

THE UNIQUENESS OF HUMAN SOCIAL ONTOLOGY

ANNE L. C. RONEHOV

Copenhagen University

ABSTRACT: Darwin's theory of evolution argued that the human race evolved from the same original cell as all other animals. Biological principles such as randomness, adaption and natural selection led to the evolution of different species including the human species. Based on this evolutionary sameness, Donald R. Griffin (1915-2003) challenged the behaviourist claim that animal communication is characterized as merely *groans of pain*. This paper argues that (1) all animals are embedded in a social system. (2) However, that does not mean that all animals are social animals. (3) That the human social ontology remains to be unique due to a gene-cultural co-evolution.

KEY WORDS: self-identity, group-identity, intentionality, collective intentionality, natural selection, gene-cultural, co-evolution.

DESCRIPTION

The uniqueness of the human race has been discussed since the establishment of Darwin's theory of evolution announcing that the human race evolved from the same original cell as all other animals. Humans are not the «crown» of creation, there is no crown and no creation. Rather, biological principles such as randomness, adaption and natural selection led to the evolution of different species including the human race.

This line of thinking has not only put the human species on the same biological scale as other animals, it also tries to put the human race on the same social scale. For instance, honouring zoologist Donald R. Griffin (1915-2003), Carolyn Ristau compiled a volume on non-human animal cognition, because Griffin had challenged the behaviourist's claims that animal communication is characterized as merely *groans of pain* (Ristau, 1991: 14). Paradoxically, Griffin' and Ristau's idea that non-human animals might be aware of their own thoughts triggered a new way of thinking about the uniqueness of the human species. Questions are raised such as, are non-human animals also social animals or does the human social ontology remain to be unique? What external and/or internal information processes underpin such social reality?

Different research results suggest that social facts are common, constant and universal, that the same biological laws are integrated in all parts of nature and that, because social facts are subject to these laws, social facts are integrated in all parts of nature as well. In addition, these social facts improve from generation to generation. The question remains though, to what degree are the social facts integrated in different parts of nature, or more precisely, in the lives of different animal species? I will argue that:

- (1) All animals are embedded in a social system.
- (2) However, that does not mean that all animals are social animals.
- (3) That the human social ontology remains to be unique.

What are the criteria for being a social animal in the true sense? I suggest the following criteria to be necessary. Firstly, one needs to possess a self-identity as well as a group-identity and a self-identity within a group. Possessing self- and group-identity requires self-recognition and self-recognition within a group. Only then it is possible to have a cognitive sense of I and me as well as I and we and also of I and me within a we. Secondly, one needs to understand intentionality as well as understanding collective intentionality something which requires possessing the Theory of Mind, which implies possessing mental concepts such as belief or desire, which one attributes to oneself as well as to others. The Theory of Mind means to possess the ability to «put oneself mentally in another person's mental shoes». To put it differently, one has to *know* ones own state of mind in order that one can infer the state of mind of others from one's own. Collective intentionality also requires mutual responsiveness and a form of coordination between the members involved. Furthermore, the members need to be sensitive to each other's behaviour and they need to understand each other's action as a specific intentional action which they are able to respond to. Lastly, the members of the group have to be committed to the joint action.

From this I argue that the criteria necessary for being a social animal is represented in different degrees within the animal kingdom and human beings. For example, while all animals possess some social skills, only few possess a degree of self and group identity and understand intentionality and group intentionality, e.g. the great apes and (bottlenose) dolphins.

But I also argue that even if some non-human animals may fulfil the criteria for being a social animal it still is the case that the human social ontology is unique. Perhaps the human species is not the crown of creation but the human race has the genetic and social powers to rule creation, for better or for worse.

DISCUSSION

Are all animals social animals?

Already the Greek philosopher Empedocles (495-435 B.C.) argued that animal co-operate with each other (Allee 1931:386). More than 2000 years later, the French philosopher Alfred Victor Espinas (1844-1922), was convinced that *all* animals were indeed embedded in some social environment at some point of their lives. According to him, «[n]o living being is solitary. [Not even those who are] devoid of distinct and separate sexes [...]» (Allee, 1931: 386). If it would have been otherwise, conservation and renewal of life would not have been possible. He continues:

«Communal life, therefore, is not an accidental fact in the animal kingdom; it does not arise here and there fortuitously and, as it were, capriciously; it is not, as is so often supposed, the privilege of certain isolated species in the zoological scale, [...] but, on the contrary [...] a normal, constant, universal fact» (Allee, 1931: 387).

