SOCIALLY COMPETENT BUSINESS AGENTS WITH ATTITUDE
Using Habitus-Field Theory to Design Agents with Social Competence[1]

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Abstract

We will argue that social competence is an emergent mental phenomenon, and as such, there is no requirement to build discrete "social" modules into an agent. In fact, we argue that there are definite advantages to be gained from the emergent approach to social competence in complex, open, multi-agent environments. In order to capitalise on these advantages we need to design socially competent agents with the ability to reason on different levels (reactive, deliberative, meta) within complex social situations. By analysing the sociological theory of Pierre Bourdieu, we describe the design of a socially competent agent through the instantiation of a generic layered agent architecture. Our instantiation provides a methodology for specifying heuristics and parameters for different layers of such architectures. Furthermore, Bourdieu's habitus-field theory is hybrid in the sense that it tries to explain the effect of individual behaviour on societal structures and vice versa. This is where the great strength of the theory lies, and where we expect a useful cross-fertilisation of ideas into AI to occur. For as much as space permits, we will illustrate our argument with a scenario from the domain of shipping companies. This scenario is defined by its openness, diversity of agents as well as tasks and time restrictions. Our work leads us to the conclusion that building social agent architectures has definite engineering advantages, underlining the importance of this concept for both MAS and DAI research.

1 The need for socially competent agents in business

In this section we argue that there is a real need for social competence within multi-agent systems (agent-to-agent and/or agent-to-person) in complex business domains. We also argue that many of the challenges we face in such domains have direct relevance to the more general AI and computer science communities.

The TeleTruck CC project (Bürckert et al., 1998) at the German Research Centre for Artificial Intelligence (DFKI) addresses the problem of designing intelligent dispatch agents for shipping (road haulage) companies. Human dispatch agents not only map incoming orders to available trucks and drivers (the typical domain of centralised planning systems), but must also collaborate with the dispatch agents of other companies – to pass on orders that may be unprofitable for one reason or another, or simply not convenient. Collaboration between different companies creates an open, dynamic, and potentially hostile/competitive environment in which social competence plays a very important role. Our intelligent dispatch agents must not only deal with the social field of inter-agent collaboration, but must also address the social fields of agent-driver and agent-customer interaction. Each social field has its own logic, and its own set of resources (capitals) that may or may not be convertible – for example, a driver may be happy to give up a weekend for extra pay or a couple days holiday, but may resent doing so if it means missing his/her child's Birthday party.

A competent behaviour in our collaborative shipping scenario requires that a dispatch agent not only understands its own capabilities, but also the abilities, motivations, attitudes, goals, plans and the behaviours of the other competing/co-operating dispatch agents and truck or driver agents. For example, a dispatch agent needs to reason about how reliable the available drivers are, how beneficial business contacts to other dispatch agents are, whether it can trust other agents to fulfil the contracts they commit to, etc. Empirical research (interviews with human dispatchers) further shows that customer/driver models must also take into account the fact that certain customers may not want certain drivers to deliver their goods – adding yet another level of complexity.

Another model barely considered in current transport scheduling systems, is the model for drivers. Again, interviews with human dispatchers tell us that it is very important for the co-operation of the dispatcher with the truck drivers to take into account their personal preferences. Such preferences can be preferred routes, overnight stays, holidays, trucks, cargo etc. They again can put constraints on the total planning and the decisions as to whether to pass on orders to competitors or not. It is therefore important to know (a) when to consider driver preferences; and (b) when to override them. Also, many systems do not take into account the added interaction of driver, customer and vehicle. Certain orders can only be processed if the right driver and the right vehicle are available at the right place – this is especially true when shipping companies deal with transporting food, highly explosive liquids or containers and only have a limited number of vehicles which are available to transport these special kinds of cargo.

Not only does a dispatch agent need to meet the constraints in its planning activities, it also needs to know how important a particular constraint is for medium- or long-term goals. For example, if it discovers that there is no solution for the current set of constraints, it needs to know which constraints can be relaxed. Decisions therefore require an understanding of the relative importance of qualitatively different constraints, which in turn requires an understanding of the relative convertibility of resources between the different social fields.

