



## **The story of the transformation of a board game into a computerized game**

**Markus Ulrich, Roger Tönz, Irene Haller, Hans-Peter Hutter,  
Florian Husmann, Peter Frischknecht**



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### **Contents:**

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- THE ORIGINAL: THE NEW COMMONS GAME
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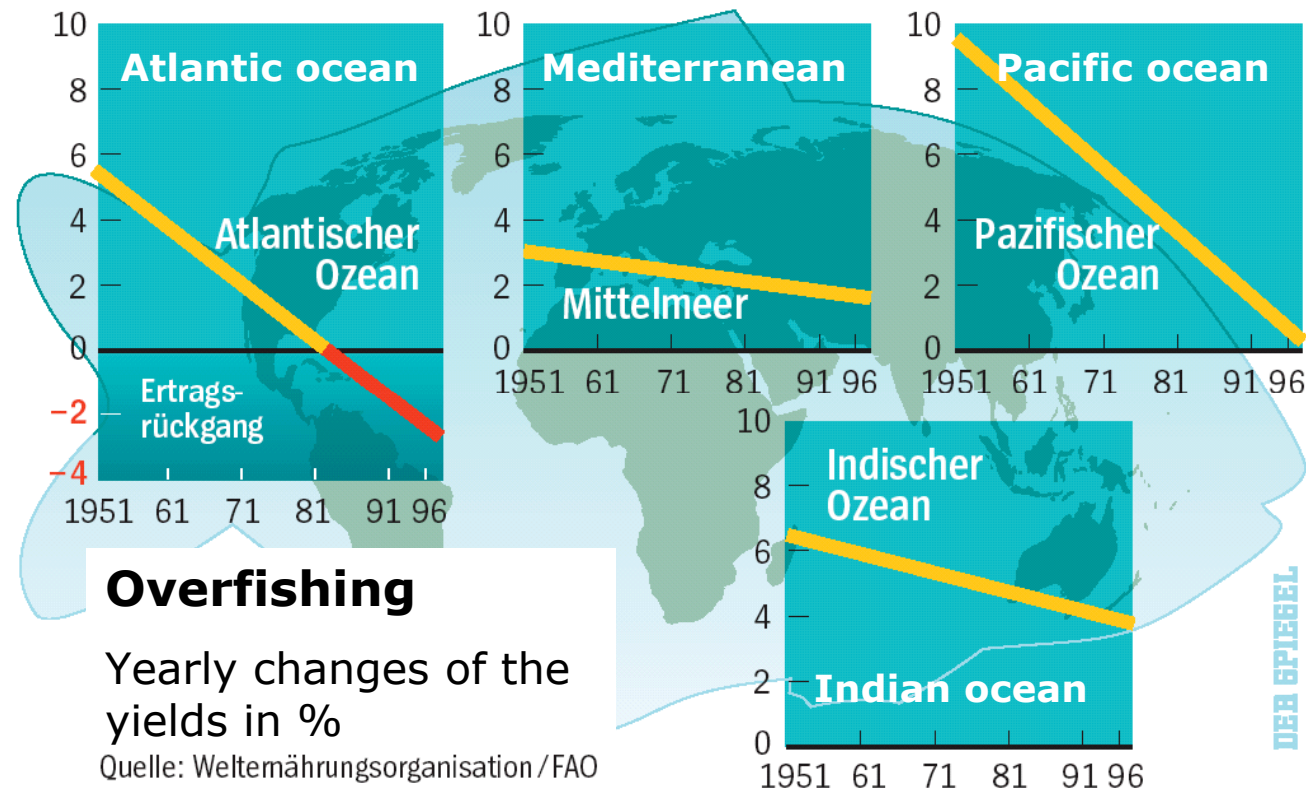
## The tragedy of the commons

