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Abstract

In this paper the results are given of an investigation into concepts from Economics, Organization Theory, Political Science, Psychology and Sociology. The goal of this investigation was to find out whether there is a set of concepts that may be considered to be basic to all these five social sciences. The set of concepts found will be modeled in terms of automata, thus providing a way of unifying the five fields in a general mathematical setting.

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1 Introduction

Not so long ago, say in the eighteenth century, research into what are now called social sciences did not make the elaborate distinctions that are made nowadays. Psychology and sociology are now considered to be different studies, one focusing on the micro-phenomena of the single actor, the other focusing mainly on macro-phenomena concerning the whole society and groups therein. Yet, the macro-phenomena are results from individual actions, on the micro-level, that on their turn are influenced by a.o. structures and norms on the macro-level. In the first case one speaks of *transition rules*, in the second of the *bridge function* between the macro-aspects and individual behaviour, somewhat unfortunate terminology. We will speak of the micro-macro transition respectively the macro-micro influence. The important thing is that sociology is based on psychology, although some researchers will maintain that sociology is to be studied only on the macro-level.
For a theoretical physicist who has worked in the field of statistical mechanics, this discussion is not unfamiliar. Ferromagnetism is a macro-phenomenon, but the theory is roughly that it is the result of microscopic interactions of magnetic spins, with single spins being influenced by the cooperatively produced magnetic field. The micro-macro transition here is described by a procedure of weighted averaging, that is notoriously difficult even for very simple models. As the "social atoms" in terms of which we would like to describe things are extremely

more complex than magnetic spins, we cannot have much hope for a similar theory. Moreover, an important difference between physics and social sciences is that the first field is dominated by the energy conservation law, that has no clear counterpart in the second field, see [1]. So we would need a different method for the averaging procedure anyhow.
The basic idea of social atom theory is that an actor is modeled as an automaton with a partial preference ordering on its set of states. Automata have inputs, outputs, rules to change states and rules to produce output. The reactions of actors on *issues* lead to interactions between actors and so determine a social network, that is mathematically an automata network.
The goal is not particularly modest, namely to define in terms of automata and networks of automata all concepts studied in social sciences. The hypothesis is that once the concepts that are basic have been modeled, in principle the various fields can be described in terms of them and a general mathematical setting has been found. An example of such mathematical modeling of concepts can be found in [2], where the concepts of *social support* and *social capital* were discussed.
The problem that stands central in this paper is to determine a first set of basic concepts from the indices of five, arbitrarily chosen, books each on one of the five fields mentioned. This without actually reading these books, some of which were of quite mediocre quality. Altogether about 800 concepts were found and these had to be compared, grouped and reduced to a small set of concepts that could be considered to be basic.
In Section 2 this reduction process is outlined. The concept of a social atom is discussed in Section 3. Section 4 describes the modeling as an automaton and contains a collection of definitions as preparation on future mathematical investigations. The concepts defined are mainly on the micro-level. Structures and processes will be discussed in forthcoming papers.

2 The selection process

The concepts were approached with a definite theory in mind, that will be explained further in Section 3. The starting point is that humans, *social atoms*, or groups of humans, *social structures*, perceive and have ideal views of states of affairs.

Definition 2.1. An *issue* I is something contemplated upon by a social atom.

It turned out that the about 800 concepts displayed four major classes of issues. These were:

- Activity
- Decision
- Goal

- Feature.

Definition 2.2. An *issue group* is a set of social atoms that share an issue or a set of issues.

It follows immediately that we may already distinguish *activity groups*, *decision groups*, *goal groups* and *feature groups*. At the start concepts were collected that could be seen as issue groups. A concept like *organization* occurred in the indices of the books on organization theory, political science and sociology. This does not mean that this particular concept does not occur in economics, but the corresponding index simply did not mention it. The concept *firm* occurred in economics, organization theory and political science. This overlap in the indices already shows that there is something to the hypothesis that unification of social sciences is possible.
In organizational theory, political science and sociology, a variety of organizational structures is mentioned. Economy deals with a rather limited, but important, subject: goods. Psychology centers on the individual human. The five fields differ in the subjects of study. We had to introduce a concept common to these subjects. The concept chosen was *issue*, see Definition 2.1.
The concept of issue group, see Definition 2.2, does not lead to a partitioning of the selected concepts, as the social structure may be considered an activity group as well as e.g. a goal group. An *institution* is probably primarily a goal group. That reaching the goal asks for activities makes the institution automatically also an activity group. In case decisions are made it would even be a decision group as well.

