

ENergy LITE racy WEEK

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Interpreting Free Energy as a System Capability Measure

ORGANIZED BY



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IN COOPERATION WITH



REPUBLIKA SLOVENIJA
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Introduction

*If somebody asked you for some money,
how much money would you give to that person?*

Outline

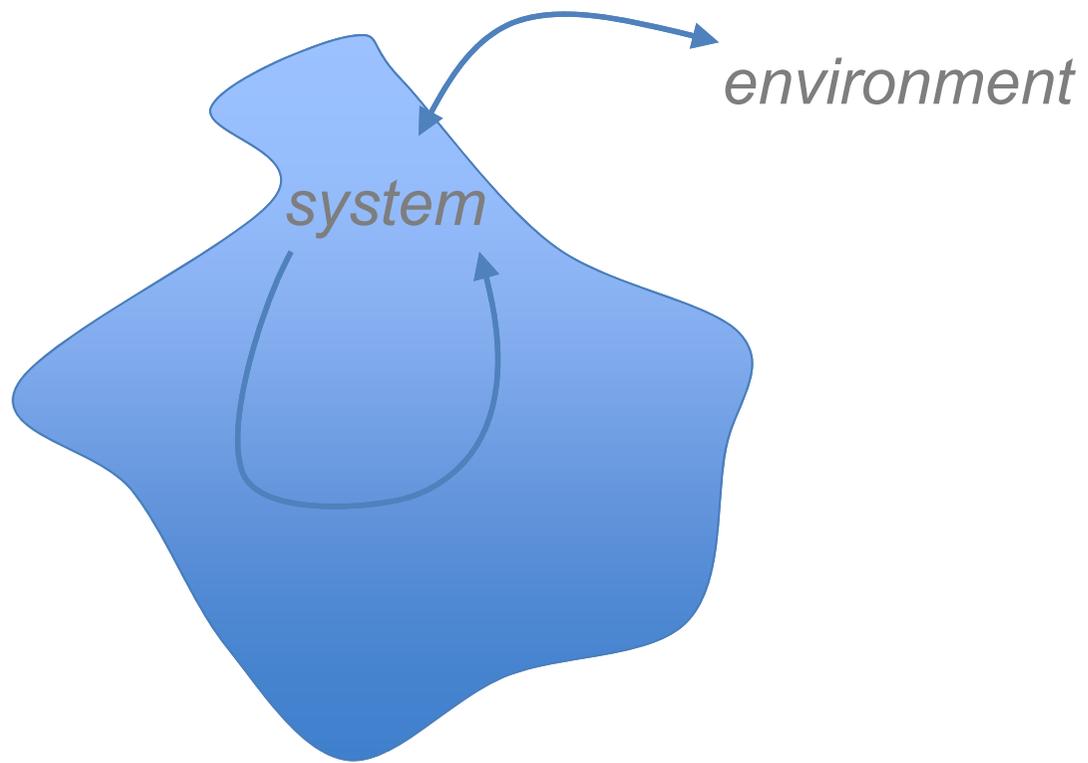
Introduction

Social free energy

Example of simulations

Conclusions & perspectives

Social free energy



Among a variety of other characteristics ...

... system has structure (institutions, ...) and dynamics

*... environment has complex, partially predictable dynamics
i.e. uncharacterised dynamics*

and that structure and dynamics are intertwined!

Example: fire protection service





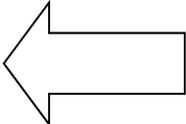


Conclusion of the example

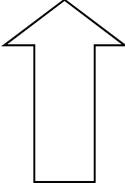
*established firemen service
Is a response of a society
to a part of environment dynamics*

*that response minimises negative impact of
recognised environment influence
and enables the society to develop further*

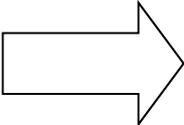
Development



*Firemen
service*

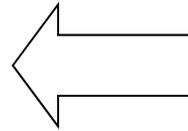


Fire

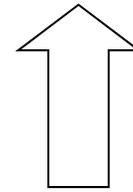
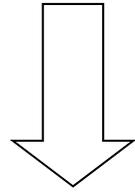


*Fire
protection
measures*

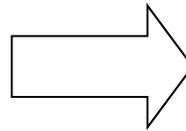
Development



Structuration



*Recognised
environment
influence*



*Resource
collecting for
its optimisation*

Question

How can we systematically approach that matter?