- The „Tragedy of the Commons“ (Hardin 1968) is important for many systems.
- What is it?
  - Step **1**: Individuals take rational decisions (homo oeconomicus)
  - Step **2**: The consequences of these rational decisions add up
  - Step **3**: An irrational dilemma results for the entire group
  - Step **4**: The freedom may end tragically
- Example 1 →

## **Example 1**



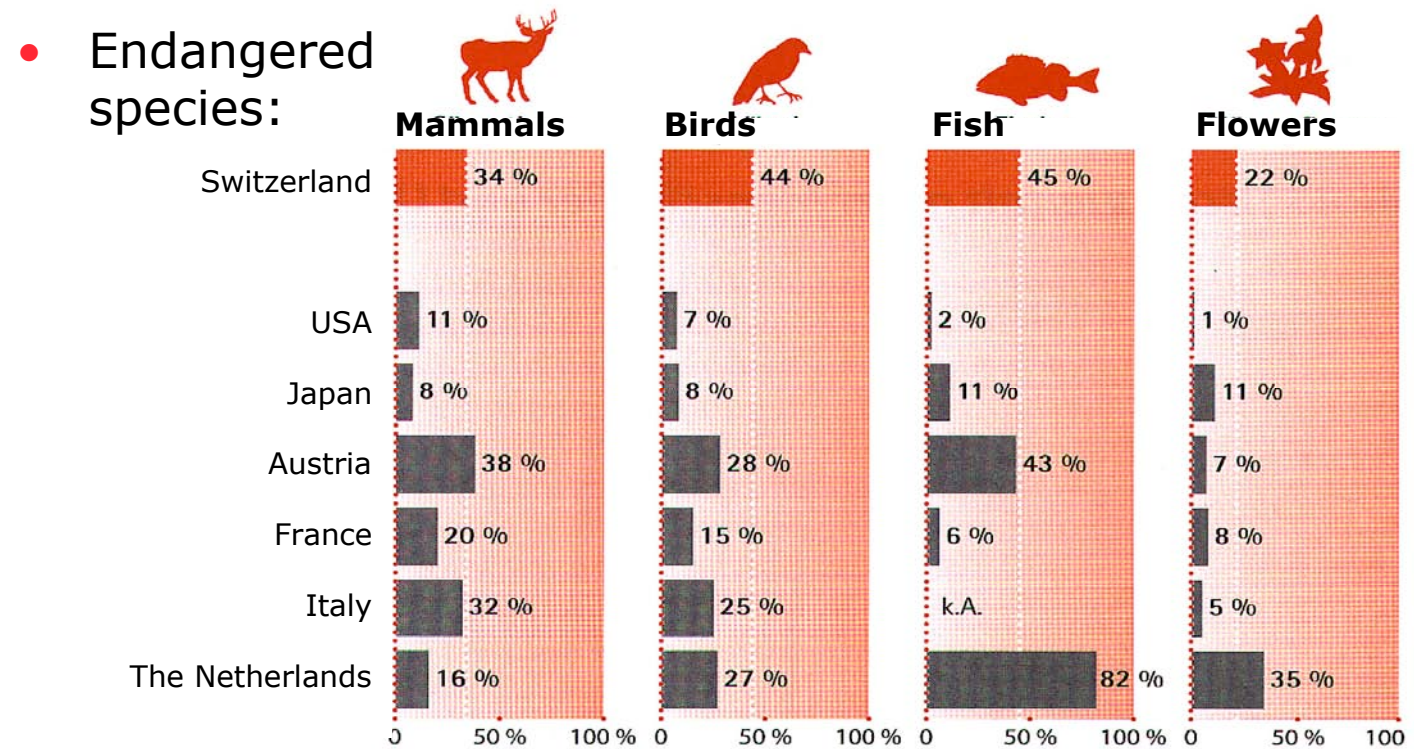
## Example 2: Fish catches in the world's oceans





## Example 3: Extinction of species

- UNO Millennium ecosystem assessment report:  
Frequency of species extinction of species: x 1000





