Combining the Sociological Theory of Bourdieu with Multi Agent Systems

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Abstract. This paper presents recent activities in the investigation of combining sociology and computer science in the "socionics" project.[1]
It presents a model of an agent society acting under some assumptions stated in the work of the sociologist Bourdieu, concerning mostly the concept of actors' habitus being the essential maxim for their activities and judgments.
Due to the interdisciplinary character of our project, where computer scientists cooperate with sociologists, we favor a graphical representation of our work. To get both a simple presentation and a clear mathematical foundation, we have chosen a special dialect of Petri nets: namely reference nets.
Keywords: Socionics, agents, Petri nets, reference nets, Bourdieu, habitus, field, symbolic capital

1 Introduction

This paper presents recent activities in the investigation of combining sociology and computer science in the "socionics" research. The project "Acting in social contexts" intends to investigate processes in public administration, especially in universities, to combine sociological theories of organizations and theories of agent-oriented Petri nets. To model such processes appropriately we build on the work in [MW97] and have adjusted our general agent Petri nets to socionic-oriented ones. According to "Rückkehr der Gesellschaft [in die Organisationstheorien][2]" [OST97] organizational theories have to be enhanced by general sociological theories. We will achieve this by modeling some basic assumptions stated by various sociologists, and integrate them for our purposes appropriately. We have started with the theory of Bourdieu. First results for the modeling of organizational theories can be found in [HM99], [HKMM00] and [HHM00]. There the garbage can model of Cohen, March, and Olsen [CMO72] has been modeled with reference nets. To apply the garbage can theory to organizations seems to be a good idea hence the way decisions are made is normally

[1] This work has been supported by the Deutsche Forschungsgemeinschaft (DFG) in the project: "Acting in social contexts" ("Agieren in sozialen Kontexten" in german).
[2] "Bringing society back [into organizational theories]"

not as rational as one would expect or desire and the failure of decision making can be explained quite intuitively.

As one can see, Bourdieu´s theory describes various relationships between groups in a field of practice and it also describes the processes running in such a field and between the fields. These processes could be used as a foundation for some models of how actors group together, communicate etc. For an overview of the first Petri net models made in our socionics project, have a look at [KLMR00], where two Petri net models are described.

These models are described in terms of our reference nets formalism, modeled with the Renew tool [KW98].

This paper is structured as follows: Section 2 gives a short introduction to the theory of Bourdieu, for which a simple model is presented in the following section 3. We then focus on some special point of the theory in section 4: the process of making a symbol official. This work ends with a conclusion and remarks in section 5.

2 A short introduction to the theory of Bourdieu

Fields of practice Bourdieu[3] conceives society as a process of social struggles for material and symbolic capital, and current social structure respectively as a basically labile and changeable result of symbolic struggles.

The arenas of those quarrels are called fields[4]. They are systems of objective relations between positions and points of view, which determine all acting that ”runs” on the field. A field is an independent world of practice, which is determined by severe mechanisms (“objective regularity”), by a specific logic of practice[5]. With explicit and specific rules (e. g. status barriers and juridical demarcations and restrictions) they exclude killjoys and punish them, and they demand from newcomers to go through initiation rituals, inquiries and tests. Thus, the field controls and defines its borders through space, time and the social world.

Habitus Actors who are born into a field, imperceptibly acquire the system of social rules and symbols by continually following and using them, i. e. by regularly acting regulated and symbolic. They make the experience of how is to be acted and thought on the field, learn what they have to do and to omit until they know how. They hurry ahead to subject and adjust to all the expressions of

[3] From the sociological point of view the illustration of the theory of Bourdieu given in this text is not only very short but somewhat different. New concepts like ”practical acceptance”, ”distinctive symbols” or the extensive use of ”symbolic capital” derive from an systematic analysis that can’t be discussed here. See forthcoming papers instead. This text refers to [Bou98,Bou93,Bou87].

[4] The original “field”-concept, like many concepts from Bourdieu, is not outlined very clearly. This text suggests a specification.

[5] Practical logic is the very opposite of pure logic: e. g. contradictory, unsystematic, ambiguous, misty.

the field's objective structures more and more. Finally, field structures and their own, field-adapted ways of acting seem self evident, predictable and calculable to the actors.

