Aquila non captat muscas :Homo Economicus between exploration and exploitation

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Abstract

Three different strategic types of ensembles are compared on basis of their calculated superadditive net profit. The superadditive and peaceful ensemble of two Homo Economicus serves us with the starting value. From there two ensemble types emerge rearranging substrate within the ensemble through exploitation with force and deception of source and/or sink. An increasing transfer of substrate will, after an initial increase of rational superadditivity, finally lead to a dominating amount of irrational subadditivity. They are a conditional and an unconditional violent and deceptive ensemble. A third type, not rearranging substrate within the ensemble, is able to increase superadditivity by exploration and transfer from the outside of the ensemble.

Dependent ensembles with a master and independent ensembles are considered. A low (realistic) finding probability for new substrate is assumed in all examples. The unconditional violent and deceptive ensemble is in most of the cases superior according to the maximal possible superadditivity. This is altered after consideration of the investments necessary. Besides the three pure types also mixed types are investigated. Mixed strategic types are constructed assuming a mosaic structure of pure behaviour. The result is the topography of superadditivity or subadditivity. With this topography it becomes possible to assess the maximal investment for force and deception and compare the strategies. Extreme subadditivity can be avoided by a revolution of the transfer direction or by a recreation of the starting conditions.

Keywords: utility function, source, sink, ensemble, supply, demand, violence, deception, framing effect, exploration, exploitation, superadditivity, subadditivity, Homo Economicus

General Introduction

"The eagle does not catch flies" is an observation from nature and characterizes the rational economy of politics and warfare in the Roman Empire as well as the rational economy of life itself. If this rule is not followed overextension and crisis will be a result; every bill has to be paid! (But by whom?) Therefore, earnings must at least compensate the spending within the same base unit (Joule, Euro, etc.) but a higher efficiency is always necessary to make a living, including the production of offspring and to compensate for wear and tear. Yes, there are birds that catch flies but they are called either martin or doomed eagle.

It is assumed that evolution has equipped all organisms with utility functions designed to make economic decisions which will maximize fitness (1); biologic evolution results in organisms with optimized fitness. Long term fitness is essentially an optimal utility function fixed in the genes of the single organism and the species it belongs to. The genetic information is an *a priori* operation instruction. In a stable environment there will be a set of optimal instructions. Within a changing environment mutated instructions will gain advantage and begin to dominate through selection – a learning process.

The social environment of man is highly variable on a very short timescale and genetic instructions optimized by biologic evolution of the long past societies entangled by genetic bonds are no longer optimal (and yet they exist still in the wiring of our brains).

Learning is also here a central aspect of adaption. Learning is based on information. Information will not always be original and self-experienced. In case the flow of information is controlled by an organism the presentation and modification of this information will be a measure to steer the behaviour of another organism, especially if the behaviour of this organism is still fixed by

genetic or other not up to date or predictable instructions. Information may be true or modified to complete deceitfulness. Delusory information will range from gentle measures like framing (2) to organized and structured lies on a large scale like political ideologies and religion. Both are united in the invention of e.g. familial relation where close genetic entanglement does not exist or they offer patterns where there are other patterns or no patterns at all.

For prudent and informed but weak parties there is brute force and fear to make them behave in the required way. Nevertheless, exploitation - the transfer of substrate contrary to the economic reasoning of at least one party by brute force and deception - though harming the individual locally, is able to increase net profit on a larger scale. The increase in net profit is called in my papers “superadditivity” (and “wise exploitation” when stable on a longer timescale), the larger scale is called “ensemble”. This is the essence of the transfer space and the ensemble concept (3, 4, and 5).

Introduction to the investigated ensembles

Every model should stand on the solid ground of experimental evidence. Turner and Chao (6) and MacLean *et al.* (7) demonstrated in two different experimental settings (phage and yeast) that exploitation will lead to superadditivity (in 6: fitness of cooperating phage is 1+1, fitness of exploiter + exploited phage is 1.99+0.65; citation from 7: “We observe, however, that after competition between “cheat” and “co-operator” strains of yeast, population fitness is maximized under co-existence.”).

In 2013 I suggested a model where voluntary as well as forced transfer in an ensemble of a source and sink would result in superadditivity over no transfer (3). The model has been described again in detail (5) and should be read prior to this paper. Saturating production functions in combination with linear cost functions form a three dimensional transfer space. Within this space

superadditivity and subadditivity will appear after transfer of substrate. The transfer may be a product of reason of two perfect Homo Economicus (take a benefit dominated substrate, get rid of a cost dominated substrate, figure 1) or a result of force and deception contrary to individual economic reason. Surprisingly, force and deception will produce additional superadditivity but also subadditivity. A positive balance may pay force and deception. The Nash-equilibrium has not to be considered as biologic organisms exist in an open system constantly powered by the energy of the sun handed over via the food chain. The exploited party will either recover or be replaced by a new generation.

Two basic cases have to be discriminated:

- A *dependent ensemble* is controlled by a master, a third party not active in the production of net profit. The master has his own interest and a reward in mind. He will milk and tax the ensemble. He is not directly affected by superadditivity or subadditivity.

- An *independent ensemble* is controlled either by source or by sink; source or sink is the master. The master is now active in the production of net profit and is directly affected by superadditivity or subadditivity.

Three ensemble types with different strategies to improve net profit have been identified so far (lit. 5; figure 1 and 2 below). All three types contain at their centre the always and everywhere superadditive ensemble of two Homo Economicus (figure 1, the central, green area). From there two directions to further increase superadditivity are possible. Either find new substrate by exploration (a) or rearrange the already available substrate by exploitation through violence and deception (b and c).

a. *An explorative ensemble*: The core is an ensemble of two Homo Economicus. This ensemble stays superadditive and peaceful within a given concentration range (here 0.5mM to 0.6mM in source and 0.4mM to 0.5mM in sink, figure 1) and will never cross the limit b-c=0; neither as a source (b_{so}-c_{so}=0) nor as a sink (b_{si}-c_{si}=0) nor as an ensemble (b_{so}-c_{so}=0 and b_{si}-c_{si}=0) controlled by a third party, a master. To increase the amount of superadditivity, the transfer size of substrate must be increased beyond the possible maximal difference (0.5mM to 0.6mM in source and 0.4mM to 0.5mM in sink). The only way to accomplish that here is by exploration for increased supply and demand (orange borders upwards and left of the green square, green arrows, figure 2).
b. *A conditional violent and deceptive ensemble*: The ensemble is always peaceful within the same limits as the ensemble in “a”, the Homo Economicus, and this will result in the same amount of superadditivity. Violence and deception start at the limits b_{so}-c_{so}=0 and b_{si}-c_{si}=0 (red lines marked by red arrows). An additional area of superadditivity will appear beyond the red limit through substrate rearrangement (blue arrows, figure 2). However, the violent or deceptive ensemble will also produce subadditivity in area II to IV when the transfer size leads to concentration pairs beyond the blue line of strict equivalence.
c. *An unconditional violent and deceptive ensemble* (the basically violent ensemble of lit. 5): This type of ensemble will always use violence and deception (purple arrows in figure 2). This has no additional effect on the maximal possible net profit within the limits of the substrate ranged in area I (green area, 0.5mM to 0.6mM in source and 0.4mM to 0.5mM in sink) and therefore will result in the same amount of superadditivity like in “a” and “b”. The Homo Economicus is able to resist when arriving at the red limits (b-c=0). This will cause very high internal costs (force and counter force) with no additional superadditivity compared to “a” or “b”. The internal cost of this

chronic violence and deception is not considered now but will be investigated and discussed later. As soon as the Homo Economicus is overcome by force and deception, the borders b_{so}-c_{so}=0 and/or b_{si}-c_{si}=0 will be crossed. The transfer size then will be larger than in “b” and so will be the superadditivity. However, the developing subadditivity will increase much stronger as this time the subadditivity does not stay in area II to IV like in the conditional case but spreads to area I (5).

The ensemble in “a” is only able to increase substrate availability and usage by exploration outside of the ensemble (the unknown) for more supply or more demand. This is an expensive and risky (finding risk) investment. The probability to find new substrate supply or demand will not be one ($p<1$).
The two other types rearrange substrate within the ensemble (the known) to have more benefit dominated substrate or less cost dominated substrate. The probability that there is a source or a sink for substrate is one ($p=1$) but violence and deception also contain risks and make investments necessary.
Violence will induce a reappraisal of benefit and cost in source and sink. This will change the behaviour with respect to giving and taking of substrate. There is no finding risk as it is clear that there is substrate within the other party as source for a benefit dominated substrate or there is the other party as sink to get rid of a cost dominated substrate. However, there is a considerable investment in force and counterforce (weapons, defence systems) and a risk to be wounded.
Deception will also induce a reappraisal of benefit and cost in source and sink. By means of deception benefits may appear larger and e.g. a cost dominated substrate will be taken against good sense and the true facts. Again, there is no finding risk and it is a less violent way to induce a transfer but investments are also necessary (cost of deception). Those investments are not necessarily cheaper or less harmful than the use of brute force.

Figure 1

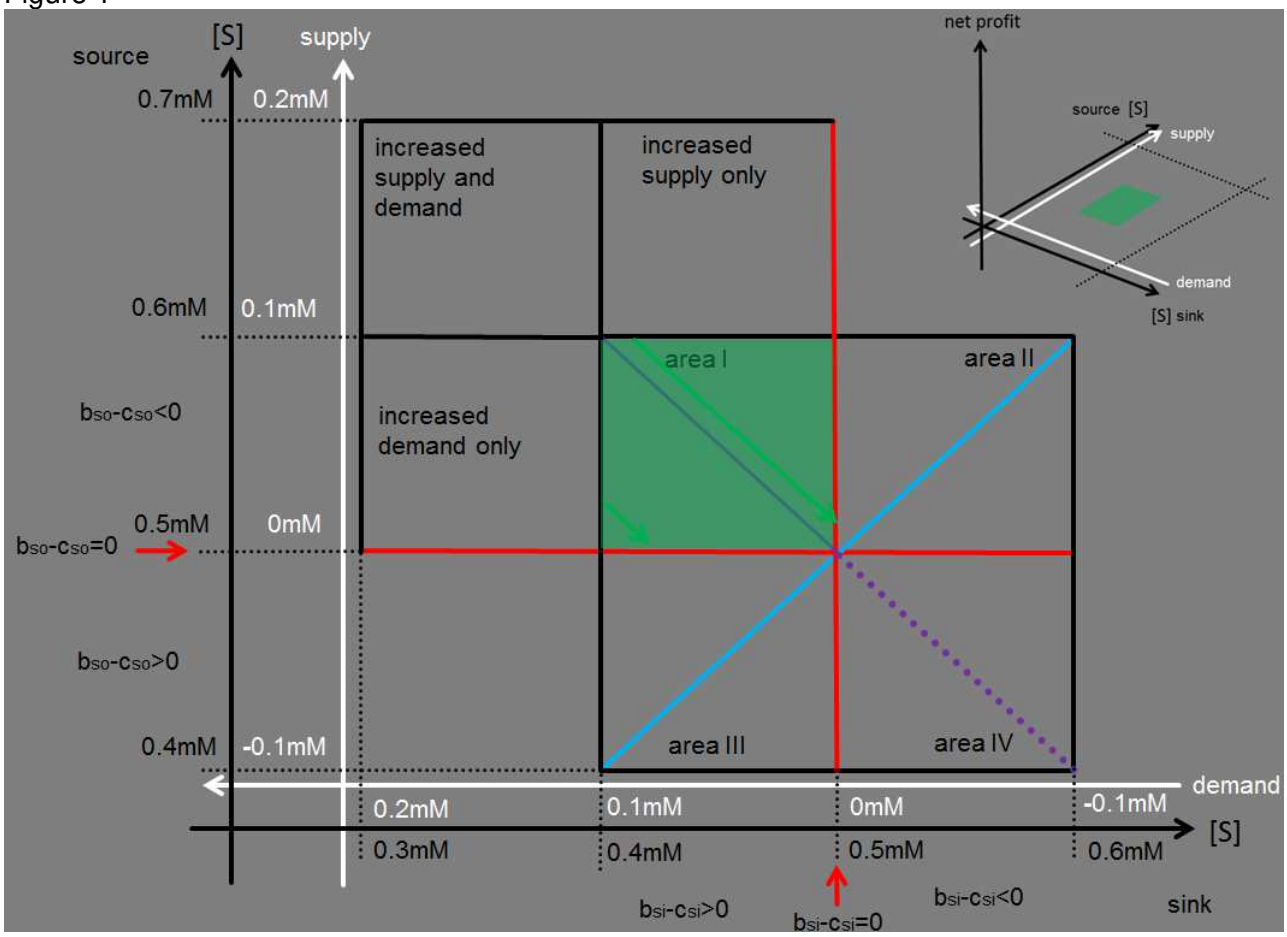

Figure 1

Here we look top down on a schema of an ensemble consisting of a source and a sink. The black coordinates show the concentration of substrate ([S] in mM). The white coordinates give supply and demand (also in mM). Supply is a coordinate for source; demand is a coordinate for sink. A third coordinate points towards the observer into the third dimension (we look top down onto the transfer space, 5) with the dimension “net profit” (np) of the ensemble of source and sink (b_e-c_e, see small inset for better imagination).

The green area (area I) in the centre is the net profit surface (three dimensional bent) of an ensemble of two rational and selfish entities (two Homo Economicus); there may be a master but source and sink are well informed and strong and thus they are able to resist a master or the other party. The source will give only when b_{so}-c_{so}<0 and the sink will only take when b_{si}-c_{si}>0 in the available concentration range (source 0.5mM to 0.6mM, sink 0.4mM to 0.5mM) of equally probable concentrations. There will be no risky exploration for new substrate supply or demand and no dangerous exploitation to rearrange substrate. The green area I is superadditive in comparison to the same ensemble with no transfer of substrate. The superadditive volume between both surfaces has the size of 0.0001258395912mM^2*np. Besides a smaller concentration range the biochemistry of the investigated ensemble is identical to the former ensemble in 5; Vmax 5µM/min, Km 0.5mM, the cost factor k (c/[S]) is 5 and therefore the linear cost function will intersect the saturating benefit function at Km. The benefit factor bf (b*min/µM) is 1 (5). At Km we find therefore b-c=0 in source and sink. The green arrows represent two ensemble paths as examples. An ensemble path connects all substrate pairs along the route before a transfer with the resulting pair (a border or a limit) after the transfer. The resulting net profit stays with each first coordinate. The result is a three dimensional, bent surface. The surface before a transfer can now directly be compared with the surface resulting after a transfer (5), the volume between both surfaces can be calculated. This volume is either positive (superadditive) or negative (subadditive). There are many ensemble paths starting at all possible concentration pairs within the observed concentration range. Wherever they start they lead here to the border b-c=0 (the red lines) in source and sink. The blue line, the line of strict equivalence, is reached in one point where strict symbiosis and strict antibiosis meet (purple).

