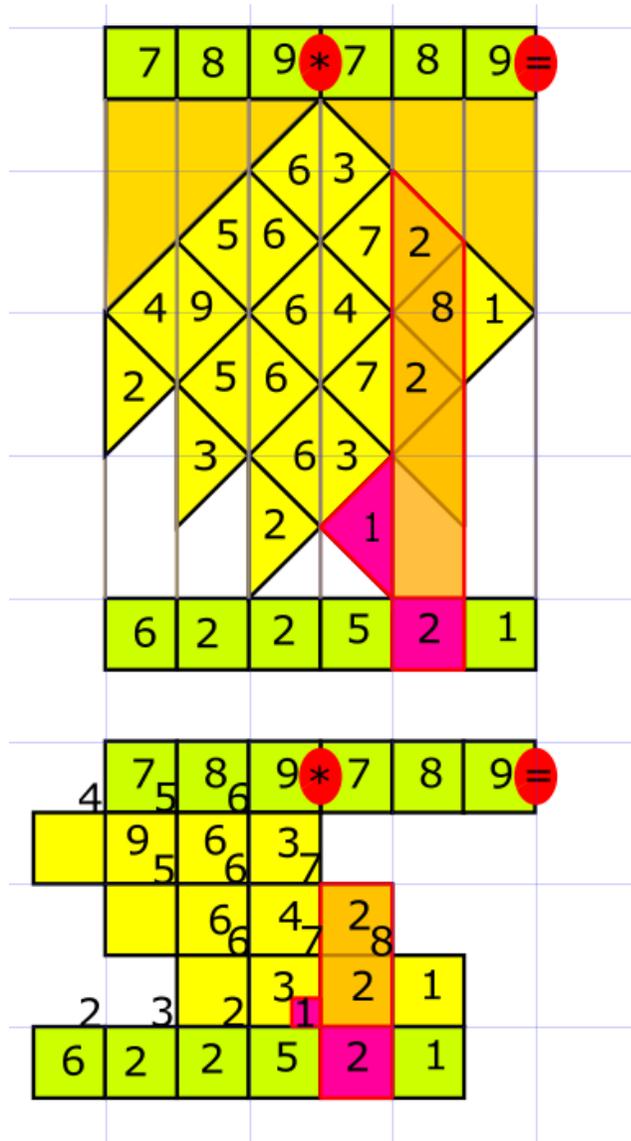
(2) Application 3 - Tulip Mathematics



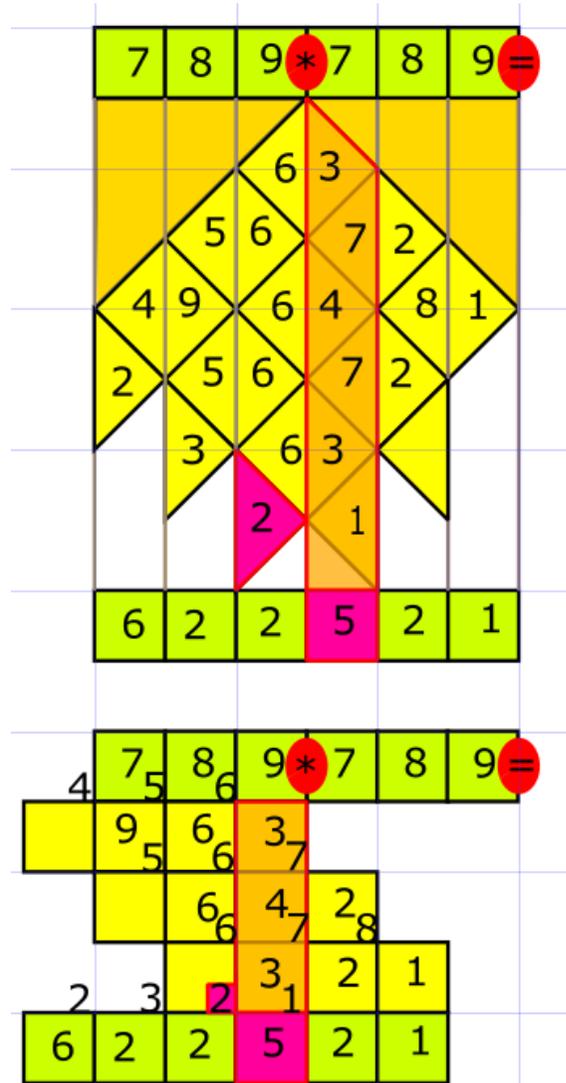
(2) Application 3 - Tulip Mathematics



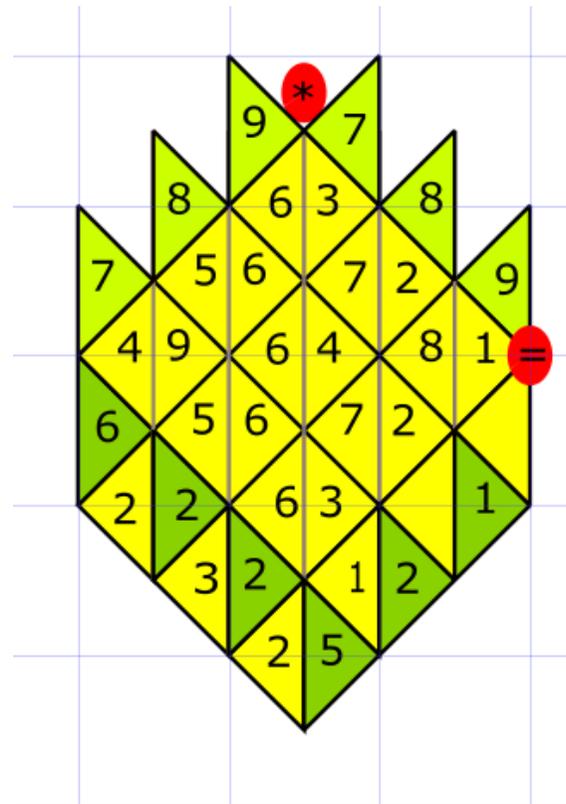