Hence, a social life does not only seem to be a common feature of life, it is also a necessary one. Social facts are subject to biological laws that are the same everywhere and constitute a «homogeneous whole thoroughly integrated in all [nature's] parts» (Allee, 1931: 387).

We can reconstruct this as:

1. Social facts are common, constant and universal.
2. The same biological laws are integrated in all parts of nature.
3. Social facts are subject to these laws.
4. Hence, social facts are integrated in all parts of nature.

Espinas also observed a development of the social habits. Indeed, not only did each generation pass on their social skills to the next generation, they also added at least some improvements to it. We can add a fifth item:

5. Social facts improve from generation to generation.

Hence, the social facts together with the biological laws they are subject to establish an increasing complex intertwined system allowing novel social features to emerge.

The American entomologist William Morton Wheeler (1865-1935) followed a similar line of thought when he maintained that not only do living beings struggle and compete for food, mating and shelter, which are all issues of *primary and individual* survival, they also co-operate in order to further develop their social structures, which are issues of *secondary and group survival*.

Furthermore, according to zoologist Warden Clyde Allee (1885-1955), the first steps towards development of societies were already taken when life began on our planet. His argument is based on his observations that even loosely organized as well as unorganized groups of animals living temporarily in the same region will co-operate for the sake of survival.

In other words, animals may congregate in some specific region at some specific time because of the survival value of that particular place at that particular time. Once the animals become adjusted to their new environment and become stronger, the survival value of the group may no longer be obvious, until existence gets less favourable again. For example, when the place becomes too crowded causing a higher rate of death amongst the members of the group, individuals and smaller groups will leave the place, in search for a new and more promising territory to rebuild a social system or die out.

Thus far, all this is not very different from modern human communication and societies. Just think about the phenomenon of urbanisation. Because of poor life circumstances in the rural areas, people moved to the cities. However, since

the 1950ies, at least in the richer parts of the world, we have experienced a counter-urbanisation. Indeed, people are moving away from the cities. There are several reasons for this behaviour but one reason is that cities have become more and more unhealthy places to live in due to pollution, crime and traffic congestion. Another important reason is the development of information technology (passed on to and further developed from generation to generation). Not only have new business-parks emerged outside the cities, today's communication facilities also allow us to connect with the rest of the world from wherever we are situated.

I believe it to be correct to argue that all animals are indeed at some point in their lives embedded in a social system, but, can it be argued that all animals are social animals? What does being a social animal require? In my view, at least two mental traits are needed, namely identity and intentionality. Let's start with identity.

Self-identity and group-identity

To be a social animal in the real sense, the animal needs to be able to form a self-identity as well as a group-identity. In other words, the animal needs to be able to have a «sense» of «I and me» and a sense of «we and I within us». Three distinctions can be made.

- (1) Animals that are part of a social group but are part of it as individuals. They may have their specific places within the group. For example, they may be the leader of that group. Perhaps one could argue that these animals have a sense of an *I* that has a specific task within an us. However, when threatened, their individual survival instinct will prevail. Another way to put it is that they are *more self-centred than group-centred*. Most mammals belong to this group.
- (2) Animals having a group-identity but no or little self-identity. These animals are *group-centred rather than self-centred*. Ants belong to this group of animals. Due to this, the behaviour of ants is often used as an example of *biological altruism*. Indeed, ants act as if they were one biological system that consists of different «modules» each performing their duty to fulfil the collective task. They act as neurons act in the brain.
- (3) Animals that have *both self- and group identity*. They are able to think in an *I-we-mode* as well as in a *we-mode that includes the I-mode*. Some mammals (the great apes and dolphins) and humans belong to this third group.

The animals of the first and second group have their specific social systems but, could it be argued that they are social animals in the true sense? Even though the animals of the first group may have a sense of identity, do they know that they are an I and a me and recognizes this I and me within the group? In other words, do these animals possess the ability of self-recognition?

Humans recognize themselves in a mirror from an early stage of infancy. However, there is evidence that the great apes (common chimpanzees) as well

as bottlenose dolphins also possess this ability (these belong to the non-human animals of the third group). Experiments suggest that both species behave in a way that it seems like they investigate the marks put on their body in mirrors or other reflective surfaces put around them.