*Is there some general relation among system's resources, needs and environment, which states what structures (e.g. institutions) and thereby realised adaptation level **are possible?***

Sociophysics is a discipline which interprets societal phenomena using formalism of theoretical physics

Suggested introductory literature:

Modelling the distribution of money in society

(A. Dragulescu, V. Yakovenko)

Analysing ethnic processes

(J. Mimkes)

Comparison of social and physical free energies on a toy model

(J. Kasač, H. Štefančić, J. Stepanić)

Social free energy

F – total amount of resources extractable from a society without change of its structure

$$F = U - T \cdot S$$

totality of resources

intensity of actions

diversity of actions

Notions, such as

- *group (ethnic, ...)*
- *individual*
- *wealth*
- *money*
- *profit*
- *....*

are interpreted in terms of

- *system*
- *agents/entities*
- *energy*
- *mediator*
- *free energy*
- *.... a measure of adaptation*

Topics to be considered in each & every case:

- inclusion of too many physical quantities without detailed understanding*
- starting from inappropriate set of quantities*
- problem of measuring*

J. Stepanić, G. Sabol, M.S. Žebec: Describing social systems using social free energy and social entropy. Kybernetes 34(5-6), 857-868, 2005.

Example of simulations

numerical simulations of agent-based model of simplified (!) society

short description

- *agent collect resources in regular time intervals*
- *quantity of collected resources is stochastically modelled*
- *agents consume some resources, and **donate** part of other resources*

- *agents which have less than some prescribed value of resources are considered poor, and other rich. In donations rich agents give part of their resources to poor agents*

idea

1. calculate free energy as a purely physical quantity, using prescribed formulas