Figure 2

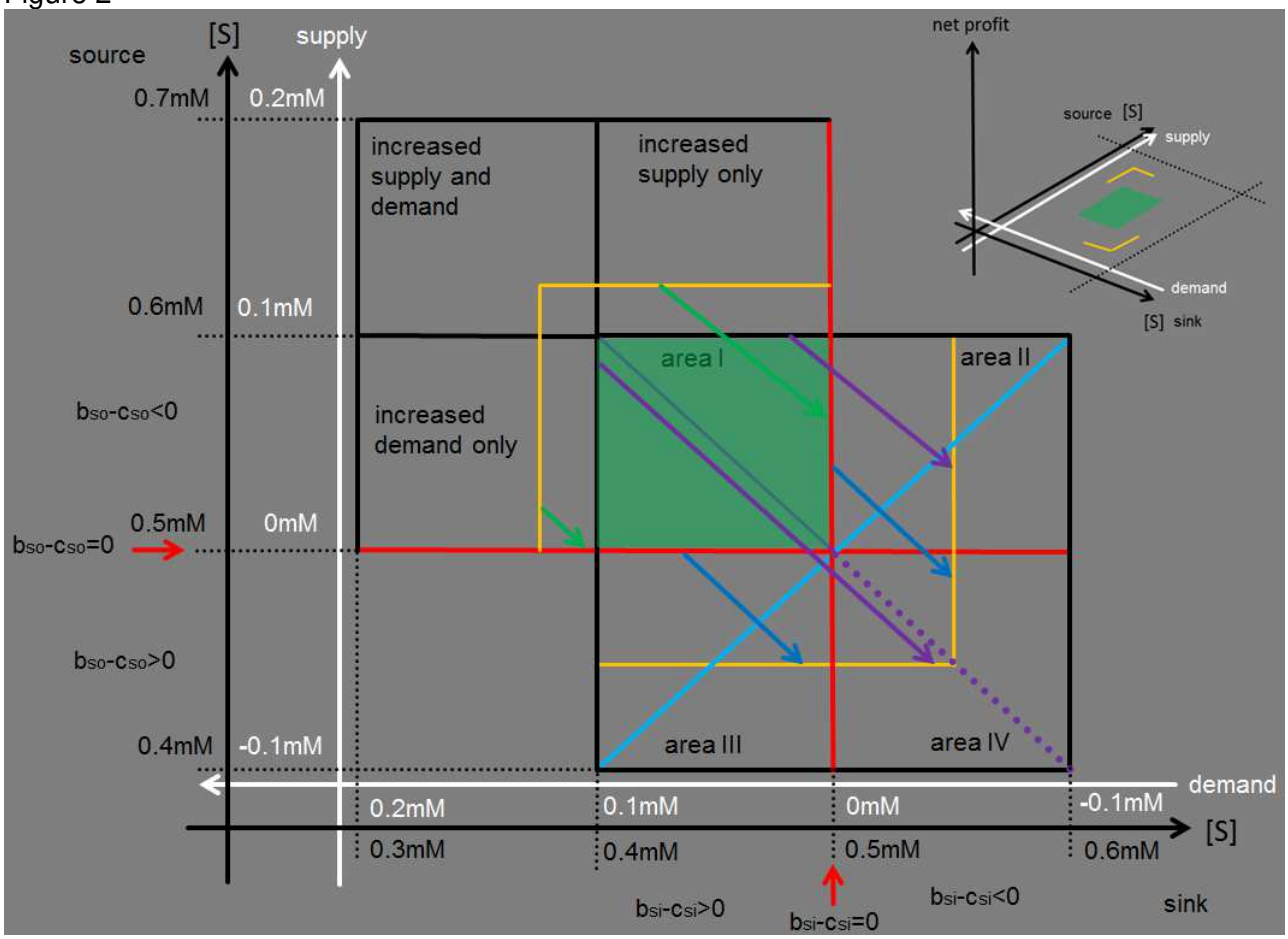

Figure 2

This ensemble is controlled by a third party as master. The two Homo Economicus are no longer able to resist the master to increase the transfer size beyond the green surface. Three different and separated strategies to increase superadditivity are possible. The three strategic types are here separated according to the substrate. New supply or demand for substrate obtained by exploration can´t mix with existing supply and demand for substrate available through exploitation. Starting from area I supply and demand is increased or decreased in 20 steps of 0.005mM.

a. The master makes source and sink increase supply and demand by exploration. A symmetrical case is shown (orange borders up and left, green arrows). Now source and sink start to give and take from the orange lines but still stop at b-c=0 in source and sink as they are still Homo Economicus there. The next two types rearrange substrate within the ensemble by exploitation.

b. This is the conditional violent and deceptive ensemble. Within area I the ensemble and the master are peaceful and honest like the Homo Economicus in figure 1 with the same superadditive net profit. Then the master will force or deceive source to give and sink to take beyond b_{so}-c_{so}=0 and b_{si}-c_{si}=0 indicated by blue arrows up to the orange borders (right and down).

c. This is the unconditional violent and deceptive ensemble. The master will always use force and deception including the green area (there without effect) but as soon as the “thin red line” is crossed, force and deception are highly effective (purple arrows, to the orange borders as in “b”) but the developing subadditivity will spread to area I.

Exploration and exploitation increase each in 20 0.005mM steps (20 different orange borders). *Exploration*: increased supply from 0.6mM to 0.7mM in source and increased demand from 0.4mM to 0.3mM in sink. *Exploitation*: the concentration in source will decrease from 0.5mM to 0.4mM and in sink the concentration will increase from 0.5mM to 0.6mM.

Superadditive and subadditive volumes are calculated and cleared. The red lines marked by red arrows are b_{si}-c_{si}=0 in sink and b_{so}-c_{so}=0 in source, respectively. The dotted line in area IV is the line of strict antibiosis continuing the line of strict symbiosis in area I. The light blue line is the line of strict equivalence. Some transfers do not respect this line and lead to concentration pairs beyond. This will reduce the amount of superadditivity up to dominating subadditivity.

Figure 3

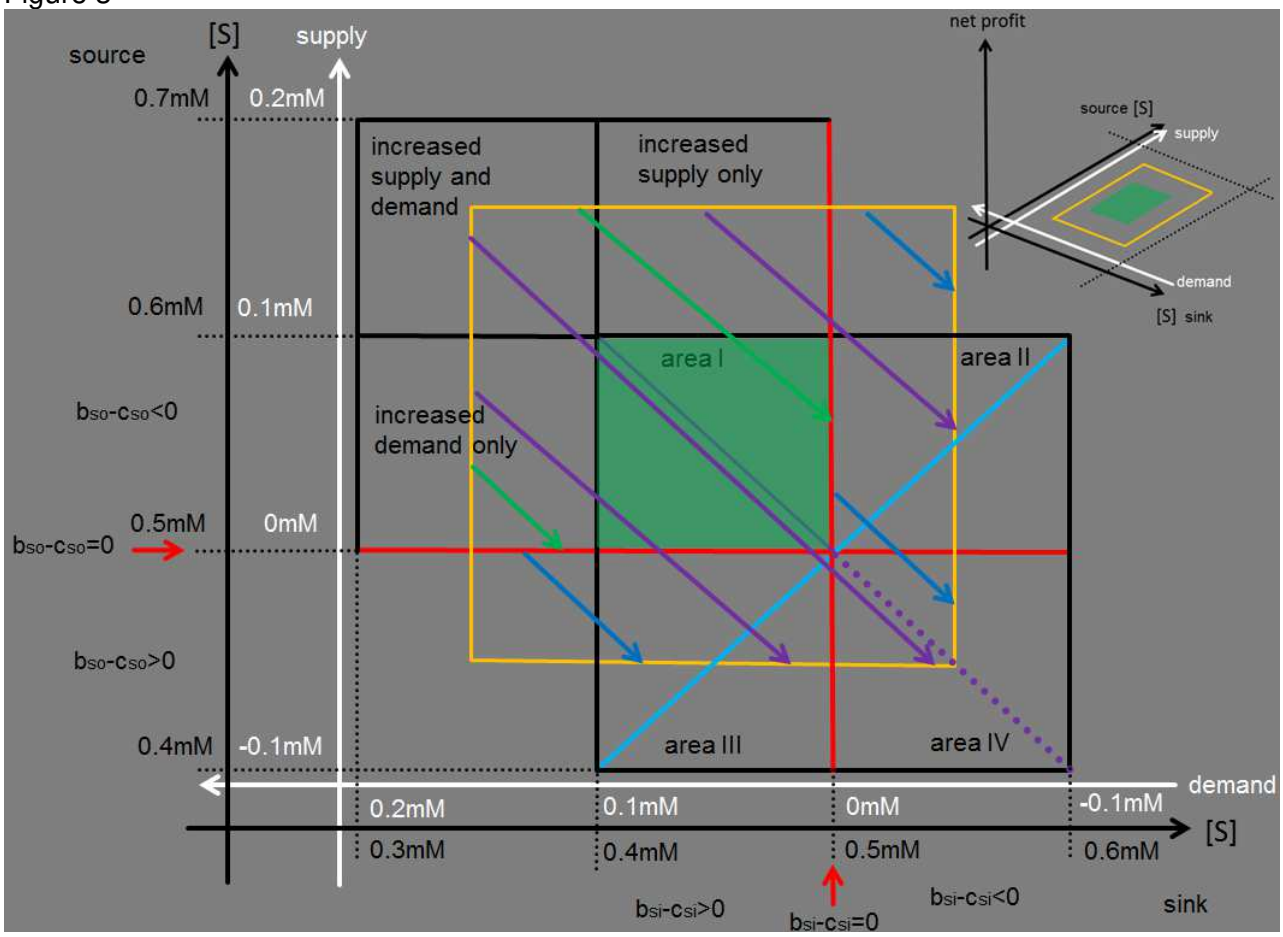

Figure 3

The schema is similar to figure 2; however, this time substrate supply and demand of the three strategic types will mix. New supply and new demand (acquired by exploration) can also be transferred by force or deception from source to sink. The change (increase and decrease) in supply and demand in source and sink is completely symmetric and will be calculated in 20 steps of 0.005mM; orange borders, a single example. The ensemble is symmetric with respect to benefit, cost and equally sized steps into exploration and exploitation.

a. The master makes source and sink increases supply and demand only by exploration. Again source and sink start to give and take (green arrows) from the orange border but still stop at b-c=0 in source and sink (red border) like in figure 2.

b. The conditional violent and deceptive ensemble is still peaceful and honest within the green area I and also peaceful using new supply and new demand (green arrows, like “a”). Beyond the red limit (b_{so}-c_{so}=0 and b_{si}-c_{si}=0) up to the orange borders force and deception will be used (blue arrows). Subadditivity results from transfers sizes beyond strict equivalence (light blue). This is a two-step process consisting of exploration (green arrows) and then exploitation (blue arrows).

c. Within the unconditional violent and deceptive ensemble the master will always use force and deception and he connects supply and demand by exploration with supply and demand by exploitation (purple arrows, one step). Subadditivity will here also spread to area I and beyond.

Besides ensembles controlled by a master there are two types of independent ensembles. The first type of independent ensemble is controlled by source (figure 4) the second type is controlled by sink (figure 5). Independent ensembles do not enter the irrational area IV. This area is only

accessible to ensembles controlled by a master. When source controls the independent ensemble source will never cross the red line b_{so}-c_{so}=0 (figure 4). This is pure selfishness as to go beyond b_{so}-c_{so}=0 would result in self-harming. Subadditivity is only produced in area II.

Figure 4

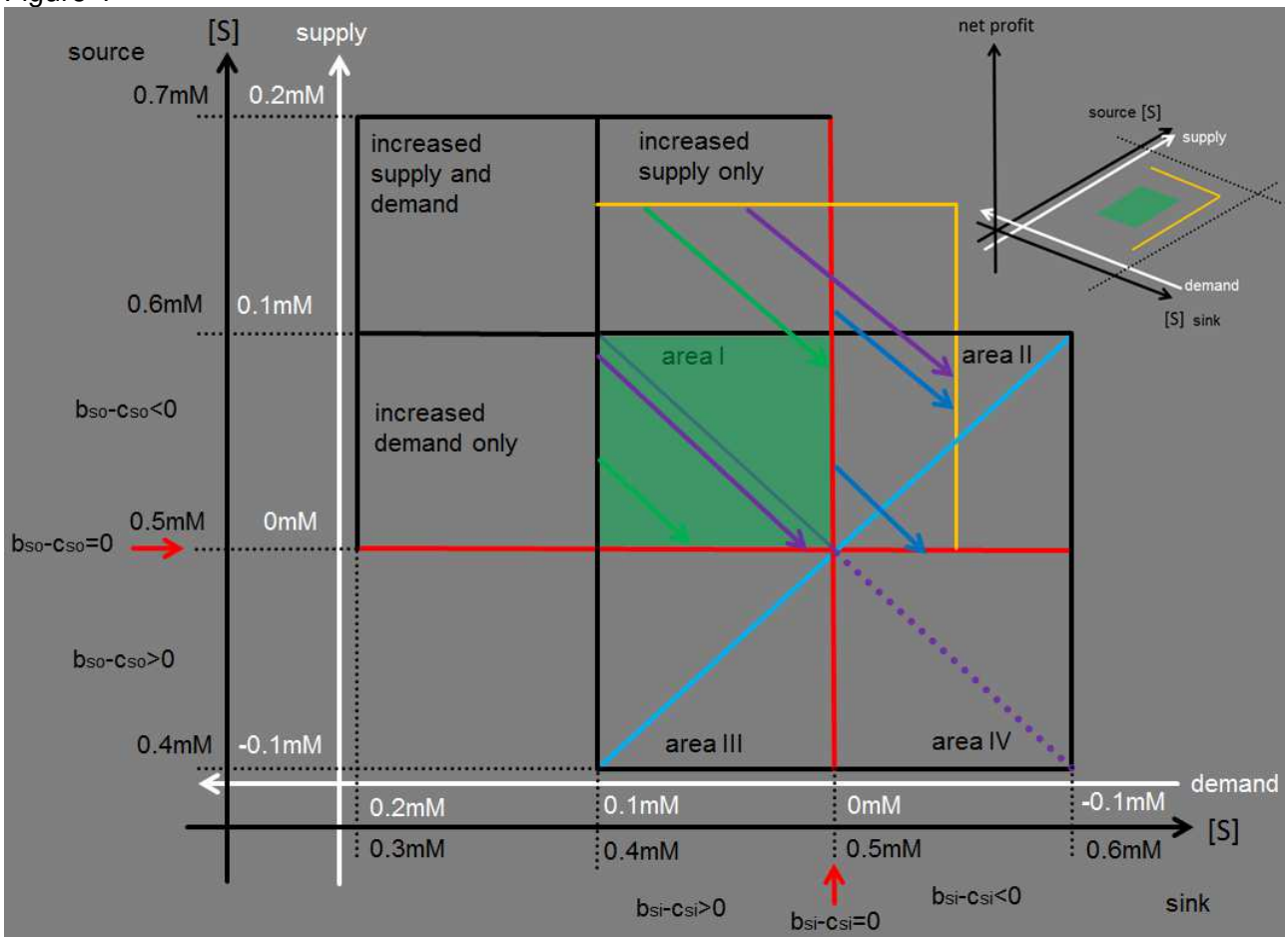

Figure 4

This independent ensemble is controlled by source. Source will increase supply only. The three strategic types are depicted similarly to figure 3. New substrate (supply) acquired by exploration will be transferred by force or deception. Source will never cross the red line b_{so}-c_{so}=0. The orange limit of supply and forced transfer is completely symmetric and will be calculated in 20 steps of 0.005mM up to 0.1mM; a single orange border of 20 steps as example. Transfer sizes leading to concentration pairs beyond the blue line of strict equivalence produce subadditivity in area II.

a. Source is increasing supply. Source may attempt to push through with force or deception beyond the limit of sink b_{si}-c_{si}=0. However, sink is able to resist a transfer of old and new supply. The green arrows end at both red borders.

b. Sink can no longer resist. Source is increasing supply but the conditional violent and deceptive source is peaceful within old supply (area I) and new supply (top green arrow) but will then use force or deception to give starting at sink´s limit of b_{si}-c_{si}=0 (blue arrows) until the orange limit is reached.

c. Sink can no longer resist. Source is increasing supply and the unconditional violent and deceptive source will transfer always all substrate to sink by force and deception until the orange border (purple arrows) is reached. Force and deception have no additional effect on superadditivity only within area I, the green area.