The smallest structures mentioned are the singleton structures:

- human, in all fields but political science
- individual, in economics and sociology
- person, in organizational theory
- unit, in political science
- ego, in psychology.

We have chosen "social atom" as the name for the singleton structure.

Of all concepts that were seen as activity groups, the concept *system* is the most general example of a structure in which activities, and the related causations between social atoms, form the main characteristic. Hence,

Definition 2.3. A *system* is an activity group.

Note that we take the issue "activity" as basic concept. We do the same with the issues "goal" and "feature", and give

Definition 2.4. An *organization* is a goal group.

Definition 2.5. A *class* is a feature group.

For the issue "decision" no specific concept was found that could be called a typical decision group. A concept like "government" is too special, as e.g. "board of directors". We will use the word *decision group* itself. By selecting these concepts, about 150 concepts from the list were covered. These were all social structures.

The basic notion for the description of the interaction between social atoms is *information*. Both the perception of an issue and the ideal concerning that issue are informational forms. The exchange of information between social atoms determines a network in the form of a *directed graph* $G(V, A)$, with loops for describing reflection of an atom on itself. The vertex set V of this network we call the *social universe* U. The arc set A is determined by the information exchange, where causations of physical nature may also be seen as giving rise to information transfer.

Definition 2.6. A *social structure* S is a subnetwork induced by subset P of U, called the *population* $P(S)$ of S.

For graph theoretical definitions we refer to any of the many text books on graph theory. The power set $\mathcal{P}(U)$ of the social universe describes all possible social structures. The set inclusion relation $\subseteq$ turns the power set $\mathcal{P}(U)$ of U into a partially ordered set $(\mathcal{P}(U), \subseteq)$. The social structure induced by U is what we call *society*.
Feature groups or classes, as we decided to call them, may be rather loose structures. Let for example the feature, issue, be "use of drugs". This class may consist of just individuals, without any information exchange, not essentially different from the class of bakers, where the feature is e.g. "baking bread". Interesting is the distinction made in psychology as well as in sociology between *in-group* and *out-group*. It shows the importance of the fact that issues have to be part of the awareness of people for the definition of certain structures. A person may not be aware of the fact that he belongs to the class of alcoholics, although he objectively does so.
The hard drug user may not consider the soft drug user to be a member of the drug user group. Difference in interpretation of the issue "use of drugs" leads to a separation of the group of drug users, in an objective view, into an in-group, of hard drug users, and an out-group of actors that, in the subjective view of the hard drug users, cannot really be called drug users.
This concludes the treatment of structures and substructures for the time being. The main new concepts introduced are that of *issue* and *issue group*.
The selection process continued by focusing on the functioning of the social atom and the role of information and perception. From there further choices of basic concepts follow. We will, however, first focus on a set of micro-level concepts.

3 The inner structure of the social atom

For each issue I a human may distinguish several states. Perc(I) denotes the perceived present state of issue I for a social atom. If $\mathfrak{I}$ denotes the set of all issues for a social atom then Perc($\mathfrak{I}$), a vector, denotes the present state of a social atom, as he perceives it.

Definition 3.1. The *state* of a social atom with issue set $\mathfrak{I}$ is Perc($\mathfrak{I}$).

Clearly a time variable might be indicated, so Perc($\mathfrak{I}$) $\equiv$ Perc($\mathfrak{I}, t$).

The basic notion for explaining the behavior of social atoms is that of the *ideal* state $Id(I)$ that an social atom has in mind for the issue I. In fact this is assumed for all issues in $\mathfrak{I}$, which may imply that there are incompatible ideal states, a phenomenon that we call *issue interaction*.