The complexity of the shipping domain is such that the *real* plan space of a dispatch agent is far greater than that covered by existing route planning and cost minimisation dispatch systems. This is clearly reflected by the fact that all the existing systems on the market require human operators to provide the missing levels of social competence. What shipping companies need are socially competent agents that can act autonomously.

Many of the requirements of socially intelligent agents are strikingly similar to the requirements of autonomous agency: agents hold inconsistent beliefs; have multiple competing concerns which are qualitatively diverse; and must be robust in the face of hostile and unknowable environments. In building socially competent intelligent agents, we will inevitable address many of the same problems faced by researchers in the field of intelligent autonomous agents – we hope that our approach will provide insights that are beneficial to both communities. In this sense, we also believe that there will be significant synergy between research on socially situated agents and research on *bounded rationa*lity, or *bounded optimality* (Russell 1997) in the more general AI and computer science communities.

2   What is social competence?

Dautenhahn and Edmonds (1998) argue that the intelligence of a socially situated individual, and social interaction, are inseparably intertwined. They make a strong case for a bottom-up approach to modelling socially intelligent behaviour, which involves working out the principal processes from which higher order social competence will follow. Our work fits within this framework.

In order to avoid the somewhat difficult to define concept of social intelligence, we will use the term *social competence*. Research on *computational organisational theory* (e.g. Carley and Gasser, 1999) tells us that the main reason for the dynamics of complex behaviour within large organisations lies in the unequal distribution of resources between agents. Which can also be stated as "if every agent had all the resources it needed, there would be no complex societal interaction." The striving of each individual to get hold of the needed resources, the communication, negotiation and action that is necessary to gain access to goal-satisfying resources will create the complexity of the behaviour of the organisation as a whole.

We consider agent behaviour to be socially competent, if it manages to recognise the strategies which lead to access to resources – this is the cornerstone of social competence. More competence is necessary if the resources become more complicated, i.e. are made up of different types, and/or there exists different modes of exchange between certain resources etc. Another difficulty in recognising which resources need to be accessed, comes from the need to know the connection between goals and resources. Furthermore, the agent must recognise that its environment is made up of a number of agents that must be dealt with individually, and cannot be treated as one homogeneous entity.

One last issue for social competence we would like to raise at this point, is the fact that every socially competent agent must deal with one outstanding kind of resource, namely time – which brings us back to the issue of bounded rationality discussed in the last section.

To summarise: the dynamic properties of societies rely on (a) the access to required resources and (b) the competence to deal with the acquisition of non-accessible resources. In this sense, agent interaction is not only the exchange of information, but also an instrument "to influence others, change their goal-balance, and induce them to adopt one's goals" (Castelfranchi and Conte, 1996). Interaction and the dependence on others means that agents must model explicitly the effects of themselves and others on society and take these effects into account when considering long-term plans. We therefore need a methodology that provides us with concepts to capture what "social" means, and to enable us to analyse and design socially competent

agents. A theory which provides such a methodology is the theory of Pierre Bourdieu.

3 How do humans achieve social competence: the theory of Pierre Bourdieu

Pierre Bourdieu' work emphasises not only the structural aspect of society, as represented in his model of social space, but also the action aspect of social life. His theory is known as the theory of habitus and field, which is intended to overcome the "clash" of social theory in the micro and macro domains. In his view, this clash results from sociologists "creating" antonyms by using either "objectively" formed structure (constitutional elements of society as a system, e.g. Luhmann, 1995), or "subjectively" formed actions (constitution of social life by interacting e.g. Berger and Luckmann), in their explanations. In breaking with these antonyms, the approach of habitus and field develops an interdependence of structure and action – instead the prevailing exclusive or treatment.