They seem to investigate their bodies in a mirror or other reflective surfaces, to focus on the special added marks for a while, giving the impression to reflect on them and to accept these marks (Reiss and Marino, 2001: 5942). They seem to think «I have never seen these marks on my body before – let's investigate them». After a while, «hm! These marks do not look that bad and they do not hurt me – OK – I'm fine».

The important issue is that, because animals that are able to recognize themselves in a mirror also recognize the other members of a group as similar to but separated from themselves; it can be argued that these animals possess self- and group-identity, which are two criteria of being a social animal in a true sense. It is now time to look at the other mental traits that the animals need to understand, namely intentionality and collective intentionality.

Intentionality and collective intentionality

To be a social animal in a true sense, the animal needs to understand, to be able to explain (not necessarily by way of language) as well as to predict its own emotional and cognitive behaviour and that of others not only from its own point of view but also from the point of view of the social group.

As philosopher John Searle argues, intentionality does not only include intending as in «I intend to go to the movies, but also includes beliefs, hopes, desires, emotions, perceptions, and lots of others» (2008: 31). Similarly, group or collective intentionality can be described as we intend, we believe, we desire or, it is the group's (our) intention, belief, desire...

This means that the animal needs to possess higher-order thought. The animals belief that p needs to include a representation not only of p but of the animal's belief that p .

Philosopher Daniel Dennett refers to this ability as possessing the concept of intentional ascent (1987). In other words, the animal is not only aware of its self-directed intentional states but also of the other's directed intentional states.

Philosopher Andrew Whiten (2000) added an interesting distinction, namely between a mental representation of a mental representation on the one hand and a mental representation of a mental representation as a mental representation, on the other hand (Browne, 2004: 649). The animals have to be aware of their own states of mind in order that they can infer the states of mind of others from their own. As such they put themselves mentally in the other animal's mental shoes».

Once again, there are experimental studies suggesting that the great apes and the bottlenose dolphins are at least aware of their own state of mind. Derek Browne performed such a study (2004).

He showed that bottlenose dolphins are actually able to not only discriminate between higher and lower tones, but they are also able to choose a middle path,

i.e. the path «I do not know whether I hear a high or a low tone» (2004: 641). At least it seems that the dolphins «know» that they «do not know».

The question is however, whether the dolphins possess meta-cognition or are we rather talking about first-order cognitive responses? In other words, is the dolphin really aware that he is in this particular mental state (in this case the state of uncertainty) or does he feel uncertain or conflicted and somehow this feeling directs him to the escape paddle (2004: 650)?

To settle the matter, another research group, Smith and his team, performed experiments with humans, dolphins and great apes. Surprisingly or not, the results showed that the response patterns were similar, except for the fact that humans tended to use the escape paddle less often (20% against 45%). According to Smith *et al.* (1995), because the dolphins, the chimps and the humans responded similarly to a complex pattern and because it is known that humans use their meta-cognitive abilities, they concluded that also the great apes and the dolphins use meta-cognitive abilities.

We can reconstruct this argument:

1. Human beings possess meta-cognition.
2. Meta-cognition implies to respond to a complex pattern in a particular way.
3. Human beings, great apes and dolphins respond in a similar way to complex patterns.
4. Therefore, also great apes and dolphins possess meta-cognition.

Of course this line of thinking is valid but is it also sound? In my view, there are some problems with premises 2 and 3. Firstly, meta-cognition does not only imply that one responds to complex patterns in a particular way, the main definition of meta-cognition is knowing about knowing, knowing one's own cognitive processes. As mentioned earlier, even though there were no stimuli involved in the experiment with the third paddle, it does not provide clear evidence that the dolphins really were aware of their cognitive (mental) state of being uncertain. Secondly, from the fact that humans use their meta-cognition (theory of mind) to perform a task it cannot be deduced that also dolphins and chimps possess this capacity on the same level as humans.