(2) Application 3 - Tulip Mathematics



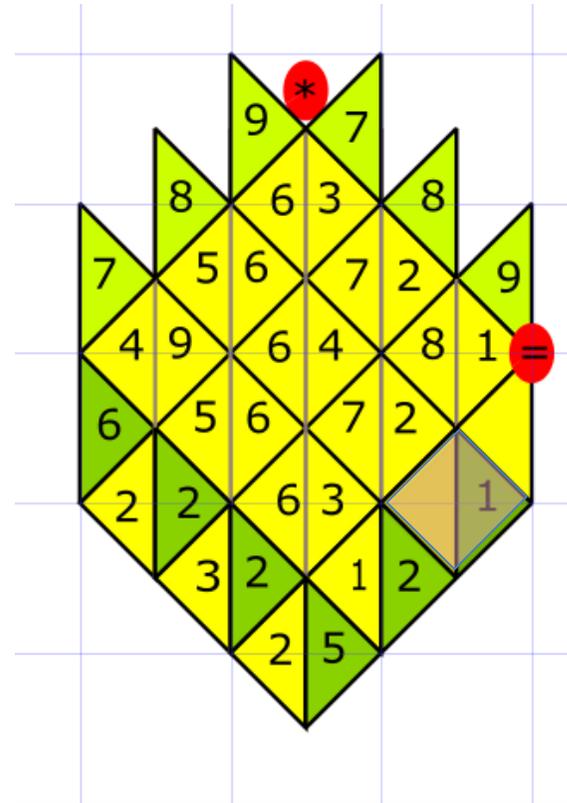
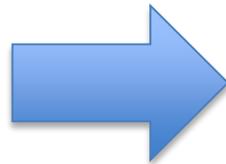
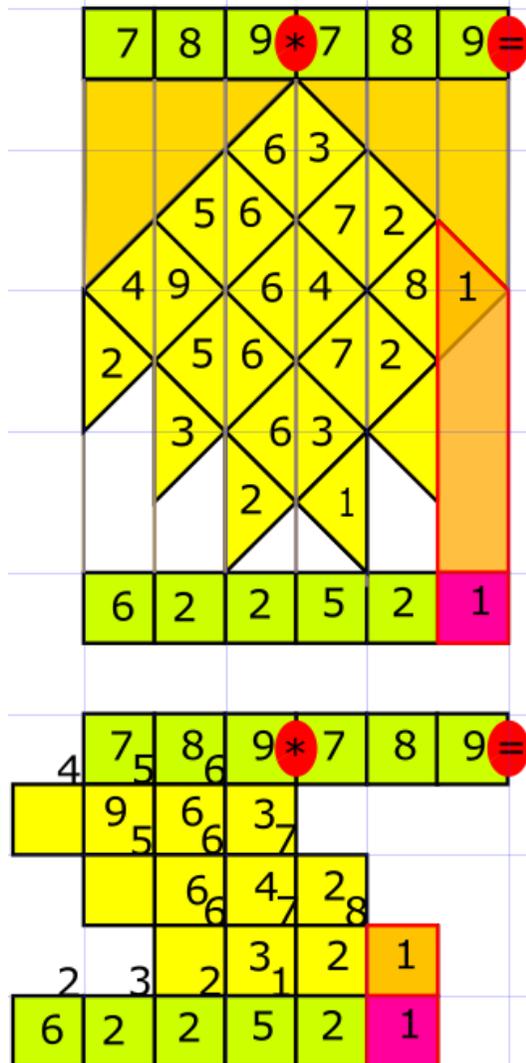
(2) Application 3 - Tulip Mathematics