3.1 Sociocentrics of cognitive structures

The basic assumptions of habitus-field theory are derived from a structural analysis of "primitive" societies conducted by Durkheim and Mauss. Observing primitive societies and their structures, Durkheim and Mauss reported a coincidence of objective social structure and cognitive structures of individuals. According to their findings, societies that are not able to give a solid mechanism which socially determines the systems of classification, will fail when attempting a shift to an advanced society. This thesis is known as the socio-centrics of cognitive systems. The existing cognitive systems are deduced from the global social system, with the categories of reason underlying the collective ideas built according to structures of the social group. Up to this point, Bourdieu's theory agrees with the thesis of Durkheim. However, Bourdieu was able to extend the habitus as a hybrid dialectic concept, linking both societal and cognitive structures (see next section). The habitus is theoretically used to explain the coincidence of social and cognitive structure by sociogenetics – i.e. transfer of group-specific shared schemas through language and the educational system (which depend to some extend on genetics).

At the heart of the sociocentrics of cognitive systems lies the basic assumption that the formation of classifications (as categories of perception) – which are based on structures of a group-specific segmented social world – organise and regulate actions in social practice (Bourdieu and Wacquant, 1992: pp. 30-34).

3.2 Action Theory: theory of practice and habitus

This practice is according to Bourdieu the product of the dialectic relation between a situation and a system of lasting and transferable dispositions of an social actor, called habitus. With his habitus concept, Bourdieu tries to capture a system of dispositions "that by integrating all former experiences seems as a matrix of action, perception and reasoning and is based on the analogous transfer of schemes (...) and allows to fulfil infinite differentiated tasks" (Bourdieu , 1977).

The action theory which Bourdieu proposes (including the habitus), argues that the underlying reason for most human action lies far away from what we know as intentional rationality – Bourdieu identifies the motives of actors as acquired dispositions. The variation of (individuals) habitus derive from the objective societal structure, primarily depending on, and mediated by, the group heritage. Thus, similar conditions of existence, which could be described objectively by group-specific positions in social structure, lead to quiet similar habitus (group-specific dispositions). These constitutive social differences will be incorporated (internalised) by processes of socialisation and enculturation using the human body. The main role of the body lies in the support of memory for those internalised, and position variable, collective schemes. The schemes themselves were sociohistorical grown, as well as the co-responding social structure. The transfer of group-specific shared schemes is mainly carried out by language and the education system – creating the coincidence of objective societal structures with the cognitive structures of individuals. Social differences and mental schemes are homologous because they are correlated genetically.

In other words: By their habitus, actors are themselves the owners of basic symbolic systems of classification of their society. The dispositions – a homologous representation of a social-structured space the actors move in – allow each actor to act as if she/he knows what is to do in almost every situation. The cognitive system and the social system form a perfect synergy. The social system allows an actor to act appropriately in his/her existing societal environment, with the criteria for success proofed by other actors – i.e. by interactive processes (see also field). The shared collective social constitution then allows any small differences to be perceived as the natural properties of individuals (i.e. gender), and in this way can be taken for granted. By transferring the basic cognition schemas to other situations or contexts, actors are then able to act appropriately in new situations – on the basis of the dispositions internalised from their existing societal environment.

3.3 Habitus concept: incorporated dispositions for perception and action

One part of the concept habitus allows us to explain the reproduction of a concrete culture and its differences. In this respect, Bourdieu uses the term structured structure for the habitus built by structure. Referring only to this dimension of the concept it seems that habitus is nothing more than that determined by objective socio-cultural structure. In this structural respect, the habitus is caused by the embedded cultural and could not be changed in a fundamental manner (so as to say we are determined by a structured habitus, conditioned by the existing cultural values and forms).

However, viewing this as the only interpretation of habitus, is a misinterpretation (Bourdieu and Wacquant, 1992: p. 19). Therefore it is important to point out the gains Bourdieu make by developing antonyms: The habitus is the basic concept for constructing a theory of structures, which is able – in contrast to most other structural theories – to answer the question of how acting may escape the structural pressure (Lemert, 1990: p. 299, op. cit. Bourdieu and Wacquant, 1992: p. 166). This is the second aspect of habitus: the aspect of structuring social structure by actors through, and according to, their specific dispositions.