The first practical experiences of practice form the basic relations between actor[6] and world, the habitus. A habitus is a super-individual[7] scheme of lasting and transferable cognitive and motivational dispositions relating to the world: perception, action, reasoning and endeavor. It arrays and arranges the thoughts, beliefs, perceptions, judging, utterances, decisions, actions – in one word, the whole practice of an actor. The habitus represents the broad relationship between the actor and the social world and manifests in posture, performance and behavior. Habitual dispositions are not just from the beginning adapted to the requirements of the practice of the field which had generated them, but on their part aspire to reproduce the social structures of this field. Thus, a habitus generates almost exclusively actions, that are observably adapted to the logic of the social field by which the has been formed. Through the glasses of its earliest experiences it selectively becomes aware only those informations that confirm it. The habitus does avoid any information that might question its accumulated "stock of knowledge", e. g. crisis and critics, or, if it can't ignore them, it rejects and spurns them.

With this attitude the habitus controls its own actions and interpretations to create and re- create a constant milieu of known situations. It stabilizes itself. What doesn't fit in its attitudes, habits and dispositions, doesn't exist for the habitus.

Symbolic capital and practical acceptance Only by acquiring and accepting things are brought to social existence. That is why the whole social practice is oriented at maximizing material and symbolic profits, and why all practical activities strive for exclusive acquirement of symbolic capital.

For symbolic capital consists of signs indicating and representing social distinction, of properties, operations or things which have a distinguishing and discriminating social effect (following called distinctive symbols[8]). By means of distinctive symbols social actors differentiate, and visualize their social differences and rank. The disposition over distinctive symbols distinguishes an actor

[6] Bourdieu doesn't use the word "actor" to prevent sociologists from thinking of groups and classes as of persons. However, we can't avoid conceiving social actors at least in a most abstract meaning: anything that has a self-generated independent effect on parts of the social world. In this text, "actor" stands e.g. for habitus, field, both habitus and field, persons, groups and classes.

[7] Habitus is a relational concept. It is bounded to bodies, but individual merely insofar, as it has to be incorporated by concrete persons and can show varied individual dispositions (personal style). But this only is a variance within the limits of the group habitus. "The 'own style' always is solely a variation of the style of a class or epoch" (Bourdieu 1993: 112/113)

[8] Typical distinctive symbols are: clothes, flats, attributes of legitimate authority, marriage, exchange of gifts, invitations for a dinner. Their distinctive value refers to their relative position in the system of all distinctive symbols.

from any other actors and increases his social specialty resp. rarity. Thus, symbolic capital ensures its owner a gain of positive or negative emphasis, a gain of distinction. This is the profit.

Social emphasis is a profit, because having distinctive symbols at one's disposal increases the practical acceptance[9] coming up to the disposing actors, which is the degree of their social impact and with it the degree of their social existence.

(1) The symbolic rich is significantly more noticed, more socially visible than the symbolic poor. Solely by his being in sight he is more effective, because actors show reaction to him an refer in their acting to him. (2) A possessor of distinctive symbols is accredited the capability to acquire symbolic capital. This pure attribution increases his de-facto-efficiency in accumulating actions and thereby capital. (3) The actors do not have the faintest idea, that they make someone exceptional (or peculiar etc.) by accepting his exceptionality (or peculiarity etc.). They treat and see symbolic capital as a legitimate property that is well founded in the character of the owner. So, symbolic capital provides its owner with legitimacy for his life form.

Summing up one can say: By using the actions "perceive as specific / ascribe specific abilities / legitimizing the property of specific abilities" the existence of a social actor is massively accepted. Thus, symbolic capital is condensed, visible practical acceptance ("practical belief" in Bourdieu's words) between habitus and field (or person and group), and the habitus makes out the incorporated symbolic capital of an actor (in relation to other actors).

Actors constitute themselves in relations to their distinctive symbols, receive their social existence from them. It is clear that an actor who would be completely ignored (i.e. would be totally out of symbolic capital and would not evolve a habitus), would cease existing, and die, if the actor is a person.

Distinctive symbols therefrom have a unifying effect, too: they produce solidarity in social groups, as they mediate and place the social acceptance, on which social actors are stringently dependent. Group-membership provides profits. They lend to their members (if they use the name and symbols of the group) in the public much more credibility and credit worthiness, and thereby more social success resp. social effect, than each could ever acquire on its own.[10]

[9] The concept "practical acceptance" does not mean "to cherish consciously", but "to treat it as if it were worth existing": In this sense one accepts unintendedly and without knowledge by buying certain cosmetics the animal experiments that were executed in their production. Practical acceptance is a non-valuing concept. It is possible to accept that somebody is an idiot, parasite or tyrant (what is the same as accepting him as an idiot, parasite, tyrant). Practical acceptance, thus, is to confer and to ascribe something on / to someone. An actor gives acceptance without willing nor even noticing it to his own group while and by he lives the group-habitus in his inconspicuous, ordinary everyday utterances in his use of speech and language, "natural" manners, life style and body language. These utterances make up memory signs and mnemonic devices for the group.

