A NEUROPSYCHOLOGICAL AND EVOLUTIONARY APPROACH TO ANIMAL CONSCIOUSNESS AND ANIMAL SUFFERING

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Abstract *Animal Welfare 2001, **10:** S47-62*

This paper will try to answer the question of whether animals can suffer.

My aim is, firstly, to discuss whether or not an irreflexive animal consciousness could experience suffering. I do this because there are authors who assume such a consciousness in animals. The second part of this contribution concerns the question of the cognitive and neural prerequisites which have to be present in order to give consciousness, or the suffering experience, a positive fitness value. Further, I analyse for which animals these brain structures and cognitive capacities have been described, since consciousness and suffering can only be expected in these animals.

In order to answer the questions, several assumptions had to be made. If the assumptions are correct than the results of the various analyses demonstrate that: i) an irreflexive consciousness is unable to experience suffering; and ii) animal suffering may, for the time being, only be expected in the anthropoid apes. However, there is an important difference between the registration of pain as a stimulus, which does not induce feelings of suffering, and the experience of pain as an emotion, which does induce suffering. According to the arguments presented in this contribution, the experience of pain as a stimulus could be expected in far more species than anthropoid apes alone.

Introduction

At first sight this contribution will be a bit weird for some readers. The reason for this is that the issues of consciousness and suffering both have a long tradition in psychology, therefore most arguments stem not from the field of ethology, but from the field of (neuro)psychology. It follows that, with regard to animals, the arguments presented are only valid if one assumes that, if there is animal consciousness or animal suffering, they should not be qualitatively different from human consciousness and human suffering. One could, of course, like Bateson (1991) assume that various animal species have their own type of consciousness, and that it may be totally different from human consciousness. There is nothing wrong with assumptions: science flourishes with assumptions. However, such flourishing is only possible if the assumption is specified (in this case by describing how the assumed animal consciousness deviates from the human consciousness), because only then is it possible to analyse the logical consequences of the assumption and only then is it a contribution to science. Since, with the exception of the idea of an irreflexive animal consciousness, I have never seen such specifications in the literature, I have chosen to present two approaches to the question of animal consciousness and animal suffering. Firstly, an analysis of the idea of

https://doi.org/10.1017/S0962728600023514 Published online by Cambridge University Press

an irreflexive consciousness, and secondly an analysis of the idea of an animal consciousness and animal suffering based upon the assumption that such an animal consciousness and animal suffering are not qualitatively different from the only consciousness and suffering we know anything about human consciousness and human suffering. With this warning to the readers I can start with my contribution.

There is no generally accepted theory about consciousness (Lokhorst 1986; Wilkes 1988; de Vries 1991) and there is further serious doubt whether we will have such a theory in the near future (Chalmers 1996). Due to this deficiency, the door is wide open for all kinds of weird theories and assumptions and, if the argument is dominated by social aims, science will be reduced to politics. For instance, Verheijen *et al* (1993) wrote 'to decide whether or not to accept the analogy-postulate, the strength of arguments not only play a role, but also the consequences of acceptance versus rejection'. Dawkins is subtler – referring to 'welfare measurement' she wrote (1998 p 308): 'such gross welfare measures should be made at the level of the individual animal, not the farm unit'. If that were turned into practice then farm animals would have more social security than people and farming would become a troublesome business. Dawkins' statement is all the more surprising since in the same article she states that there are no correct welfare measurements at hand (Dawkins 1998 p 323):

> In a thoughtful and provocative essay entitled *The Myth of Animal Suffering*, Bermond (1997) correctly points out that none of the methods proposed so far for assessing 'suffering' in animals actually do so. 'Suffering', as applied to humans, means conscious experience of something very unpleasant. Strictly speaking, none of the measures of 'poor welfare' or 'stress' discussed so far demonstrates the presence of comparable states in nonhuman animals.

Several attempts have been made to substantiate the idea that most animals do have consciousness and are therefore capable of experiencing suffering. The following substantiating arguments for animal suffering are mentioned in the literature: i) physiological stress responses in animals; ii) conditioning of animals by negative reinforcers; iii) emotional behaviour in animals; iv) registration of behaviours indicating that some animals will overcome various barriers in order to flee from negative situations; v) information processing by animals on a rather high level; vi) Romanes' analogy postulate; vii) the assumption that there are species-specific types of consciousness; and, finally, viii) Pepperberg's talking parrot. Since I have argued before that all these arguments and assumptions are incorrect (Bermond 1997, 1998), I will not discuss them here and will merely refer to these earlier publications.

In this contribution 'suffering' is, in accordance with Dawkins (1998), defined as a conscious negative mental state, because suffering does not refer to behaviour but to an experience, and experiences are by definition conscious. Consciousness is, in this contribution, defined as 'knowing that you know'. An irreflexive consciousness is, within this definition, in principle possible. Further, this definition is less severe than that of, for instance, Carruthers (1989) who assumed that there is only consciousness if the knowing that you know results in further conscious cognitions.

