



AN
AUDIOVISUAL ANALYSIS
OF THE GENETIC CODE

Signs and sign systems, i.e. codes, are part of our daily life. Some of them are simple and intuitively comprehensible. Others are complex and difficult to understand for non-experts. Nevertheless they play an important role in our everyday social life. A prominent example are the various codes used in digital information technology. These have been developed and optimised over decades and can be considered a major triumph of the human mind.

It is fascinating to realise that nature was a pioneer in that respect. The genetic code, basis of all life, is structurally very similar to the digital codes developed by humans and by now we understand how efficient and highly developed the genetic code is. In our bodies as much as in the bodies of all living beings processes analogous to processes in computers, which however seem to be rather abstract to most of us, constantly occur.

Aim of this work is to enable us to experience this fascination. To this avail the genetic code is analysed from the perspective of semiotics. Inspired by the code itself, a sign system is developed and used to display two important mechanisms of the genetic code, transcription and translation, as audiovisual processes. In particular this should make it possible to transport microscopic processes, usually invisible to us, into our macroscopic reality. This aim shall be achieved by an audiovisual room installation.

AN

AUDIOVISUAL ANALYSIS

OF THE GENETIC CODE

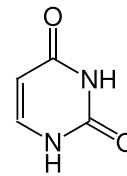
Change of sign system

Biology:

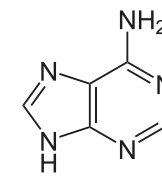
DNA system with the nucleobases Adenine, Cytosine, Thymine, Guanine (A, C, T, G) transcribed to RNA system with nucleobases Adenine, Cytosine, Uracil, Guanine (A, C, U, G).

New sign system: font «Base»

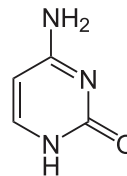
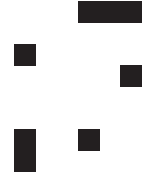
N becomes a square, NH a 2-square rectangle and NH₂ a 3-square rectangle. NH can be vertical or horizontal. O becomes a circle, in order to reflect the chemical distinction between O and N.



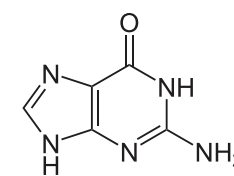
Uracil



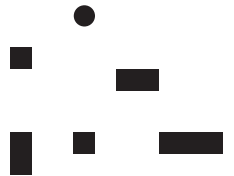
Adenine



Cytosine



Guanine



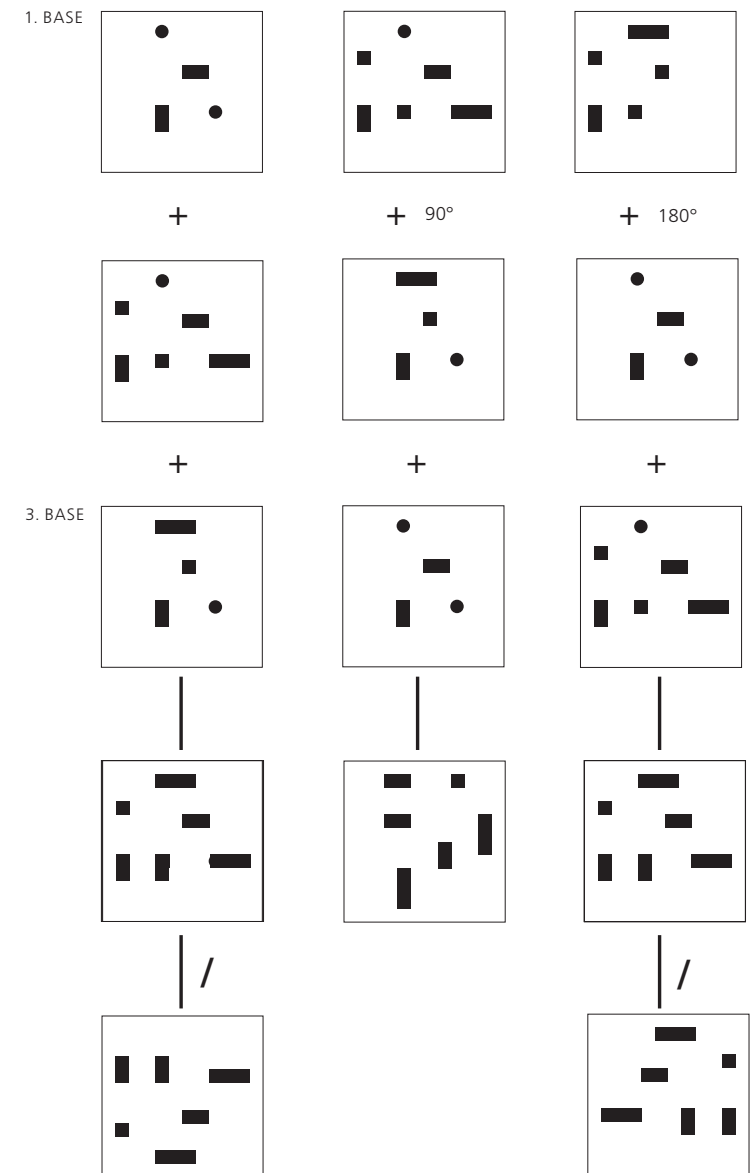
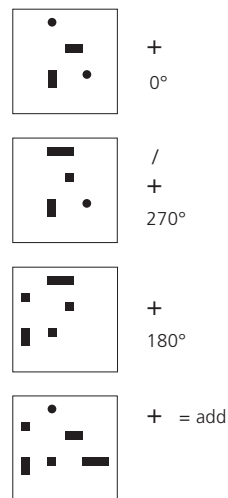
TRANSCRIPTION