Now we assume that the social atom has *valuations* for both Perc(I) and Id(I), where that for Id(I) is assumed to be higher. Note that Id(I) is usually also one of the possible states of I. Even for one issue there may be more states than one that are valuated equally. This holds even more so for all combinations of states of issues in $\mathfrak{I}$. Id($\mathfrak{I}$) will consist of a set of states, not necessarily combinations of states Id(I) for all I, due to issue interaction. Seldomly there will be a unique ideal state of the social atom. The valuation of the total states $\mathfrak{I}$ may be a function of the issues in $\mathfrak{I}$ of rather complex nature, having local maxima. If the social atom is in a state Perc($\mathfrak{I}$), for which the valuation v(Perc($\mathfrak{I}$)) is a local maximum, changing to a more preferred state may involve temporary worsening. This is what *acts* are about. The social atom is assumed to try to change Perc($\mathfrak{I}$) into another state with higher valuation, for him.
For the decisions made by the social atom information is of vital importance. The states possible for $\mathfrak{I}$ may not all be known to the decision maker. In fact the ideal state Id($\mathfrak{I}$) may not even be a state that he is aware of.
Having discussed Perc($\mathfrak{I}$) and Id($\mathfrak{I}$) and their valuations v(Perc($\mathfrak{I}$)) and v(Id($\mathfrak{I}$)) by a social atom, we can define what is driving actions.

Definition 3.2. The *tension* of a social atom is $T(\mathfrak{I}) = v(\text{Id}(\mathfrak{I})) - v(\text{Perc}(\mathfrak{I}))$.

We may use the notation $T(\mathfrak{I}, t, i)$ for the tension of social atom i at time t on his state vector $\mathfrak{I}$.

LAW: Social atoms will tend to lower their tension.

This law, that may be called the "first law of psychodynamics", is at the basis of our theory. Note that we use the verb "tend to". It may be the case that the possibilities to lower T are not given.
There are, in principle, always four ways to lower tension. Involved are Perc($\mathfrak{I}$) and Id($\mathfrak{I}$), next to the valuations of these states by the social atom. All four concepts are subjective and the social atom may:

1. Lower $v(\mathrm{Id}(\mathfrak{I}))$,
2. Change $\mathrm{Id}(\mathfrak{I})$,
3. Raise $v(\mathrm{Perc}(\mathfrak{I}))$,
4. Change $Perc(\mathfrak{I})$.

In case 1, the *coping* with the tension is done by relativizing the ideal state.
In case 2, the coping is done by changing $\mathfrak{I}$ in such a way that the new $\mathrm{Id}(\mathfrak{I})$ has a lower valuation. Certain states may be considered to be unattainable. Giving up such ideal states is an example of coping in case 2.
In case 3, the actual state is valued higher. Things are considered to be not as bad as they first seemed.
In case 4 we have to do with *self deceit* of *denial*.
The most important way to lower tension, from the point of view of sociology, is by acts that lead to a change in $\mathrm{Perc}(\mathfrak{I})$, such that, if $\mathfrak{I}$ changes into $\mathfrak{I}^*$, then

$$v(\mathrm{Perc}(\mathfrak{I}^*)) > v(\mathrm{Perc}(\mathfrak{I})).$$

There are also *events* that may enable the social atom to cope with his tension. These may be due to acts of other social atoms or to accidental changes in the surroundings. As an example of the selection process for concepts carried out, let us consider some of the many concepts expressing tension, most of them coming from psychology. We mention

Demand	:	Economy
Envy	:	Economy, Psychology
Fear	:	Psychology
Frustration	:	Economy, Psychology
Importance	:	Organizational Theory, Political Science, Psychology
Indifference	:	Economy, Political Science, Psychology
Motivation	:	Organizational Theory, Political Science, Psychology
Need	:	Psychology, Sociology

Table I: Some concepts expressing tension and the fields in which they were mentioned in the indices of the consulted books.

