Cognitive Psychology and Cognitive Neuroscience/Evolutionary Perspective on Social Cognitions

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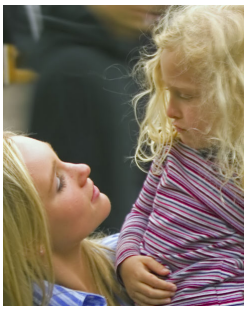
Introduction



Why do we live in cities? Why do we often choose to work together? Why do we enjoy sharing our spare time with others? These are questions of Social Cognition and its evolutionary development.

The term Social Cognition describes all abilities necessary to act adequately in a social system. Basically, it is the study of how we process social information, especially its storage, retrieval and application to social situations. Social Cognition is a common skill among various species.

In the following, the focus will be on Social Cognition as a human skill. Important concepts and the development during childhood will be explained. Having built up a conceptional basis for the term, we will then take a look at this skill from an evolutionary perspective and present the common theories on the origin of Social Cognition.

The publication of Michael Tomasello *et al.* in the journal Behavioral and Brain Sciences (2005) [1] will serve as a basis for this chapter.

Social Cognition

The human faculty of Social Cognition

Playing football as a complex social activity

Humans are by far the most talented species in reading the minds of others. That means we are able to successfully predict what other humans perceive, intend, believe, know or desire. Among these abilities, understanding the intention of others is crucial. It allows us to resolve possible ambiguities of physical actions. For example, if you were to see someone breaking a car window, you would probably assume he was trying to steal a stranger's car. He would need to be judged differently if he had lost his car keys and it was his own car that he was trying to break into. Humans also collaborate and interact culturally. We perform complex collaborative activities, like building a house together or playing football as a team. Over time this led to powerful concepts of organizational levels like societies and states. The reason for this intense development can be traced back to the concept of *Shared Intentionality*.

Shared Intentionality

An intentional action is an organism's intelligent behavioural interaction with its environment towards a certain goal state. This is the concept of Problem Solving, which was already described in the previous chapter.

The social interaction of agents in an environment which understand each other as acting intentionally causes the emergence of Shared Intentionality. This means that the agents work together towards a shared goal in collaborative interaction. They do that in coordinated action roles and mutual knowledge about themselves. The nature of the activity or its complexity is not important, as long as the action is carried out in the described fashion. It is important to mention that the notion of *shared goals* means that the internal goals of each agent include the intentions of the others. This can easily be misinterpreted. For example take a group of apes on a hunt. They appear to be acting in a collaborative way, however, it is reasonable to assume that they do not have coordinated action roles or a shared goal – they could just be acting towards the same individual goal. Summing up, the important characteristics of the behaviour in question are that the agents are mutually responsive, have the goal of achieving something together and coordinate their actions with distributed roles and action plans.

The strictly human faculty to participate in collaborative actions that involve shared goals and socially coordinated action plans is also called *Joint Intention*. This requires an understanding of the goals and perceptions of other involved agents, as well as sharing and communicating these, which again seems to be a strictly human behaviour. Due to our special motivation to share psychological states , we also need certain complex cognitive representations. These representations are called *dialogic cognitive representations*, because they have as content mostly social engagement. This is especially important for the concept of joint intentions, since we need not only a representation for our own action plan, but also for our partner's plan. Joint Intentions are an essential part of Shared Intentionality.

Dialogic cognitive representations are closely related with the communication and use of linguistic symbols. They allow in some sense a form of *collective intentionality*, which is important to construct social norms, conceptualize beliefs and, most importantly, share them. In complex social groups the repeated sharing of intentions in a particular interactive context leads to the creation of habitual social practices and beliefs. That may form normative or structural aspects of a society, like government, money, marriage, etc. Society might hence be seen as a product and an indicator of Social Cognition.

The social interaction that builds ground for activities involving Shared Intentionality is proposed to be divided into three groups:

- **Dyadic engagement**: The simple sharing of emotions and behaviour, by means of interaction and direct mutual response between agents. Dyadic interaction between human infants and adults are called *protoconversations*. These are turn-taking sequences of touching, face expressions and vocalisations. The exchange of emotions is the most important outcome of this interaction.
- **Triadic engagement**: Two agents act together towards a shared goal, while monitoring the perception and goal-direction of the other agent. They focus on the same problem and coordinate their actions respectively, which makes it possible to predict following events.
- **Collaborative engagement**: The combination of Joint Intentions and attention. At this point, the agents share a goal and act in complementary roles with a complex action plan and mutual knowledge about the selective attention and the intentions of one another. The latter aspect allows the agents to assist each other and reverse or take over roles.

