

Assimilation, Imitation and the Elementary Social Fact. Towards a Definition of Social Interactions

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Abstract

A definition of the elusive notion of *social* is proposed within the framework of a cyclic conception of organisations. Social interactions, obeying logically the dynamics of interactions between organisational cycles will appear determined and defined by the assimilation process inherent to the functioning of circular reactions. Social interactions will then be seen as depending on the ability of the agents to recognize their conspecifics on the basis of a similarity between their own behavior and those of the others. This theoretical analysis hopefully offers some opportunities for a better discernment of the priorities in the elaboration of an artificial social intelligence.

What Is the Elementary Social Fact ?

The adjective « social » is currently applied to such a variety of phenomenon and processes that it may appear as a rather unproblematic common sense notion. But, to date, serious attempts to define the very notion of *social* have been excessively rare and we are rather drawn to the conclusion that the social is a necessary but, particularly elusive concept.

Indeed, at the turn of the century, sociologists fiercely debated about the definition of the elementary social fact, but no definite position emerged and, later, the human sciences have seemingly renounced this objective. So much so that, in the introduction of his handbook of social psychology, Zajonc (1967:8) could write:

It is unfortunate that the field being introduced to the reader bears a "social" label —which, because it means so many different things, actually means very little.

However, robotics and DAI both aim at building artefacts endowed with some social intelligence and therefore give a renewed importance to the necessity of understanding the very meaning of *social*. It is obvious that the ability to grasp the invariant of the multiple forms of social interactions will help define more precisely the research agenda and will help avoid the many deadends that a superficial appreciation of what is social and what is not would invite.

Such a definition could give a common ground and, hopefully, a common language to the many disciplines

investigating social interactions.

Circular Reactions and Assimilation

In our attempt to distil the essence of the social, the cyclic conceptions of organisations or organisms first proposed by Baldwin (1895), then by von Uexküll (1926), Piaget (1935) and more recently by Varela (1979) or Brooks (1986), appear quite relevant. Most importantly, they point to the crucial fact that all social interactions will necessarily occur between two organisations which cyclic structure determine their dynamics of interaction. These cyclic conceptions of organisations are based on organisational unities —sensory-motor loops, circular reactions, assimilation cycles, schemas, habits or what-have-you— which all comprise a specific stage consisting in the perception, recognition or *assimilation* of the stimulus of the corresponding motor response. These reactions are cyclic because the execution of the motor response produces precisely the stimulation which tends to trigger it again. For example, a crying baby produces a stimulation whose assimilation or recognition will precisely lead to the reproduction or the maintenance of the cry. The termite making a pellet with a mixture of earth and saliva gives rise to an odoriferous stimulus which will keep its building behavior in activity.

But assimilation acquires its full meaning in social interaction, when one observes, for example, that the cry of a baby, when assimilated by another baby, will usually trigger its crying circular reaction (Simner 1971). Likewise, when assimilating the odor of the earth + saliva pellets produced by its conspecifics, the termite will resume or enhance its building activity (Grassé 1959, Salvador 1995). One can see in Figure 1 that the cry A of

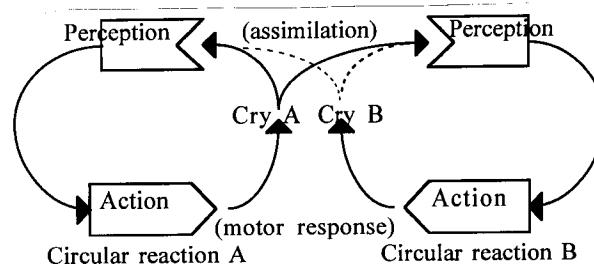


Figure 1 Interactions between circular reactions

the circular reaction A has been « recognized » by the circular reaction B, being assimilated to the cry B usually produced. The circular reaction B is consequently triggered, and therefore produces a cry, similar to the first one, which is then re-produced or imitated.

As it is only stressing the invariant dynamics of interaction between behavioral cycles, no matter their level of complexity, the very same figure would fit any other interactions between circular reactions reciprocally assimilating their productions. It could represent the interaction dynamics of, for example, the building behavior of termites, the collective photoluminescence of fireflies (Buck and Buck 1978), the chorus of cicadas (Williams and Smith 1991) and, finally, the whole spectrum of collective behavior, from simple gregarism to scientific fashions (Salvador 1996).

The Elementary Social Fact

In such a framework, my contention is that social interactions can be defined *a minima* as instancing an assimilation process of one agent by another. One should say, more precisely, that an agent is in a social interaction as far as s/he is assimilating, at least partially, the pattern of stimuli emitted by the entity with which s/he interacts, whether this assimilation is justified or not, whether it belongs or not to a more specific behavior (attraction, aggression, fleeing, etc...).

Therefore, an artificial ant which perceives the other ants as mere physical obstacles disturbing its wandering, is not in a genuine social situation when interacting with them. On the other hand, when detecting and recognizing the trail of pheromone left by its conspecifics, a natural ant is in a genuine social situation, even if alone, since it assimilates this substance to the one it usually produces. A good proof of it lies in the fact that the ant imitates : after assimilating the pheromone, it will indeed follow the trail, i.e., it will reproduce the spatial exploration behavior first exhibited by its conspecifics.