Note that some concepts might have been mentioned in other fields as well. As we are aiming for unification anyhow, this is not important.
The concepts in Table I express aspects of tension, zero-tension in case of *indifference*. Particularly interesting is *fear*. The change of $\mathfrak{I}$ into $\mathfrak{I}^*$ by an event is seen as a potential rise of the tension. *Hope* likewise is a potential lowering of tension. The change $\partial\mathfrak{I}$ is feared respectively hoped for. When the change has a high probability of occurring the change is *expected*. Although we do not know how the valuation functional is shaped, it may be defined on a continuous or on a discrete set of states, we may use ∂v to denote the change in valuation due to the change of state $\partial\mathfrak{I}$. Assuming that $\mathfrak{I} = \mathrm{Perc}(\mathfrak{I})$ and that $\mathrm{Id}(\mathfrak{I})$ is fixed we have:

Definition 3.3. The *hope for* or *fear of* a change $\partial\mathcal{I}$ is $\partial v(\partial\mathcal{I}) = v(\mathcal{I}^*) - v(\mathcal{I})$.

Note that we consider potential changes in tension so, according to Definition 3.2, we have

$$\begin{aligned}\partial v(\partial\mathcal{I}) &= T(\mathcal{I}) - T(\mathcal{I}^*)\\ &= [v(\mathrm{Id}(\mathcal{I})) - v(\mathrm{Perc}(\mathcal{I}))] - [v(\mathrm{Id}(\mathcal{I}^*)) - v(\mathrm{Perc}(\mathcal{I}^*))]\\ &= v(\mathrm{Perc}(\mathcal{I}^*)) - v(\mathrm{Perc}(\mathcal{I}))\\ &= v(\mathcal{I}^*) - v(\mathcal{I}),\end{aligned}$$

for the tension reduction. If positive there is hope for $\delta\mathcal{I}$, if negative there is fear of $\delta\mathcal{I}$.
In this qualitative modeling v may be assumed to take values in the reals. $\mathcal{I}$ is more problematic, as it is just one of a set of states and $\delta\mathcal{I}$ denotes a change of state. In this definition we have not considered acts of the social atom. Hope and fear exist also for atoms that cannot act. If the social atom can act, hope is an *incentive* to do so and fear as well.
An incentive to act is only leading to an act if the *will* to act is present. This will depends on the cost of achieving $\delta\mathcal{I}$. In general there will be more incentives than one. The will to act is leading to a choice from the incentives. In fact, will may be seen as the choice.

Definition 3.4. *Will* is the choice amongst incentives $\delta v(\delta\mathcal{I})$.

Definition 3.5. *Goal* is the state $\mathcal{I}^*$ to which the chosen incentive would lead.

The choice, that is made, may not lead to the highest rise in v. Let us assume that there is a distance defined on all pairs of states $\mathcal{I}$ and $\mathcal{I}^*$, that can be interpreted as the *cost* of achieving $\delta\mathcal{I}$. $\delta\mathcal{I}$ then indicates both the change and the cost of this change. δv may then be called the *utility* or *profit* of $\delta\mathcal{I}$ for the social atom (a concept mentioned in the indices of the books on economy, political science ans psychology).
The natural choice seems to be the incentive with the highest profit-cost ratio. The cost may, however, be prohibitive. In case rationality does not prevail, the values of the available incentives may be seen as determining the probability that a certain incentive is chosen. Another aspect of our modeling worth mentioning is that for a social atom the view of the available states $\mathcal{I}$, and therewith the information about possible changes $\delta\mathcal{I}$, may be so restricted that $v(\mathcal{I})$ is a local maximum and the atom only considers other states $\mathcal{I}^*$, close to $\mathcal{I}$, that gives negative incentives, i.e. changes that are feared. As a consequence inertia occurs and the social atom is inactive. A typical inaction is *tolerance*.
Our further modeling will now first focus on acts.