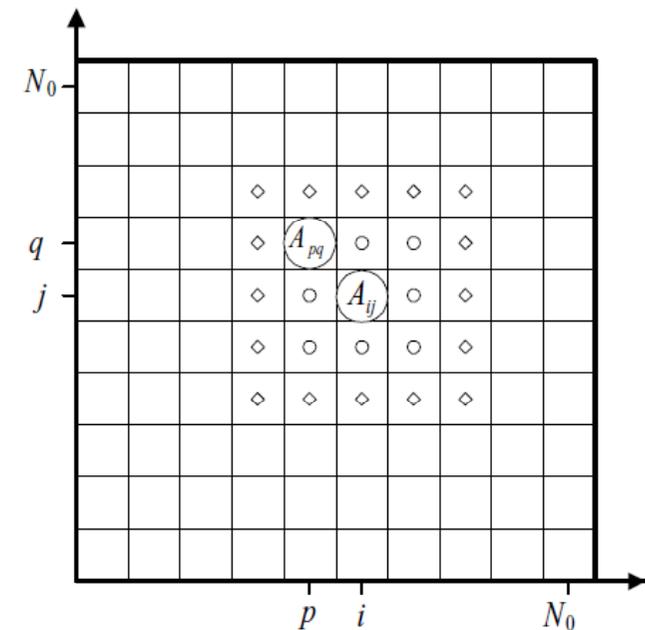
$$\rightarrow F_1$$

2. determine surplus of resources

$$\rightarrow F_2$$

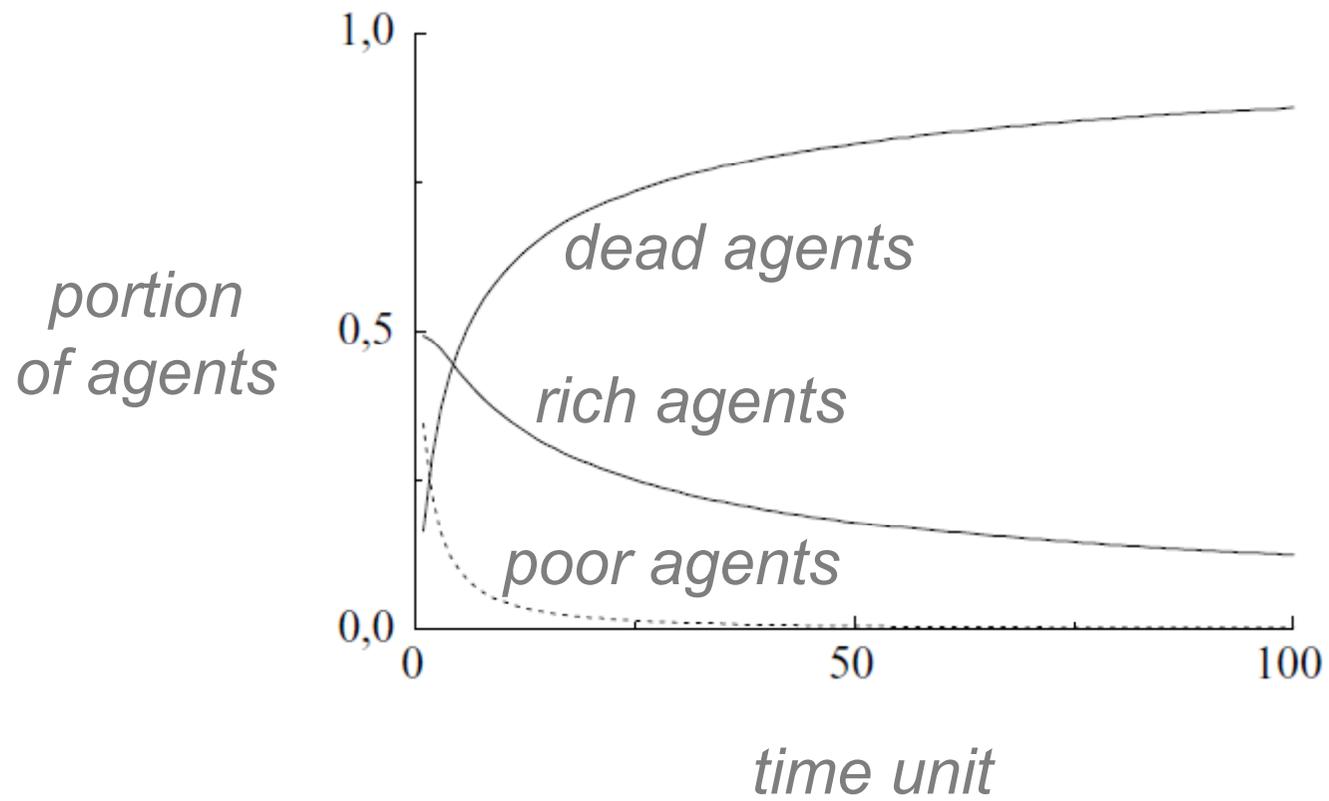
Remarks:

- during 1. we do not consider what is the meaning of some part of resources*
- during 2., we do not consider any of prescribed formulas, we just add surpluses*