When sink is in control sink will never cross b_{si}-c_{si}=0 (figure 5). Selfishness again prevents a completely subadditive ensemble in area IV, although some subadditivity appears but only in area III.

Figure 5

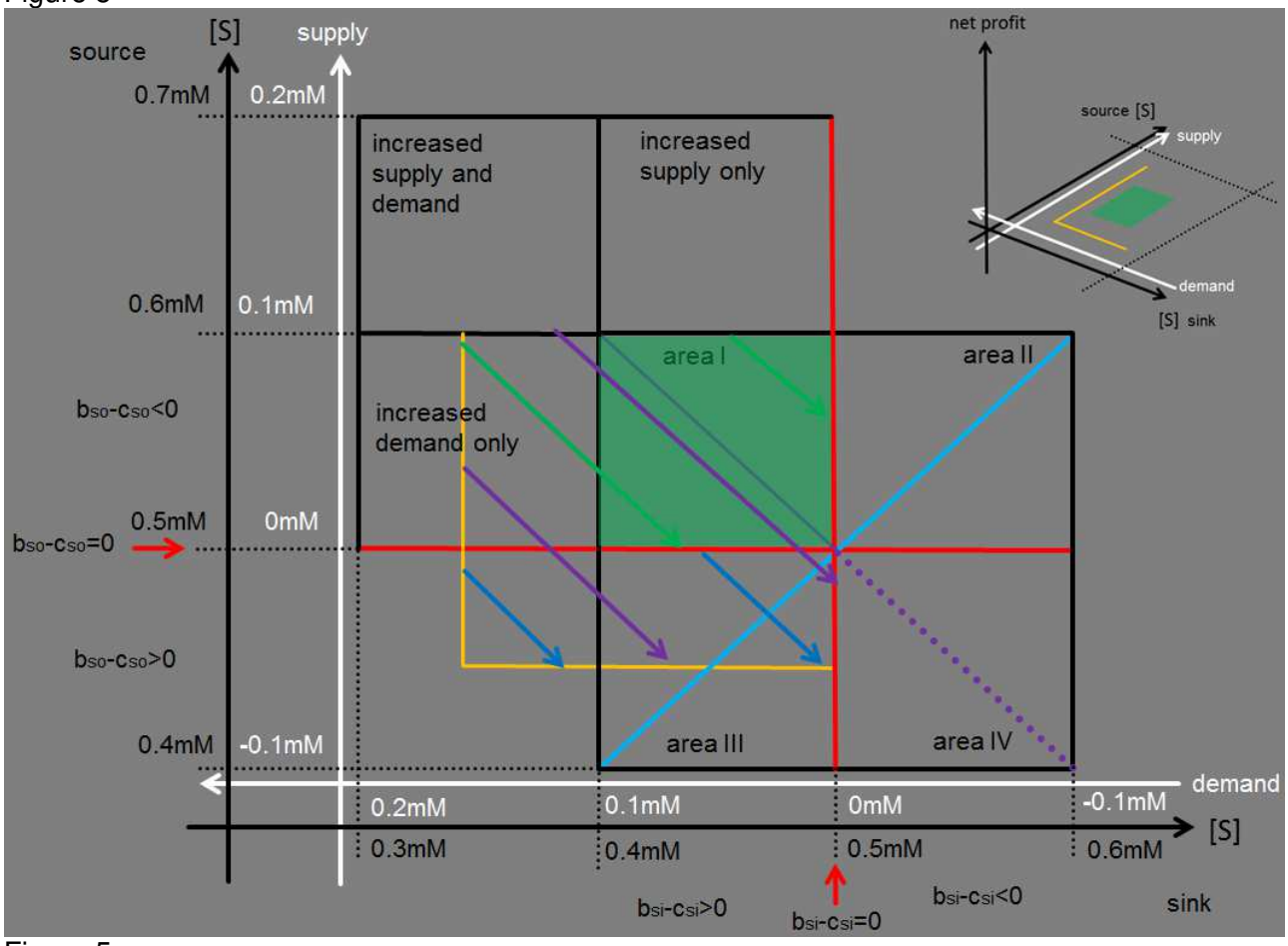

Figure 5

This independent ensemble is controlled by sink. Sink will increase demand only. Sink will never cross the red line b_{si}-c_{si}=0. The three strategic types are depicted similarly to figure 3. New demand acquired by exploration (new desires, products and services) will be transferred by force (new laws to make the services or products a must) or deception (commercials) in some cases. Again, the limit of demand and forced transfer is completely symmetric and will be calculated in 20 steps of 0.005mM up to 0.1mM; a single orange border of the 20 steps as example. Transfers to concentration pairs beyond the blue line of strict equivalence produce subadditivity in area III.

a. Sink is increasing demand. Sink may attempt to push through with force or deception beyond the limit of source b_{so}-c_{so}=0. However, source is able to resist a transfer powered by old and new demand. The green arrows end at the red borders.

b. Source can no longer resist. Sink is increasing demand but the conditional violent and deceptive sink stays peaceful within old demand (area I) and new demand (left green arrow) but will additionally use force or deception to take away starting at source´s limit of b_{so}-c_{so}=0 (blue arrows) until an orange limit is reached.

c. Source can no longer resist. Sink is increasing demand and the unconditional violent and deceptive sink will take always all available substrate from source away by force and deception until the orange border (purple arrows) is reached. Force and deception have no additional effect on superadditivity only within the limits of area I, the green area.

Calculations and Discussion of the Results

At the centre of figure 1 to 5 in area I (green area) we look at an ensemble of two Homo Economicus. The superadditivity that will be created by a transfer at free will and to the advantage of both sides (win-win situation) within the available supply of 0.1mM (0.5mM to 0.6mM) and demand of 0.1mM (0.4mM to 0.5mM) will be $0.0001258395912 mM^{2}*np$ in total. No subadditivity is produced, nothing has to be cleared! This value is the starting point for all three strategic ensemble types increasing the net profit either by exploration or exploitation or by a combination of both.

The increase of superadditivity by exploration in figure 2 has two aspects; an increased supply (in total 0.1mM at 0.005mM steps) and an increased demand (also in total 0.1mM at 0.005mM steps). The substrate amount available (supply) and the substrate amount needed (demand) is symmetrically increased (orange borders up and left). The more asymmetry (benefit (sigmoidal shaped, Km, Vmax), cost, probability of concentration pairs, etc.) I would introduce, the more complex the surfaces and the resulting superadditivity and subadditivity could become locally and globally.

The increase of superadditivity and subadditivity by exploitation in figure 2 follows the same procedure. Supply and demand are symmetrically decreased (orange borders, down and right) in source and sink beyond the limits of b_{so}-c_{so}=0 and b_{si}-c_{si}=0. A decrease in supply is less substrate in source (in total 0.1mM, 0.005mM steps) and a decrease in demand is more substrate in sink (in total 0.1mM, 0.005mM steps). Violence and/or deception always come into use when a red line has to be crossed. As soon as the blue line of strict equivalence is crossed irrational subadditivity is the result (5). When the master makes the ensemble cross all red limits (into area IV) the subadditivity is even stronger as not only one side acts irrationally but the

complete ensemble acts irrationally (irrationality=subadditivity). The result is that both sides are harmed simultaneously. The master will not care if his reward is not directly coupled to the outcome. However, clever masters know that easily achievable 10% of 1000 is to be preferred over hard to achieve 100% of 100. The meaning of irrationality in this context is that an inactive ensemble would have a higher net profit. Beyond this remark the inactive ensemble is here no longer considered and looked at. In all calculations the inactive ensemble appears indirectly as the amount of superadditivity or subadditivity is calculated as volume between the surfaces of active and inactive ensembles. The result of the calculations of the schema in figure 2 is depicted in figure 6A.

The superadditive net profit (mM^2*np) in the case of exploration is growing very strongly (figure 6A, green) about 20 fold within the observed concentration range. The success of the two exploitation strategies is mixed. Within the unconditional violent and deceptive ensemble superadditivity will grow instantly (purple) when b-c=0 is exceeded. Superadditivity by rearrangement of substrate within the conditional violent and deceptive ensemble (blue) will grow slowly but more sustainable. Between step 6 and 7 (figure 6B) the two ensembles are of nearly identical success. After that the conditional violent and deceptive ensemble is better. Better in this case has the meaning that the conditional violent and deceptive ensemble will produce subadditivity more slowly. However, both are producing a considerable and increasing amount of subadditivity and thus the superadditive net profit will decrease further until finally both types fall below $0mM^2*np$; they both become completely subadditive (superadditivity-subadditivity$<0mM^2*np$). The subadditivity will finally consume all superadditivity including that from area I; the pure superadditivity of two Homo Economicus in a win-win situation.

Figure 6A

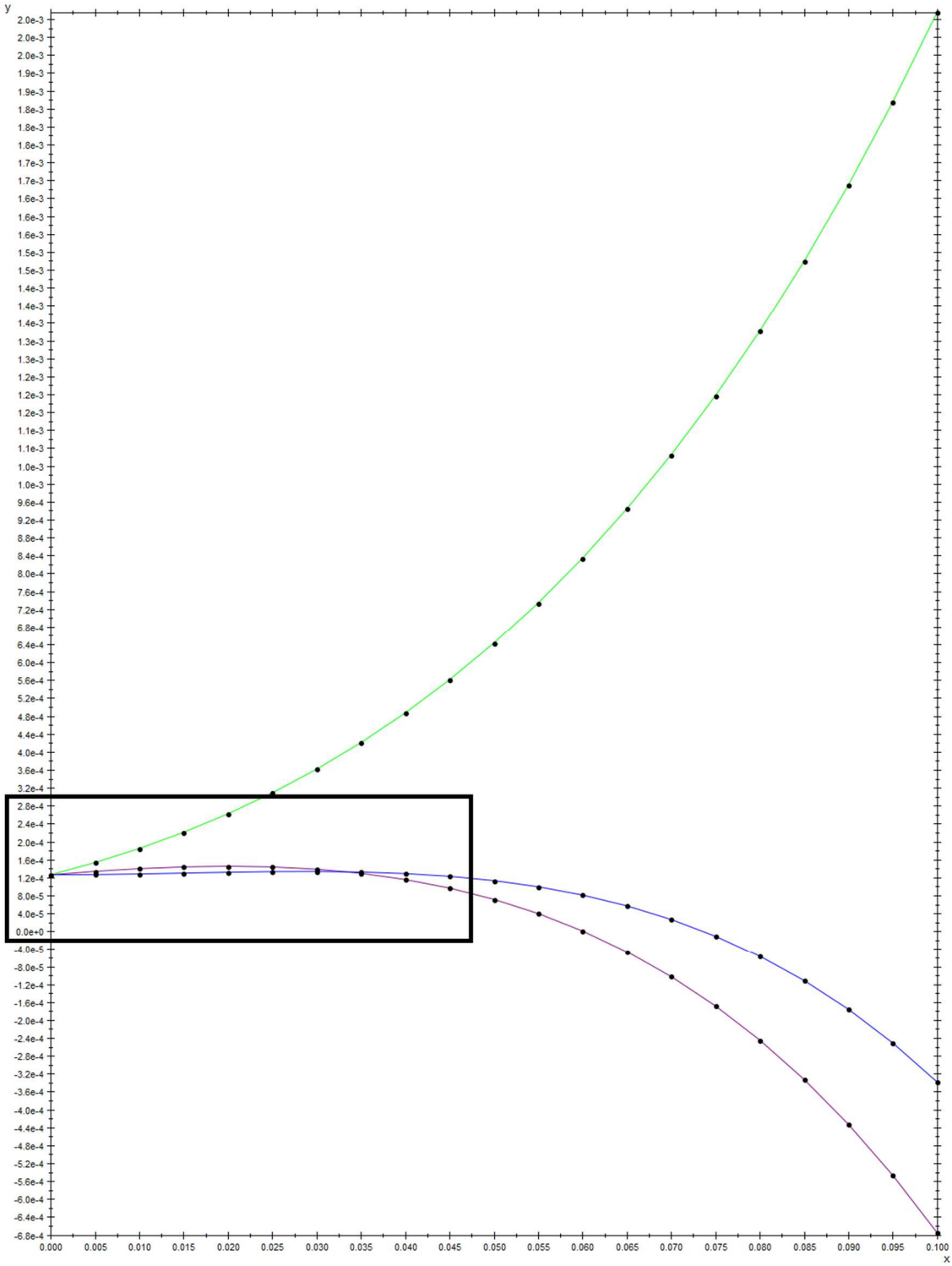

Figure 6A

This figure is based on the schema in figure 2. At the x-axis the additional (by exploration) or rearranged (by exploitation) substrate is shown in 20 steps of 0.005mM. At the y-axis the unit is mM^2*np. These values are a result of the calculated superadditivity reduced by the calculated subadditivity in the three strategic types according to figure 1 and 2. The green curve represents an ensemble obtaining new substrate by exploration (only superadditive). The blue and purple curves are two different types of ensembles rearranging substrate within the ensemble by exploitation; conditional violent and deceptive in blue, unconditional violent and deceptive in purple. All curves start at 0mM additional substrate with a superadditivity of 0.0001258395912mM^2*np – the ensemble of two Homo Economicus - contained in all three types.

Figure 6B

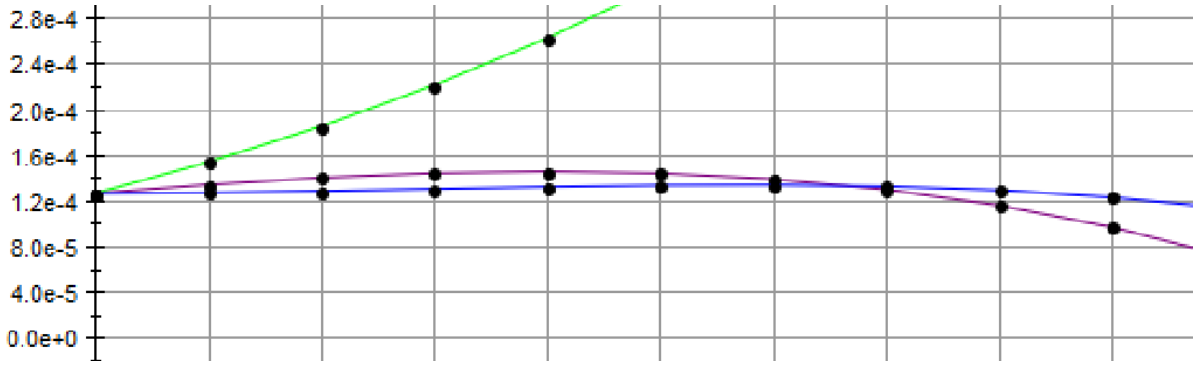

Figure 6B
The magnification of the boxed sector in figure 6A; the unconditional violent and deceptive ensemble is at small transfers better than the conditional violent and deceptive ensemble. This relationship is reversed at larger transfers as the unconditional violent and deceptive ensemble produces more subadditivity. The ensemble active in “exploration only” is the best in all points.

The strong growth of superadditivity by pure exploration is impressive but also not quite realistic. The main difference between exploitation and exploration is probability and knowledge. To take away a benefit dominated substrate by force or deception is preceded by the knowledge that the other party is in possession of this good. Information is easily obtained by observation. The probability to find substrate in the other party then becomes one. To take away by force or deception will make investments necessary but this will be dealt with much later. The same is true for getting rid of a cost dominated substrate.