[10] One proves his identity as a German, introduces himself as "Roman Langer, University of Hamburg", lets show the scarf of the fans of Arsenal etc.

Furthermore all competitors are objectively accomplices, because they reproduce by the means of their quarrel the actual social structure. The mutual acceptance implicates, hence, always the acceptance of the membership in the social relations and relationships which constitute a field (the practice of a group) and the position of an actor in it: The limits of communicating, sharing things and shared using of symbols are the limits of the practice of the group resp. of the field itself. Each group member is nolens volens keeper of the group's borders and limits, because and insofar it participates on the group's relationships and capital and it acts in the way demanded by the acceptance of distinctive symbols (norms, values, rules, world views etc.).

The process of making official The accumulation of symbolic capital is a means to reproduce existing social relations, and to enforce the acceptance of power.

Those get, who already own: the dominating (most symbolic rich and accepted) class anyway has the biggest chance to accumulate symbolic capital.[11] The dominating actors (the already distinguished and the aspirants of distinction) are the agitators of social struggles. While the distinguished strive for strengthening, tightening and consolidating the actual social order, from which their power is derived, the aspirants try and often manage to score the exclusive characteristics of the distinguished.[12] By succeeding in it, they lessen the distinction value of those characteristics.

The yield on shares of symbolic capital is in- and decreasible. The yield on emphasis is the higher, (a) the more seldom the used symbols are, and the more exclusive their acquirement is. The yield declines, the more frequent, common, reachable and wider spread they are. But again it raises, (b) the more the actors figure, that exclusive behavior is desirable, natural and easy to do, that its costs are low. The maximal profit of emphasis is highest exclusiveness.

The distinguished, therefore, construct new and new exclusive attributes, with which they can push away themselves from the aspirants and affirm their own exclusivity. They do this by making things official[13]: power groups meet to confess publicly, so that they exhibit their power[14] and let their right to be visible accept publicly.[15]

[11] Their members can even afford to violate or change accepted norms, because they are seen as paragons and trend setters.

[12] Dominated classes stay merely defensive in symbolic struggles, they serve as an anti-standard.

[13] Their goal is (a) to define common interests, to raise own particular interests symbolically to those of common, and to symbolically annex accepted common interests, with the consequence to be considered as a legitimate representative of common interests.

[14] Power: the relative position in the system of relations of all actors (groups/fields), condensed in distinctive symbols.

[15] At the same time they draw a distinction between their own official power and all the other, now forms of power and their symbolisms, which now are supposed to be (and depreciated as) minor, occult, and mystic.

By communicating their confessions (= showing distinctive symbols), just by speaking, showing and letting watch, they treat the official symbolic language, and thereby the borderlines between the thinkable and unthinkable, in their sense. Because showing (speaking) repeatedly the same symbols (confessions) unfold magic symbolic effects: Not only the power group, but also the disprivileged groups accept the symbols.

That is a crucial step. With the scope of its acceptance increases the degree of distinction of a symbol. Actors who do not dispose over, but co-produce the symbol by acceptance, operate their own out-running of privileges in benefit of the dominating power groups. They more or less rule and reign over themselves, and simply by acting accept the official distinctions in power and the relations of dominance. In this manner de-facto-differences are to be transformed in legitimized social inequality, and enforcement is reinterpreted as legitimate, self-evident, and natural-appearing distinctions between positions, ranks and values, or as voluntary and emancipated relations.

Afterwards, the official differences can be institutionalized as titles, names and positions. Then dominance withdraws from the access of the consciousness and power of odd actors. Hence, relations of dominance are as (or even more) opaque and durable as material things, because they are conciliated by objectivated and institutionalized mechanisms, and detracted from direct interaction. For relations of power and obedience now apparently persist between titles, office positions and goods, and between the institutions[16], that originate and ensure the societal value and the distribution of titles and positions to individuals.

3 Modeling parts of Bourdieu´s theory

Before we present a simple model of Bourdieu's theory in subsection 3.2 we present some comments on reference nets in subsection 3.1.