However, there is an experiment performed by Leslie Brothers that might give the evidence needed. In 1989, Leslie Brothers performed an experiment on empathy of monkeys. Empathy is said to be the highest form of mind-reading. Briefly, Brothers' study was as follows. Firstly, the monkeys in the experiment were taught to fear a certain tone. The monkeys soon learned to avoid this tone by pushing a certain lever whenever they heard that tone. Thereafter, the monkeys were separated and could only see each other's face through a closed circuit television. One of the monkeys was exposed to the tone. The other monkey, seeing that his fellow monkey was hurt by watching the expression on his fellow monkey's face, pushed the lever that would stop the noise (1989: 10-19).

This led Brothers to conclude that empathy is a capacity that is innate in primates. Be this the case or not, what Brothers experiment shows is that the

monkeys not only knew their own state of mind (being in pain) but seem to be able to infer the fellow monkey's state of mind from their own. And further more, act in accordance to it (release the fellow monkey from his pain). This suggests that monkey's possess a higher form of mind-reading, perhaps the theory of mind?

Thus far we have provided at least some evidence that some non-human animals possess self- and group-identity and that they may understand intentionality. Hence, let us continue with investigating collective intentionality.

Collective intentionality

According to Searle, collective intentionality is a genuine biological phenomenon (2008: 31). He means that, a social reality (or fact) is established as soon as two or more humans or animals are involved (2008: 32). If we accept his view, all animals should be capable to establish social realities. However, in my opinion a distinction should be made between biological intentional behaviour and agent-controlled intentional behaviour.

As philosopher Fred Dretske also argues «to be an agent it is not enough to be a thinker and a doer. The thinking must explain the doing» (1999: 19). Only then, he argues, we can talk about expressions of agency (1999: 20). Only then we can talk about agent-controlled intentional behaviour that besides the I- and we-mode is a necessary condition for understanding collective intentionality and for being a social animal in the real sense.

For instance, all hungry animals intend to find food, for themselves and during a certain period also for their offspring. This type of intentionality is what is meant by biological intentionality or in Dretske's words, animal behaviour.

However, only some animals and humans may have the attention to find food for the social group they are part of and only some animals and humans may have the intention to find food for members of another social group. This type of intentionality fulfils the criteria of agent-controlled intentionality or in Dretske's words, agent action.

Finding food for yourself and your offspring belongs to natural behaviour; it is instinctive and evolutionary basic. Finding food for other members of your society and member of foreign societies may enhance your own possibilities of survival but your actions need careful planning and strategies.

Take for example, carefully planning investments in undeveloped societies with the aim to increase local employment and income thereby improving the environmental quality, which in turn improves the environmental quality of the whole world to which one belongs (Wheeler, 2001). Humans know what helping others means for the others and for themselves; their intentions are agent-controlled.

However, once again there is evidence of non-human animals helping members of other social groups. Indeed, bottlenose dolphins seem to behave as intentional agents (Pryor *et al.*, 1990). These dolphins have been fishing alongside humans at Laguna (Brazil) since 1847. They actually herd fish towards the

fishermen who wait in the shallows. Once the fish is close by the fishermen, they signal the fishermen to cast their nets. Furthermore, they go after the fish that want to escape the nets.

According to Karen Pryor *et al.*, this particular behaviour has not been found in other dolphin population. Apparently, this particular intentional act has some specific meaning for the Laguna bottlenose dolphins. However, on the basis of this, can we conclude that these dolphins that seem to act as agents also are agents? In other words, «do they understand that they are giving a signal to the fishermen to cast the[ir] net[s] or have they acquired this unique signal through blind, mindless, year-long trial and error learning» (Nissani, Schiefler and Milioli)»?

Yet another question, can we conclude that the dolphins help the fishermen, because they know what helping them means? Is their intentional behaviour biological intentional or agent controlled? For us to be able to answer this question we need to make yet another distinction.

In Dretske's words, «there is a difference between being caused by an event that means M and being explained by the fact that it means M (1999: 20). In the case of the dolphins, their helping the fishermen (the event) caused the fishermen to sell fish on the market and buy other necessities (M). However, this does not mean that their selling fish and buying other necessities is explained by the behaviour of the dolphins.

To put it differently, it is doubtful that the dolphins, in contrast to a human animal could form a belief or predict the intention of the fishermen. The reason is that, if they can, they need to be able to infer the fishermen's intended actions from their own repertoire. In my opinion, it is hard to see they would be able to do so, dolphins do not sell or buy things, so how could they predict that driving in the fish to the fishermen would help the fishermen to sell the fish?