Visual semantics: combination rules

1. rule: Select one of the many codons of the group of codons which biologically encode the same information, i.e. the same amino acid. Selection is done in such a way that the resulting audiovisual object differs from the one assigned to the other 19 codon groups.

2. rule: The three »Base«-Glyphs of a codon are added by overlaying them.

3. rule: The overlaid symbol is rotated clockwise depending on the first base (U = 0 degrees, G = 90 degrees, A = 180 degrees, C = 270 degrees). The rotated symbol is horizontally mirrored depending on third base (U, A = not mirrored, C, G = mirrored).



TRANSLATION

Acoustic semantics: score synthesis

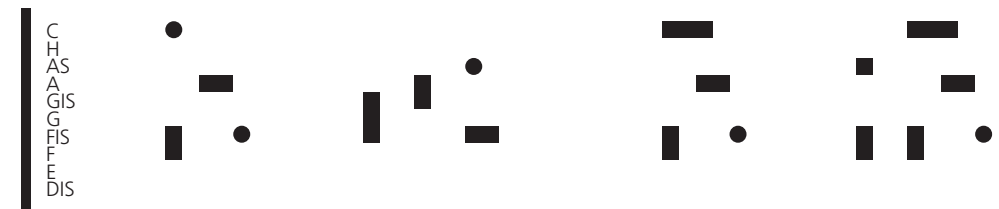
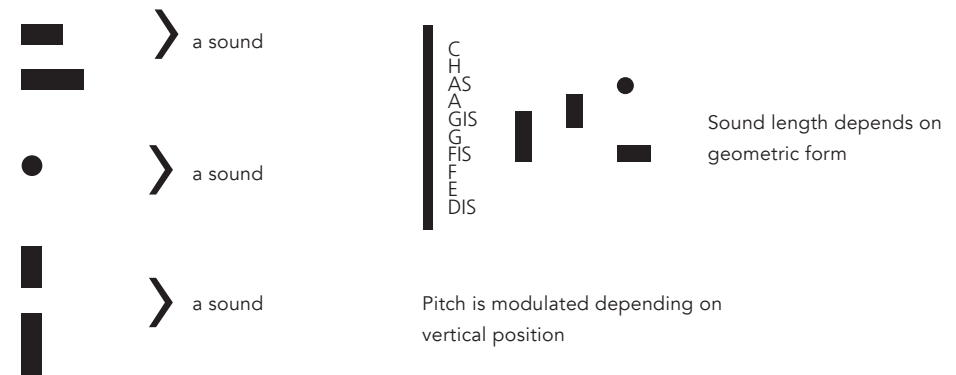
1. rule: The grid of the visual symbol is identified with a grid indicating pitch levels. The visual grid consists of 12 columns and 12 rows, meaning that 12 semitones can be encoded. The second row from the top is set as a "C".

2. rule: The geometric shapes are divided in three groups: horizontal shapes (square, horizontal rectangles), vertical shapes (vertical rectangles) and circles. Each group is assigned a specific sound, whose pitch is modulated depending on the vertical position of the shape in the symbol. The sounds are generated by software synthesizers selected and configured by myself.

3. rule: The sequence is read and played from left to right. The horizontal size of a shape determines the length of the sound played. The total horizontal size of the visual symbol corresponds to a full bar.

4. rule: There can be several sounds at different pitch level played simultaneously. These form harmonies.

These rules imply that in my interpretation of translation a musical piece is generated which is encoded in the long character string of »Base«-glyphs, corresponding to the biological mRNA.



TRANSLATION