## The original NEW COMMONS GAME by Richard Powers

- Board game
- 6-24 players act as fishermen / fisherwomen in 6-12 teams
- Objective 1: To experience the tragedy of the commons and to learn how to overcome the dilemma situation.
  - To convey the systemic nature of resource management,
  - To shift the focus from individual behavior to a systemic view, to measures that reduce the risk of destruction of the resource.
- Progression in fast rounds, 15-60 rounds
- 5 choices to exploit the resource →



## THE NEW COMMONS GAME: The choices



Blue: Punishment for Red



Red: Maximal yield, affects the resource



Green: Sustainable yield, no impact  
on resource



Orange: Incentive for green



Yellow: Pension, minimum yield





## **THE NEW COMMONS GAME**

### **by Richard Powers**

- Communication within the game:
  - Start: no communication
  - Later: short conferences in regular intervals
- Objective 2 (within the game):
  - every team maximizes its point earning
- 90 minutes to 3 hours



## The original NEW COMMONS GAME



**State of the resource indicator**

**Participants behind shields**





## Examples for the utilization of the original NEW COMMONS GAME

- ETH Zurich:
  - Welcome weekend for 100-150 new students of environmental sciences
    - **Objective:** System thinking + unfreezing
- University Winterthur:
  - Project week on Sustainable Development (100 students)
    - **Objective:** Set a common ground + unfreezing
- University of Applied sciences in Zurich:
  - Course in ecology, up to 200 students
    - **Objective:** Mutual dependence of structure and action, institution transformation



## ETH Zürich: 150th anniversary, public science exhibition

- **The idea:** to transform the original NEW COMMONS GAME into a computer game for the exhibition
- **Objective:** to promote the system-oriented disciplines of natural sciences at ETH Zürich using a computer game based on sound theory



## The challenge 1:

- Visitors spend only 5-10 minutes for the game
- Visitors deliberately enter and quit the game
- Visitors shall not communicate with each other
- No organized debriefing



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  - Strategies proposed by computer
  - Specific feedback on compliance
- No organized debriefing
  - Detailed automated evaluation
  - Students assist visitors



## The challenge 2:

### Visitors should get insights quickly:

- Software shows **two** perspectives:
  - **Within** game:  
6 players play on 6 separated computer station:
    - Immersion
    - Only limited information
  - **Observer**: Visitors can observe the course of the game:
    - Distant view
    - Full transparency



## The challenge 3:

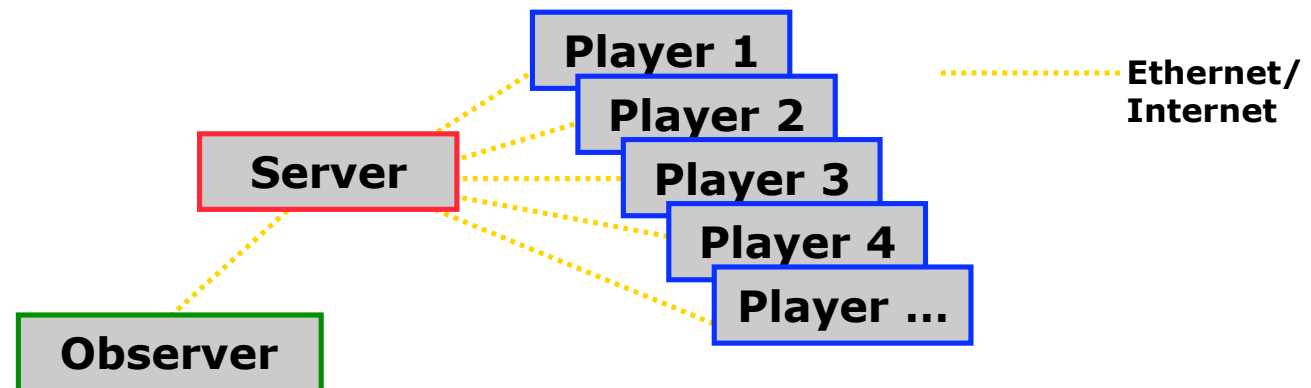
### Lucid metaphor:

- Additional features:
  - Four different systems:
    - Water
    - Air
    - Soil
    - Living beings (creatures)
  - One common resource.