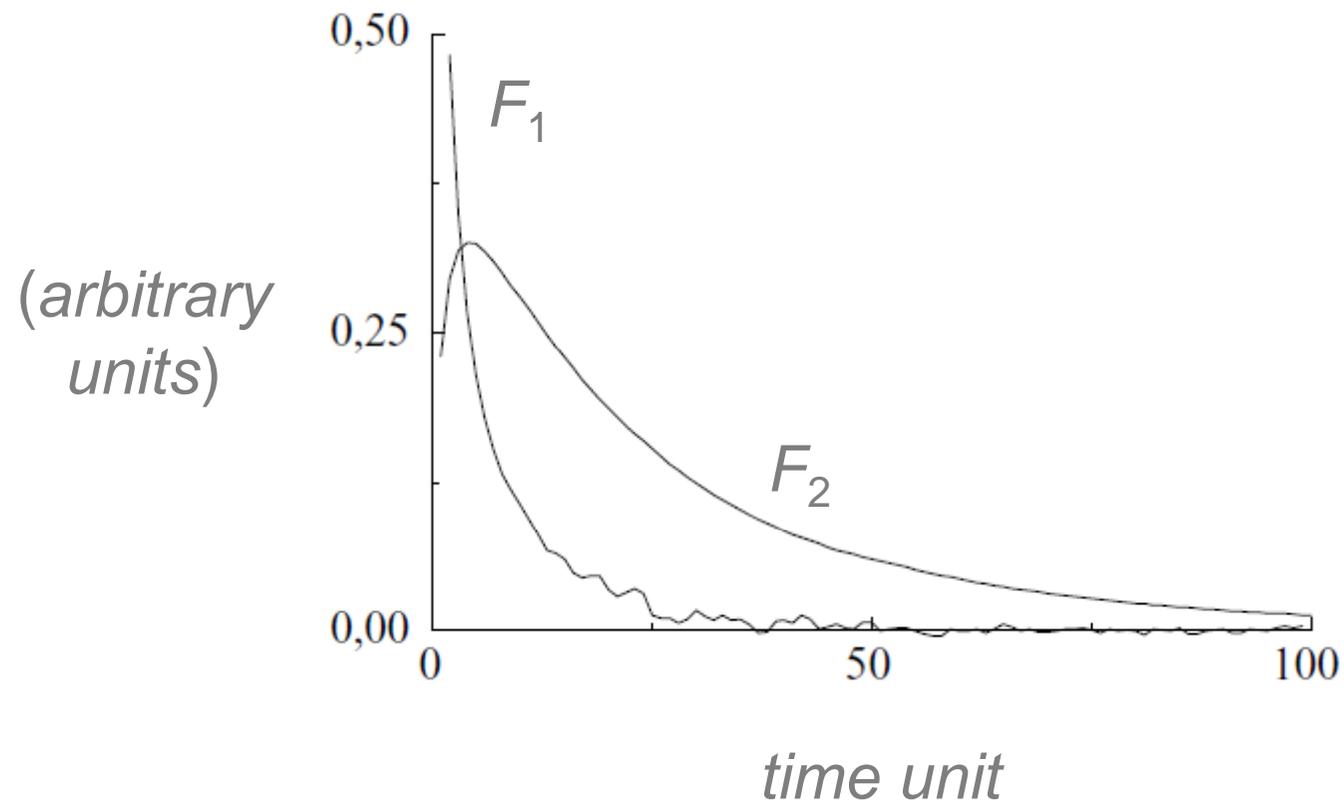
question

are F_1 and F_2 equal?



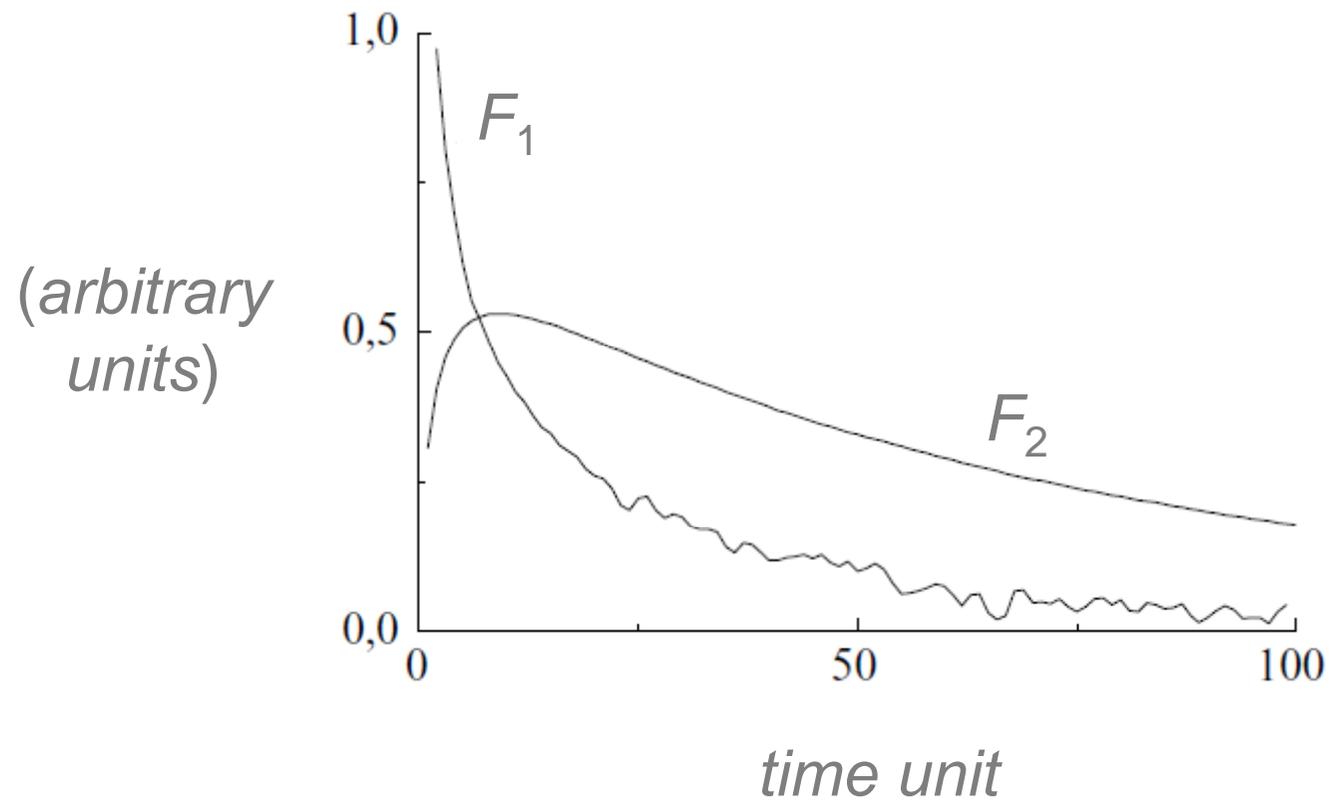
case a)