3.1 Reference Nets

Reference nets are a so-called "high-level" variant of Petri nets. The reader is assumed to be familiar with appearance and dynamic aspects of Petri nets. This subsection only explains the differences between the relatively new formalism of reference nets and other high-level nets like colored Petri nets [Jen92]. Detailed information on Petri nets can be found in [Rei85], while reference nets are described in [Kum98,Kum99].

Basically, reference nets look like other Petri nets, but they offer two important additional features: communication by means of synchronous channels and net instances together with net references ("nets in nets").

Synchronous channels were first considered for colored Petri nets by Christensen and Hansen [CH94]. They synchronize two ore more transitions which all fire atomically at the same time. All transitions must agree on the name of

[16] Bourdieu calls them "mechanisms".

the channel and on a set of parameters before they can synchronize. Reference nets generalize this concept by allowing transitions in different net instances to fire. However, the channel itself has a direction, while parameter passing is bidirectional.

The idea of *nets in nets* is that tokens of a so-called *system net* correspond to Petri nets on a lower level, called *object nets*. Reference nets put this idea into practice by creating tokens that reference other Petri nets.

When a reference net is constructed, it is specified as a static structure that serves as a template. During simulation an arbitrary number of copies can be created using this template. These copies are net instances. As mentioned above, the different net instances (system and object nets) communicate by means of synchronous channels. The type system of reference nets is closely related to that of the Java language.

3.2 A simple model

As one can see, Bourdieu´s theory describes various relationships between groups in a field of practice and it also describes the processes running within such a field and between the fields. In the following we present some work in visualizing and formalizing parts of Bourdieu's theory.

Have a look on the subject and objects and their relationships in a social field as defined by Bourdieu. Besides the original textual description of those elements and their relations we are going to present parts of the theory in a graphical manner. We are going to model some aspects of the theory by a Petri net to obtain an operational description.

We know, that our presentation will not reach the degree of detailedness as the textual work of Bourdieu could do: Some aspects will be left out, some will be simplified. But in our opinion this presentation is well suited to act as the base of some discussion about sociological theories.

Some relations and processes, introduced in the preceding section, are illustrated in the reference net in fig. 1. The net describes some of the actions, which are initiated by groups in a field: forming, examine ritually, act symbolic, distinguish, make official and objectify.

Those parts, belonging essentially to the field itself, are drawn at the right side of this figure, while parts belonging to the groups are drawn at the left. One could identify several entities, drawn as places: The group´s values, rules, acceptance and symbols – or for short: its symbolic capital – exist separately for each group. The assignment of a group to its symbolic capital is represented by the pair $(group, SC)$. Also interesting entities are soc. existence, distinction, self-interpretation and institution. Let's have a closer look on the transitions in fig. 1.

- We could identify the relevant objects for the transition form: The symb. capital and the conditions of existence create the symbolic capital in the field (symb. capital (field)).