An irreflexive animal consciousness?

An irreflexive consciousness is a consciousness with neither past nor future, and which does not add any cognition to the experience. For instance Lijmbach, who assumes such an irreflexive consciousness in animals, states (Lijmbach 1998 pp 5 & 149): 'I will emphasise

this distinction and say that animal experience, unlike human experience, is impersonal, bodily bound, here-and-now experience', and: 'many ethologists see animal experiences as separated from animal behaviour, namely as causes of behaviour. I do not see them as separated from, and certainly not as causally related to, behaviour'. In other words, an irreflexive consciousness is a minimum, a pure phenomenological consciousness, containing only qualia without accompanying cognitions and without any function for behaviour.

Qualia refer to the quality of perceptions, in particular to those aspects of the perception which are represented in the physical world in a different way. For instance, in the physical world there are electromagnetic waves with different wavelengths. However, we do not see wavelength, we see colours. Likewise, smells are, in the physical world, just certain molecules. The qualia (colours, taste, pain, emotional feelings, odours and sounds) exist, therefore, only in the mind of the conscious perceiver and not in the physical world. This is distinct from the cognitive aspects of a perception. When we see a yellow house, and we are not hallucinating, then there is a house in the outside world, but the yellow is only in our brain or mind.

This definition of qualia could easily lead to the false idea that correct animal motor responses to what humans experience as qualia are proof of animal consciousness. However, since it is known that most human reactions to stimuli are initiated before the stimulus is consciously perceived (see later in this contribution), it is possible that some species react to, for instance, different electromagnetic wavelengths without seeing anything. In fact, this has been described for some humans with lesions in the primary visual cortex. These persons are blind in the sense that they cannot see consciously any more, but they are still capable of giving correct motor responses to the 'unseen' stimuli (Weiskrantz *et al* 1974; Sacks 1995). This phenomenon has been named 'blindsight'. It has further been described that such people can, using this blindsight, also differentiate correctly between various colours, although they cannot experience the quale (singular of qualia) of the colours since they process visual stimuli only at a non-conscious level (Weiskrantz 1997).

The idea of a minimum consciousness has also been a subject in philosophy. Chalmers (1996), who separates qualia from cognition, assumes that such a consciousness could exist and, according to him, it is an epiphenomenon. He assumes that such a consciousness containing only qualia does not emanate from the brain, but that it is a basic natural phenomenon in itself which cannot be explained by physics: these ideas do not have many supporters.

Dennett (1996) and Searle (1997) have also speculated about such a minimum consciousness and both reject the idea. Dennett argues that such a minimum consciousness should not only have sensitivity, like a thermostat or photographic paper, but also something extra (X) in order to lift or turn the sensitivity into a conscious experience, and he asks himself (Dennett 1996 p 62):

> What does sentience amount to, above and beyond sensitivity? This is a question seldom asked and has never been properly answered. We shouldn't assume that there's a good answer. We shouldn't assume, in other words, that it's a good question.

According to Dennett, the real question is therefore what this X is, and since there has been no-one so far who could even suggest what this X may be, it is therefore better to reject this idea altogether.

https://doi.org/10.1017/S0962728600023514 Published online by Cambridge University Press

Searle sets it aside because, according to him, the qualia and the accompanying cognitions cannot be separated from one another, since if they could there would be no consciousness left (Searle 1997). Likewise, Baars (1997 p 84) states: 'even animals with mainly sensory consciousness must be able to think about events outside the sensory field'. Baars' and Searle's ideas become clearer if we ask ourselves what an irreflexive consciousness could experience if the input was, for instance, a lemon. Certainly not a lemon, because that requires cognitive processing. In fact not even a yellow spot, since that is a cognitive interpretation also. What will be left is the experience of pure 'lemon yellow', whatever that may be. However, although we lack the imagination to conceive of such experiences, it is no proof that such experiences could not exist.

The emotional psychologist Frijda (1986) also makes a plea for an irreflexive consciousness and so a plea for animal consciousness. Frijda states (1986 p 188):

> Irreflexive emotional experience also, by its very nature, is 'projective': the properties are out there. These properties contain the relationship to the subject: emotional experience is perception of horrible objects, insupportable people, oppressive events. They contain that relationship implicitly: the 'to me' or 'for me' dissolves into the property.