The habitus concept can therefore be divided in to two aspects: One depends on the incorporation of the existing historically grown structure. In so far, behaviour of actors seems to be determined by the process of internalisation objective cultural patterns (see pattern variables and his normative paradigm in Parsons, 1964). The other aspect is that if an actor has internalised the structures of social life, he may interpret them, and by the act of reproducing them, change them (see A. Schütz, 1940, and the interpretative paradigm).

He [the habitus] *is a socialised body, a structured body, a body, which has internalised the immanent structures of a world or of a specific sector of this world, of a field, structuring same actors' perceptions of and actions in this* Bourdieu, 1998: Practical reason: On Theory of Action).

3.4 The field as a social context

Habitus and field are effectively related (Bourdieu and Wacquant, 1992: pp. 34-49). Bourdieu develops the conditions of "objective" structure in his field concept as a model of social space. According to several sociologists[2], the process of differentiation in modern societies is continuing, and Bourdieu represents this ongoing process in his model of social topology. The task

of this model was to re-construct the social space in its actual forms and differences. The basic characteristic of this space can be found in the reciprocal relations of the objects which are included. Social sciences in Bourdieu's perspective try to objectify the main principles of differentiations according to observed social differences. Thus, an investigator is able to explain the statistical distributions in a given societal structure.

The social world may conceptualised as a multidimensional space, which empirically is constructed by the differentiation, by which the given societal universe could be explained, or in other words, throughout the discovery of the forces or forms of capitals, which like jokers in a game of cards, becoming in this specific universe effective or could, i.e. in that fight (or the competition) around rarely goods, which are located in this universe (Bourdieu and Wacquant 1992: p.106).

The distribution of social energy – as Bourdieu also names the downward explicated capitals – corresponds to the distribution of attributes. By these processes, their owners gain force, power, and on the basis of both, profit.

3.5 Autonomy of fields and interests

In Bourdieu's view, the whole social space is partitioned into several universes, which he calls "fields". Each social field gains (produces and reproduces) its own identity by actors interested in objects which are part of the game in this special field. Each field (e.g. the field of economics, art, science etc.) produces its own "nomos" (Greek: rule), which is independent from all other fields – i.e. each field is autonomous. This autonomy is created by competition of the interested actors, investing in the specific field and its objects. E.g., if each artist produces her/his objects and actions for only explicit economic reasons, there would be no longer any social difference between his/her art and the actions of an undertaker or workman who are producing goods for the demands of a market. If this were really the case, then the field of art could be defined according to the tautological rule of the economic field (business is business): "art is business". But, by stressing the basic difference between the two fields in a mostly unconscious way (see: habitus), each actor engaged in the countless and various objects of art (artists, Galleries, "gourmets" of art) creates the field and restores its social autonomy.

This process of differentiation and becoming autonomous, leads to the rise of universes which have distinguished, not reducible basic rules [...] and so they are decision fields [battle-fields] *for special forms of interests. What concerns people in the field of science and leads them to competition is quiet different to its equivalent in the economic field* (Bourdieu, 1977). E.g. "investments" of "social capital" in the "social sub-field" (a sort of family through parental care of actors).

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[2] See Durkheim, Weber, Simmel and for example Luhmann's conception of the social system (functional differentiation) as divided into functional subsystems, organisational systems and interactional systems

The actors being involved in a field and its objects, do not need to intentionally plan their goals of action (e.g. game-theory), nor do they need act exclusively for economic benefits (see fields with interests on the non economic interests, e.g. religious field). The future is something they anticipated in their presence by the help of their dispositional practical sense. The shape of interests depends on the objects in the game.

Social actors who possess a sense for the game and have incorporated the countless practical schemas of perception and evaluation, which work as instruments of construction of reality, as principles of observation and tidiness of the world in which they move, do not need to put (...) the aims of their practice as a purpose (Bourdieu, 1979: p. 144).