4 The social atom as an automaton

A social atom $A = (\mathfrak{I}, v)$ may cope with tension by inner adjustment. The more interesting phenomena occur if tension reduction is attempted by action. The goal of the acting social atom is achieving the change of state $\delta\mathfrak{I}$ that would realize the profit δv of the chosen incentive $\delta v(\delta\mathfrak{I})$ by changing $\mathfrak{I}$ into the goal state $\mathfrak{I}^*$. By the act some $\delta\mathfrak{I}$ will be achieved. As far as this $\delta\mathfrak{I}$ is perceived, it will change the states of other social atoms.
Let $\mathfrak{I}_1$, and $\mathfrak{I}_2$ be the possible sets of issues of the social atoms 1 and 2. $\mathrm{Perc}(\mathfrak{I}_1, t, 1)$ and $\mathrm{Perc}(\mathfrak{I}_2, t, 2)$ are the actual states of these issue sets as perceived by atom 1 respectively atom 2. An act by atom 1 causing $\delta\mathfrak{I}_1$ changes $\mathrm{Perc}(\mathfrak{I}_1, t, 1)$ into $\mathrm{Perc}(\mathfrak{I}_1^*, t, 1)$. This $\delta\mathfrak{I}_1$, the *output* of atom 1, may partially change $\mathrm{Perc}(\mathfrak{I}_2, t, 2)$ into $\mathrm{Perc}(\mathfrak{I}_2^*, t + \delta t, 2)$. This change $\delta\mathfrak{I}_2$ acts as an *input* for atom 2.
If $\delta\mathfrak{I}_1$ is "no issue" for social atom 2, then $\delta\mathfrak{I}_2 = 0$, $\mathrm{Perc}(\mathfrak{I}_2, t + \delta t, 2) = \mathrm{Perc}(\mathfrak{I}_2, t, 2)$ and social atom 2 has no input.

Definition 4.1. The *output* of a social atom A is the change $(\delta\mathfrak{I})_0$ in $\mathrm{Perc}(\mathfrak{I}, t, A)$. The *input* of a social atom B is the change $(\delta\mathfrak{I})_i$ in $\mathrm{Perc}(\mathfrak{I}, t, B)$. Here output is due to an act of A and input is due to circumstances outside B.

In both cases the changes are changes in the perceptions of A and B. For a description of what is happening when A's output causes B's input, the perception of a third person C, a scientist, is needed. All issues of all social atoms together form a universe of issues $\mathfrak{I}_u$. The act of A may have consequences for $\mathfrak{I}_u$, of which A is is not aware. $\mathfrak{I}_u$ may be seen as a vector, with elements describing issues, as perceived in society by C. The changes in $\mathfrak{I}_u$ form the output of A, as perceived by C. When the changed issues include issues of B, these determine potential inputs for B, as far as C can judge. Whether the changes are actually inputs for B depends on B's perception of them.
The scientist C will have to take into account all the changes in $\mathfrak{I}_u$, caused by A's act, as perceived by C, and all the changes for the other actor B, as perceived by B, to obtain a proper description.

We can now more precisely describe what we mean by an *automaton* as model of a social atom. An automaton is a quintuple

$$(A, O, S, \tau, \omega),$$

where A is an *input alphabet*, O an *output alphabet*, S a set of *states*, τ a *transition function* $S \times A \to S$ and ω an *output function* $S \times A \to O$.
$S \times A$ is the Cartesian product of the sets S and A and consists of all pairs of states and inputs. Being in a state s_1 and receiving an input $a \in A$, the automaton jumps to a state $s_2 = \tau(s_1, a)$ and produces an output $O = \omega(s_1, a)$.
In our theory $\mathfrak{I}$, in all possible states of the components I, plays the role of S. A consists of inputs $(\delta\mathfrak{I})_i$, O consists of outputs $(\delta\mathfrak{I})_o$. A state $\mathrm{Perc}(\mathfrak{I}, t, A)$ changes by $(\delta\mathfrak{I})_i$ into $\mathrm{Perc}(\mathfrak{I}^*, t + \delta t, A)$. This state generates, by incentive evaluation of A, the output $(\delta\mathfrak{I})_o$. The output may be "no change", i.e. no output may occur as no act is carried out.

Let us now see whether some action concepts from the five chosen fields can be seen to fit in this theory of the behavior of social atoms. In most of these five fields we encounter the concepts *behavior*, *change*, *controlling* and *consuming*. Behavior is, of course, a general universal in the sense that in all five fields the concept is used. For the social atom, as an automaton, it can be defined as the pair (τ, ω), the transition function and the output function, that describe the reaction to input stimuli.
Consuming is an other universal, as the social atom as an organism has to be maintained. Basic needs are rather dominant among the issues.
The main process involved in interaction between social atoms seems to be exchange. An act of atom 1 yields a change δI_2 for atom 2, an act of atom 2 yields a change δI_1 for atom 1.
Controlling makes sure that the intended $\delta\mathcal{I}$ are not counteracted by others.
The chosen modeling by automata seems to be appropriate for defining these important concepts, that are not completely basic concepts, but for "behavior".