This author has an ornate style, and is therefore sometimes hard to understand. What is meant here? Firstly, it is assumed that there is a relationship between the subject, the 'I', and the properties in the outside world which induces the emotional feeling. Secondly, it is assumed that this concept of 'I' or 'to me' or 'for me' dissolves into the properties of the outside world. One thing is clear: there is a contradiction – there is a concept of 'I', and at the same time this concept dissolves into thin air! The author does not explain how this dissolving takes place, he just states: 'the notion of irreflexive experience is that of awareness without awareness of itself' (Frijda 1986 p 188). However, we can still imagine something from Frijda's statement. During 'blind rage' or the '*crime passionnel*' we act like a machine, without any reflection; the reflection only comes afterwards, as does remorse. The 'I' concept does not dissolve: it is, during such an act, simply not there. The crucial question here, however, is whether we could become so angry without having ever registered that we are individuals among other individuals. If that were the case then it would have been impossible to blame someone else for our misfortune and it is this blaming which induces the feeling of anger. In other words, the emotional experience becomes, without the concept of 'I' or 'me', not only aimless but also without content.

Emotions are triggered by stimuli which are, for some reason, important to the perceiver (Frijda 1986). For this reason, conscious reflection is sometimes required since it is, sometimes, only after the reflection that the importance becomes clear. Further, we cannot imagine emotional experiences without accompanying conscious cognitions: for instance, the feeling of fear is unthinkable without thoughts like: 'How can I escape?', 'What should I do?', 'Should I defend myself or should I run?', etc. All these thoughts are part of our emotional experience. Finally, the emotional experience needs a subject. It is always an 'I' who is sad, afraid or happy. It is not, as Frijda assumes, projected onto the outside world. 'We' are irate if we are maltreated, but the world around us is not angry. The emotional feeling is part of us, not of the environment. The environment contains the emotion-inducing stimuli not the emotional feeling. However, the emotional behaviour does not require emotional feelings (Bermond 1997, 1998 and later in this contribution). If we add a fear-substance (a substance secreted by some types of fish after they are wounded) into an aquarium, then all other fish of that species will flee and hide, even if there is no predator

around (Verheijen 1988; Bateson 1991). The fish's behaviour is induced by a stimulus response mechanism without any cognitive interpretation and, therefore, as we will see later, without any accompanying emotional feelings. In such cases, one could rightly say that the 'fear' is in the aquarium and not in the fish, which only show fear behaviour. However, if we speak about a fear experience then it is the subject who is loaded with emotions and not the environment. It is for this reason that LeDoux (1989) writes: 'emotional experiences, it is proposed, result when stimulus representations, affect representations, and self-representations coincide in working memory'. In other words, the emotional experience requires the concept of self, or self-consciousness.

Irreflexive consciousness and pain or suffering

Suffering is the experience of pain and negative emotions such as fear, sorrow and guilt. Although pain has already been defined by Aristotle and Plato as an emotion (Menges 1992), most people still think that the pain experience is just a sensorial experience. The fact that all sensorial experiences, except pain, can be induced by electrical stimulation of sensorial cortex (Libet 1982) indicates that pain is more than just a sensorial experience. There are two types of pain: i) pain as a sensorial registration which is experienced as neither negative nor positive; and ii) pain as a pain experience or pain emotion, which does induce suffering (Trigg 1970; Menges 1992). Likewise, Sherrington, who, early last century, observed pain behaviour in decorticated mammals, which he described as 'pseudo affective', drew a distinction between pain and 'nociception' (Bateson 1991). Furthermore, pain behaviour does not need a conscious pain experience, as is indicated by the pain behaviour of paraplegic patients (Jennett 1989). This observation also indicates that pain behaviour is already partly regulated at the spinal cord level.

The emotional experience, and thus the pain experience, disappears if our natural tendency to reflect upon the pain is blocked, as for instance after destruction of our evolutionarily most recent brain parts the prefrontal cortex (PFC; Trigg 1970; Damasio *et al* 1990). It was for this reason that, in the 40's and 50's, frontal lobotomy was used as a remedy to block chronic pain (Freeman & Watts 1950; Freeman 1971; Kucharski 1984; Kolb & Whishaw 1990). The pain before the operation was overwhelming and permanently the centre of attention, while after the operation patients lost any interest in their pain, although they claimed that the pain itself had not changed. After the operation the sensed pain did not annoy them any more; the pain left them literally cold (Trigg 1970). The important issue here is that such people can still experience pain as a pain stimulus, but they cannot experience it as a pain emotion, and thus they cannot experience pain suffering any more (Krystal & Raskin 1970; Trigg 1970).

The fact that pain suffering needs pain-related reflection explains why we can reduce our pain experience by directing our thinking to other issues, a trick use by many people when their molars are drilled out by a dentist. Further, since there are cultural differences in pain expectations, this also explains cultural differences in pain suffering, because the less pain we expect the less pain-related reflection, and thus the less pain we experience. Lerich, a front surgeon in the First World War, was told by Russian officers that the Cossacks did not need narcotics during operations. Limited in supplies, Lerich tried, although against his 'better' judgement, amputations on Cossacks without narcotics. To his surprise the 'poor victims' showed no signs of pain experience (Menges 1992).