But there is more to the story of collective intentionality. As mentioned earlier, the following criteria need also to be fulfilled:

- (1) Mutual responsiveness.
- (2) A form of coordination between the members.
- (3) Sensitivity to each other's behaviour.
- (4) Understanding of each other's action as a specific intentional action which one is able to respond to.
- (5) Commitment to the joint action.

The question is now; to what extent are these criteria fulfilled by non-human compared to human animals? (Tummolini *et al.*, 2006: 117).

Non-human animals do instinctively capture the intention of the group to collectively say escape from some danger. Practically, when hearing a certain sound of one of the animals in the group, animals A, B and C will start to run. In other words, they will collectively behave in a certain way. The act is intentional in the sense that A, B and C intend to escape danger. There seem to be a mutual responsiveness (to the specific sound) and some form of coordination between A, B and C's behaviour (running together in the same direction). Hence criteria 1 and 2 may be met.

However, could it be argued that A, B and C are sensitive to each other's behaviour, that they understand each other's action as a specific intentional action to which they are able to respond? Furthermore, could it be argued that animal A, B and C are committed to their collective act?

In my opinion, that the latter criteria are fulfilled is not clear. As Searle puts it: «[c]ollective intentional behaviour [...] is not the same as the summation of individual intentional behaviour. In our example, the intentional behaviour of animals A, B and C running for their lives does not necessarily represent collective intentional action but does represent a summation of animal A, B and C's individual intentional behaviour. What about the great apes and dolphins?

If we return to the Laguna dolphins, one would like to say that, indeed all criteria are fulfilled. However, we need to remember that this complex strategic behaviour of the dolphins has been going on for more than 100 years – we cannot exclude the importance of training, learning, trial and error.

However, another study performed by Michael Tomasello *et al.* suggests that dolphins do share intention and that this might be one end of a continuum that also contains «awareness of others» and «awareness of other's intentions», as well as the more basic ability to form an intentional plan of action' (2005: 706).

While he was snorkelling around three wild rough-toothed dolphins, (two adults and one youngster), he saw how one of the adult dolphins trailed a piece of plastic from one of its pectoral fins. Then the three dolphins passed this plastic piece forth to one another. They did not make any attempt to steal the plastic but waited for the plastic to be released. They also passed the plastic on to the youngster, seemingly to ensure the participation of the young dolphin. This observation of wild dolphins, in their own free environment, suggests that dolphins do have the capacity of collective intentionality. Their play is not caused by training or learning, trial and error, it comes spontaneously similarly as play comes natural to children. Tomasello concluded that such behaviour might provide the basis of simple forms of culture (2005: 706).

In conclusion, perhaps we may suggest that some animals are or at least may be social animals in a similar sense as human animals are. The experiments mentioned clearly suggest the probability that some non-human animals fulfil the criteria for possessing self- and group identity, intentionality and collective intentionality.

However, there still is something unique about human social ontology. While some non-human animals may be cultural in a basic way, human's culture is far more complex.

Humans as institutional animals

Humans are not only social animals they are also cultural or institutional animals. Humans do not only live in societies, they create their societies; they create culture and institutions.

Take the example of trade. In the early times of human social evolution, the form of trade that was used was barter, i.e. people simply exchanged goods and

services. Later, barter was replaced by commodity money, i.e. any commonly available commodity that had intrinsic value (seashells, cacao beans and even bread). From about 2000 BC currency was introduced as a medium for trade. In the beginning, the currency was represented by standardised coins, later paper-money was introduced and today trade is mostly done by electronic transactions, i.e. by cyber-money.

The point is that money, being a piece of paper or an amount of numbers on a computer, is collectively accepted to have what Searle calls *deontic power*. Money, unlike a candle, performs a certain function not in virtue of its physical structure but in virtue of its collective attitudes (2008: 33).

In the language of logics: X counts as Y in context C. Other examples are wedding rings, passports, certificates, stock-markets, contracts, corporations, etc. (Searle, 2008: 39). Only human social ontology includes deontic powers. Non-human animals do not need contracts stating that they have the right to live in their «house». The question is why did human social ontology become so advanced? I suggest there are three main basic reasons.

The Underpinning evolutionary mechanisms

The first reason was already emphasized by Charles Darwin in his theory of evolution. He asserts that species are *populations of individuals* that carry a pool of genetically acquired information through time. Furthermore, political and social complexity is driven by population growth. Surely, this is something which is mirrored in the human societies (Richerson and Boyd, 2005: 59).