Two other concepts are worth mentioning, *threat* and *promise*, both can be seen as acts that lead to virtual changes in the states of others, leading to presumed lowering or rising of the other's valuations. For the output of the automata it may make a great difference whether the threat or promise is carried out or not. If Perc($\mathcal{I}$) indicates the actual state, Perc*($\mathcal{I}$) will indicate the perceived state changed by the virtual changes due to threats and promises (note that $\mathcal{I}$ stays the same as nothing has happened yet), the state as it would be if ..... .

Virtual changes play a very important role also in the case of *norms*. Norms prescribe desired acts or non-acts or, equivalently, prescribe values over states. A hypothetical social atom with such valuations will be called a *normal atom*. There are as many normal atoms as there are different norm systems. For every social atom there exists a normal atom. The "better ego" so to say. The valuations of the normal atoms form the basis of the *group norm*.
Usually people do not completely live up to their norm. The law book may be accepted as norm setting device and yet transgression may take place.
The group norm is the perceived average of the valuations of the normal atoms in the group, not of the real atoms. From childhood on people are exposed to information about the norms of others. Parents, teachers, priests mould the normal atom. The perceived mores, habits, show the actual valuations that lead to acts.

Definition 4.2. A *normal social atom* is a social atom, associated with a real social atom, having a valuation function v that would lead to acts according to the norm system accepted by the real social atom.

Definition 4.3. The *group norm* of a group of social atom is the average of the valuations of the normal social atoms associated with the group members.

In modeling the social atom as an automaton we have introduced two valuation functions on the states, one describing the real valuation and another describing the normal valuation that the social atom declares to accept. Actual acts are seen as due to the real valuation.

5 Some concepts on the micro-level defined in terms of social atom theory

In Section 4 we have given the basic modeling of the social atom. In this section several concepts with be shown to be definable in terms of automata. They are mainly from the field of psychology as we consider concepts on the micro-level. The discussion should make clear how the considered 800 concepts have been studied.

An interesting set of concepts is

$$\{ \text{Id, identity, personality, psyche, self, I, me}\}.$$

In our modeling we have the automaton

$$M_i = (A, O, S, \tau, \omega)$$

as model of the social unit i.
We recall that $\mathfrak{I}$ is the issue set. One of the many issues may be M_i itself. Social atom M_i may be concerned about all five of its constituent features.

Definition 5.1. The social atom M_i is *aware of its self* if M_i belongs to its issue set $\mathfrak{I}$. M_i is its *identity*.

Definition 5.2. The *personality* of a social atom M_i is the triple (S, τ, ω) of its constituents.

Definition 5.3. The *behavior* of social atom M_i is the pair (τ, ω) of its constituents.

As an example of the attempt to interpret concepts we will consider the set {Id,I,me}. We equate "I" with "ego" in Freud's triple {Id,ego,superego}. The issues carry valuations. However, we distinguished atoms and normal atoms. This distinction referred to two different valuations. On one hand the valuation as it determines acts and on the other hand the valuation that is felt as norm, determining acts as they should be.

Definition 5.4. *Conscience* is the valuation of the normal social atom.

It seems natural to identify normal social atoms with Freud's "superego's". Thus, there remains the distinction between "Id" and "ego". "Ego" is identified with the social atom with behaviour and valuations as are evident from actual acts or non-acts.

The distinction between "ego" and "id" can be made in the following way. The transition function τ determines the incentives for arbitrary issues. The incentives can be seen as reactions of the "id", basic urges. It is in the evaluation of incentives that the output function ω is determined. Herein issue interaction may play an important role. The decision on the actions may or may not take issue interaction into consideration. In the first case one might attribute the decision to "ego" and in the second case to "id". Basically there only seems to be a difference in the complexity of the evaluation and there is no need for a special concept "id".
"Me" is equated with "ego" as object of perception and "psyche", just as concepts like "mind", "spirit" and "soul" will not be discussed here, as the social atom as a model of man has its, severe, limitations.