It is interesting that after frontal lobotomy, when the emotional experience has fully disappeared, the frequency of emotional behaviours is increased, whereas the duration of emotional responses is decreased. At the same time, the emotional behaviour becomes, as it is in most animal species, stimulus-bound (Levine & Albert 1948; Freeman & Watts 1950;

Jarvie 1954; Nemiah 1962; Trigg 1970; Kucharski 1984; Fuster 1989; Valenstein 1990; Damasio & Anderson 1993; Malloy & Duffy 1994). The behaviour of prefrontal patients is: 'captured by salient sensory cues that reflectively elicit strongly associated actions. They are unable to override these impulses' (Miller 2000 p 61). This not only demonstrates that there are different neural circuits for emotional behaviour and emotional feelings, but also that it is the emotional feeling which gives, by emotional rumination, the emotion duration until long after the external emotion-inducing stimuli have disappeared. Since the extended emotion steers our behaviour, it often results in maladapted behaviour. The psychological defence mechanism of displacement (you are angry at your boss, but you are not allowed to show that and therefore you yell, hours later, at your children or spouse) is an example of such maladapted behaviour. Such an extension of the emotional period is absent in most animal species. The lioness does not fall into a depression when her cubs are killed by the new alpha male: after a few days she comes into heat and mates with the killer. The foster parent birds do not hate the cuckoo chick which throws their own young out of the nest: they just keep on feeding the little bastard. It should be kept in mind that subjective feelings in humans require the PFC, and are therefore thought to be a relatively late evolutionary development (Plutchik 1994). As stated above, the extension of the emotional period due to the emotional feeling means that the emotion endures after all external emotion-inducing stimuli have disappeared, and that the emotion is kept alive with the aid of internal stimuli. Therefore, descriptions of animals which show long-term emotional behaviour while the inducing stimuli are still there cannot be used as an argument for animal consciousness. For instance, the primatologist Frans de Waal describes female monkeys which will often carry around their deceased baby for days, but if they lose the corpse, simply because it has fallen apart due to decay, then immediately all signs of grief disappear (de Waal 1996).

The experience of suffering requires reflection, imagination and understanding of 'duration', of past and future. Dennett writes (1996 pp 166-167):

> Many discussions seem to assume tacitly that suffering and pain are the same thing, on a different scale; that all pain is 'experienced pain'; and that the 'amount of suffering' is to be calculated ('in principle') just by adding up all the pains ... What is wrong with this scenario is, of course that you can't detach pain and suffering from their contexts. What is awful about losing your job, or you leg, or your reputation, or your loved one is not the suffering this event causes in you, but the suffering this event is.

Dennett's aim here is to indicate that the loss of, for instance, a child can only result in the experience of suffering if the context knowledge concerning that child (how life was when the child was still alive) can be retained, or if one can, much later, imagine how life now would be if the child was still around. Without knowledge of past and future, reflection and imagination, which are by definition absent in the irreflexive consciousness, there is no suffering.

In conclusion, we may say that if there is such a thing as an irreflexive consciousness then it will be free of pain experiences and suffering, although it remains possible that such a consciousness could still non-emotionally register pain stimuli which do not induce pain suffering.

Congenital pain indifference

Some people are born with pain indifference. They register pain, like frontal lobotomy patients, only as a stimulus and cannot experience pain as an emotion. They can therefore do

all kinds of horrible things to themselves without being troubled by pain. Many of them could earn good money by performing 'pain' inducing theatre acts. One wanted to make a living by showing his own crucifixion. Special gold-plated wire nails were made, which were literally hammered through his hands and feet. Although he had planned several such performances, only one show was staged, since the audience fainted *en masse* during the first performance (Krystal & Raskin 1970). This is what remains of the pain experience if pain can only be registered as a stimulus and not experienced as a pain emotion. The suffering is in the observer, not in the 'self pain inducing' performer. Since we belong to a species which has, on average, a high capacity for empathy, we are inclined to project feelings of pain onto others if we get emotionally aroused by seeing that others are seriously hurt. That is why most of the pubic fainted while watching the crucifixion. For the same reason, it is almost impossible for us, because we become emotionally aroused if we see animals which are hurt or showing pain behaviour, to consider the possibility that these animals may not be suffering.

How did consciousness develop?

Consciousness as a natural 'emergent' property of increasing complexity

Some authors have argued that consciousness is an 'emergent' property of the increasing complexity of the brain, an idea which is now very popular in the field of artificial intelligence. However, Weiskrantz (1997) describes microscopically small lesions which do not make the human brain less complicated and which result in specific losses in consciousness. Weiskrantz therefore states (1997 p 82): 'it is obvious that the answer must lie in the way the nervous system is organised, not in complexity as such'. Further, since no-one can indicate which level of complexity should be the turning point, this assumption remains in the domain of belief and is thus not a part of science. How should the question be approached?