Exploration deals with not only a different place but also with a different time - the future. However, the future is an “undiscovered country”. The probability to find new substrate by exploration is not one. I have chosen arbitrarily the probability to find new substrate to be p=0.01 (figure 7). The effect is that within the window of observation the maximal superadditivity by exploration is in the same range as the maximal superadditivity through exploitation.

Another unrealistic assumption still used in figure 7 is that supply and demand obtained by exploration do not mix with supply and demand obtained by exploitation. This will change in figure 8.

Figure 7

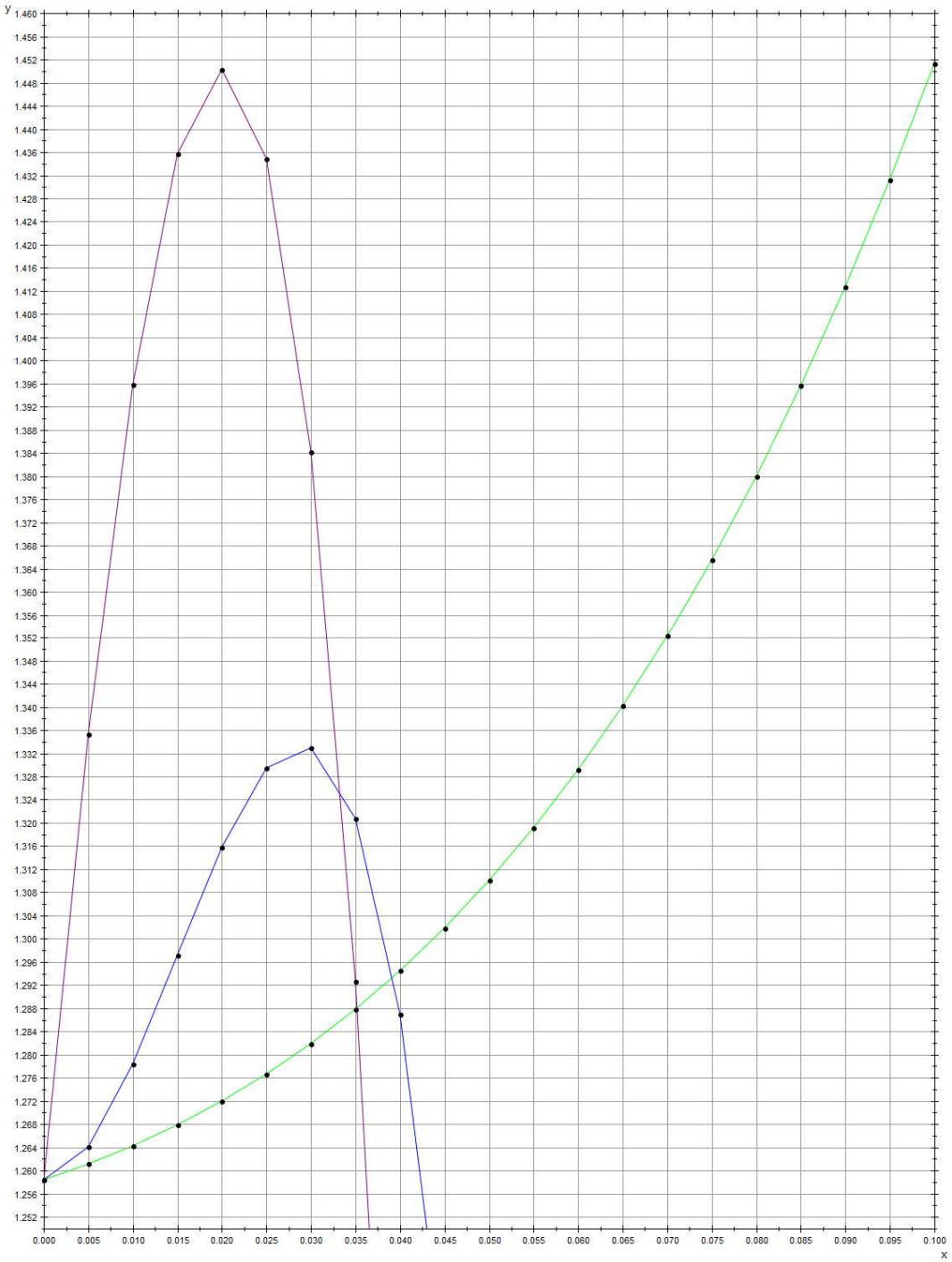

Figure 7

This figure is based on the schema in figure 2. The probability to find substrate by exploration is reduced from p=1 (figure 6) to p=0.01 here (green curve). The probability to find substrate by rearrangement (conditional exploitation, blue and unconditional exploitation, purple) is still 1. The extension of the y-axis (10^{-4}) is smaller than in figure 6. Therefore, data points in exploitation at higher substrate transfers (blue and purple) are missing as they are increasingly subadditive – many below zero.

Three different areas can be distinguished. For the first 7 data points of transfer (0.005mM to 0.035mM of rearranged or new substrate) conditional (blue) and unconditional (purple) exploitation is now better than exploration at a lower finding probability. The unconditional ensemble is the best up to 0,03mM. At 0.035mM the conditional ensemble has the highest superadditive net profit. At 0.65mM exploration beats the best value of conditional violence and deception and finally at 0.1mM exploration beats the best value of unconditional violence and deception.

Now the system seems adjusted according to the size of the superadditive effects within the window of observation (0.4mM to 0.7mM in source and 0.3mM to 0.6mM in sink) and we can study a more realistic version where supply and demand by exploration and exploitation will mix (figure 8).

Figure 8

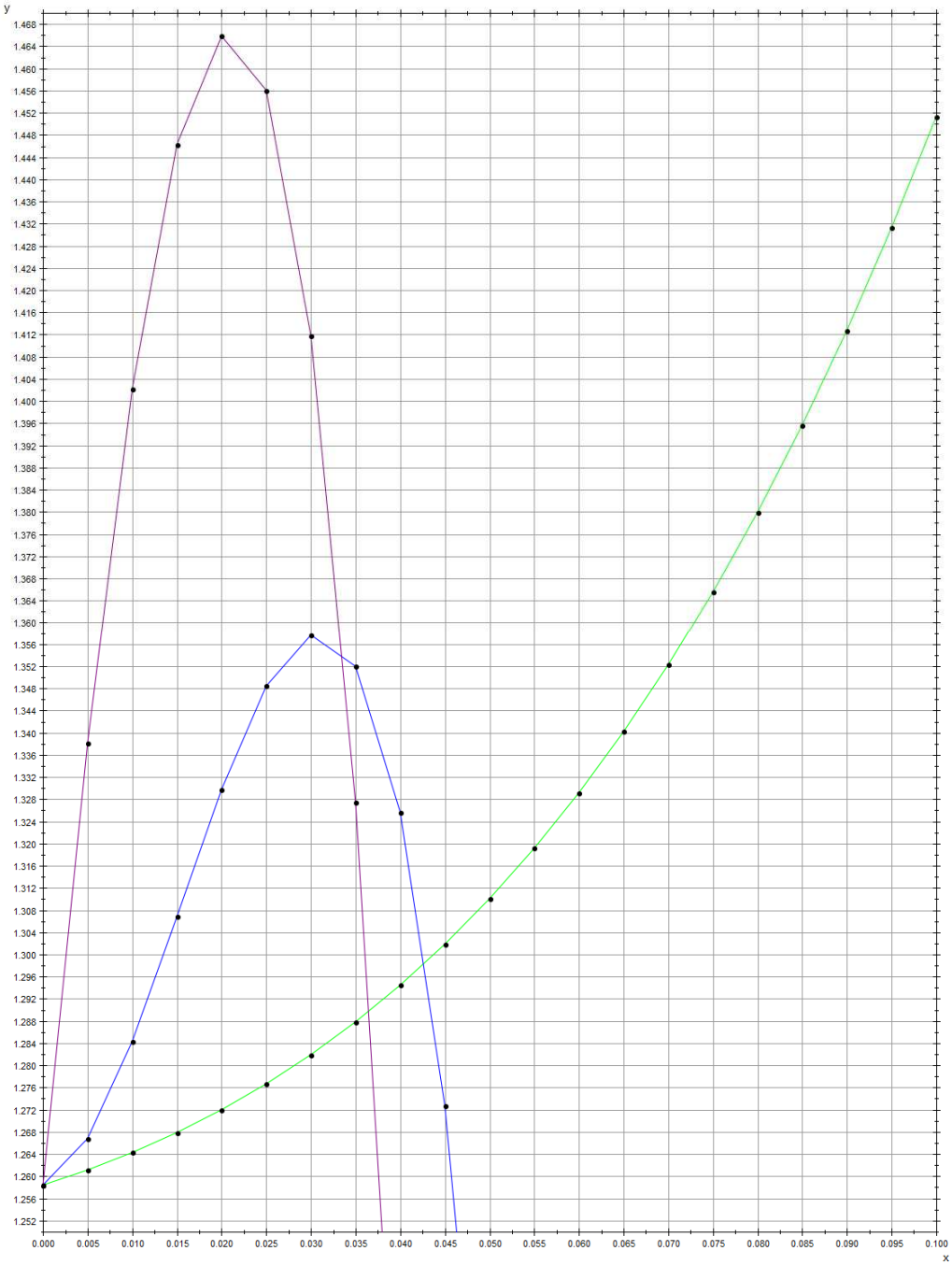

Figure 8
Here (y-axis, 10^{-4}), supply and demand from exploration (p=0.01, green curve, identical to figure 7) is mixed with supply and demand from exploitation (p=1) in a transfer by conditional (blue) or unconditional (purple) force and deception. This figure is based on the schema in figure 3.

The difference is only of quantitative nature. Conditional and unconditional violence and deception increase a little in the production of superadditivity as substrate by exploration has only a low probability (p=0.01) and does not contribute much at smaller forced transfers to the superadditivity by rearranged substrate while at larger forced transfers the subadditive effects of rearranged substrate dominates. The probability of 0.01 is identical for all amounts of substrate accessible through exploitation. To find new additional 0.005mM has the same probability as to find an additional 0.1mM. I could have also decided to make it less probable to find 0.1mM.

Within area I to IV of the ensemble we have always the same amount of total substrate. Within the range of 0.4mM to 0.6mM in source and 0.4mM to 0.6mM in sink the concentration in the ensemble will be 1.2mM at best and 0.8mM at worst but the average is always 1mM for the ensemble. The basic assumption was (5) that all these concentration pairs (0.6mM+0.4mM …. 0.4mM+0.4mM …. 0.6mM+0.6mM …. 0.4mM+0.6mM) have the same probability. This can be changed. The probability of certain substrate pairs could be increased or decreased linearly on the diagonal between the pair 0.6mM source+0.4mM sink and 0.4mM source+0.6mM sink. The substrate concentration will not change as e.g. the pairs on the diagonal 0.4mM+0.4mM to 0.6mM+0.6mM will have the same probability at an average concentration of still 1mM for the ensemble. In case we e.g. decrease the probability for high substrate concentration in source plus low substrate concentration in sink and increase mirrored the probability for low substrate concentration in source plus high substrate concentration in sink linearly and symmetrically the blue curve becomes larger while the purple curve becomes smaller. However, as the value of the starting point (at 0mM substrate rearranged by exploration or exploitation; Homo Economicus) is also strongly affected by only a decrease in probability all curves decrease in size (data not shown)

and are difficult to compare with the uniform distribution of probabilities. The unconditional violent ensemble has always an advantage in the beginning as more substrate is transferred in the peaceful region (Homo Economicus) as soon as the red line is crossed. For this advantage concerning the maximal outcome in terms of b_e-c_e there seems to be no positive compensation in this example. On the other side subadditivity will always be much larger in the unconditional violent ensemble as subadditivity is not only developing in area IV but subadditivity is also spreading to area I. It is important to emphasize again that the cost of the substrate in source or sink does not yet include the cost of force or deception – especially for the unconditional, chronic use confined to area I where there will be no effect at all on the total superadditivity.

The schemata in figure 4 and 5 for the independent ensembles seem somehow redundant because of their symmetry to the central axis of strict symbiosis and strict antibiosis. However, at lower substrate concentrations in source and sink (area III) both benefit functions are steep; at higher substrate concentrations in source and sink (area II) both benefit functions are flat. The cost function is linear and has everywhere the same slope. As a result the transfer of benefit dominated substrate will produce much more superadditivity (area III) than the transfer of cost dominated substrate (area II). Transfers resulting in concentration pairs located beyond the line of strict equivalence will result in subadditivity. More subadditivity will be produced in area III than in area II. Therefore, it is necessary to separately investigate both cases because they do not behave as image and mirror image. In figure 9 I look at first at the transfer of cost dominated substrate and at an increase of supply only by an ensemble controlled by source (area II, area “supply only” and neighbouring area in between).

Figure 9

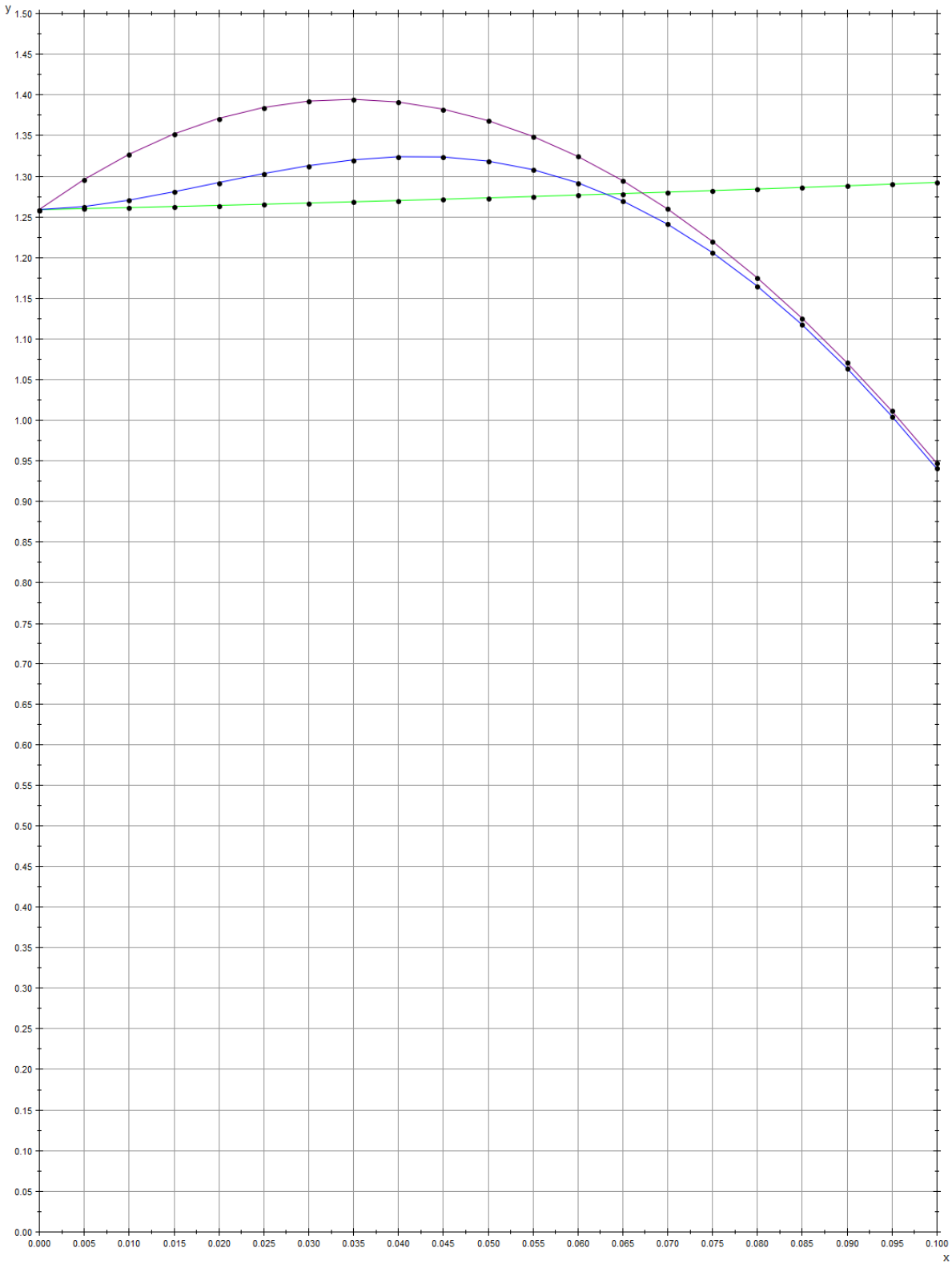

Figure 9
Here, “supply only” from exploration (p=0.01, green curve) is mixed with supply and demand from exploitation (p=1) in a transfer by conditional (blue) or unconditional (purple) force and deception. This figure is based on the schema in figure 4. The starting point for all is again at 0mM rearranged or new substrate the volume of superadditivity with the size of 0.0001258395912mM^2*np (y-axis, 10^{-4}). The developing subadditivity is so weak that all data points stay above zero.

