When biologists and psychologists talk at cross-purposes

Misunderstandings in communication happen every day—and this also happens in the sciences. A new study explored the "theories behind the theories" on "personality" and individual differences and unravelled fundamental misunderstandings between biologists and psychologists. These misunderstandings not only hamper collaborative research across disciplines; but they can also mislead the development of theories. This is an all-too-common story about how language can produce understanding and misunderstanding. A story that can also be told in the sciences.

Almost 100 years ago, pioneers of psychology, such as Wolfgang Köhler, Robert Yerkes and Donald Hebb and the physiologist and physician Ivan Pavlov reported on pronounced individual differences in the behaviour of animals, in particular, in great apes and dogs. But in those times, such reports were regarded as unscientific and were dismissed as mere anthropomorphism. The predominant idea was that only humans could develop individuality. The idea that prevailed in biology until the 1990s was the assumption that, in every animal species, there are optimal behavioural patterns and that any deviations from these optima would be random and thus unimportant. These beliefs were held despite the fact that Charles Darwin had already recognised in 1859 that individual differences are a vital precondition for evolution – but he had focussed on bodily properties rather than on behavioural ones.

In the 1990s, both psychologists and biologists began to rethink their assumptions. "Personality" differences were now increasingly being explored from the viewpoint of evolution. Research on individual behavioural differences in animals was becoming popular. It almost seemed as though animal researchers could not wait to finally explore what had for so long been considered non-existent and thus not worthy of exploration. The number of animal studies increased rapidly, and with them, the number of animal species being studied.

But the differences in the species being studied and especially in the research methods that were being used in biology and psychology led to tremendous difficulties and a bewildering diversity of terms and concepts. Whereas a focus on individual differences and individuality was still comparably new in biology, psychologists had already been exploring these topics for more than 100 years. Francis Galton, a relative of Charles Darwin, had already developed a comprehensive body of psychological concepts and methods of analysis in the 19th century.

It is important to distinguish between two central approaches. First, some researchers study and categorise individual differences in a population; this is the objective of research in Differential Psychology – the psychology of individual differences. Individuals can differ from one another, for example, in their degrees of anxiousness, gregariousness or aggressive-ness. These differences between individuals describe the particular population under study. Thus, the focus of differential research is on the population.

But knowledge about individual differences does not reveal anything about the particular combinations of features that may be specific to a particular individual and that make this individual unique. This individual-specific combination is called "personality"; it refers to the person—the individual. For example, compared with other individuals of his or her reference population, an individual may be very anxious, moderately gregarious and hardly ever aggressive. Another individual, by contrast, may be much less anxious, very gregarious but also far more aggressive than others. Hence, in "personality" research, the central focus lies on the single individual.

In everyday language, the term “personality” is used almost exclusively with regard to single individuals. A comparison of individuals with one another is commonly referred to as a consideration of “personality” differences. But in research, a different use of language was established additionally. This most likely happened because the correct labelling of the two central areas of research resulted in rather cumbersome terms. In the German-language area, for example, the entire field today is called Differential and “Personality” Psychology. In the English-language area, by contrast, “Personality” Psychology mostly refers to both research on individual differences in populations and research on single individuals.

All this could be considered an expression of scientific pedantry. But psychologists’ imprecise and linguistically simplified use of terms caused tremendous misunderstandings when biologists began to explore individual differences and “personality” in animals in the 1990s. In a new study, Jana Uher therefore explored the “theory behind the theories”—referred to as meta-theory in science—and located exactly where misunderstandings have occurred between researchers from different disciplines and what has caused them.

In the last two decades, animal researchers have primarily focused on individual differences that occur in particular populations of animals. Bodily features, such as fur colour or body size, change rather slowly; therefore, individual differences can be directly recognised. But behaviour changes from moment to moment. These strong fluctuations make it almost impossible to recognise individual differences directly. Jana Uher showed that a behavioural pattern can be specific to an individual only if it differs from those of other individuals and only if these differences occur repeatedly in similar ways rather than just once. Thus, individual differences in behaviour must be relatively stable for at least for some period of time.

