IGN-Forschungspreis 2018 – PD Dr. Lorenz Gygax

Summary

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Wanting, liking and welfare:
The role of affective states in proximate control of behaviour in vertebrates

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Based on homology arguments, we can ascribe affective states such as emotions and mood to animals, specifically vertebrates. Given the complexity of these affective states it seems unlikely that they do not have a function. That is, if they did not have a function, they would have disappeared in the course of evolution. To assess this functionality, I combine here findings from the fields of classical ethology (the science of the proximate control of behaviour), psychology, and the neuro-sciences in an integrated, conceptual model. In this model, I show that there are at least three different aspects for which affective states are relevant.

Animals have to decide innumerable times each day what to do next (**wanting**). How an animal decides depends on internal and external circumstances that are often labelled as stimuli. The valence and strength of an emotion that is elicited by these stimuli help to choose among the numerous potential behaviours. In this view, a variety of different simultaneous emotions are piped into a decision process. In this process, the valuation of the emotions follows a hedonic principle in respect to the expected (future) benefit of a stimulus. Many decisions seem to maximise the perceived „pleasure“. At the end of this evaluation process, the strongest motivation is identified and the corresponding behaviour is executed.

Animals seem to have an expectation of which goal they are about to reach with a given behaviour. These expectations are called the “proximate goals”. If such a goal is reached, the original motivation for the respective behaviour is reduced. The goal is “**liked**” by the organism. Successfully reaching a goal also leads to a positive but fleeting emotional sensation. Not reaching the goal leads to a negative affective state (disliking) and, usually, an alternative behaviour to reach the goal is tried. If a goal cannot be reached chronically, abnormal behavioural may occur.

The outcome of a behaviour and the goal that has been strived for are continuously compared. If there is a cumulative mismatch between the outcome and the goal, that is, if the reaching (or not reaching) a goal is repeated, **mood**, a more long-term affective state, is changed. This mood state leads to a more optimistic (or pessimistic) stance in response to subsequently encountered stimuli and the decisions that are taken in response to these stimuli.

Even though a language is used here, that implies an active participation of animals in their behavioural decisions, this implication needs to be considered with care. Are the animals **conscious** of their affective states? There is no clear scientific evidence in this respect. The comparative view suggests that at least simple forms of conscious perception of an emotion or mood are to be expected in vertebrates. It can be assumed that this perception lead to subjective states, in which animals perceive themselves to be in an agreeable or disagreeable state.

Research on affective states in animal in relation to questions of **animal welfare** has focused on the emotional assessment of stimuli (*wants*): which stimuli are to be avoided for the welfare of the animals and which should be promoted? This is a difficult question because in practice, many stimuli cannot be avoided and others may not simply be presented. Moreover, emotions that lead to specific wants are not enduring. Therefore, a re-orientation towards the goals of behaviour could be useful (*liking*): if animals can reach the goals that they want to attain based on their internal and external circumstances, the control loop of behaviour is closed. Moreover, positive states of liking do occur. In addition, if the expectations of animals are surpassed regularly, mood may be improved.

The neurosciences have identified many elements and systems in the neural system, specifically the brain, which contribute to emotional processing. Yet, we are far from a position, in which we could understand how behaviours are "calculated". That is, we do not know which neural processes are necessary in detail, such that stimuli and states lead to specific behavioural decisions and how goals of these behaviours are assessed. If we ever crack the high-dimensional network structure of the brain at all, some decades of additional research will be necessary. Yet, the algorithms of behavioural decisions can be investigated based on the output of the decision system: the performed behaviour itself. We can provide animals with ecologically meaningful multiple choices to see in which situations which wants occur and how they are prioritized. We can and should also be interested in the goals that animals try to reach and give them the opportunity to reach these goals. Such studies should be set in a comparative-ontogenetic framework at best. In these steps, we learn about animal species so well that we can provide them with an environment in which they can actively engage and, with a certain effort, reach the goals of the wants that arise. In this way, we may be able to provide a basic level of animal welfare in a deep way instead of providing band-aid solutions.