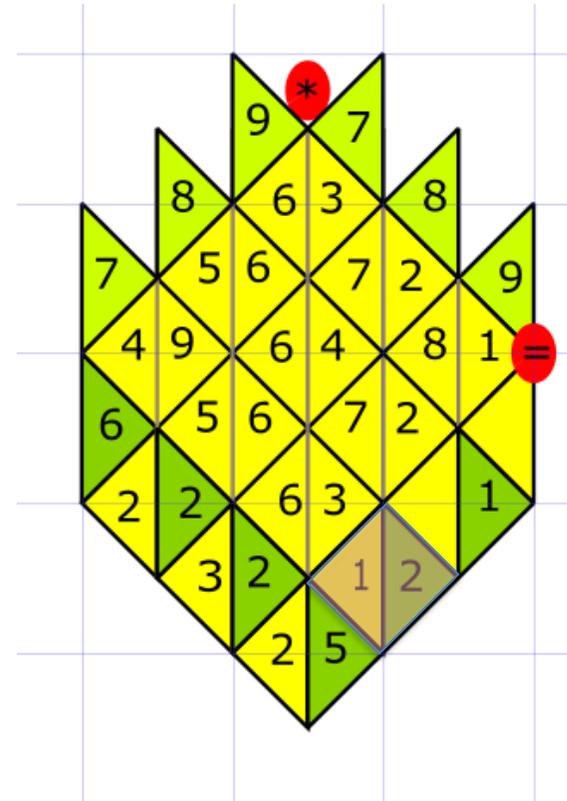
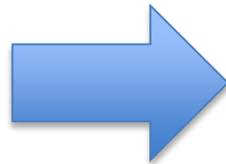
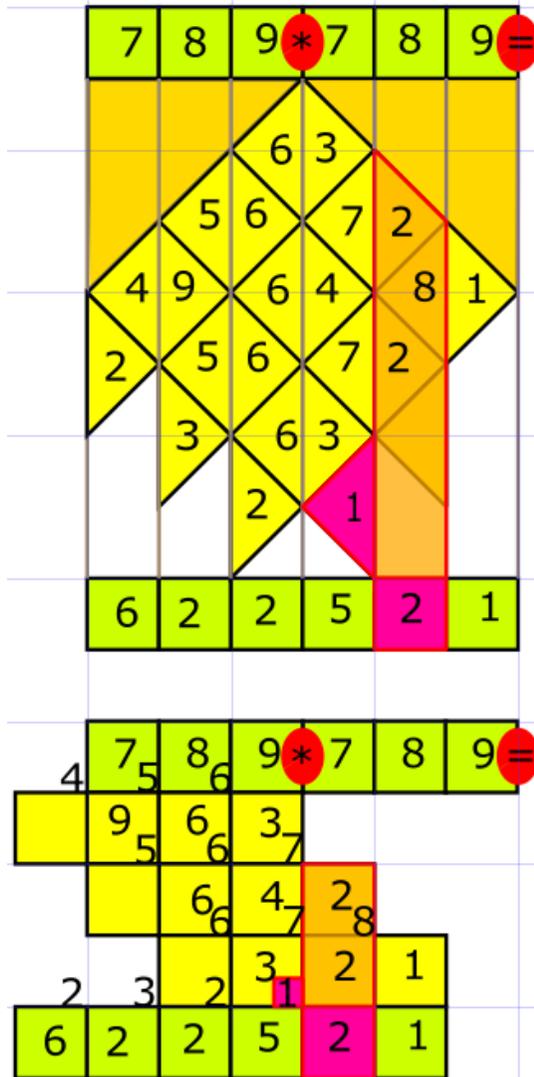
(2) Application 3 - Tulip Mathematics