Three questions concerning consciousness and suffering

In order to approach the problem of animal consciousness and animal suffering we can pose ourselves three questions.

Firstly, we can ask ourselves which evolutionarily latest part of the human brain is a prerequisite for experiencing pain and suffering? Why the evolutionarily most recent brain part? Doesn't correct pain behaviour have an immense fitness value and should it not, for this reason, be assumed that it developed early in evolution? Yes, we should assume that! However, as argued before, pain behaviour is already regulated at the spinal cord level, while human pain emotion and the experience of suffering both need the PFC in order to occur. For these reasons, we have to assume that regulation of pain behaviour developed much earlier in evolution than the experience of pain suffering. Furthermore, brain parts are connected with one another. The longest distance between two neurones is only four synapses (Pöppel & Ruhnau 2000). Due to this high level of interconnection within the brain, inhibition or stimulation of a particular brain centre always results in inhibition or stimulation of other brain structures. This could easily result in wrong conclusions as, for instance, Baars (1997) who, firstly, correctly states that after bilateral destruction of a rather small nucleus in the brainstem humans lose consciousness and, secondly, that these nuclei are also present in all vertebrates. He then uses these two statements as an argument for the assumption of consciousness in all vertebrates. What is the described function of these brainstem nuclei? They regulate, through their connections with the nuclei reticularis thalami, the amount of sensorial information which is sent to the neocortex (Heilman *et al* 1993). Unilateral

destruction of one of these brainstem nuclei induces such a severe reduction in the amount of sensorial information sent to one side of the neocortex that it results in unilateral neglect (stimuli in one side of the 'Umwelt' [environment], although processed correctly on a non-conscious level, cannot reach the consciousness level any more): bilateral destruction leads to neglect on both sides of the 'Umwelt' (Heilman *et al* 1993). No wonder that such patients lose consciousness: since the neocortex is deprived of information and since all sensorial information remains unconscious, there is nothing for their consciousness to react to. Baars' suggestion is like pulling the plug of the television set and then stating that the image-producing device is in the plug and not in the picture tube. Baars' (1997) suggestion is all the more dubious, since elsewhere in the same book he writes that conscious visual perceptions need area 17 of the neocortex.

The higher up one is in the brain, or the information stream, the fewer difficulties one has with the interpretation of the results. One could, of course, when a particular function disappears after lesioning the evolutionarily newest neural structure, assume that this function does emanate from an evolutionarily older structure, lower in the brain, which only needs pre-processed information of the newer structure in order to 'produce' the function being studied. However, if we make such a rather dubious assumption then it follows that the evolutionarily newer brain structure is still a prerequisite for that particular function to occur. It is for this reason that we have to look for the evolutionarily latest part of the human brain which is a prerequisite for the experience of pain as an emotion and suffering.

The line of reasoning presented here is, however, only correct if the functions of the evolutionarily older brain structures have, for the question being studied, not changed fundamentally. This assumption could very well be correct since evolution is 'ultraconservative' (Plutchik 1994), and the evolution of the vertebrate brain has mainly consisted of adding new functional elements to what was already there (MacLean 1990). This last argument implies that this approach is, in principle, only suitable within the sub-phylum of vertebrates. However, if we have specified the neural structures concerned we can describe them in functional neural architectural terms, and see whether these functional neural architectural interconnections have been described for non-vertebrate animals.

The second question is about which prerequisite cognitive capacities have to be there in order to give consciousness a fitness function. The assumption here is that consciousness is the result of an adaptive development. New developments never occur in isolation. Legs enabling organisms to move around quickly on solid ground are useless if these organisms still have gills instead of lungs. Likewise, consciousness and mental suffering are only useful if they occur in combination with other cognitive powers.

Finally, we can ask ourselves which human capacities are impossible without the interference of consciousness. The assumptions here are, again: i) that consciousness is not an epiphenomenon; ii) that it emanates from brain structures; iii) that evolution is economical, only developing new brain structures if they make something possible which could not be done before; and iv) that animal consciousness is not qualitatively different from human consciousness.

We start with the last question, because answering this question brings us naturally to the other two questions. It has been demonstrated that almost no human capacity needs consciousness, eg conditioning, acquisition of complex procedural knowledge, learning of natural and artificial grammars, breakthroughs in physics and mathematics, solving equations, and learning processes and decisions which steer our behaviour in daily situations (Nisbett & Wilson 1977a, b; van Heerden 1982; Lewicki 1985, 1986; Penrose 1989;

Greenwald 1992; Carruthers 1996; Mook 1996). It has further been demonstrated that it takes 0.5s before a stimulus reaches consciousness, while our behavioural reaction to the stimulus takes only 0.25s (Libet 1982, 1993). It has also been demonstrated that the non-conscious 'brain decision' to act precedes our experience of 'free-will' to act by about 0.3s, and that 'free-will' can inhibit motor actions but not induce actions (Libet 1985, 1993; Naätänen 1985; Wegner & Wheatley 1999).