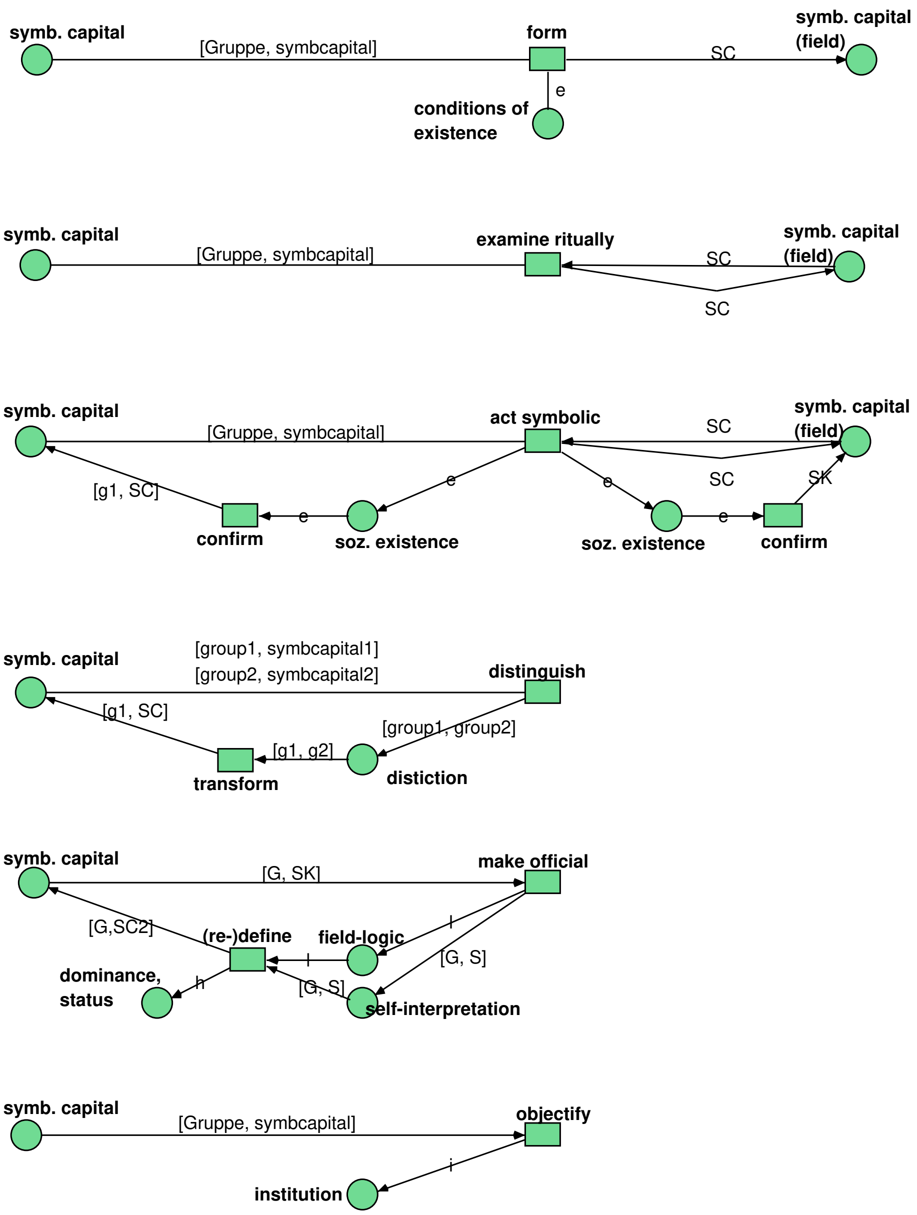

Fig. 1. Presentation of some aspects of a field

- The transition act symbolic shows, that the habitus is self-conserving, since symbolic acting creates social existence and social existence recreates the symb. capital. We could say, that symbolic acting preserves its own conditions. This effect is observable both in the field and for the groups.
- The transition distinguish creates distinction, which differentiates group1 from group2. One group (group1) could use this distinction to obtain more symb. capital).
- This symb. capital could be used to change the field-logic and the self-interpretation. This is done by the transition make official. The power of defining the interpretation of the world could be used to accumulate further symb. capital since this group owns the authorship of this interpretation. It is also used to establish the legitimation of dominance and status, represented by the place dominance, status.
- The action objectify is able to manifest the mind construct of symb. capital in an objective: an institution.

The presentation of actions happening in a field is the start for a simple model of the dynamics and the relationship between symbolic acting and distinguishing – or for short: the process of making official.

This process will be modeled in our agent architecture based on reference nets, where we will focus on the process of making a distinctive symbol official.

4 Publication of symbols

Our basic modeling approach is the assumption that the habitus is observable as a sum of the communication between an agent and its environment.

Following Bourdieu, an important part of the formation of the habitus is done by means of the publication of new symbols (to make them official). This section takes a closer look at this process. Groups are treated as indivisible actors, single individuals are not discussed here.

Subsection 4.1 introduces abstract agent models and refines them to specific protocol driven agents. Such agents are used in 4.2 to present the process of making symbols official in a detailed example.

4.1 Introducing agents and protocols

The agents used in this paper are communication oriented: They have the ability to receive messages, to eventually process these messages, and to send messages to other agents. Some work about the use of Petri nets for protocol specification can be found in [BDF98]. Hammami et al. ([HMCS98]) emphasize an agent communication strategy and a monitoring system for Flexible Manufacturing Systems (FMS) in the proposed architecture.