In figure 9 (based on the schema in figure 4) we observe a surprising feature. Within our observation window the unconditional violent and deceptive ensemble controlled by source stays all the time on top of the conditional violent and deceptive ensemble at unchanged probabilities. In area II the transfer of low probability (p=0.01) new substrate (supply only) by force and deception is sufficient to compensate the increase of subadditivity. The total amount of subadditivity is very small and the curves stay above zero. An increase in superadditivity by supply only (green) is weak and never matches the maximal values of unconditional (purple) and conditional (blue) violent and deceptive ensembles! It seems that the strategy to get rid of a cost dominated substrate – a load – by unconditional force and deception is an effective strategy in a source controlled ensemble.

In figure 10 (based on the schema in figure 5) we observe similar features compared to figure 9 but with some differences. Exploration for new demand (figure 10) is a little more effective in the production of net profit than is exploration for more supply (figure 9). The maximal net profit through conditional and unconditional violence and deception in a sink controlled ensemble is also better than in a source controlled ensemble. However, the production of subadditivity is much stronger in the sink controlled ensemble than in the source controlled ensemble. The source controlled ensemble (figure 9) and the sink controlled ensemble (figure 10) are producing less net profit (superadditivity) than the master controlled ensembles, but what is more important, they produce much less subadditivity (in area II or III only) and stay above zero final net profit while the master controlled ensemble falls far below zero. On the other hand, conditional violence and deception has only in a master controlled ensemble a window of success, as the unconditional violent and deceptive ensemble suffers from a dramatic increase in subadditivity in area IV and unexpectedly in area I.

Figure 10

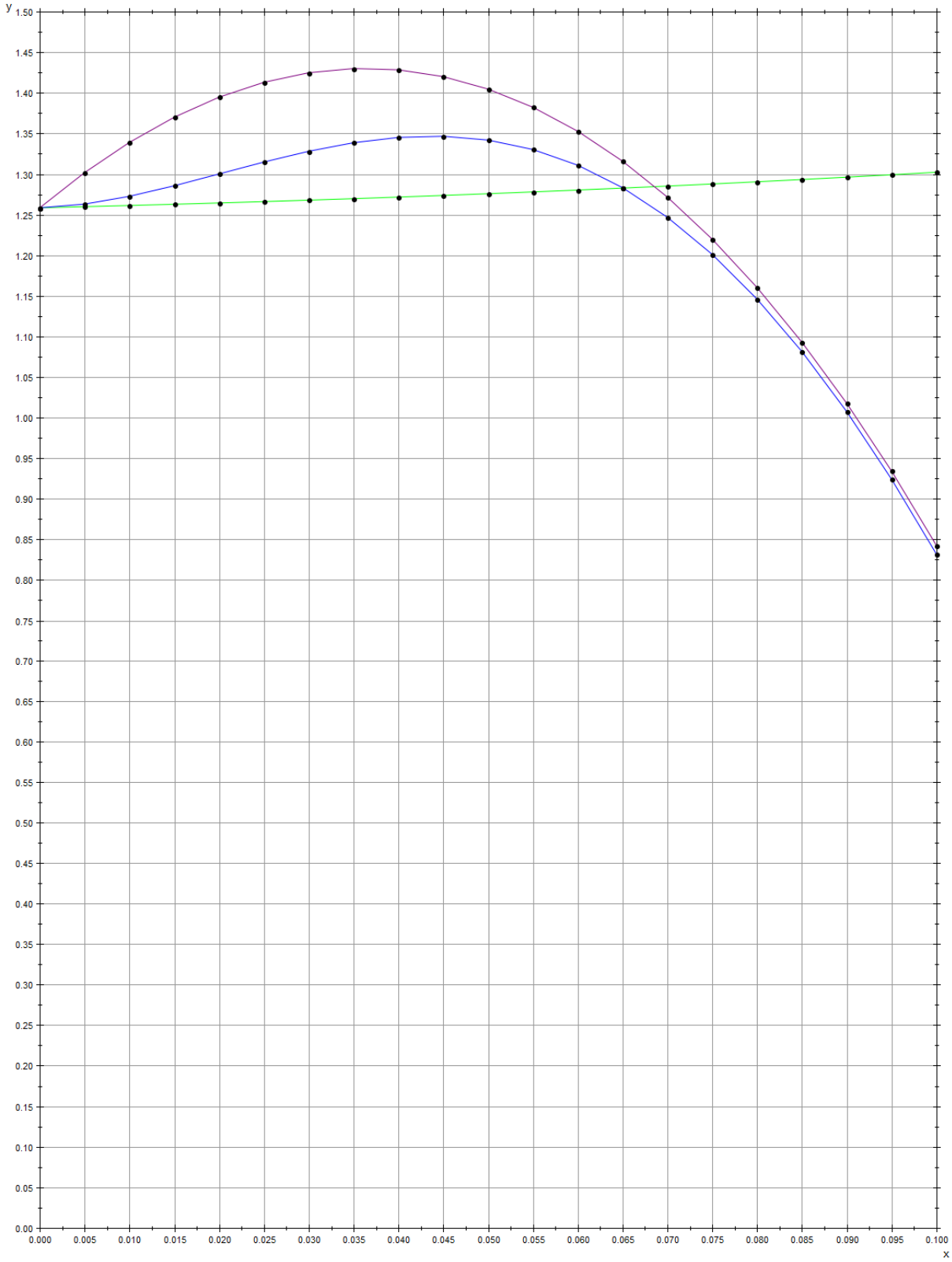

Figure 10
Here, “demand only” from exploration (p=0.01, green curve) is mixed with supply and demand from exploitation (p=1) in a transfer by conditional (blue) or unconditional (purple) force and deception. This figure is based on the schema in figure 5. The starting point for all is again at 0mM rearranged or new substrate the volume of superadditivity with the size of 0.0001258395912mM^2*np (y-axis, 10^{-4}). The superadditivity by exploitation is larger than in figure 9 and so is the subadditivity.

An additional observation within the model has to be discussed. The superadditive achievement of an ensemble of two Homo Economicus is represented by a volume between two bent curves; the inactive and the active ensemble.

The conditional violent and deceptive ensemble is within the limits of the Homo Economicus also a rational and peaceful ensemble indistinguishable in behaviour and result (superadditivity) from the ensemble of two Homo Economicus. Starting at the borders of source and/or sink (b_{so}-c_{so}=0 and/or b_{si}-c_{si}=0), new superadditivity and a new feature - subadditivity - are added at different rates “sideways”.

The unconditional violent and deceptive ensemble is within the limits of two Homo Economicus indistinguishable by result (in terms of total superadditivity not considering the futile investments) but not by behaviour! As soon as a minuscule amount is transferred beyond the limits b_{so}-c_{so}=0 and/or b_{si}-c_{si}=0 there will be similar to the conditional violent and deceptive ensemble superadditivity and subadditivity sideways. But in addition new superadditivity will emerge on top of the old superadditivity and new subadditivity will emerge below the surface of the inactive ensemble within the boundaries of the ensemble of two Homo Economicus. Only a decrease in K_m or an increase in V_{max} would have a similar effect - but without subadditivity.

This appearance of new superadditivity and subadditivity without change of K_m and V_{max} within the limits of the Homo Economicus must appear to a “Flatlander” like a miracle. However, there is no room for arrogance as we all, as part of many different ensemble, are Flatlanders. The single party is two dimensional and does not extend into the ensemble, not even a Planck length. The ensemble lies in a direction towards neither source nor sink can point within their own coordinate system; the ensemble is a new entity in a higher dimension.

The present day “two dimensional” game theory is unable to shed light on the group/ensemble. Whenever a three dimensional “thing” is forced into two dimensions we observe distortion and mingling. Observations within the model and in reality will no longer match everywhere (e.g. the earth depicted with a Mercator projection in comparison to a globe). The inexplicable observations (distortions) must scientifically be treated as exceptions with the necessity to modify the theory and the need of local assumptions and new variables. Other protagonists see the hand of a god, an explanation that was their aim right from the start.

A way for the Flatlander to understand the three dimensional ensemble beyond his two dimensional limits is to include the second party into the own balance and to understand the quantitative change in the second party as a qualitative change in the first party and vice versa. This implies an entanglement of both parties and has been already examined (8).
To entangle a genetically unrelated source and sink by deception is a very effective measure of many masters to sell the loss of a benefit dominated substrate or the gain of a cost dominated substrate. This entanglement usually claims familial relation (brother, sister, father, mother) or connects the fate of two parties (e.g. comrade).

The amount of superadditivity produced by an ensemble will decide the success when ensembles compete. Within a given “biochemistry” there will be starting conditions sustaining both parties and the ensemble will produce a certain superadditivity. In the course of repeated transfers it may occur that the transfer rate between source and sink is not balanced with the rate of accumulation in source or with discharge in sink. Source may become increasingly empty and sink may become completely saturated; superadditivity will become smaller and will finally be lost (up to subadditivity).

There are three measures to revive superadditivity:

- When source is empty and sink is full a transfer will be usually subadditive as most transfers will lead to concentration pairs beyond the line of strict equivalence or the concentration pairs are already there. A revolution of the transfer direction is a real possibility to bring back superadditivity. However, source and sink are characterized by more than a surplus or a lack of substrate. Usually there will be additional features like delivery and reception devices characterizing a source as a source and a sink as a sink. Simply exchanging source and sink may be successful for a brief moment only. When the extreme values have disappeared, the use of e.g. a source as a sink may be harmful to the whole ensemble and its superadditivity and it will take some time for the new source and the new sink to adapt. Revolutions occurred and occur and can be observed.
- Destructive mixing has already been discussed (3). The main weakness besides the destruction of (expensive) structures is the change from an internal timescale of concentration difference build up to an external.
- Another possibility is the recreation of the superadditive starting condition of source and sink (Homo Economicus, area I). In Judaism and Christianity, the concept of the “Jubilee year” is a special year of remission of sins and general pardon. In the book of Leviticus, a Jubilee year is mentioned to occur every fiftieth year, during which slaves and prisoners would be freed and debts would be forgiven. A Sabbath year (day) is a similar idea on a shorter timescale (7 years, 7 days) as is crop rotation with a fallow period, a recovery period. The old masters seem to have been already quite thoughtful to participate through tax, donation and harvest on a lasting, sustainable superadditivity. The used vocabulary is already unmasking (shepherd, flock, sheep etc.).

Finally, a confusing point may be the fact that within my model the active Homo Economicus has such a big share in the total superadditivity and the additional effect by force and deception is so small even at the optimal amount transferred. The reason is the large amount of possible concentration pairs (0.5mM to 0.6mM in source and 0.4mM to 0.5mM in sink) for a rational activity - give a cost dominated substrate, take a benefit dominated substrate - of the Homo Economicus. Imagine that the possible concentration pairs would all only belong to the red line b-c=0 in source and sink. Source would have no cost dominated substrate to give and sink could not take benefit dominated substrate, the two Homo Economicus would be completely inactive and all superadditivity (and subadditivity) would have to come from force and deception. On top of this consideration comes the fact that I have not considered the existence of a fix cost up to now.

Besides the variable (intrinsic) cost connected to the substrate and investment costs of force and deception the fix cost must be additionally subtracted from the benefit. The fix cost may or may not be present in the active and/or in the inactive ensemble to the same or different extend. After subtraction the fix cost is no longer visible as such. All net profit values of the ensemble (active or not) are parallel shifted; therefore, I usually omit them.
In figure 11 I give a scheme of a dependent ensemble with a fix cost. The continuous white borders include any transfer sizes not sufficient to produce enough net profit to pay the fix cost and the variable cost. This is only a part of area I where an increasing transfer at free will to the advantage of both sides will finally reach the maximal value of the win-win situation in the complete green area I (pure superadditivity).
Force and deception starting then outside of area I will at first further increase the net profit (superadditivity>subadditivity) until the increasing subadditivity will decrease the total superadditivity (including that from area I) so strong

that net profit of the ensemble (all cost types considered: (b_e-c_e=0, fix cost, variable cost and investment cost for force and deception) becomes zero (dashed white borders). A positive net profit of the ensemble will only be observable between the two types of white borders.