I know that the idea of a consciousness which lags behind real time is hard for most people to swallow. However, this lagging behind is to be expected, since only the end products of the neural analyses can reach consciousness (Nisbett & Wilson 1977a, b) and no matter how fast these neural processes are they still take time. Indeed, there are data which can only be explained by a consciousness with a time lag, like in the famous phenomenon which has been described by Dennett (1991), among others. In this experiment, two light spots are presented shortly after one other at different locations. The trick here is that the first light spot is green and the second red. This results in the perception of a moving light, which halfway along its route changes from green to red. Now we either have to assume that the perceived colour change is a paranormal preview of the near future or that the experience of the present is just a reconstruction of the recent past. Another example is presented by patients with unilateral neglect, induced by lesions in the pre-motor cortex. The one-sided neglect in these persons is not due to disturbances in the processing of sensory stimuli, but due to a disturbance in motor responses in the left side of the 'Umwelt'. It is remarkable that, therefore, the stimuli in the left visual field are also not perceived consciously any more. This indicates that the motor response to a stimulus adds up to the conscious perception of that stimulus, which in itself is only possible if consciousness lags behind in time. This assumption is confirmed if one presents the stimuli through a mirror device. The stimuli, although in the right part of the environment (where the motor response has to be made), are now seen as mirror reflections in the left visual field. Not only are these patients then able to give a correct motor response to the left visual field stimuli, but these stimuli are now also consciously perceived, whereas the stimuli in the right visual field (requiring a motor response to the left) are now not perceived consciously any more (Bisiach 1992). Bisiach describes more such examples, and concludes (1992 p 120):

> The division of preconscious labour among several processors with no sole gate-way to consciousness entails a relativity of the timing of consciousness as well as the possibility of ongoing rearrangement of what is being experienced.

The idea that consciousness does not induce behaviour was already assumed by early evolutionists like Huxley (Baars 1997), and this idea has recently been theoretically and experimentally confirmed by, for instance, Wegner and Wheatley (1999) and Gollwitzer (1999). It has further been demonstrated that human consciousness has no access to the unconscious brain modules that steer our behaviour (Nisbett & Wilson 1977a, b; Bargh & Chartrand 1999; Gollwitzer 1999; Wegner & Wheatley 1999). That consciousness fills the information gaps up with confabulations, and by doing so gives us false ideas about the reality around us, and the false impression that the behaviour is initiated by our consciousness or our 'free will' (Nisbett & Wilson 1977a, b; Gazzaniga & LeDoux 1978; van Heerden 1982; Farthing 1992; Mook 1996; Bargh & Chartrand 1999; Gollwitzer 1999; Wegner & Wheatley 1999). Furthermore, consciousness does not like loose ends. Information presented to it must make sense; it must fit into the cognitive knowledge which is already there and, if it does not fit, the information is reinterpreted until it does, which also

results in confabulations. This tendency is so strong that Mook (1996) calls it 'a coherence motivation'. All these confabulations function as new input to our brains, and so steer our future behaviour (Bargh & Chartrand 1999). And, since these confabulations are by definition wrong descriptions of reality, they result in maladapted behaviour, making the question about the fitness value of consciousness all the more important.

It has also been demonstrated that the conscious working memory is far from perfect, since it can contain only between two and five elements (Bower & Hilgard 1981; Schwartz & Reisenberg 1991). It has further been demonstrated that people can easily experience exogenously induced behaviour as being produced by their own free will, and endogenously induced behaviour as being induced by others (Bargh & Chartrand 1999; Gollwitzer 1999; Wegner & Wheatley 1999). Finally, the linear conscious processes are extremely slow compared to the parallel-functioning non-conscious processes, and therefore may exceed the span of consciousness (Kihlstrom 1987). Altogether, these facts indicate that consciousness is an imperfect device and a recent development.

Conscious information processing always requires mental effort (Bargh & Chartrand 1999): we could therefore ask ourselves which cognitive processes cannot take place without mental effort. Long-term planning, especially the intention to act in the future differently than we are inclined to, and the inhibition of these pre-programmed behavioural intentions, always requires conscious mental effort (Bargh & Chartrand 1999). However, the execution of the planned behaviour itself does not require consciousness (Libet 1985; Bargh & Chartrand 1999). The intention to behave differently in the future requires, besides planning, initiative (Gollwitzer 1999). This brings us to the first question; for planning, inhibition of the behaviour we are inclined to, and initiative we need our most recent brain structure – the PFC. Furthermore, the PFC is also required for the emotional experience and the tuning of our behaviour in accordance with the demands of the social situation (Trigg 1970; Valenstein 1990; Damasio & Anderson 1993; Damasio 1994; Malloy & Duffy 1994; Fuster 1997). We use our consciousness, of course, for far more functions: learning languages or complex motor responses, knowing who is a nice person and who is not, etc. However, the point here is, as argued above, that all these processes can also take place non-consciously.