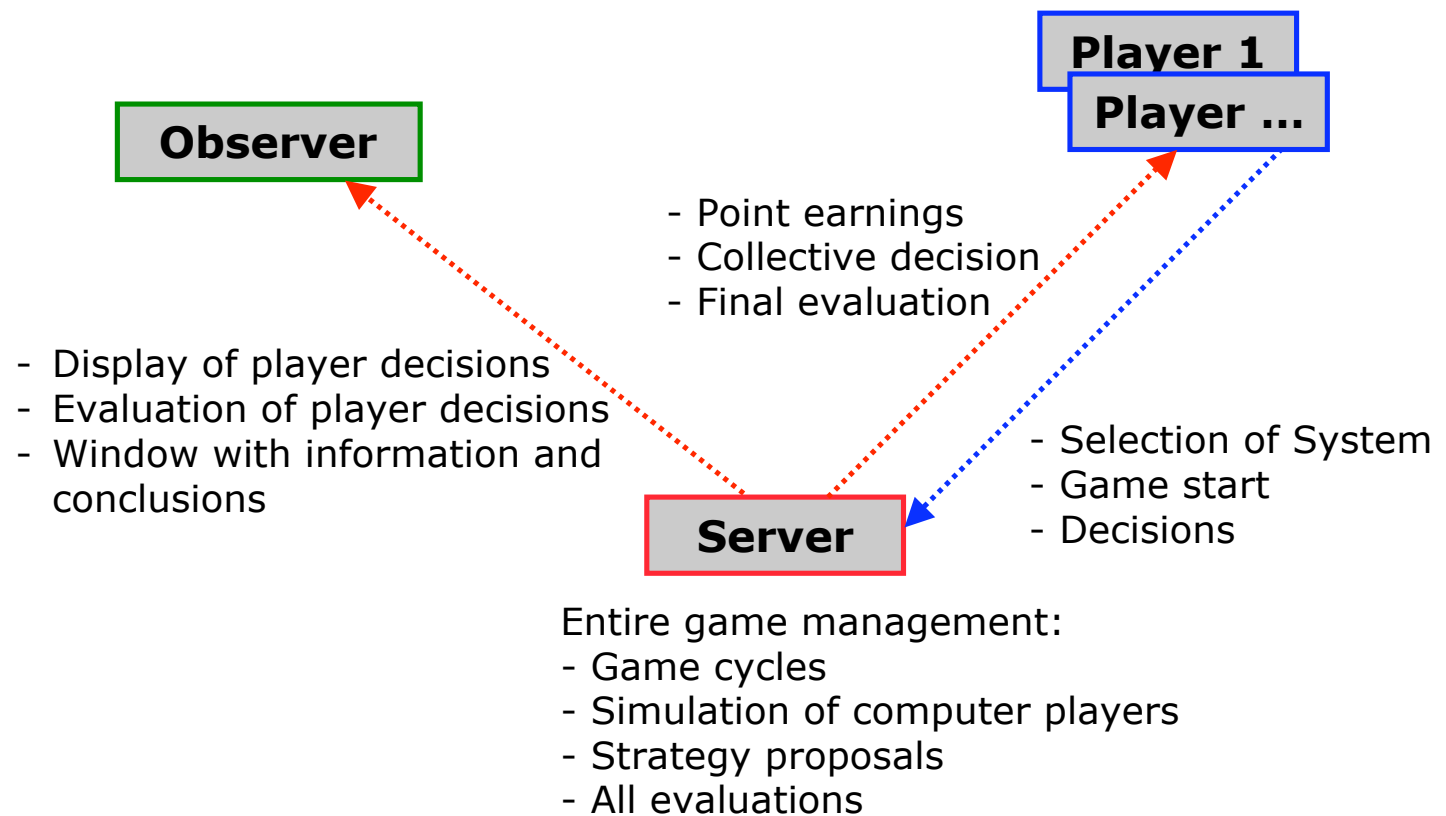
## The implementation of SUSTANIA

- Implementation with Java
- Configuration with XML-Files:
  - Situations
  - Strategies proposed to players
  - Information window
- Architecture:





## The implementation of SUSTANIA





## The exhibition "Feuer Erde Wasser Luft"





## Demonstration

- Server
- Players:
  - 3 real players
  - 3 computer players
- Observer screen providing full information about the course of the game



## Demonstration: Players (Client Screen)

**SUSTANIA**

SUSTANIA ist das Spiel der natürlichen Lebensgrundlagen. In diesem Spiel nutzen Sie und die anderen Spieler und Spielerinnen (real oder im Computer) eine gemeinsame Lebensgrundlage und erhalten dabei Punktegewinne. Wer am Ende am meisten Punkte hat, gewinnt das Spiel.

Jedes Mal, wenn eine Spielerin oder ein Spieler einen maximalen Punktegewinn für sich herausholt, verschlechtert sich die Lebensgrundlage. Die Punktegewinne sinken, und langfristig verlieren alle.

Es braucht einen massvollen Mix aus Gewinnstreben und Zusammenarbeit. Dabei helfen Belohnungen und Strafen, die Sie verteilen können und die Strategien, die das Spiel von Zeit zu Zeit vorschlägt.

Viel Erfolg!

Deutsch | English  
Impressum

German version

English prototype version

**SUSTANIA**

SUSTANIA is the game of the natural resources. Your goal is to obtain high point earnings AND to conserve the resources. This is tricky. High earnings destroy the resource. Long-term strategies only provide moderate earnings. They are successful only if supported by all players. The available incentive and punishment choices may help you to get the support of other players. Furthermore, comply whenever the game suggests a common strategy. Take the chance!

Deutsch | English  
Impressum





# Demonstration: Observer Screen

German version

English prototype version

**SUSTANIA: For how long will this world survive?**

**SUSTANIA is the game of the natural resources**  
In the game SUSTANIA, the players at the computers choose one out of five colors in every round. Each time, they decide on a specific situation:

They do either consider long-term aspects, and preserve the resource. Or, they maximize their point earnings, as everybody needs points to live on. However, this affects the resource. Let's see what will happen...

**Available choices and point earnings**

- BLUE** is the long-term choice. It preserves the resource in the long-run, point earnings are lower. 75 to 160 Pts.
- YELLOW** yields maximum points, but it affects the resource. Warning: penalty, if others choose RED. -50 to 250 Pts.
- GREEN** activates a bonus for those who choose BLUE. The costs for GREEN are shared among all who choose GREEN. -60 to -10 Pts.
- The RED choice fines those who choose YELLOW.** The costs for RED are shared among all who choose RED. -60 to -10 Pts.
- GREY** yields a minimum of points. A minimal pension, helpful when the resource is low. 25 Pts.

**Evaluation of the course of the game**

**Natural resources**

Remaining time, round 14

10"

**Natural resources**

35

0 70

Trend: constant

**Choices of the players**

Station 1  
Station 2  
Station 3  
Station 4  
Station 5  
Station 6

**Satisfied players**

all  
nobody

**Strategy: Proposal**  
(en)Der Erhalt der Lebensgrundlage soll sichergestellt werden. Der Reihe nach soll eine Spielerin ROT, eine andere GRÜN und die restlichen BLAU wählen. So wird BLAU (langfristige Nutzung) gefördert und die Ausbeutung (GELB) bestraft.