The second reason for why human social ontology became that complex may be the idea that a *co-evolution of genes and culture* took place, which is more than a pass-on of social skills from generation to generation. Co-evolution can be explained as evolutionary systems «in which two species are important parts of each other's environments so that evolutionary changes in one species induce evolutionary modifications in the other» (Richerson and Boyd, 2005: 192). The gene-culture co-evolution played a crucial role in genetic evolution of human psychology, because genetically evolved psychological biases steer cultural evolution in genetic fitness enhancing directions. On the other hand, culturally evolved traits affect the relative fitness of different genotypes in many ways. Take for example a culture in which punishment is adapted. Indeed, culturally evolved moral norms can affect fitness if the violators of these norms are punished. The violator gets the chance to reevaluate his actions (enhancing his fitness) or experiences a decrease of social fitness (imprisoned, not respected, becoming an outsider) (Richerson and Boyd, 2005: 193). Richerson and Boyd argue that genes and culture are obligate mutualists. Genes alone cannot promptly adapt to the rapid environmental changes and culture would not exist without brains and bodies. Hence, genes and culture are tied together but culture remains nevertheless subject to evolutionary forces that pull behaviour in different directions (2005: 194). This line of thought seems to go hand and hand with Allee's, namely that social facts are subject to biological laws. The difference

is that in Richerson and Boyd's view, there is strict mutual causation between the two.

A third reason for the uniqueness of the human social reality is explained by way of the *social complexity hypothesis*, a key driver of human intelligence. This hypothesis means that animals living in large social groups (as apparently human do) should display enhanced cognitive abilities. The larger a society becomes, the more social cognition is demanded. This makes sense, because within each society, the individuals have to recognize the other individuals; they continuously need to hold track of the social position, social behaviour and social success of other individuals; they have to classify the others by age, gender, genetic relationship, family status and social rank, physical capacities, reliability, preferences, expertise, etc., and update all this information as circumstances change (Bond *et al.*, 2002: 479; Byrne & Whiten, 1988).

Moreover, because humans typically align themselves with different sub- and side-groups (e.g. religious and political groups), they must understand and remember how each member relates to these sub- and side-groups and how the different groups relate to each other. The more socially differentiated and complex groups become, the more cognitive power is needed. Hence, at some point in the history of evolution, the neo-cortex simply had to evolve and further develop.

CONCLUSION

All species are populations of individuals that carry a pool of genetically acquired information through time. Social facts, since they are subject to biological laws that are integrated in all parts of nature, are also integrated in all parts of nature and furthermore that the social facts improve form generation to generation. There is evidence that some non-human animals are or may be social animals in a true sense.

However, because the gene-culture evolution only took place in humans, humans do not only live in societies, they create societies and complex cultures and institutions.

Humans acquired a gene pool (neural system) that enabled them to not only reproduce but also to enhance the fitness of themselves and their offspring. Therefore, they could establish large social groups including sub- and side-groups.

Secondly, the cultural traits influenced the human gene-pool and vice versa, which in favourable circumstances, enhanced their cognitive abilities further and further, which in turn gave rise to more and more complex social systems. It is this that remains to be unique for the human-animal.

However, because in the end, everything remains subject to evolutionary forces, an interesting question is perhaps how much longer can these forces allow the human animal to advance as it does?