These different levels of social engagement require the understanding of different aspects of intentional action, as introduced above, and presuppose the motivation to share psychological states with each other.

Development of Social Cognition during childhood

Children making social experiences

A crucial point for Social Cognition is the comprehension of intentional action. Children's understanding of intentional action can basically be divided into three groups, each representing a more complex level of grasp.

1. The first one to be mentioned is the identification of animate action. This means that after a couple of months, babies can differentiate between motion that was caused by some external influence and actions that an organism has performed by itself, as an animate being. At this stage, however, the child has not yet any understanding of potential goals the observed actor might have, so it is still incapable of predicting the behaviour of others.
2. The next stage of comprehension includes the understanding that the organism acts with persistence towards achieving a goal. Children can now distinguish accidental incidents from intentional actions and failed from successful attempts. This ability develops after about 9 months. With this new perspective, the child also learns that the person it observes has a certain perception - thus a certain amount of predicting behaviour is possible. This is an essential difference between the first and the second stage.
3. After around 14 months of age, children fully comprehend intentional action and the basics of rational decision making. They realise, that an actor pursuing a goal may have a variety of action plans to achieve a goal, and is choosing between them. Furthermore, a certain sense for the selective attention of an agent develops. This allows a broad variety of predictions of behaviour in a certain environment. In addition to that, children acquire the skill of cultural learning: when they observe how an individual successfully reaches a goal, they memorise the procedure. Hence, they can use the methods to reach their own goals. This is called imitative learning, which turns out to be an extremely powerful tool. By applying this technique, children also learn how things are conventionally done in their culture.

Evolutionary perspective on Social Cognition

So far we discussed what Social Cognition is about. But how could this behaviour develop during evolution? At first glance, Darwin's theory of the survival of the fittest does not support the development of social behaviour. Caring for others, and not just for oneself, seems to be a decrease of fitness. Nevertheless, various theories have been formulated which try to explain Social Cognition from an evolutionary perspective. We will present three influential theories which have been formulated by Steven Gaulin and Donald McBurney[2] .

Group Selection

Vero Wynne-Edwards first proposed this theory in the 1960's. From an evolutionary perspective, a group is a number of individuals which affect the fitness of each other. Group Selection means that if any of the individuals of a group is doing benefit to its group, the group is more likely to survive and pass on its predisposition to the next generation. This again improves the chance of the individual to spread its genetic material. So in this theory a social organism is more likely to spread its genes than a selfish organism. The distinction to the classical theory of evolution is that not only the fittest individuals are likely to survive, but also the fittest groups.

Moai at Rano Raraku

An example would be the history of the Rapa Nui. The Rapa Nui were the natives of Easter Island which handled their resources extremely wasteful in order to build giant heads made of stone. After a while, every tree on the island was extinct because they needed the trunks to transport the stones. The following lack of food led to the breakdown of their civilization.

A society which handles their resources more moderate and provident would not have ended up in such a fate. However, if both societies would have lived on one island, the second group would not have been able to survive because they would not have been able to keep the resources.

This indicates the problem of the Group Selection: it needs certain circumstances to describe things properly. Additionally, every theory about groups should include the phenomenon of migration. So in this simple form, the theory is not capable of handling selfish behaviour of some agents in altruistic groups: Altruistic groups which include selfish members would turn into pure selfish ones over time, because altruistic agents would work for selfish agents, thereby increasing the cheaters' fitness while decreasing their own. Thus, Group Selection may not be a sufficient explanation for the development of Social Cognition.

Kin Selection

Since altruistic populations are vulnerable to cheaters, there must exist a mechanism that allows altruism to be maintained by natural selection. The Kin Selection approach provides an explanation how altruistic genes can spread without being eliminated by selfish behaviour. The theory was developed by William D. Hamilton and John M. Smith in 1964 [3] . The basic principle of Kin Selection is to benefit somebody who is genetically related, for example by sharing food. For the altruistic individual, this means a reduction of its own fitness by increasing the fitness of its relative. However, the closer the recipient is related to the altruist, the more likely he shares the altruistic genes. The loss of fitness can be compensated since the genes of the altruistically behaving agent have then the chance to be spread indirectly through the recipient: The relative might be able to reproduce and pass the altruistic genes over to the next generation.