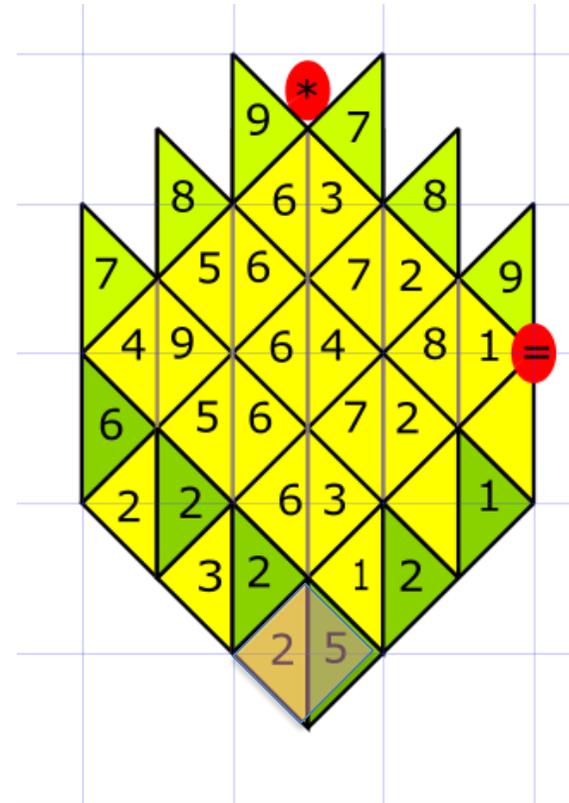
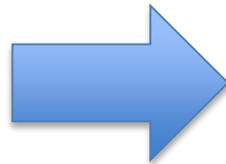
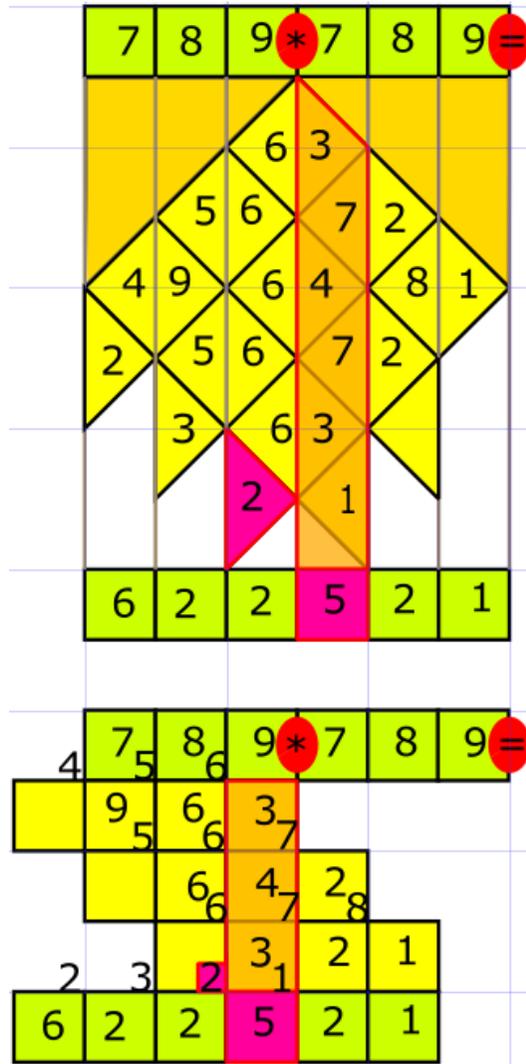
(2) Application 3 - Tulip Mathematics