REFERENCES

- ALLEE, W. C. (1931), «Co-Operation Among Animals», *The American Journal of Sociology*, Vol. 37, No. 3, 386-398.
- BROTHERS, LESLIE (1989): «A biological perspective on empathy», *American Journal of Psychiatry* 146: 10-19.
- BOYD, R., and RICHERSON, P. (1985), *Culture and the evolutionary process*, Chicago: University of Chicago Press.
- BROWNE, D. (2004), «Do Dolphins know Their Own Minds?», *Biology and Philosophy* 19: 633-653.
- BYRNE, R. (1995), *The Thinking Ape*, Oxford: Oxford University Press.
- BYRNE, R., and WHITEN, A. (eds.) (1988), *Machiavellian Intelligence: Social Expertise and the Evolution of Intellect in Monkeys, Apes and Humans*, Oxford: Oxford University Press.
- DARWIN, CHARLES (2009 [1874]), «The Descent of Man, and Selection in Relation to Sex», *Digireads.com publication*. www.digireads.com
- DENNETT, D. (1987), *Intentional systems in cognitive ethology. The Intentional Stance*, Cambridge, MA MIT Press.
- DRETSKE, FRED I. (1999), «Machines, Plants and Animals: The Origin of Agency», *Erkenntnis* 51: 19-31.
- PREMACK, D. (1988), «Does the chimpanzee have a theory of mind?». Revisited in BYRNE, R., and WHITEN, A. (eds.) (1988), *Machiavellian Intelligence: Social Expertise and the Evolution of Intellect in Monkeys, Apes and Humans*, Oxford: Oxford University Press.
- PRYOR, K., and NORRIS, K. S. (1998) (eds.), *Dolphin Societies, Discoveries and Puzzles*, London: University of California Press.
- REISS, D., and MARINO, L. (2001), «Mirror self-recognition in the bottlenose dolphin: A case of cognitive convergence», *PNAS*, Vol. 98, No. 10: 5937-5942.
- RICHERSON, PETER J., and BOYD, ROBERT (2006), *Not by Genes Alone: How Culture Transformed Human Evolution*, London: The University of Chicago Press.
- RISTAU, CAROLYN A. (ed.) (1991), *Cognitive Ethology: The Minds of Other Animals*. Volume compiled in honor of Donald R. Griffin. Hillsdale: Lawrence Erlbaum.
- (1983), «Language, Cognition, and Awareness in Animals?». In: *The Role of Animals in Biomedical Research*, Annals of the New York Academy of Sciences, Vol. 406, 170-186.
- SAMIR, OKASHA (2008), «Biological Altruism», *Stanford encyclopedia of philosophy*. <http://plato.stanford.edu/entries/altruism-biological/>
- SEARLE, J. (2008), *Philosophy in a New Century: Selected Essays*, Cambridge: Cambridge University Press.
- SMITH, J. D.; SCHULL, J.; STROTE, J.; MCGEE, K.; EGNOR, R., and ERB, L. (1995), «The uncertain response in the bottlenosed dolphin (*Tursiops truncatus*)», *J. Exp. Psychol. Gen.* 124: 391-408.
- TOMASELLO, M., and CALL, J. (1997), *Primate Cognition*, New York: Oxford University Press.
- TOMASELLO, M.; CARPENTER, M.; CALL, J.; BEHNE, T., and MOLL, H. (2005), «Understanding and sharing intentions: The origins of cultural cognition», *Behavioral and brain sciences*, 28: 675-735.
- TUMMOLINI, L.; CATELFRANCHI, CH., and RAKOCZY, H. (2006), «Pretend play and the development of collective intentionality», *Cognitive Systems Research* 7: 113-127.
- WHEELER, D. (2001), «Racing to the Bottom? Foreign Investment and Air Pollution in Developing Countries», *Journal of Environment & Development*, Vol. 10, No. 3, September 2001, 225-245.

- WHITE, T. I. (2007) (ed.), *In Defence of Dolphins. The New Moral Frontier*. Malden, Oxford: Blackwell Publishers.
- WHITEN, A. (2000), «Chimpanzee cognition and the question of mental re-representation». In: SPERBER, D. (ed.), *Metarepresentations: A Multidisciplinary Perspective*, Oxford: Oxford University Press.

BIBLIOGRAPHY

Anne L. C. Runehov holds the degree of reader (assoc. prof.) in philosophy of religion from the Uppsala University, and is guest researcher at the faculty of Theology, Copenhagen University. She holds a master degree in theoretical philosophy and a Doctor degree in Theology, philosophy of religion both from the Uppsala University. She is EiC for the *Encyclopedia of Sciences and Religions*, as well as for the *Copenhagen University Discussions in Science and Religion*. Ed. for the *European Journal of Science and Theology*. Author of *Sacred or Neural? The Potential of Neuroscience to Explain Religious Experiences* (2007) and has published several peer-reviewed articles. She received ESSSAT research prize in 2006. She is also the director of the *Copenhagen Network for Science and Religion*.

Department of Theology
University of Copenhagen, Copenhagen, Denmark (Cancelled)
aru@teol.ku.dk

ANNE L. C. RONEHOV