Figure 11

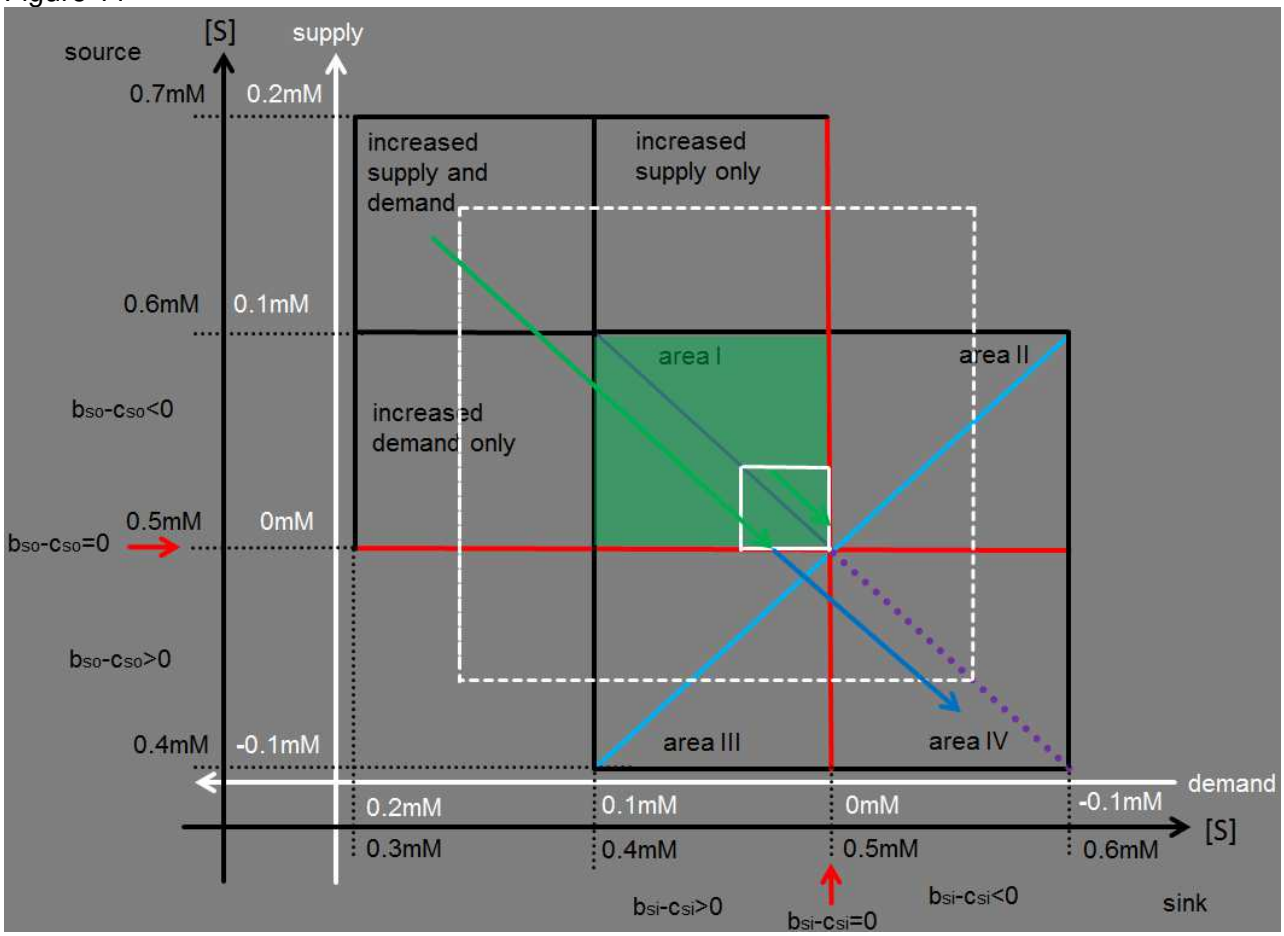

Figure 11
This is a scheme of an ensemble controlled by a conditional violent master. The continuous white lines include the transfer size (short green arrow) and concentration pairs of the ensemble that will not jet be sufficient to produce a positive net profit due to fix cost and variable costs (c>b). The dashed white lines indicate the border beyond where the additional net profit through exploration and exploitation will fall back again under the sum of fix cost, variable cost and investment cost for force and deception due to subadditivity (c>b, blue and long green arrow).

In case the fix cost is too high (larger than the green area I, up to the dashed white border) the whole ensemble will never be able to produce any positive net profit by any means. This does not imply that the ensemble will stay inactive under a master. In case the master is payed according to the amount transferred in “the here and now” and not to the positive net profit produced in

the future the master will be very active to force and convince the ensemble to transfer. The complexity of this problem in industry and commerce has been recognized and discussed (9 and 10); in other parts of society this insight and discussion is yet to come.

Within the continuous white borders - as long as the voluntary transfer is not jet producing a positive net profit due to the fix cost - there is room for trust forming actions, pledge of reciprocity, tests of stamina and promises of a bright future for the single parties and the ensemble of both. The measures in reality depend strongly on the type of ensemble: dependent and controlled by a master or independent with source or sink in the driver seat. In case the continuous white lines will fall onto the dashed white lines the promises of truth will be a lie and the proof of stamina will be self-defeating. The ensemble will never produce a positive net profit; this will be a completely consumptive ensemble – but if there is no competitor or the competitor is even worse off or only the masters compete (success measured by transferred amount); who cares as long as the sun will shine?

In case the continuous white line encompasses completely area I a positive net profit will be the result only of force and deception or exploration. This is similar to the case already mentioned above with assumption of an absent probability of appropriate concentration pairs within the green area I.

In addition, within a perfect symmetric ensemble the variable cost of the single parties appears as a fix cost to the ensemble of both. The cost that is lost in source is gained in sink to the same extend. This will become an additional stepping stone in an ensemble with an intelligent master, an intelligent source and an intelligent sink to come to a mutual understanding.

It is now not attempted to repeat all calculations with a fix cost. I will only look briefly at the dynamics of an increasing transfer size within the green area I with a step size of 0.005mM as above. The dynamic increase in net profit in the green area I is shown in figure 12.

Figure 12

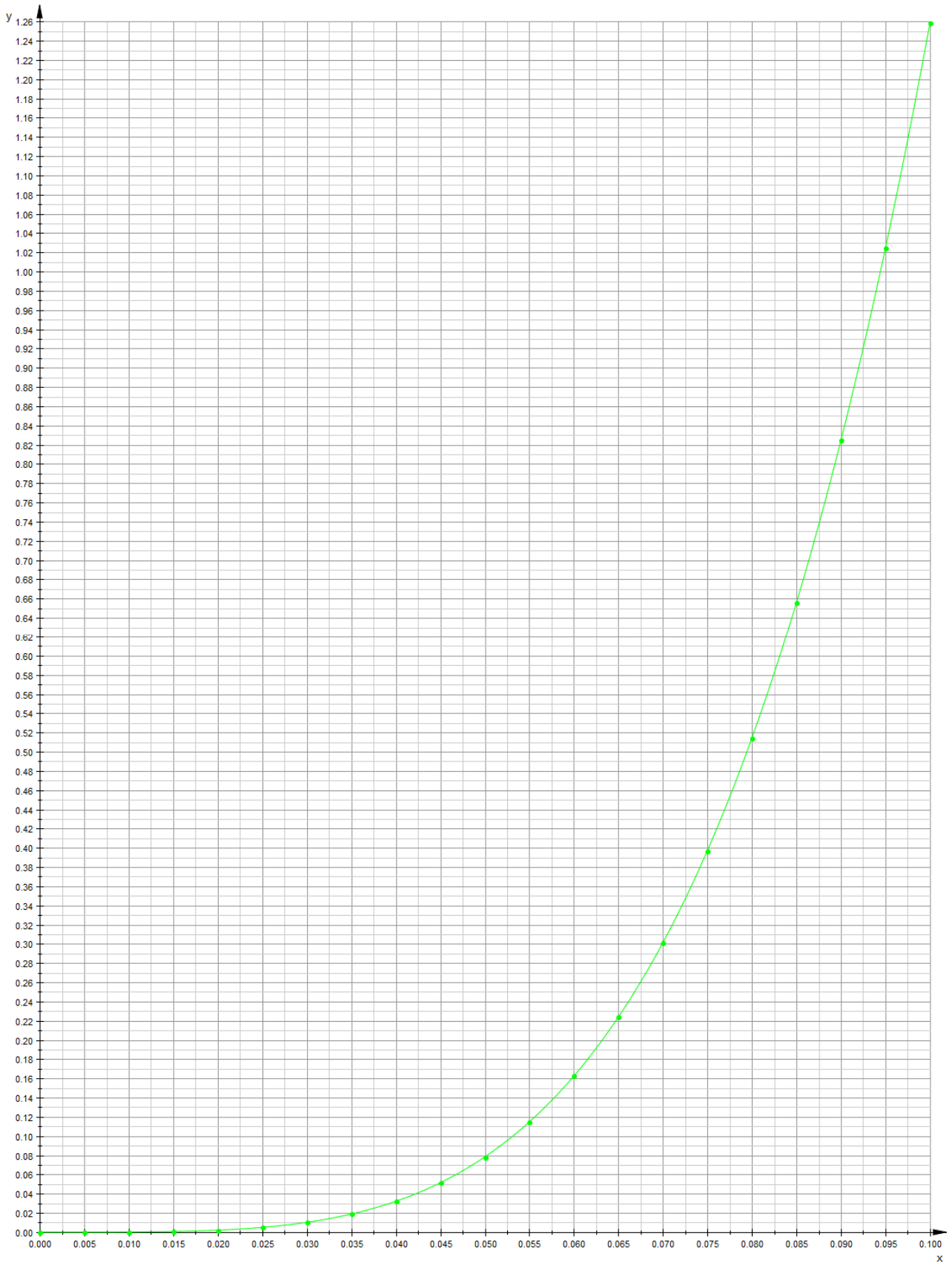

Figure 12

The green curve shows the dynamic net profit increase in an ensemble of two Homo Economicus (area I); no fix cost. In this figure 0.0001258395912mM^2*np (y axis *10^{-4}) is the maximal value. This value was the starting point in the pictures above, the complete area I.

The first 0.05mM substrate transferred from source to sink in full approval of both sides will create only 6.25% of the complete superadditivity possible in area I (within my example). The next 0.05mM of transferred substrate will create an additional superadditivity of 93.75%!

The topography of superadditivity under consideration of investments in mixed strategic ensembles

The three pure strategic ensemble types are possible and existing strategies but there will be also a mix of strategic types. They may be controlled to different extend by a third party as master (figure 8) or/and by source as master (figure 9) or/and by sink as master (figure 10). The master could be biased and make a coalition with source or sink to a different intensity in the different mixtures.

I focus on the three basic strategic types of ensembles and their mixtures all and only controlled by a master and a transfer size of 0.02mM by exploration (p=0.01) and 0.02mM by exploitation (p=1). All three types are at this transfer size to a different extend superadditive within my example (figure 8, table 1). The resulting total superadditivity in exploration and two types of exploitation is used as the three coordinates x, y, and z in a three-dimensional coordinate system. The mixed types will now form a surface between the three coordinates. In case I would observe many transfer-seizes simultaneously I would have many surfaces as layers. That would become confusing but as only $1/8^{th}$ of the available space is consumed source and sink controlled ensembles could be included sideways.

In figure 13 I show an example of the maximal net profit of area I. This is an ensemble of two Homo Economicus still without consideration of fix cost. All three coordinates are of the same size as exploration and two types of exploitation are not yet distinguishable. The result is 1/8th of a sphere with the radius 0.0001258395912mM^2*np (figure 13a, b, c).

Figure 13

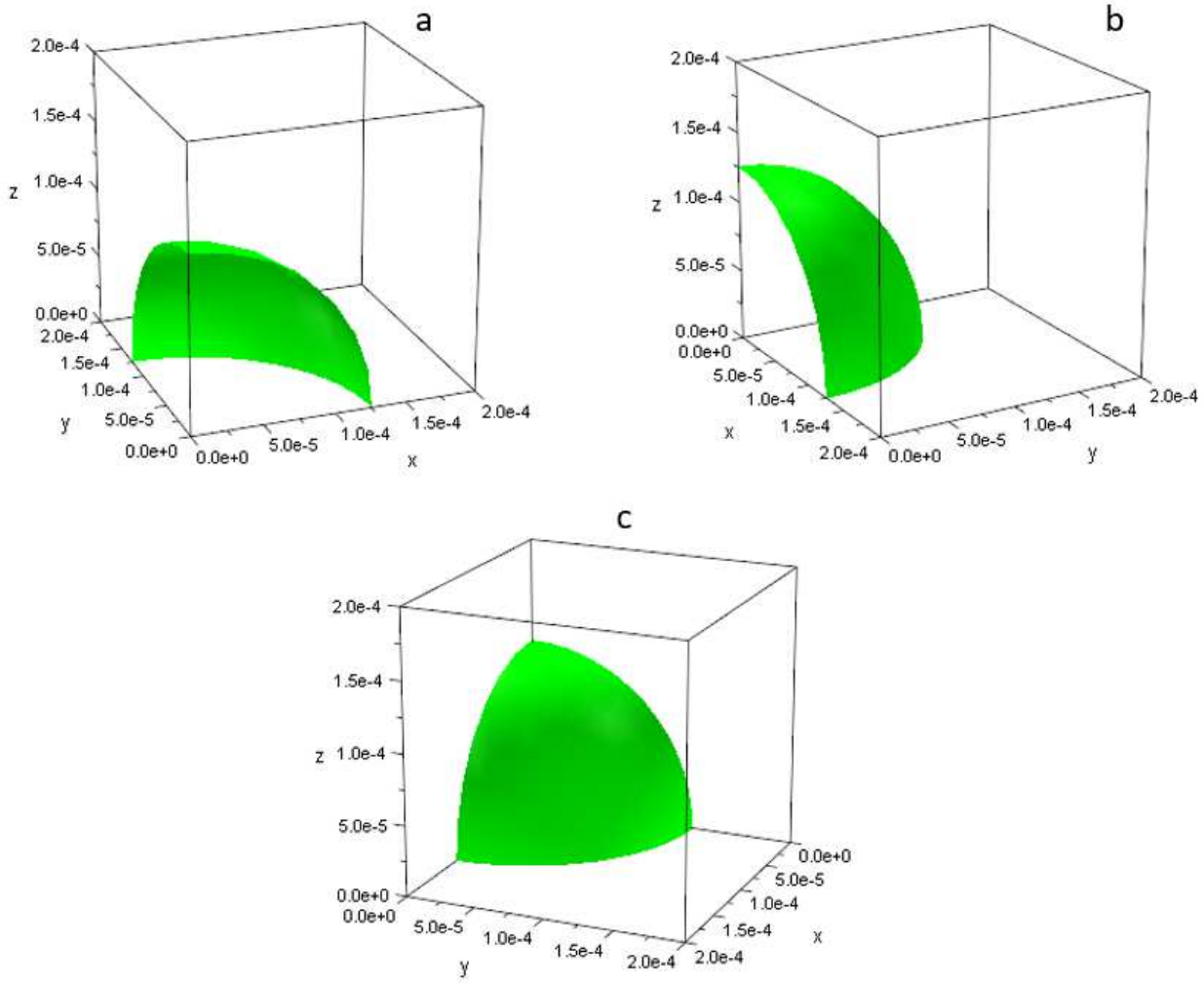

Figure 13
We look from different angles (a, b, c) at the same idea – the superadditivity of two Homo Economicus in the limits of area I. The green surface is 1/8th of a sphere with r=0.0001258395912mM^2*np without a fix cost or an investment into force and deception. The radius was the starting point in the other pictures above (exception is figure 12 where it was the endpoint); the superadditive volume of the complete area I.

However, even in a peaceful and rational ensemble of two Homo Economicus we must consider fix costs. They are related to information costs of two parties and their peaceful master. The source must signal the will to give

substrate as the source is cost dominated, sink must signal the will to take up substrate as the sink is benefit dominated and the master will have some brokerage costs and he must detect the status of source and sink. In the following pictures the superadditive volume (mM^2*np) is therefore reduced by 2% and always depicted in orange. The additional superadditivity at 0.02mM (table 1) in all three strategic types of ensembles is the result of investments into force, deception and exploration.

Table 1

	maximal superadditivity ($10^{-4}mM^2*np$)	additional superadditivity	assumed investment	resulting superadditivity ($10^{-4}mM^2*np$)
Homo Economicus	1.258		2%	1.23284
Exploitation, unconditional	1.466 (at 0.02mM)	16.53%	10% 30%	1.3194 skilful investment 1.0262 unskilful investment
Exploitation, conditional	1.33 (at 0.02mM)	5.72%	5% 10%	1.2635 skilful investment 1.197 unskilful investment
Exploration	1.272 (at 0.02mM)	1.11%	1% 5%	1.259 skilful investment 1.2084 unskilful investment

The aim of such investments is new and rearranged substrate. I assume that the investments will be paid by the total superadditivity of each ensemble (no credit). A credit would be necessary if the superadditivity of the two Homo Economicus and their peaceful master would not exist (p=0) or the fix cost would completely consume area I. Will there be sufficient superadditivity to pay interest and repayment would then be an interesting question. As result of a skilful investment into exploration and exploitation the additional, cleared superadditivity will be larger than the superadditivity of the not investing dependent ensemble of two Homo Economicus with information costs. With an unskilful investment into exploration and exploitation the additional superadditivity will not be able to earn the investment. The ensemble of two Homo Economicus (minus 2%) will then have a better superadditivity. Such

unfortunate investment (table 1) is rotating among all three types in the next figures.