**SUSTANIA: Wie lange überlebt diese Welt?**

**SUSTANIA ist das Spiel der natürlichen Lebensgrundlagen**  
In SUSTANIA geht es um die Balance zwischen Profitmaximierung und Erhalt der Lebensgrundlage. In jeder Runde sehen die Spieler eine konkrete Situation und entscheiden sich für eine von fünf Wahlmöglichkeiten. Mit einem massvollen Mix aus Gewinnstreben und Zusammenarbeit, aus Belohnungen und Strafen können alle gewinnen.

**Wahlmöglichkeiten und Punktzahl**

- BLAU erhält die Lebensgrundlage,** aber gibt weniger Punkte; Bonuspunkte bei GRÜN. 75 bis 160 Pts.
- GELB schädigt die Lebensgrundlage,** aber gibt maximale Punkte; Strafe bei ROT. -50 bis 250 Pts.
- Wer GRÜN wählt, belohnt BLAU** und bezahlt dafür mit eigenen Punkten. -60 bis -10 Pts.
- Wer ROT wählt, bestraft GELB** und bezahlt dafür mit eigenen Punkten. -60 bis -10 Pts.
- GRAU gibt minimale Punkte** und sichert das Überleben bei schlechter Lebensgrundlage. 25 Pts.

**Auswertung des Spielverlaufs**

**Lebensgrundlage**

70  
0

**So wurde gewählt**

Konsole	1	2	3	4	5	6	Pts.
1	BLAU	BLAU	BLAU	BLAU	BLAU	BLAU	120
2	BLAU	BLAU	BLAU	BLAU	BLAU	BLAU	120
3	BLAU	BLAU	BLAU	BLAU	BLAU	BLAU	120
4	BLAU	BLAU	BLAU	BLAU	BLAU	BLAU	120
5	BLAU	BLAU	BLAU	BLAU	BLAU	BLAU	120
6	BLAU	BLAU	BLAU	BLAU	BLAU	BLAU	120
<b>Zufriedene Spielerinnen und Spieler</b>							<b>540</b>

**Wahl optimiert**

120  
-60  
120  
120  
120  
120  
**540**

**Langfristig möglich**

250  
100  
100  
100  
100  
100  
**750**

**Auswertung von Runde 17**

**Lebensgrundlage**

35

0 70

Tendenz: konstant

**Allgemeine Empfehlung**  
Den Spielern wird in dieser Runde keine bestimmte Farbe zur Wahl empfohlen.

**Rekorde früherer Welten**

- 16 Runden, 26.11.2006
- 16 Runden, 26.11.2006
- 3 Runden, 26.11.2006

**Optimierte Wahl**  
Oft liegt der totale Punktegewinn der Gruppe unter dem möglichen Maximum ("Wahl optimiert", links unten, während der Auswertung von Runden ohne Strategievorschlag).

Dies geschieht, wenn die Entscheidung nicht abgestimmt werden können. Der totale Punktegewinn ist z. B. vermindert, wenn in einer Runde mehrfach ROT oder GRÜN gewählt wird.

**Qualität Quantität und Sicherheit von Nahrungsmitteln**

**Das ist Thema im Studiengang**

**LEBENSMITTELWISSENSCHAFTEN AN DER ETH ZÜRICH**

**ETH**  
Eidgenössische Technische Hochschule Zürich  
Swiss Federal Institute of Technology Zurich



## Conclusions

- Feedback of visitors and students:
  - Approx.  $\frac{3}{4}$  “got the message”
  - Interesting discussions
  - About 10% highly interested (kids, teachers)
- Personal conclusion:
  - Fascinating speed of computerized game
  - Computerization: access to new audience
  - Extreme richness of “simple” board game
  - Tradition or innovation?



## Future

- ETH Zurich:
  - Online version of the game (will become available early 2007, [www.sustania.ethz.ch](http://www.sustania.ethz.ch))
  - Demonstration at the days for interested young highschool students
- Environmental education
  - Additional material?
  - Multiple languages?
  - Partnership with regional organizations?



## Discussion