Although a PFC can be identified in higher mammals, only anthropoid apes show a well-developed PFC (Kolb & Whishaw 1990; Kupfermann 1991) and some parts of the PFC are specific to humans (Luria 1980). The PFC is a higher order association area. Here, information which has already been processed in primary and secondary one-modality sensory neural projection areas and also interpreted on high cognitive levels in multi-sensory modality-association areas, is once again reprocessed and reinterpreted. Furthermore, the PFC has ample efferent connections to evolutionarily older neural structures and has thus a 'top down' control over these structures (Jones & Powell 1970; Kolb & Whishaw 1990; Miller 2000). Such extremely high neural step-by-step progress, neural processing systems with top down control, have not been described in animals without a PFC. This alone limits tremendously the number of species in which consciousness may be expected.

The fitness function of consciousness and suffering

Summarizing the literature concerning consciousness, Weiskrantz states (1992 p 8):

> One dominant theme is to attach its benefits to benefits of active thought itself – in allowing the initiation of predictive strategies, in detaching the observer from an immediate dependence on current inputs, by allowing current inputs to be linked, with or without imagery, to other

> events distant either in space or in time, and in allowing flexible rather than automatic processing.

Likewise, Laird and Bresler (1992) reached the conclusion that a specific but very important aspect of consciousness, the emotional feelings, are not epiphenomena, but rather that they force us to reflect. Emotional experiences are, according to these authors, like other conscious contents, constructed from lower-order elements that are themselves not part of consciousness. When we feel an emotion, we are aware of information about the situation and how we are acting. This conscious information can then be processed like any other piece of conscious information. This processing may, by estimating the consequences and the long-term (social) demands of various alternative actions in advance, lead to conscious choices from alternative behaviour patterns. By means of an emotional experience, the stimulus-induced emotional behavioural tendencies can be inhibited so that the actual behaviour can be released from the obvious responses, and eventually a mode of behaviour more suitably matched to this or comparable future situations can be shown. The main functions of consciousness (see earlier in this contribution) and the emotional experience lie, therefore, not as generally assumed by laymen in the induction of (emotional) behaviour, but in the inhibition of the (emotional) behaviour to which we are inclined. The conscious free choice out of behavioural alternatives also enables the organism to manipulate others, by pretending behavioural tendencies or emotions.

The ability to deliberately (under volitional control) induce the wrong impression in others, at the right moment, has a great fitness value (Dennett 1996). It is for this reason that Leakey and Lewin assume that there was, in the early hominids, a selection pressure for the capacity to manipulate others (Leakey & Lewin 1992 p 294): 'the answer, I suggest, is the intense intellectual demands of primate social interactions, with the constant need to understand and outwit others in the drive for reproductive success'. Dennett (1996) comes to essentially the same conclusion, although by a totally different line of thinking (by asking himself how intelligence may have developed in evolution). He argues that higher cognitive powers, through which secret-keeping can emerge, and language (as a tool to take one element out of a cognitive network and place it freely in any other network) are prerequisites for consciousness. According to him, the fitness value of consciousness is given by the fact that it enables the organism to 'bluff' others.

All these ideas are derived from Nicholas Humphrey who argued, in the 70's, that the development of self-consciousness was a stratagem for developing and testing hypotheses about what is going through the minds of others. He suggested that one uses one's self-consciousness as a source of hypotheses about other-consciousness or, because when one gets into the habit of adopting the intentional stance toward others, one notices that one can usefully subject oneself to the same treatment (Dennett 1996). Leakey and Lewin state (1992 pp 296-297):

> The Inner Eye, as Nick Humphrey call this mental model, must also generate a sense of self, the phenomenon we know as consciousness: the Inner 'I'. In evolutionary terms it must have been a major breakthrough ... Imagine the biological benefits to the first of our ancestors who developed the ability to make realistic guesses about the inner life of his rivals; to be able to picture what another was thinking about and planning to do next; to be able to read the minds of others by reading his own.