The better the internalised schemas (the dispositions of an individual) fit with the habitus (the structure of a specific field mediated by the "community" of engaged actors – i.e. the scientific community of CS), the greater the chance of an individual to become a "master" in that field. The group-specific generating process of individual habitus explains both the processes of social integration (e.g. forms of co-operation) and the processes of differentiation (e.g. forms of conflict).

3.6 Practical logic of the field: capitals as different forms of social resources

According to Bourdieus investigations[3], the forces of social life cannot be reduced to s single dimension. The models of utilitarian approaches are in his view much too simplistic to explain social phenomena. With the logic of the practice, Bourdieu broadens the narrow model of the utilitaristic perspective (comp. Bourdieu/Wacquant, 1992; p. 147). In an actual social universe (e.g. French society) the only accepted form of resources by utilitarian approaches (the economic capital), will not suffice. Thus Bourdieu adds other forms of societal energy: cultural, social, and symbolic capital. The actors are then distributed over the whole space to variable degrees based on the possession of convertible capitals (includes possibility of loss same as extensions of ones stock).

3.7 Three Dimension of Social Positions

Bourdieu differs three dimensions of distribution: (1) according to the whole volume on capitals one possess; (2) according to the composition of their stocks of capitals (especially the relation of economic and cultural capital); and (3) according to the development of their whole capital in time, i.e. according to their career in social space (Bourdieu, 1997: pp.108/109).

Competition in a field leads to a permanent and latent conflict of actors for transferring one form of

capital into another. The substrate of the economical capital is money – it is objectified as "possession", and institutionalised in the form of ownership rights. The probability of converting money into other forms is "high", with risks of deterioration lying in social crisis (wars, revolutions, economical crisis).

A similar analysis can be made for the other capitals, as for example with the capital of culture (or more precisely, the capital of information). The substrate of cultural capital is "knowledge". Cultural goods and knowledge are its objectified forms, and it is institutionalised by titles of education. The substrate of social capital can be identified as relationships, which in its objective form, Bourdieu terms this capital "networks". Its institutionalised forms are titles of aristocracy as individual predicates and the status of profession as an collective schemas. To convert social capital has little reliability and is risky, but often necessary.

4 How does Bourdieu's theory match this design and help to build socially competent agents?

Bourdieu's theory describes in a natural way how societies evolve and adapt. These processes unfold with the need of the individual to adapt his/her habitus to the logic of the field, in order to pursue interests and to benefit from previous investments. Therefore, using the sociological theory of Bourdieu will automatically lead to an artificial society that cannot deny its anthropological origin. This again is a strength of using the concept of habitus to design agents – providing a framework that allows us to explain the behaviour of a given system and fine-tune its design more accurately than without the conceptual apparatus of this human adequate theory.

If we briefly look at our scenario again, we can identify four different fields of interaction for the dispatch agent. The field of interaction with: (a) customers; (b) drivers; (c) trucks; and (d) the dispatch agents of competing companies. When interacting in these fields, the dispatch agent needs to take into account their relative importance, preferences, reliability and persistence in relation to their commitments. This interaction depends on the field. For example, the dispatch agent will pass on or receive orders from other dispatchers, give orders and receive information about costs from the trucks. Finally, the dispatch agent will be informed about preferences by the drivers and will give them orders in the form of route plans. The dispatch agent's habitus will be shaped by what knowledge has been implemented off-line and the experiences that it has made during runtime in a variety of different situations. To take up again the second part of Bourdieu's habitus, we can say that the agent's habitus will also have an effect on the structure of the whole society of agents. For example, if the percentage of agents which

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[3] For an extensive overview of Bourdieu's works see Bourdieu and Wacquant 1992; p. 295-307

are neither reliable nor co-operative, is too large, we will get a society of agents with a different kind of social structure than if the distribution of resources would rule out conflicts about resources.