input = 0,8 * consumption



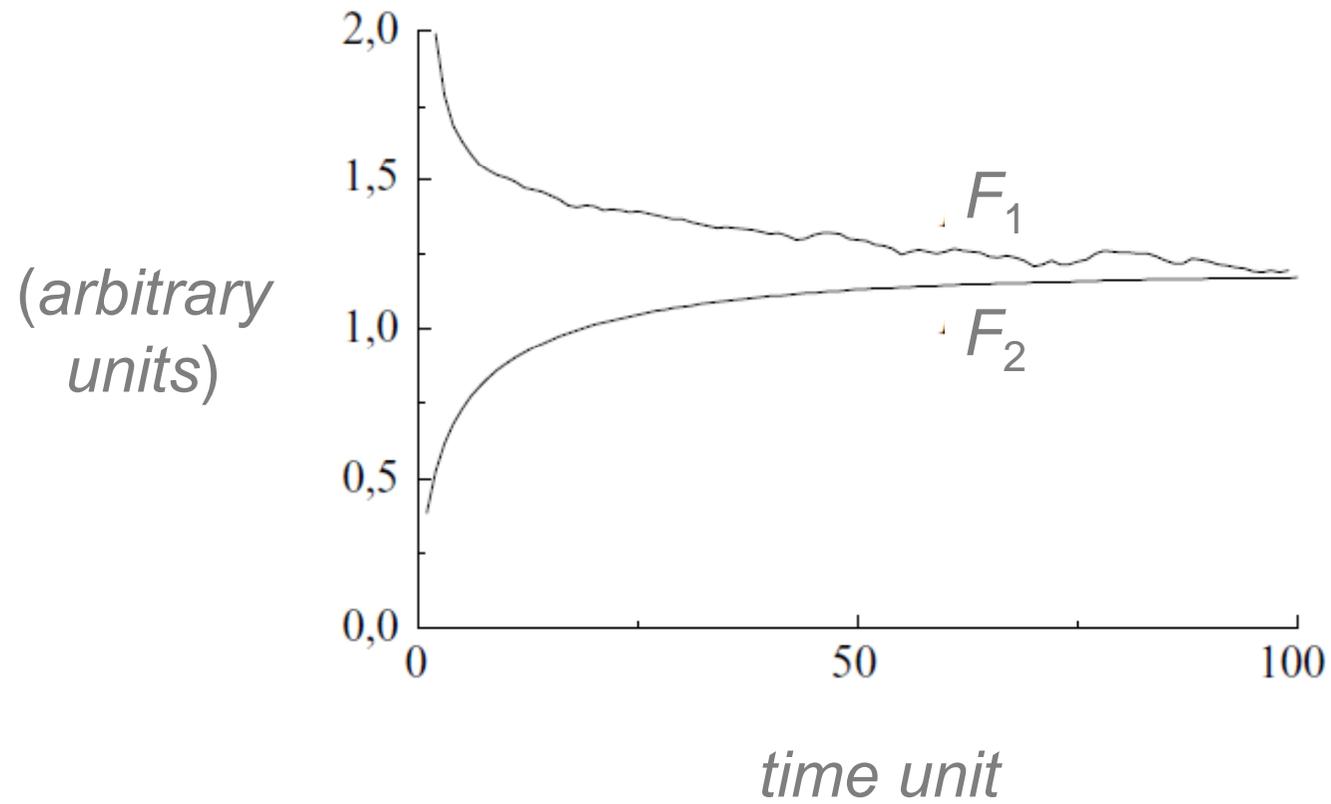
case a)

input = 0,9 * consumption



case a)

input = 0,99 * consumption



Discussion

- when input of resources equals consumption of resources F_1 tends to be equal to F_2
- difference exists during initial, equilibration interval

Conclusions & perspectives

conjecture: social free energy is realistically important

Introductory question

*If somebody asked you for some money,
how much money would you give to that person?*

Additional question

*If somebody asked you for some help,
how much help could you offer to that person?*

Thank you!