It is in this way that the hundreds of concepts can be investigated. In this first paper we now give only a few definitions of concepts more to show how the theory is to be developed further.

Definition 5.5. The *character* of a social atom is his preference ordering of possible states $\mathfrak{I}$.

Definition 5.6. The *wellbeing* of a social atom in state $\mathfrak{I}$ is $v(\mathfrak{I})$.

Definition 5.7. The *attitude* of actor A towards actor B is the valuation of the concept "actor B" by A.

Again only as an example of the procedure used, we note that concepts seen as related to "attitude" are

> {support, generosity, altruism, affection, dissociation, prejudice, love, scapegoat, self esteem, sympathy, social capital, social support, alienation, mimicking, prestige}.

We refer to Hoede [2] for a more detailed discussion of the following two concepts.

Definition 5.8. *Support* of B by A is the rise of $v_B(\mathfrak{I})$ due to acts of A.

Here v_B denotes the valuation of B.

Definition 5.9. *Capital* of B with A is the incentive of A to support B.

We conclude by a table of concepts that have been defined in this paper and form part of the set of basic concepts we are looking for. Most of them are concepts on the micro-level.

1. Issue
2. Issue group
3. System
4. Organization
5. Class
6. Social structure/Population
7. State
8. Tension
9. Hope/Fear
10. Will
11. Goal
12. Input/Output
13. Normal social atom
14. Group norm
15. Selfawareness/Identity
16. Personality
17. Behavior
18. Conscience
19. Character
20. Wellbeing
21. Attitude
22. Support
23. Capital

Table II: Basic concepts defined in this paper.

6 Discussion

The concepts listed in Table II are mainly concepts on the micro-level. For that reason we may see them as concepts from psychology, describing aspects of the social atom. However, issue groups also can be seen as social units, and quite a few of the distinguished concepts can be used for them. Of course, concepts like "group norm" have to be introduced when aggregation of social atoms is considered. Our goal now is to show how the concepts considered, and many more on extension of the study, can be defined in terms of the basic concepts introduced here. Many concepts concern macro-level aspects like social structure and processes in and between them. This will be discussed in the second paper.
Getting more and more specific, i.e. considering research themes in economy, organization theory, political science and sociology in particular, more and more specific concepts will have to be included. Some concepts seem to come from specific areas. Consider "utility" and "price". These concepts seem to be typical for terminology in economy. Our goal must be to base them on the social atom model. That such a thing is indeed possible will be shown by showing how even for the social atom, on the micro-level, these concepts can be defined.

Definition 6.1. The *utility* $u(\delta I)$) of a change δI in issue I, giving state I^* for the issue, is $v(I^*) - v(I)$.

As an example, note that an item in a shop has no utility in itself. The state of the issue I is e.g. "not having the item", δI is e.g. "buying the item", and I^* is e.g. "having the item".
Let $\mathfrak{I}$ again denote the set of issues of a social atom.

Definition 6.2. The *co-issue* co-I of an issue I of a social atom is $\mathfrak{I} - I$.

The change of I into I^*, δI, usually occurs with a change of $\mathfrak{I}$ into $\mathfrak{I}^*$, as well as a change of the atom's overall state Perc($\mathfrak{I}$) into Perc($\mathfrak{I}^*$). Buying the item, δI, influences some other issues or even creates new issues. Assuming Perc($\mathfrak{I}$) = $\mathfrak{I}$, as we did before, we have

Definition 6.3. The *price* $p(\delta I)$ of a change δI in issue I, giving state I^*, is $v(\text{co-}I) - v(\text{co-}I^*)$.

Note that people use the word "price" in a way that is not necessarily economical.

To illustrate the very simple definitions given here on the micro-level; consider the following simple situation.
Utility is attributed to a change δI, and the consequences for the co-issue determine the price paid for the change. If for example an item X is found, then a new issue "having X" is created. For determining the price for finding X, the issue is added to $\mathfrak{I}$, before the finding took place, with state "not having X" and valuation 0. If other issues are not effected the *price* is 0. If the utility is positive, in that case, there is an overall rise in $v(\mathfrak{I})$, i.e. a rise in the *well-being*, according to Definition 5.6.
This examplifies the way further development of the theory is planned.

References

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