The capitals in this setting include the social capital, i.e. the relationships ("contacts") to certain dispatchers that have proven to be of mutually beneficial or drivers that have shown to be trustworthy, punctual etc. There is also the capital of economics which mirrors (for example) the amount of trucks available or the amount of money that has been gathered in the past. An example for the information capital would be the knowledge about the preferences a customer has acquired during previous interactions and can be exploited for specifically tailored future services. Conversion between these capitals is manifold. Contacts can be used to find out about customer preferences before making an offer for a certain order, or knowing the preferences of a customer can be used to decide which driver must be sent to him/her. Social capital in the form of "owes me a favour" can be converted to make a driver accept an order, which he would otherwise have rejected (weekends etc.). Of course there is also the traditional conversion between capitals using economic money, like buying information, stabilising relationships to customers by reducing prices etc. This list of capitals and their conversion is not exhaustive.
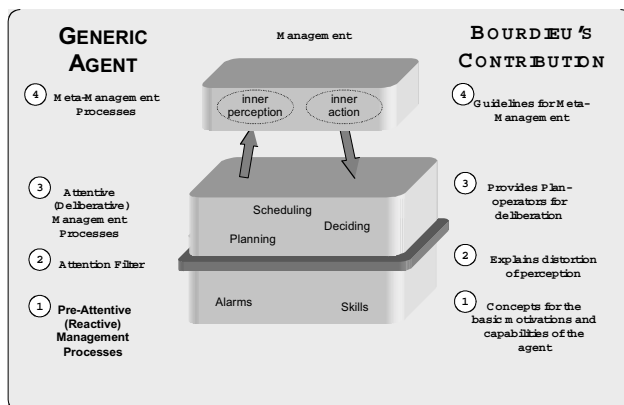

Figure 1 The contribution of Bourdieu's theory to social agents.

Having outlined the application of Bourdieu's theory to the fields in the shipping scenario, we will now apply it to a model of a generic multi-layer agent architecture – which we believe fits to many modern agent architectures (Allen, to appear; Müller, 1996; Jung 1999; Sloman, 1999; etc.). This generic architecture consists of three layers of reasoning: a reactive layer; a deliberative layer; and a meta-deliberative layer (see Figure 1). The pre-attentive/reactive layer and the deliberative layer are separated by a filter to stop excessive interruption of deliberative/attentive layer by insignificant events in the environment. An example for a methodology for such a filter could be Sloman's Attention Filter Penetration Theory (Sloman, 1992). The

"meta" layer deals with the management of the deliberative layer (monitoring and control of the deliberation). In some architectures the arrangement is slightly different, however these "processing levels" are in one way or the other represented.

We will now show the difficulties of breaking down the aforementioned abstract parts of the architecture into implementable concrete algorithms. Furthermore, we will show how habitus-field theory helps us to conceive concepts and determine values that can be calculated or learnt respectively during runtime.

Let us first deal with the lowest level of the architecture. Bourdieu would label this level as the level in which the basic interests/concerns of the agent in its environment are realised. Some interests in the field (i.e. increase blood sugar level if hungry) provide goals and therefore start the process of trying to get access to certain resources. In Bourdieu's terms this would be the motivation to take part in the game of this social context. Other interests that may be hindering the cognitive process are specified by the inability of the individual to cope with the current situation, as the habitus (the set of action dispositions) can neither be changed rapidly nor is the habitus of this level completely known to the individuals and escapes conscious manipulation.

Every reactively generated goal (or processed percept) that is to be recognised by deliberative processes, must pass through the attention filter. We believe that the attention filter is a very good concept to describe the fact that certain aspects of a situation are perceived by some individuals and neglected by others (for a discussion see Köstler, 1968). In practice, it turns out to be rather difficult to define the insistence parameters for the different percepts that in the end decide which percept will receive any attention. Bourdieu's theory gives more insight into the heuristics that need to be chosen for defining the parameters. From his point of view it is evident that the attention that is paid to perception is restricted by the experiences (acquired habitus) and the education or culture (incorporated habitus) of the individual. The primary/reactive layer's purpose is to provide good candidates for consideration by the deliberative layer above. This is especially useful when evaluating contingent situations, i.e. situations where a number of different possible worlds need to be considered simultaneously. Which candidate for consideration is chosen in the end depends on the individuals habitus, its incorporated dispositions for action and perception.