In figure 14 the unskilful investment of the unconditional violent and deceptive master (30%) lowers the superadditivity below the ensemble of two Homo Economicus. Here the conditional violent and deceptive dependent ensemble (5% cost of violence and deception) and the exploratory and dependent ensemble (1% research cost) act very skilful.

Figure 14

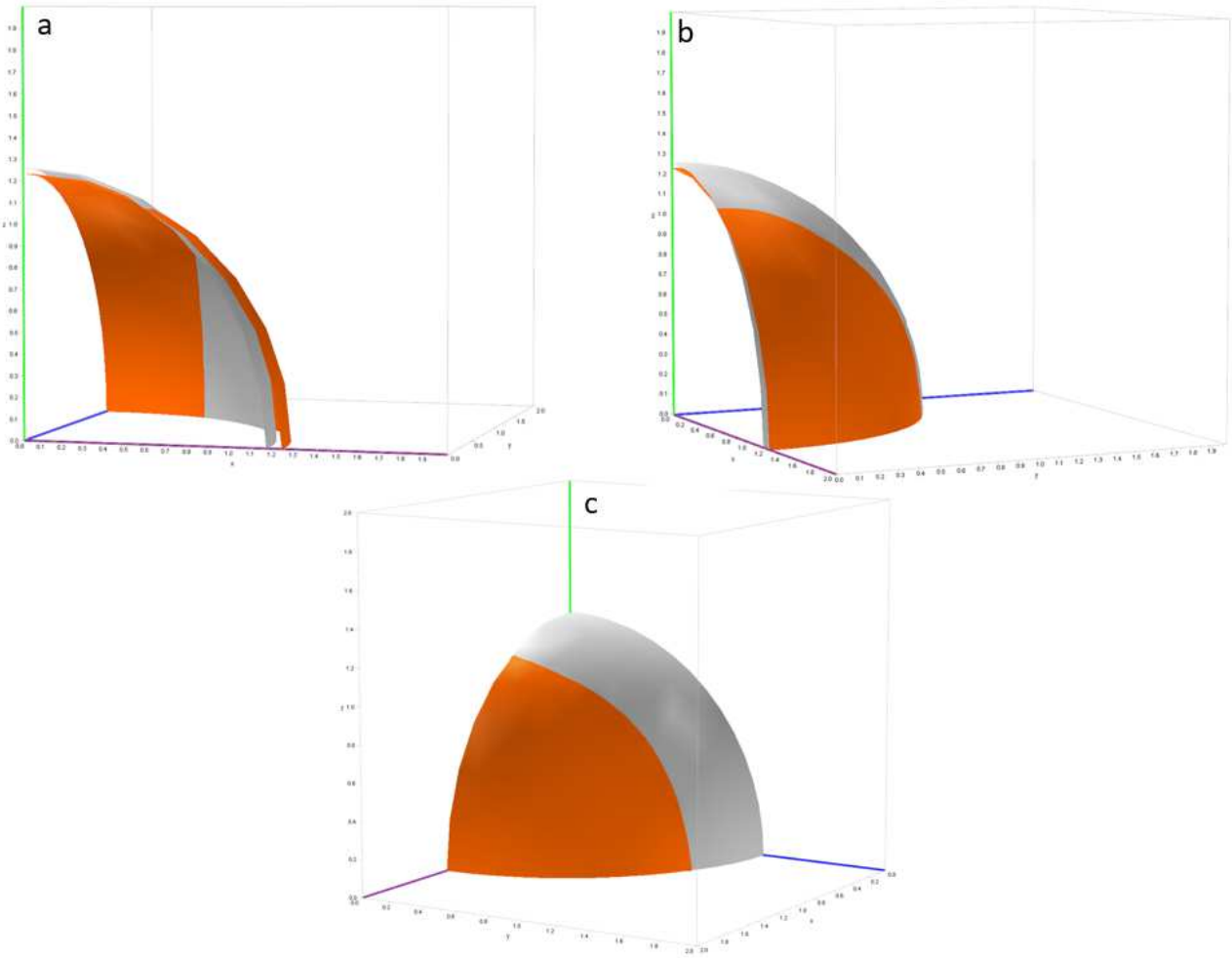

Figure 14
We look from different angles (a, b, c) at 1/8th of a sphere and 1/8th of an ellipsoid. The orange sphere is a dependent ensemble of two Homo Economicus in the limits of area I with information costs of 2%. The radius of the orange sphere is reduced by two percent compared to the green sphere in figure 13. The grey ellipsoid represents all possible mixtures of the three strategic types (three radii): X-axis, purple: unconditional violence and deception (unskilful); Y-axis, blue: conditional violence and deception (skilful); Z-axis, green: exploration (skilful).

In figure 15 the investment of the conditional violent and deceptive master into brute force and deception to obtain additional 0.02mM is unskilful (10% cost of total superadditivity). The unconditional violent and deceptive master obtains at the same percentage of investment more as the cake is larger; therefore, his investment is skilful. Exploration is also still skilful as the research cost (1%) is smaller than the resulting, additional superadditivity.

Figure 15

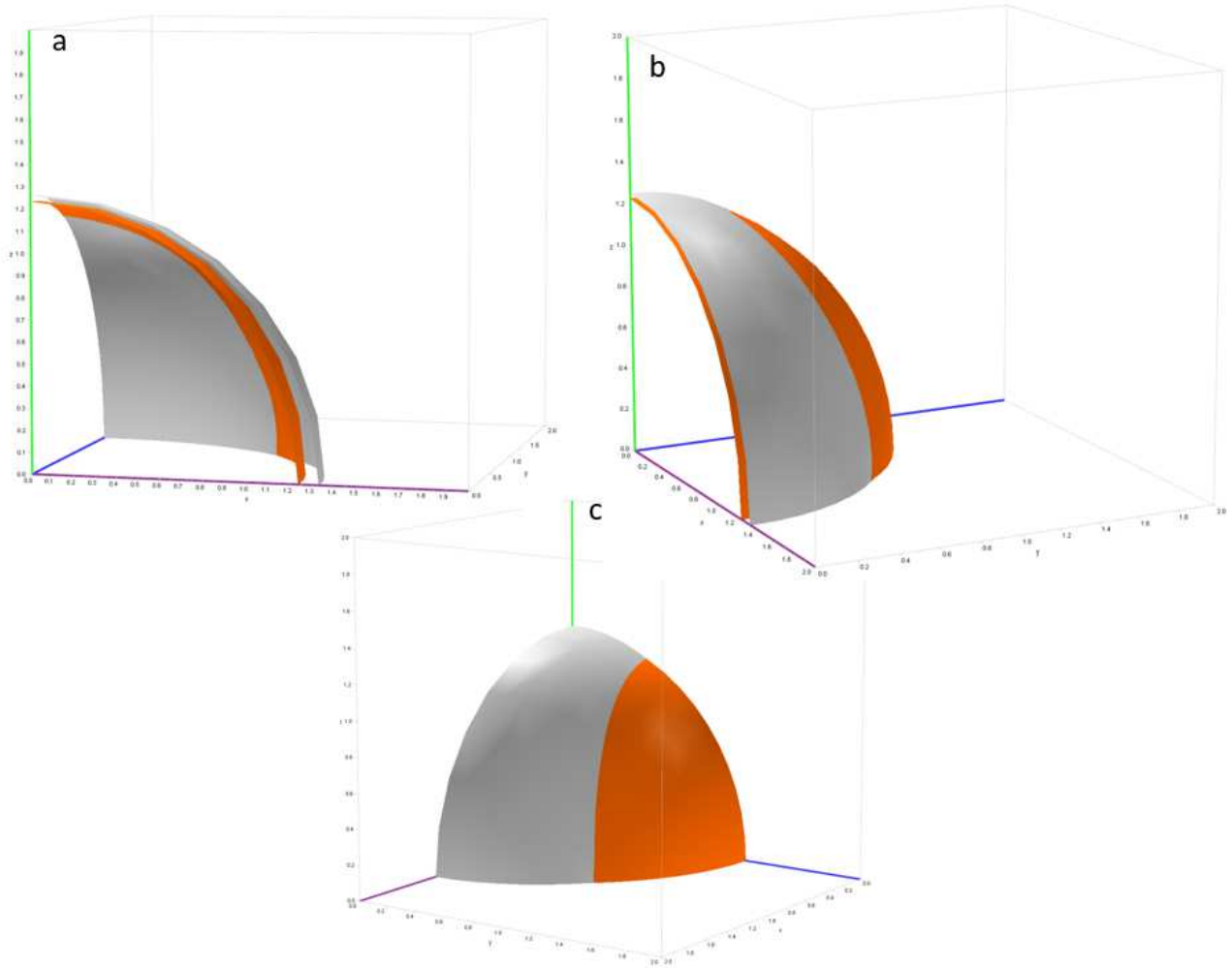

Figure 15
Three observation angles are depicted (a, b and c), again. The orange sphere is the dependent ensemble of two Homo Economicus in the limits of area I with information costs of 2%. The grey ellipsoid is a mixture of the three strategic types: X-axis, purple: unconditional violence and deception (skilful). Y-axis, blue: conditional violence and deception (unskilful). Z-axis, green: exploration (skilful).

In figure 16 the unskilful investment is made by the master making source and sink explore the unknown. The investment into exploration is increased to 5% but at an unchanged finding probability (p=0.01; more administration, same amount of equipment and scientists) of the expected superadditivity. At that low finding probability and low superadditivity the investment is consuming more than it will earn.

Figure 16

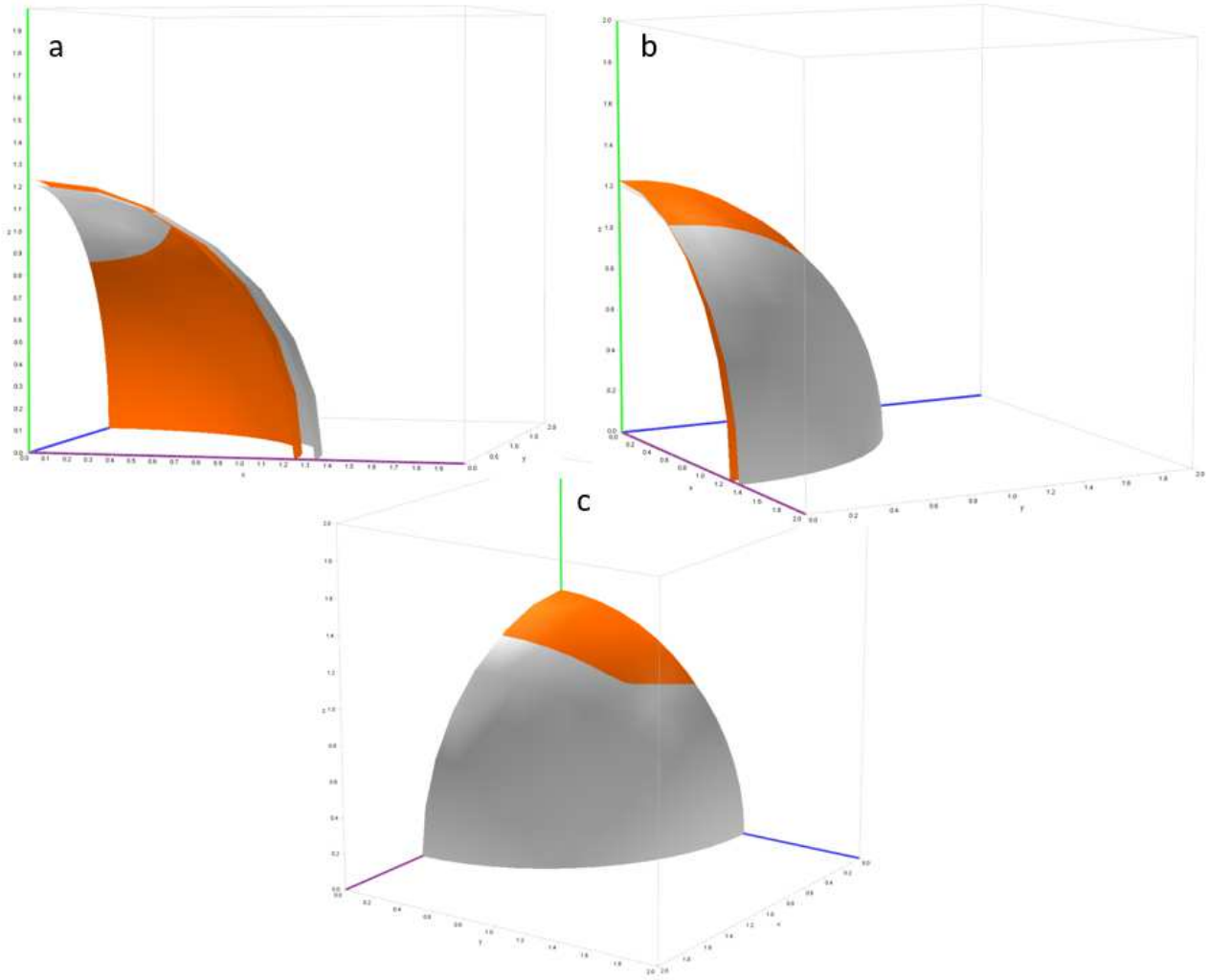

Figure 16
The orange sphere is again the dependent ensemble of two Homo Economicus in the limits of area I with information costs of 2%. The grey ellipsoid is a mixture of the three strategic types with the following assumptions: X-axis, purple: unconditional violence and deception (skilful). Y-axis, blue: conditional violence and deception (skilful). Z-axis, green: unskilful exploration.

In figure 17 I will now combine all three different possibilities of skilful and unskilful investments. The result is a complex topography of all possible strategic types above and below the reference – the Homo Economicus. I could have decided to lower the superadditivity of two strategic types below the ensemble of two Homo Economicus. Several combinations of “below” and “above” are imaginable and the single topography would change accordingly.