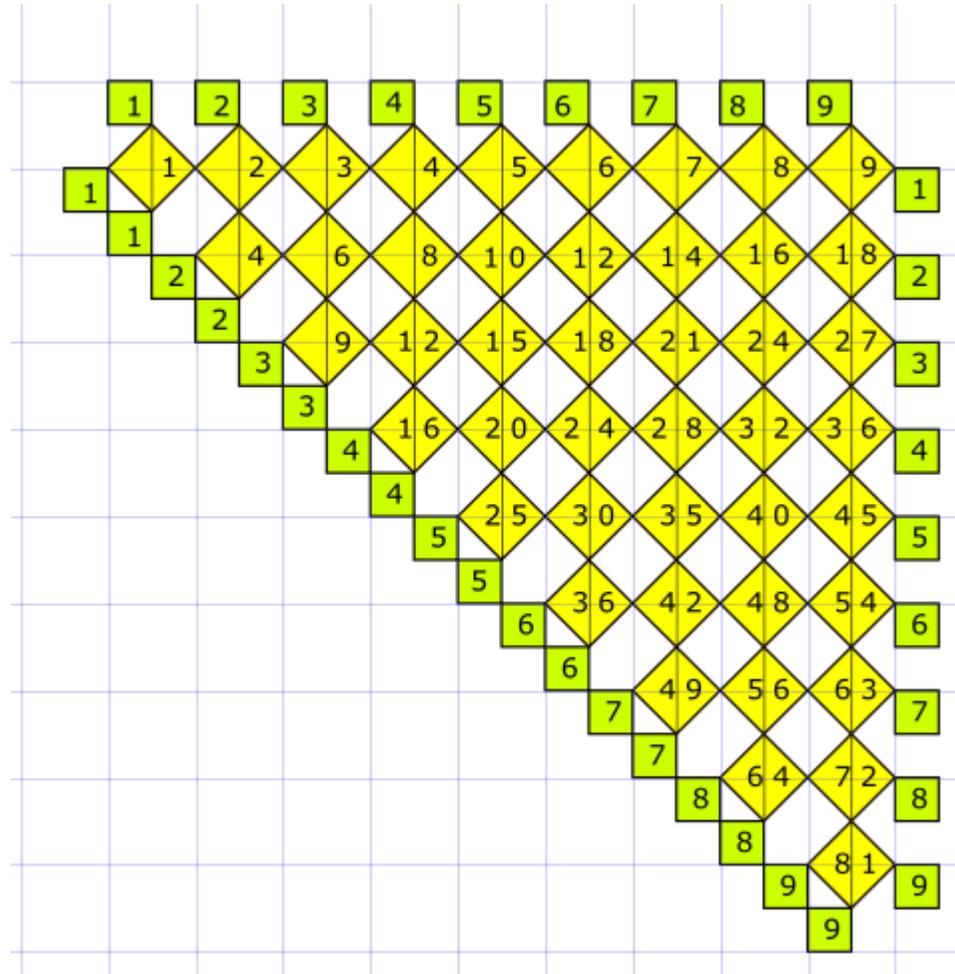
(2) Application 3 - Tulip Mathematics



(2) Application 3 - Tulip Mathematics



(2) Application 3 -Small 1x1 – with diamonds (rhombi)



(3) Conclusions from Generalized Montessori Principle applied to Tulip Mathematics

It is possible to use kinesthetic movement of parts

- The same process (multiplication) can be equivalently represented by the same *number size*
- The order of the process is a long term trajectory → intermediate results are stored in an (room time) order.
- This leads to better learning (more information in the environment available)
- There takes place an information density increase
- „interdisciplinarity“ between „hand“ and „eye“ is by means of „material and order“ -> biocybernetic feedback cycle
- Interdisciplinarity is possible by means of number containers

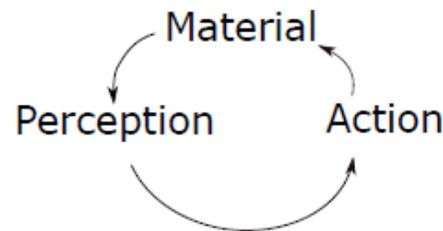


Fig. 3 Biocybernetics feedback cycle

(3) Conclusion

- „Making“ is a way to
 - connect the biocybernetics feedbackcycle better to humans,
 - learning is enhanced and
 - practical implementation of „compression of information“ takes place.