The close connection between social interaction and imitation (in a generic sense) comes as no surprise. It is a mechanical consequence of the cyclic structure of behavior in which assimilation leads to a reproduction of the stimulation. Thus, one can understand that Tarde's motto has been « society is imitation » (1903:87) as well as the fact, underlined by Strum and Latour (1987:799) that :

From the different languages, the historical genealogy of the world « social » is construed as following someone, then enrolling and allying and, lastly, having something in common. (*italics are mine*)

This conception of the elementary social fact as the assimilation of one agent by another is congruent with several approaches belonging to the fields of sociology, psychology, ethology or evolution theory. In robotics too, several works have made rather implicit reference to this idea which has been, however, clearly expressed by Dautenhahn (1995) or Mataric (1993:434) :

The ability to categorize the perceptible objects in the

world into at least two classes: « others like me » and « everything else » is a necessary condition for intelligent collective behavior.

My position is specific only in the sense that assimilation is here rooted in the circular reaction mechanism whose heuristic value will now be tentatively underlined.

Consequences

There are many reasons why it is heuristic to consider social interactions as depending on the ability of the agents to recognize their conspecifics on the basis of a similarity between their own behavior and shape and those of the others :

1) this conception will help to draw the line between those simulations or realizations of collective behavior among artificial agents which are really investigating social interactions and those whose programming or conception tricks result in a serious trivialization of the matter. For example, when a robot learn by radio broadcasting with its workstation that the obstacle actually detected by IR sensors is another robot (Mataric 1993), it has absolutely no need for assimilating the characteristics of the other to its own. The problem of assimilation is completely bypassed.

2) In the same vein, a robot which is directly informed of the behaviors of its conspecifics by radio broadcasting of symbolic information is freed of the necessity of an assimilation of their behavioral expression (Parker 1993). Therefore, the social interaction is extremely poor because an immense part of meaning is missing. An assimilation restricted to the symbolic level can make sense, of course (cf. Turing's imitation game) but in order to obtain a satisfying ecological validity, the symbolic level has probably to emerge from a coupling with the sensory-motor one, where the three fundamental aspects of the psychological dynamics — cognition, conation and affect— remain united.

3) Let us suppose a population of robots whose members emit a « species specific » light or IR signal perceived by the other members but not by the emitter. In such a case, there is indeed assimilation or pattern matching between the anticipation of the signal and the perceived signal itself. But being unable to perceive its own signal, the robot does not genuinely assimilate the others to himself. This key-lock mechanism allows no « projection », i.e. no representation of the other on the basis of the self-knowledge inherent to the circular reaction.

4) This isolation is avoided by the circular reaction mechanism thanks to the permanent transaction between self and others resulting from the assimilation process and often expressed by imitation. For example, the baby unable to see her own mimics —and therefore deprived of a visual circular reaction concerning her face— can, nonetheless, assimilate and imitate the mimics expressed by an adult face. This is to be explained by the existence of a representation of the face built on the sensory-motor loops of the kinesthetic modality. The baby loops on herself via

the kinesthetic modality, and this kernel of body schema allows an intermodal matching, namely, a visual assimilation, which in turn, leads to a reproduction of the mimics. (Meltzoff and Moore 1994).

5) Now, concerning some of the fundamental questions raised in this workshop, I would first like to suggest that social intelligence, understood as an ability and a state of adaptation to its social environment, is necessarily rooted in the assimilation process. Since a social behavior has any chance to be adapted only when based on a representation of the *other*. And such a representation is built by assimilation since an agent has no other basis to understand another agent than its own schemas or circular reactions.

6) Thus, concerning the interactions and communications between humans and artefacts, it is highly probable that humans, because of the richness of their schema repertoire, will always be able to assimilate the artefacts to themselves, even excessively. This assimilation which is nothing but empathy, will probably have to be educated because, quite opposite to the innocuous empathy for a bat or a tree, the assimilation of an artefact has to be adapted in order to yield correct anticipations of their behaviors.

7) On the contrary, in the near future, artefacts will probably show poor understanding of the human condition. Their limited schema repertoire will only permit simple assimilations, at best, equivalent to those of animals. But this is not a problem as far as we know exactly what to expect from them.

8) The quality of social interactions between humans and artefacts will obviously depend on the ability of the artefact to assimilate humans along the cognitive, conative and affective dimensions altogether. For example, the hunters and their dogs, on account of their reciprocal assimilation, operate the collective action of hunting while in a relation of shared cognition (representation of space, of the prey), shared conation (same objective of capture of the prey) and shared emotion (tension then satisfaction or frustration). Of course, such a sharing is not sophisticated when compared to the one than between humans, but the unity between the cognitive, conative and affective assimilation makes it real, effective and, as a matter of fact, fully satisfying. Such a psychological unity of the assimilation process appears as a necessary condition of a genuine social interaction.

Conclusion

My attempt, here, has been to expound how the notion of assimilation which has been used by Piaget to model the cognitive functioning from an individualist perspective is, in fact, a cardinal notion in the understanding of social interactions. It has been shown that, as far as one has acknowledged the cyclic character of organisations, assimilation appears necessarily as *the* locus of social interaction. As a consequence, it appears that an agent, natural or artificial, can only conceive of another agent in direct proportion to the richness of its behavioral

repertoire. This is because an agent can elaborate a representation of another agent only by assimilating the pattern of stimuli produced by others to the one produced by its own circular reactions. Other-representations will therefore be moulded on self-representations. But if two agents assimilate each other, reciprocal imitation will probably ensue and therefore, self-representations will also be moulded on other-representations. By assimilating themselves to their artefacts, humans will acquire new understanding of their psychological functioning.

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