This leads to the most simplified (but nevertheless meaningful) view on an agent, which is presented as a reference net in figure 2. The communication interface of this abstract agent consists of the transitions input and output. The agents

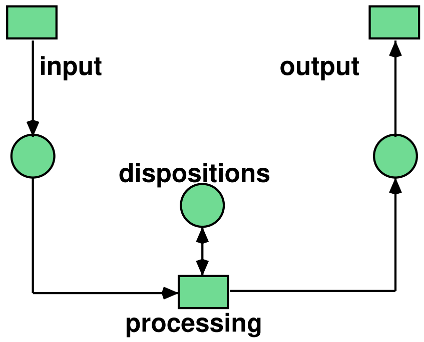

Fig. 2. Simplified Petri net agent

communicate to other agents via synchronous channels that are not represented in the figure.

The agents presented in this paper are encapsulated: Every access to an agent's internal state is controlled, permitted and eventually disallowed by the agent itself. This guarantees a certain degree of autonomy. An agent's state is represented by the place dispositions, that is a side condition to the (message) processing transition. A more elaborated agent model replaces this transition with a (possibly complex) net. Such a refined agent is presented in figure 3.

The figure shows the system net of an agent. The agent's behavior and functionality is hidden in object nets that are called *protocols*. A protocol controls the flow of messages and internal actions of one agent. If an (abstract) action involves more than one agent the appropriate protocols form a *conversation* [CCF$^+$99].

The agents presented in this section use messages for communication. Therefore the transitions input and output of figure 2 are renamed to incoming messages and outgoing messages in figure 3. There are two different ways of how an agent may select a protocol: *proactive* and *reactive*[17]. A reactive protocol selection is triggered by an incoming message, while a proactive selection is an autonomous decision of the agent. Figure 3 points up this distinction by opposing the transitions reactive and proactive. Transition reactive is only activated if a message arrives, while proactive may fire due to the dispositions of the agent only.

If a protocol is selected (and instantiated, what is done in the same step), it forms a new conversation or adds to an existing one. The protocol[18] is therefore put into place conversations. An instantiated protocol may receive messages (transition in) from other agents taking an active part in the conversation or send messages (out) to arbitrary agents.

[17] The agents presented here are *hybrid* agents (both pro- and reactive).
[18] To be more precisely: The reference to the protocol net.

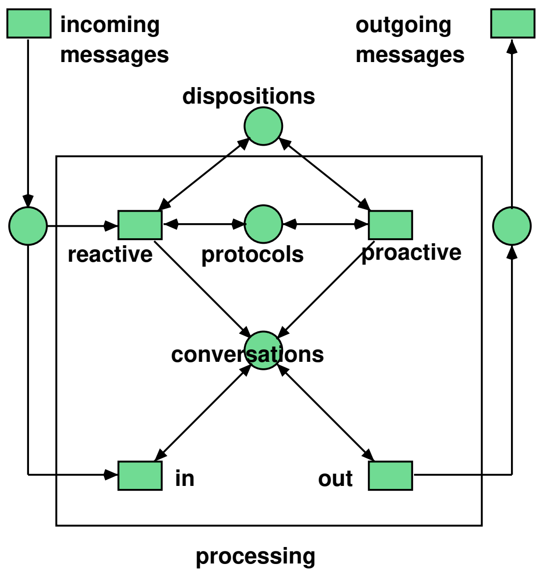

Fig. 3. Protocol driven agent

The main idea behind the approach to model an agent's behavior by means of protocols and to model the dynamic aspect of a multi-agent-system with conversations (both presented as reference nets) is the following: It is often easy to give an abstract "message flow" between agents to achieve a desired action. In this approach, this flow of messages can be directly used to specify the behavior of the agents that participate in the action. This is exemplified in the next subsection.

4.2 Protocols: Acceptance of symbols

A part of the field net of figure 1 is taken as an example of use for the modeling of protocol-driven agents. It is the part where the acceptance of new symbols is handled. The overall conversation for this process is given in figure 4.

A group[19] – group i in figure 4 – creates a new symbol. This may be done by an arbitrary refinement of transition symbol creation. This new symbol is communicated to the field through the use of the shared place between group i and the field. The field is responsible for communicating the symbol to the other groups that are present in the field. In figure 4 this is done by the transition communicate symbol, that has one output arc for each group. A possible refinement for this transition is to communicate different aspects of the new symbol

[19] Remember that groups are the actors within the examples.