Figure 17

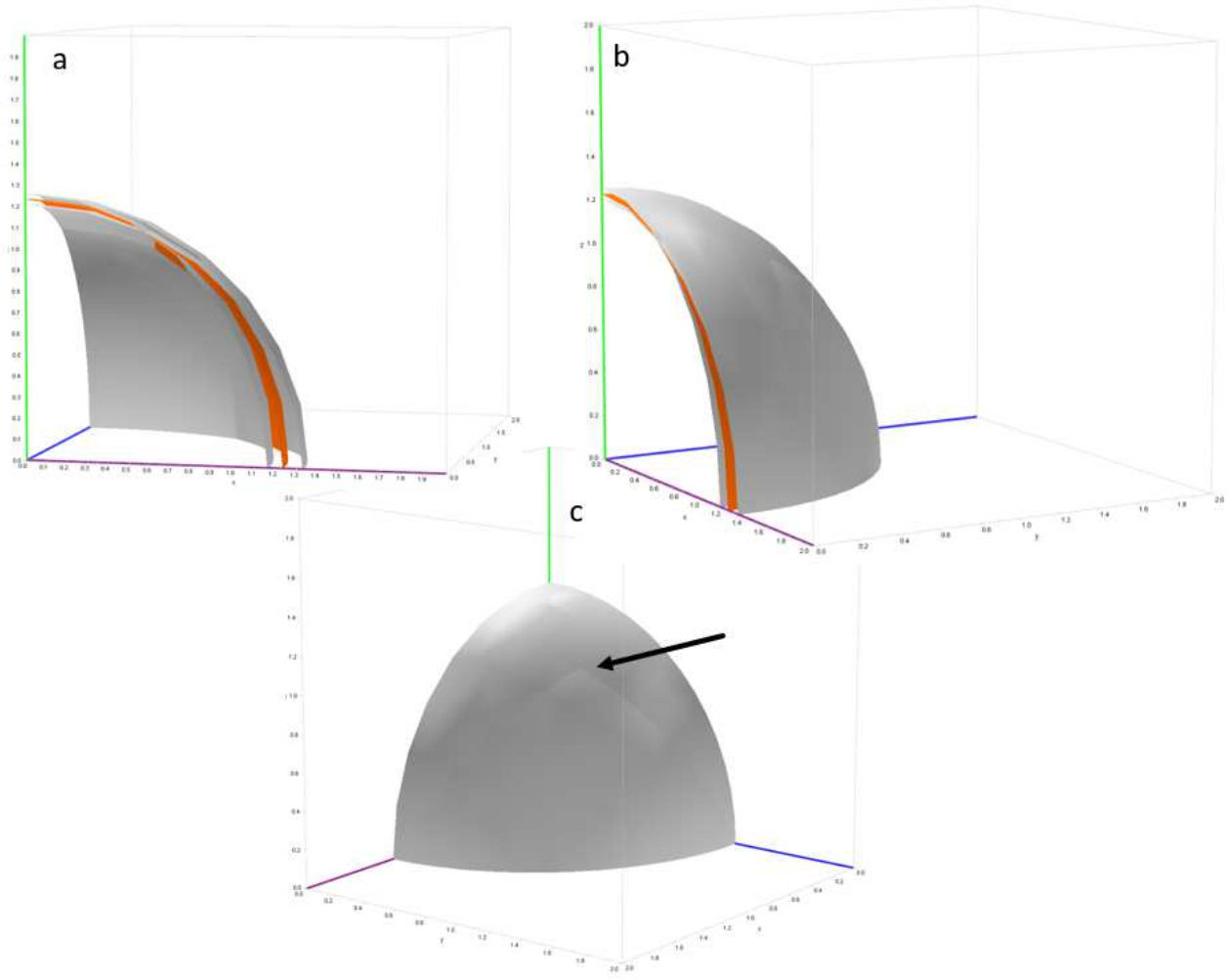

Figure 17
This figure is a combination of figure 14, 15 and 16. We look at a topography of a mixture of different pure strategies and different sized investments (violence, deception, exploration) from three different angles (a, b and c). The black arrow marks the intersection point of the three ellipsoids.

The Homo Economicus is now no longer directly visible. He is sandwiched between more and less successful combinations of exploration and

exploitation. Another reason why he is not easily detectable in observations. In case of larger unskilful investments an orange triangle would appear in or near the central part where the three ellipsoids intersect (difficult to see in figure 17c, black arrow). That is an interesting observation. The Homo Economicus may appear after dramatically unskilful investments but only if: 1. $p \neq 0$ for superadditive concentration pairs in area I; 2. fix cost is not identical to the superadditivity achievable in area I. Similar pictures are obtained for the two independent ensembles and their mixtures of the three strategic types with skilful and unskilful investments (not shown).

It is now easily imaginable that two adjacent ensembles with identical transfer size and very similar but not identical investment structure (slightly varying combination of the three strategic ensemble types) at the same investments will come to contrary analytical conclusions. One may be just superior to an ensemble of two Homo Economicus while the other is just inferior. This ensemble will praise the rationality, peace and success of the Homo Economicus and choose it as role model while the first one will look down at the Homo Economicus as a weaker strategic alternative with less superadditivity and consider it therefore an anti-model.

Two ensembles may have an identical mix of the three strategic types but a slightly different investment structure. These two ensembles may appear in the same spot above and below the surface of the ensemble of two Homo Economicus. Here the insight into the reason for the difference would be more obvious. Either the investments must be changed or the strategic mix is to be changed. However, the solution for improvement is difficult and what is the aim? The ensemble on top or the ensemble of two Homo Economicus with all what´s necessary?

On the other hand, two ensembles with a completely different mix of strategic types and with completely different investments into exploitation and exploration (and maybe even different transfer sizes which is not treated here) may both be better than the ensemble of two Homo Economicus and their peaceful master and they may be even equivalent in direct comparison. What a surprise to the inhabitants of two such ensembles. The other ensemble does everything differently and will spend larger or smaller investments (money and effort) on welfare, health care, police, military, research, development, education, propaganda, and cultus and yet their final, cleared superadditivity is comparable – although the relation of superadditivity and subadditivity is different. They may develop the idea to improve their own superadditivity or reduce subadditivity by reducing or increasing investments to imitate the investment structure (or transfer size) in the other ensemble.

Let us discuss the case of a moral master who wants to reduce violence and deception. Unconditional violence and deception at 0.02mM substrate (new and rearranged, figure 8) is responsible for a considerable amount of superadditivity. The loss of superadditivity after reduction of unconditional violence and deception will be much more pronounced in a strategic mix where the apparent need for less violence and deception seems to be most important – what a disappointment.

Now, let us discuss the case of a greedy master – 0.02mM additional substrate rearranged by deception or violence does not yet produce enough superadditivity for him. He has two options for the conditional violent and deceptive case: enforce more substrate transfer with more conditional violence and deception or a change of strategy *i.e.* more unconditional violence and deception (exploration has too small effects here).

More unconditional violence and deception will successfully produce more superadditivity without more substrate transfer in ensembles with a mix dominated by the conditional strategy. However, in case the mix is dominated by the unconditional type more transfer will reduce superadditivity. There will be a mixture of strategic types where the unconditional use of violence and deception in the conditional type at the same transfer size of substrate will be compensated by the decrease in the unconditional type by more transfer of substrate. More violence and deception alone or in combination with more transfer of substrate will both be successful for a conditional violent and deceptive master at 0.02mM. Neither more violence and deception (more transfer) nor a switch to less violence and deception will be successful for the unconditional violent and deceptive master as he has reached an optimum.

The choice of the different sizes of investment are arbitrary but follow the idea to let two pure strategic types above the ensemble of two Homo Economicus (orange surface) and lower one strategic type below the ensemble of two Homo Economicus. The reasons for the investments are plausible and the underlying superadditivity or subadditivity is a real thing based on measurable quantities (net profit derived of a benefit and a cost in dependence of concentrations in two compartments before and after a transfer). This is less arbitrary than the choice of the always subadditive and propagandistically use of the dimensionless numbers in “prisoner´s dilemma” to advertise the superiority of “cooperation”. What is *e.g.* the physical dimension of a “temptation to defect” and how can I compare this to a “punishment for no cooperation”? How can such a concept ever be quantified and checked in the real world?

General Discussion

The Homo Economicus is real – he exists in contrast to all triumphant and jeering condolences (11). He is “alive and kicking” but he is also kicked or deceived and that is the problem when we observe him.

When kicked (forced) or especially when deceived by lifelong education in a human culture he behaves still rational in his own view but this is difficult to understand as the observer does not walk exactly in his identical shoes and does not share all of his many considerations based on true but also intentionally wrong information. He must have simultaneously many second thoughts besides the action of hormones and old wiring. External observers see irrational or unreasonable behaviours and think that there is no Homo Economicus. However, HE has to consider many things with different currencies in parallel on the basis of possibly false data and misleading educational instructions and he is making compromises - lots of compromises. That is the reason for so much confusion in Economy, Sociology and also in Biology.

In Biology irrationality does not appear in the objects of observation but in the observer. Rational behaviour of organisms is interpreted by scientists educated and conditioned by society and in some cases by religion. The observer is already loaded with *a priori* interpretations and cultural founded illusions. Those misleading concepts have been invented in the past to produce superadditivity by deception within the human ensemble. Today they produce scientific confusion and a waste of research money; subadditivity.

On top of the confusing observations stands the fact that the Homo Economicus is not of human appearance. He is THE biologic organism *per se*; he is Biology. He dates back to the origin of all life with all evolutionary history. All organisms obey the physical laws. On the foundation of physics lie the conservation laws. The conservation laws exclude miracles - every bill

has to be paid. The only way out is to have someone else pay the bill; this may include the use of force and deception. In the course of evolution we would expect that organisms learn to circumvent harming circumstances like force and deception. Organisms try to but are not always successful. Counterforce and better or true information must be financed and that is not always payable. Furthermore, force and deception can lead to a higher efficiency of the ensemble of both parties as shown in my model. An already saturated sink may carry an additional burden to reduce the cost for the ensemble; an already unsaturated source may still give a benefit to a sink were the loss will be overcompensated improving the superadditivity of the ensemble.

Force and deception are not evil *per se*; “evil” is a moral category and applies mainly to the use of force and deception by others. Strength is an indicator of better muscles or weapons. Planned and organized deception is an indicator of more or better information gathering and information processing. It is reasonable to put scarce or needless resources into the place of best efficiency (higher benefit or less cost) within a group which I prefer to call an ensemble. Ensembles compete and the better and more efficient ensemble will prevail. The ensemble concept (3) teaches us that the clever rearrangement of benefit or cost dominated substrate may result in much better efficiency of an ensemble than the sum of two strong but isolated parties (*The whole is greater than the sum of its parts*; Aristotle. What Aristotle did not realize is that the whole can also be smaller than the sum of its parts).

Substrate (e.g. the supply side, area III) is usually scarce and achievable only with a small probability by exploration. Exploitation by force and deception, rearrangement of substrate to a place of better efficiency, is a very successful strategy. The successful action of an ensemble with a master using force and deception has been recently demonstrated in experiments with humans (12).

Milinski *et al.* state: “Everybody gains, but the extortionate representatives and their groups gain the most.” The “extortionate representative” appears to me as a master using force and deception. In case a stronger exploitation will earn more than it will cost, this proceeding will be successful on the short run. If wise limits are still respected it may also be a long term strategy (5). However, the most important proof of the success of a master-servant ensemble is described in Rogers *et al.* (13).

Yamagishi *et al.* (14) are interested in the question (citation): “Is human prosociality a consequence of cognitive control of selfish impulses? Alternatively, is it a default option that most people use unless they are cognitively persuaded that a given situation does not require them to behave prosocially?” and they have an answer: “Our results support the latter argument.”
In addition they state: “Participants with weaker cognitive control fairly shared a reward with another participant even when there was no chance of punishing unfair behaviour, whereas those more capable of cognitive control behaved selfishly in the same situation. These findings demonstrate that participants’ intuitive choices in economic games are prosocial”. End of citation. The “cognitive control” correlates with “cortical thickness of the dorsolateral prefrontal cortex”. Is this a measurable difference in an aspect of intelligence?
Citation from 14: “….. showing for the first time, to our knowledge, that strategic reasoning and cortical thickness of the dorsolateral prefrontal cortex were not related to giving in the UG (ultimatum game) but were negatively related to giving in the DG (dictator game). This implies that the uncontrolled choice in the DG is prosocial rather than selfish, and those who have a thicker dorsolateral prefrontal cortex and are capable of strategic reasoning (goal-directed use of the theory of mind) control this intuitive drive for

prosociality as a means to maximize reward when there are no future implications of choices." This interpretation contradicts my conviction that the Homo Economicus lies at the centre of all decisions and reasoning. I have two suggestions:

- My model is of a strict biochemical nature. I assume that the participants of this study were all well-fed (saturated). To be saturated, however, is a basic condition in my model to give with more ease than to take. We then would find the participants in area I as a "Homo Economicus source". This is not farfetched as it is known that serotonin levels modulate behaviour towards unfairness (15; citation from 15: "Participants with depleted 5-HT levels rejected a greater proportion of unfair offers") and high serotonin levels shut off appetite. Appetite is connected to taking (food intake); to shut of appetite may mediate a giving behaviour within the Homo Economicus. The rational behaviour within the voluntary area I is misinterpreted as prosociality.
- The "asymmetry of the cortical thickness" within the population may not be an accidental distribution. The reasons for heterogeneity in a population are manifold. Heterogeneity may contribute a useful asymmetry like in sickle-cell anaemia. A small group of individuals suffer but the population gains an advantage. Asymmetries, when appearing in my model, can reduce conflicts "to give a benefit" or "to take a cost" dramatically as I have already shown (4).

  Within a perfect symmetric ensemble there will be at certain concentration pairs and borders an intensive need for force and deception to give a benefit dominated substrate and to take a cost dominated substrate. This conflict will significantly be reduced or absent when one side is genetically adjusted to behave in a way that will reduce the duration or intensity of conflict and increase superadditivity.

However, within such asymmetric ensembles a new danger appears; subadditivity at the best will of both parties (4).

Finally, in another more recent paper (16) by Yamagishi *et al*. it is demonstrated that moral behaviour is preferred when the loss is small. That´s my Homo Economicus: an honest hypocrite depending on the currency, the exchange rate between different currencies and size of benefit and cost.

Man is not altruistically inclined, this would be a weakness evolution would instantaneously eliminate from the gene pool! When man gives he gets rid of a load or he is deceived or forced to give something of value. When man takes he takes something of value. In case he takes a burden he is forced or deceived to do so. We are as rational as all organisms but forced and deceived by culture to serve the ensemble. But we are also part of this ensemble and participate in the ensemble´s success or failure.

For social animals the position in a hierarchy is very important. A high rank will give access to (high quality) food and (high quality) mating partners. This will directly correlate to evolutionary success. Altruism in contrast is inversely correlated to evolutionary success separating benefit and cost.
In animals a high rank is the result of strength and experience (*i.e.* knowledge, intelligence). High rank may also be a result of tradition. The offspring of high rank females will in later life gain a high rank themselves with higher probability either by heritage or better starting conditions.
Man has developed a highly complex form of tradition – culture. Cultures define the characteristics and knowledge of a group of people. All members are educated within the culture by the culture through carrot and stick. The results are shared patterns of behaviours and interactions, cognitive constructs and understanding that are learned by socialization. A central

aspect of this education is the clear message that good reputation and prestige - a high rank - are the result of obedience to the rules. Funnily enough, there are lots of different and sometimes opposing and therefore confusing messages. Business people advance in rank when they accumulate lots of money, citizens will advance in rank when they donate money, soldiers will advance in honor when they follow orders and sacrifice their health (or life) and artists advance in fame when they do not follow the rules; and some people take part in a Chilli Eating Contest. These cultural characteristics are exploiting man beyond the limits of the Homo Economicus, harming individual health and fertility but produce additional superadditivity in case the developing subadditivity is kept under control – the real challenge. Man is not altruistically inclined, he is appreciation dependent and rank oriented. And yet, there may be an elusive feeling for the ensemble in entangled parties (8). My model includes and explains all that but my model has also a weakness: it is unforgiving, it lacks fuzziness. At the point of indifference (b-c=0, b/c=1) is no room for different shades of grey.

This is not a dystopian model; the model is realistic and does not contain a salvation promise unlike models with the promise of peace through cooperation and non-entangled brotherhood. The “Homo Economicus” is the core. But besides the two dimensional Homo Economicus there is also the three dimensional ensemble. The behaviour depends on many different external and internal starting conditions and the assessment of those starting conditions done on the basis of different currencies with different and varying exchange rates, preferences and abilities - a complex, flexible, never secure and ongoing process with room for errors and learning, force and deception, always guided by the economy of nature:

Aquila non captat muscas!

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