(3) Outlook: Tulip-Calculator I

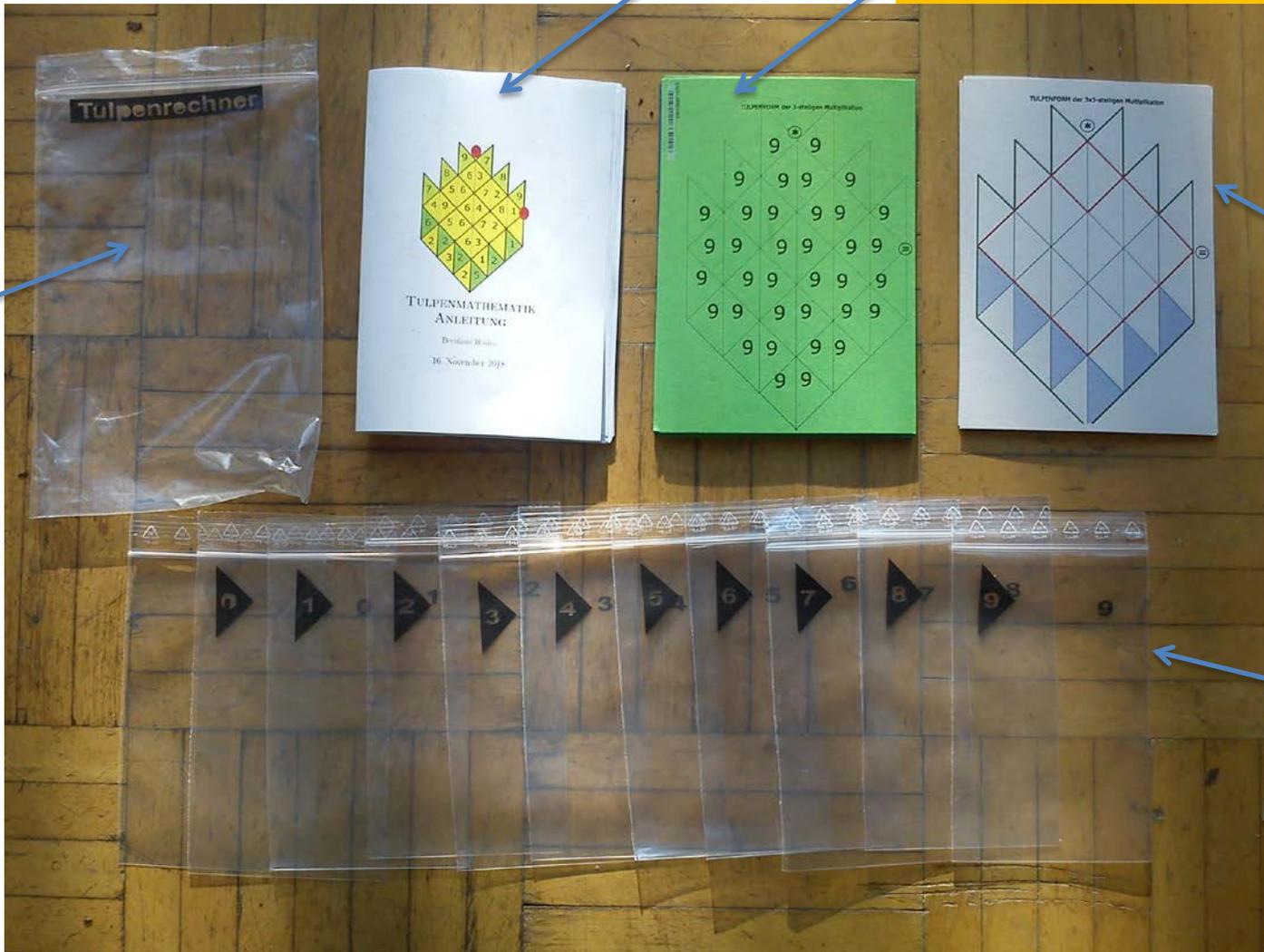
Manual

Set of precutted numbers

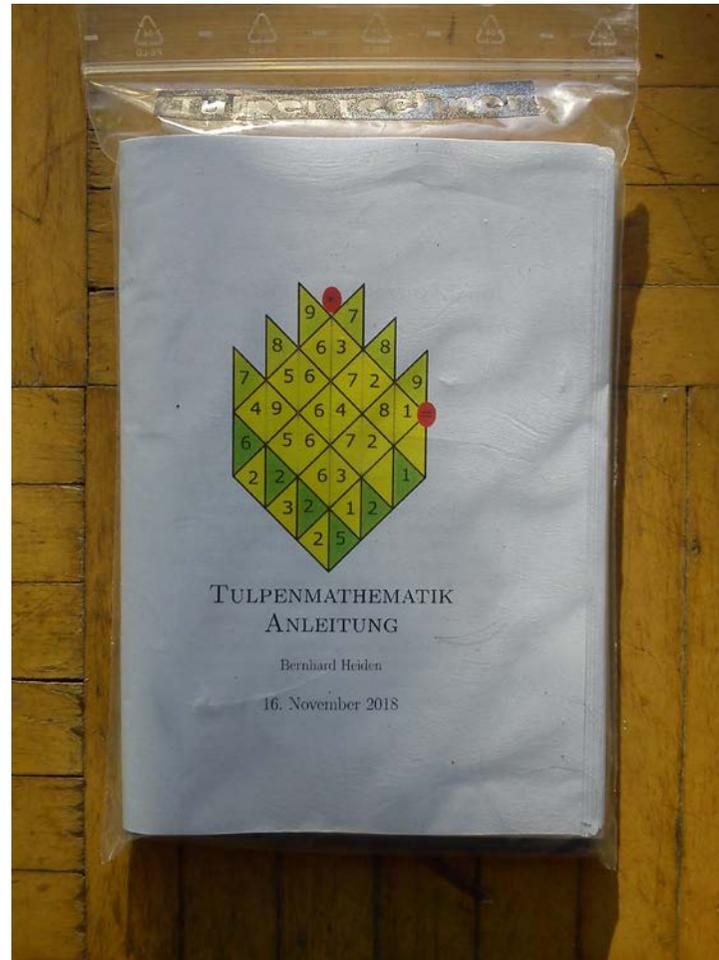
Storage Bag
for Tulip
Calculator

Guideline of
Calculations

Number of
Containers
for Ordering



(3) Outlook: Tulip Calculator II



Interdisciplinarity as an Approach of Unifying Science:

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3. Conclusion and Outlook