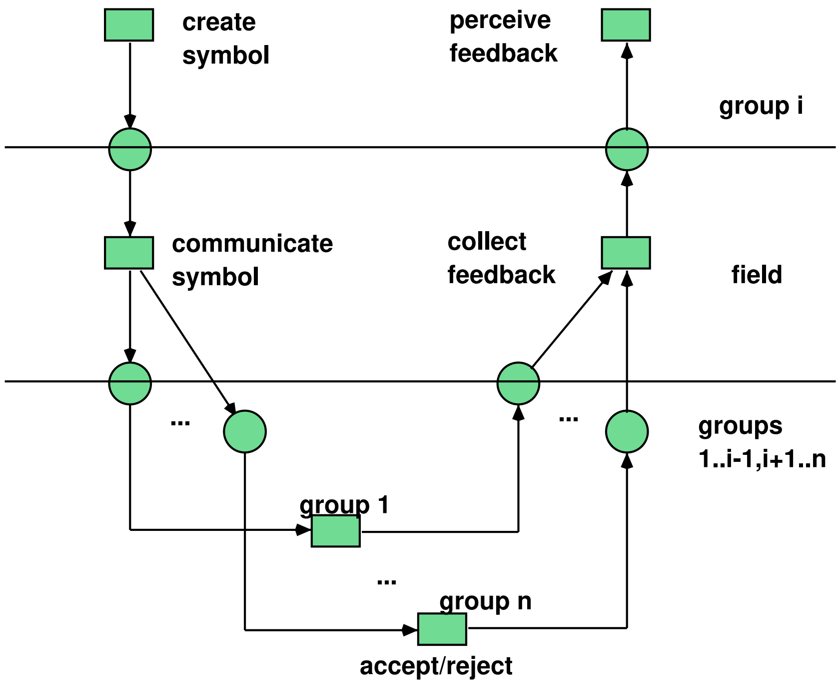

Fig. 4. Conversation for a new symbol

to different groups modeling the perception via different senses or communication channels. The other groups may now decide if they accept or reject the new symbol. This process is again implemented using transition refinement (of transition accept/reject).

The feedback of the various groups is collected by the field (transition feedback) and communicated to the group that created the new symbol. This group may initiate further actions as a response of the feedback (transition percept feedback).

One aim of our modeling approach is to reuse the conversation model for the protocols that drive the actions of the participating agents. To support this aim, figure 4 includes the agents boundaries. The conversation model is now cut at these boundaries, leaving three different types of (place bordered) nets. To enable communication by means of synchronous channels these nets are supplemented with input and output transitions. The nets are adopted to gain a uniform appearance inspired by the abstract agent models of subsection 4.1. This leads to the nets that are presented in figure 5, 6 and 7.

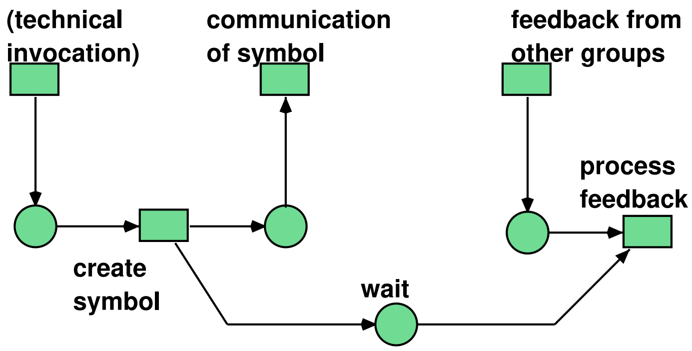

Fig. 5. Group i: Creation of a new symbol

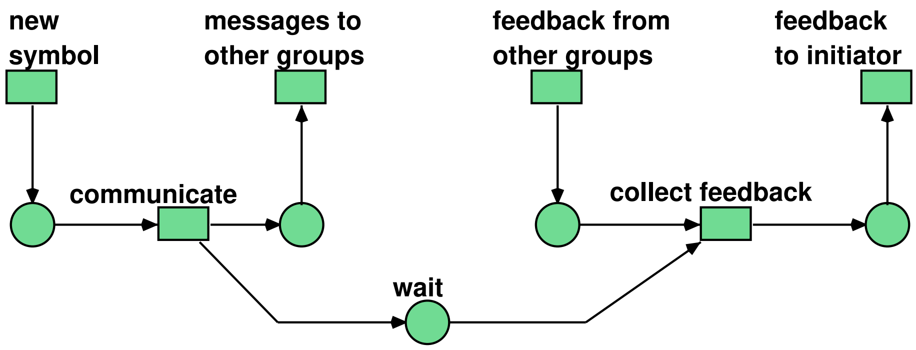

Fig. 6. Field: Communication of the symbol

Since the agent protocols are directly derived from the conversation model of figure 4 they are not explained here again in detail. The protocols for the symbol creation and communication consist of two loosely interconnected parts (a wait place). This is a frequent detail: Such protocols perform an action, send a message and *wait* for an answer to that message.