In principle, the disadvantage for the giver should always be less than the increased fitness of the addressee. This relation between costs and benefit is expressed by Hamilton's rule taking additionally the relatedness of altruist and recipient into account:

$$r \cdot b > c$$

where

r shows the genetic relatedness between altruist and recipient (coefficient between zero and one),

b is the reproductive benefit or increased fitness for the recipient and

c are the altruist's reproductive costs or the reduction of his fitness in the performed action.

If the product of relatedness and benefit outweighs the costs for the giver, the altruistic action should be performed. The closer the recipient is genetically related, the higher costs are acceptable.

Examples for kin-selected altruism can be found in populations of social insects like ants, termites or bees. An ant colony, for instance, consists of one fertile queen and several hundreds or more of sterile female workers. While the queen is the only one reproducing, the workers are among other things responsible for brood care. The workers are genetically closer related to the sisters they raise (75%) than they would be to their own offspring (50%). Therefore, they are passing on more of their genes than if they bred on their own.

According to Hamilton's rule, altruism is only favoured if directed towards relatives, that is $r > 0$. Therefore, Kin Selection theory accounts only for genetic relatives. Altruism however occurs among not related individuals as well. This issue is addressed by the theory of Reciprocal Altruism.

Reciprocal Altruism

The theory of Reciprocal Altruism describes beneficial behaviour in expectation of future reciprocity. This form of altruism is not a selfless concern for the welfare of others but it denotes mutual cooperation of repeatedly interacting species in order to maximise their individual utility. In social life an individual can benefit from mutual cooperation, but each one can also do even better by exploiting the cooperative efforts of others. Game Theory allows a formalisation of the strategic possibilities in such situations. It can be shown, that altruistic behaviour can be more successful (in terms of utility) than purely self-interested strategies and therefore will lead to better fitness and survivability.

In many cases social interactions can be modelled by the Prisoner's Dilemma, which provides the basis of our analysis. The classical prisoner's dilemma is as follows: Knut and his friend are arrested by the police. The police has insufficient evidence for a conviction, and, having separated both prisoners, visits each of them to offer the same deal: if one testifies for the prosecution against the other and the other remains silent, the betrayer goes free and the silent accomplice receives the full ten-year sentence. If both stay silent, the police can sentence both prisoners to only six months in jail for a minor charge. If each betrays the other, each will receive a two-year sentence.

Possible outcomes of the Prisoner's Dilemma:

Prisoner 1 / Prisoner 2	Cooperate	Defect
Cooperate	6 months each	10 years / free
Defect	free / 10 years	2 years each

Each prisoner has two strategies to choose from, to remain silent (cooperate) or to testify (defect). Assume Knut wants to minimize his individual durance. If Knut's friend cooperates, it is better to defect and go free than to cooperate and spend six months in jail. If Knut's friend defects, then Knut should defect too, because two years in jail are better than ten. The same holds for the other prisoner. So defection is the dominant strategy in the prisoner's dilemma, even though both would do better, if they cooperated. In a one-shot game a rational player would always defect, but what happens if the game is played repeatedly?

One of the most effective strategies in the iterated prisoner's dilemma is the mixed strategy called Tit for Tat: Always cooperate in the first game, then do whatever your opponent did in the previous game. Playing Tit for Tat means to maintain cooperation as long as the opponent does. If the opponent defects he gets punished in succeeding games by defecting likewise until cooperation is restored. With this strategy rational players can sustain the cooperative outcome at least for indefinitely long games (like life) [4] . Clearly Tit for Tat is only expected to evolve in the presence of a mechanism to identify and punish cheaters.

Assuming species are not able to choose between different strategies, but rather that their strategical behaviour is hard-wired, we can finally come back to the evolutionary perspective. In The Evolution of Cooperation Robert Axelrod formalised Darwin's emphasis on individual advantage in terms of game theory[5] . Based on the concept of an evolutionary stable strategy in the context of the prisoner's dilemma game he showed how cooperation can get started in an asocial world and can resist invasion once fully established.

Conclusion

Summing up, Social Cognition is a very complex skill and can be seen as the fundament of our current society. On account of the concept of Shared Intentionality, humans show by far the most sophisticated form of social cooperation. Although it may not seem obvious, Social Cognition can actually be compatible with the theory of evolution and various reasonable approaches can be formulated. These theories are all based on a rather selfish drive to pass on our genetic material - so it may be questionable, if deep-rooted altruism and completely selfless behaviour truly exists.

References

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[2] Gaulin, S. J. C, & McBurney, D. H. (2003). *Evolutionary Psychology*. New Jersey: Prentice-Hall.

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