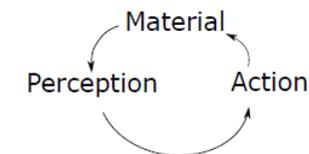
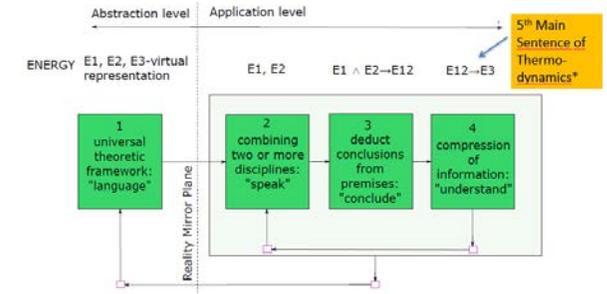
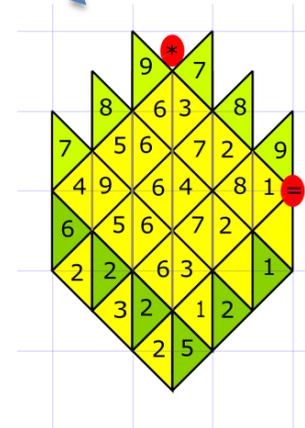


Fig. 3 Biocybernetics feedback cycle



Thank you cordially for attention!



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PS.: The presentation can later also be found at:
<http://www.dr-heiden.com/Vortraege.htm>

Used and Recommended Literature

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