The protocols shown in figure 5 to 7 are not executable reference nets[20]. To give an idea of the (few) remaining steps that lead to executable nets, figure 8 is presented.

This detailed protocol shows some additional aspects of reference nets not mentioned before: Every arc owns an inscription that describes the data (ob-

[20] An executable Petri net may be simulated in an appropriate simulator.

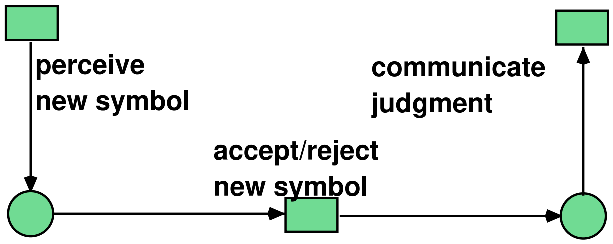

Fig. 7. Other Groups: Acceptance or rejection of the symbol

jects) that are carried by these arcs. Transition inscriptions that have a colon as their first character are calls of synchronous channels which are used for communication.

The feedback messages incorporate a rating which is evaluated to trigger the incrementation of two counters for positive and negative feedback, respectively. If a given threshold value is outnumbered by one of the counters, an appropriate message is generated and sent to the group that created the rated symbol.

5 Summary and outlook

Our work shows a part of the theory of Bourdieu, which certainly has to be considered as a simplification of the original textual description. Nevertheless, some aspects – especially: the concept of the habitus and its relationship to groups – has turned out to be attractive for computer scientists. It is also attractive for sociologists, since it shows some parts of Bourdieu's theory, which are weakly formalized. The integration with other organizational theories has not yet been done, however, first attempts will be made in the near future.

Our decision to choose reference nets as our basic description formalism has been rewarded with comprehensibility by the sociologists in our team, who did not have any modeling experience.

One of our project aims is to obtain a modeling technique for the behavior of agents and we expect our presented protocols as one step in this direction. The main idea is to specify a systemwide protocol on an abstract level first and then decompose it into the independent agent protocols, which are refined afterwards.

We first used Petri nets simply as a formalizing technique, but we realized their aptitude as a communication medium in our project. During our joint modeling activity we discovered that some differently used concepts exist, which have not been recognized in talks and discussions.

This work demonstrates the possibility to model aspects of a sociological theory by means of Petri nets. So, we are optimistic to combine these and fol-

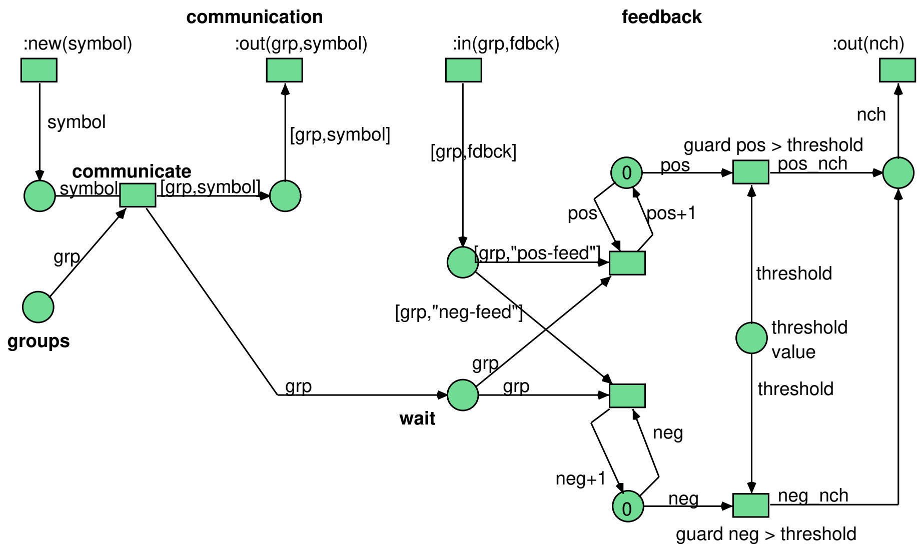

Fig. 8. Field: Communication of the symbol – refined

lowing models to a Petri net framework for description and analysis of processes in public administration.

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