Frans de Waal (1996), who reacts against the selfish gene idea of Richard Dawkins (1989), assumes that various animals could have moral ideas, and therefore morally guided behaviour. He assumes that non-cognitive or non-conscious moral behaviour could develop in groups in which the individuals are mutually dependent upon one another. Real altruism (helping others without benefiting yourself directly or indirectly) is a troublesome phenomenon for neo-Darwinism. De Waal therefore also writes that this moral behaviour could basically very well serve one's own interest. However, according to him, stressing this self-interest, as is done by the selfish gene idea, blocks our view of possible altruistic behavioural mechanisms which could develop on a basis of self-interest. Further, de Waal states that cognitive or conscious empathy is not widespread in the animal kingdom: according to him it is only seen in humans and, possibly, in anthropoid apes. It is a sobering thought, but we have no other option: the original function of consciousness was not social progress, but selfishness and deceit.

Summarizing, we can state that higher cognitive powers like language, the capacity to keep secrets, to have knowledge of the demands of the social environment, to judge the motives of others, and to evaluate the consequences of behavioural alternatives in advance are all prerequisites for consciousness in order to get positive fitness value. Due to the consciousness-induced extension of the emotional period and the consciousness-induced confabulations, consciousness would, without these higher cognitive powers, only have a negative fitness value.

Consciousness may therefore only be expected in animals which show these higher cognitive capacities in their behaviour. For the experience of emotional feelings, further knowledge of 'self' is required. Since these capacities have, up to now, only been recorded in the anthropoid apes (Plutchik 1994), they are the only species in which consciousness and suffering may be expected. Plutchik (1994 p 238) states:

> There is little existing evidence, other than anecdotal, for intentionality in animals, and there is even less evidence for self-consciousness ... Investigators have replicated this phenomenon of self-recognition (and by implication, self awareness) in orangutangs as well as chimpanzees, but every attempt to replicate the phenomenon in lower primates – spider monkeys, capuchins, mandrill and hamadryas baboons, and gibbons – has failed.

De Waal (1996), referring to Gallup (1982), confirms these statements. According to de Waal, Gallup (1982) compared self recognition to higher cognitive capacities like language, knowing what is going on in the minds of others, deceit, reconciliation and empathy, and came to the conclusion that humans and anthropoid apes have cognitive powers which set them apart from other animals. De Waal further writes that no matter how much he wanted to record deceit in macaques, he was unable to see a single example of such behaviour.

However, even with the limitation of anthropoid apes only, we have to be careful in our conclusions. Firstly, although there are beautiful descriptions of planning and deceit in chimpanzees (*Pan troglodytes*; Dawkins 1993; de Waal 1996), formal experimental testing has indicated that this ability is limited: only one out of four showed deception of others in a situation in which such deceit paid off (Plutchik 1994). Secondly, the ability to plan also seems limited, in our close relatives, to the direct needs of the situation at hand. Christopher Wills (1989) correctly stated that a chimpanzee has never been observed to select a nice stick to be used for fishing for ants the next day. Thirdly, Dennett (1996) reminds us that the 'AHA Erlebnis' (sudden insight) of Köhler's apes was mainly based on trial and error

learning, not on a sudden enlightening insight, and that some of Köhler's apes never saw the light.

Conclusions

Irreflexive consciousness and suffering don't go together. Suffering and pain which is experienced as unpleasant is an emotional experience, and reflection is a prerequisite for such experiences. However, pain perception as a pain stimulus, which does not induce suffering, could still be possible with an irreflexive consciousness.

Standard emotional behaviour is not induced by the emotional experience. On the contrary, the emotional experience derives its fitness function from the fact that it can inhibit the stimulus-bound emotional behaviour so that, by using imagination and information from the past and future, more adaptive behavioural responses can be imagined, planned and later executed.

The PFC, or comparable super higher order association area, is a prerequisite for spontaneous planning of this kind, and for the emotional experience, and thus for the experience of pain as an emotion, or suffering.

Consciousness confabulates, and conscious emotional feelings extend the emotion until long after the disappearance of the external inducing stimuli. Consciousness and emotional feelings are therefore sources of maladapted behaviour.

Higher cognitive powers like language and the capacity to keep secrets, to have knowledge of the demands of the social environment, to judge the motives of others, and to evaluate the consequences of behavioural alternatives in advance, are all prerequisites for consciousness and the experience of suffering in order to get positive fitness value. Consciousness may therefore only be expected in animals which show these capacities in their behaviour. Since these capacities have, up to now, only been recorded in the anthropoid apes, they are the only species in which consciousness may be assumed. And even then we have to be careful in our conclusions, since there are various indications that anthropoid apes show severe limitations in these capacities. However, as argued before, there is an important difference between the conscious registration of pain as a pain stimulus, which does not induce feelings of suffering, and the experience of pain as an emotion, which does induce suffering. According to the arguments presented in relation to the issue of an irreflexive consciousness, the conscious registration of non-emotion- and non-suffering-inducing pain stimuli could be possible in far more species than anthropoid apes alone.

I would therefore like to end with the following statement. Rejoice! Rejoice! For there is far less animal suffering than our anthropomorphic minds are inclined to believe.

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