Once a percept has received attention, it is dealt with by the deliberative layer of the architecture, i.e. we talk about the layer that is able to reason. Like Conte (1997), we argue for a heterogeneity of rationality. In her words, we need to introduce a substantial differentiation, namely a qualitative heterogeneity among individual agent's goals. To do this, a goal-based rather than preference-based view of endogenous motivations should be chosen (this fits well with Bourdieu's idea of broadening). The difference between goals and prefer-

ences is fundamental: the essential difference between them is on the qualitative vs. quantitative characterisation. While preferences are quantitatively defined, goals are symbolic and qualitative notions. Unlike the former, they allow agents to be heterogeneous. Only this choice can guarantee that a variety of social actions can be described and predicted – in terms of rational decision theory applied to social settings, only defection or co-operation is possible. Social life is interspersed with different types of pro-social action, from influencing to exchange to co-operation. Conte argues that utility cannot actually account for such a variety, while a qualitative notion can.

So when we talk about symbolic representation of the goals of an agent in its deliberative layer, we also need to talk about some kind of calculus that is able to manipulate these symbols. Here a suitable AI technique would be automated planning. Crucial for planning is the provision of plan operators (we would like to stress this point, as the division of actions into plan operators is not trivial). If the system is not aware of the available and necessary operators, no algorithm will be able to find a satisfying plan. This is crucial to the success of the agent in an open system and places an emphasis on the ability to recognise plan operators. If we do not expect agents to learn *everything* from scratch, we need some description that underlies plan operators. Again, this is were Bourdieu comes in. He lays out that every field (i.e. social context) has its own number of capitals (or, in AI terms, resources).

The goals of an actor can be represented in a description of which capitals the actor wants to increase. Following Bourdieu, the description of the plan operators is merely the description of how one capital can be converted into another. For example, buying a prestigious car is the conversion of some economic capital (money) into another form of economic capital (possession) and symbolic capital (a car that stands for status). Thus the problem can be reduced to that of specifying the number of capitals and the conversion matrix. With this concept at hand, it is far easier to socially learn the plan operators, either by imitation or by advice taking. Of course, trial and error is still an option. However, knowing what has to be learned in principle (namely the capitals and their convertibility) will make the task a great deal more feasible. Yet another way to enable the agent to cope with the complex social situation is to build in the most important parameters. Bourdieu also captures this kind of procedure. He calls it the incorporated part of habitus, with all the problems that come with it, i.e. the problem of changing a maladjusted part of the habitus in contrast to the desired continuity of the habitus.

The top level of our architecture deals with the management of the deliberative layer. This is the level on which the agent monitors its own deliberation processes and tries to work out which of them lead to blind alleys, are ineffective, or deadlocked. This layer is about controlling the thought process. As well as with the other layers, the processes on this level should be made flexible enough to be able to react to changes in the environment and use plan operators as they become available (e.g. by changes in the field) etc. Therefore, just as in the other layers, the processes must exhibit some features of habitus, they are a result of their own history.

5 Conclusions

The theory of Bourdieu helps us in instantiating a generic agent architecture. We argued with Bourdieu's theory, that the history of the individual and what it experiences results in dispositions to certain actions, ways of perception and considerations. These dispositions may be incorporated or imitated, i.e. learned by observation and acquired by advice. We deny that there is a habitus module somewhere in a social agent architecture, instead, we argue that the habitus is the result of processes that adapt to the environment on all layers of the generic architecture. This emphasises the importance, and the influence, of the culture of the agent society on the behaviour of the individual. When looking from the other direction, Bourdieu's habitus-field theory predicts how interaction in a society will change as compatible and incompatible habitus are forced to interact by their interest in the social field.

Acknowledgements

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