Animal owners are very familiar with this. A single observation does not say much about how an individual typically behaves—the individual might be scared right now or tired, hungry or ill. When choosing a new pet, it is therefore advisable to observe one’s potential new housemate on different occasions and to ask the breeder or previous owner about its habitual behaviour. Here, also, the following is very obvious: The fact that there are individual differences in the behaviours of dogs, cats, horses and other individuals towards humans and conspecifics does not say anything about what particular kind of individual we have right in front of us. Rather, it is the combination of typical behavioural tendencies that an individual shows in comparison with other individuals—his or her “personality”.

The problem is that pronounced fluctuations in the behaviour of individuals always lead to individual differences in behavioural data that thus emerge by pure chance. Whether there are in fact “personality” differences can be explored only by repeatedly studying the same individuals: The individual differences must occur in similar ways again after some time.

Now, here is a tricky point: How stable must individual differences be in order to be interpreted as “personality” differences? Ultimately, individuals also change over the course of their lives and as they develop their “personality”. In psychology, differentiating “personality” differences from mere random variation requires evidence for strong stabilities across some number of weeks or months. By contrast, many animal studies have reported about only weak or moderate stabilities even across only short periods of time but they have interpreted these findings as evidence of animal “personalities”. However, most animal studies explore only individual differences. Stable yet individually distinct combinations of behavioural patterns, to which the concept of “personality” actually refers, have hardly ever been studied in animals.

“It is curious that in the past, individual differences were dismissed as mere random variation in animal research. Today, animal researchers interpret random variation as evolutionarily meaningful”, says Jana Uher. She warns against premature conclusions. “Such dramatic changes in the interpretation of research results are always in need of explanation. They show that it is always the particular viewpoint of the researchers that determines which particular phenomena are considered worthy of an explanation and which ones are not.”

Jana Uher has also revealed fundamental differences in the ways in which researchers analyse stability. Animal researchers often report interrelations between different kinds of behaviours that show up in similar ways again at later times in the animal population under study; biologists call these behavioural syndromes. However, for identifying “personality” differences, it is individual differences and their stability over time that are essential. Certainly, when they are hungry, all individuals of a given species show more feeding behaviour and take more risks than when they are not hungry. This fact alone leads to interrelations between feeding and risk behaviours that are stable over time. But such findings do not show that in a given species there are, in fact, some individuals that take more risks than others or that feed more often than others.

So, what is it with the „personality“ of animals? Jana Uher assumes that many differences between biological and psychological research on animals derive from differences in the particular species being studied. Most psychologists study only humans and the few psychological animal researchers focus mostly on human’s closest living relatives, the nonhuman primates. Biologists, by contrast, hardly ever study humans but they study all animal species. She assumes that in primates and other mammals, there are a number of pronounced individual differences and individual-specific combinations of behavioural patterns. But such patterns may be much less pronounced in fish and insects. Therefore, the findings—and thus also the concepts—necessarily differ between the disciplines.

But Jana Uher emphasises: “It is only research that can show which animal species show which particular kinds of stable individual differences that can be interpreted as “personality” differences, individual behavioural strategies or individual behavioural phenotypes and that may be meaningful for the evolution of the species”. There are methodologically sound studies from Australia showing that even octopuses exhibit stable individual behavioural differences. Many dog studies have shown what dog owners have already known for a long time: A dog’s individual combination of behavioural patterns does not differ from day to day and it is not merely random; rather, it characterises an individual over at least some period of time. In her studies on great apes, Jana Uher has shown how, on the one hand, stable individual behavioural differences and, on the other hand, stable but individually different combinations of behavioural patterns can be measured in “personality” profiles (see the Science Blog “No one alike – ‘personality’ differences in the great apes”).

The researcher offers a note of caution: “The methods required for ‘personality’ studies are a bit more tricky than those required in other areas of research. This is still not well considered by many animal researchers. Animal researchers should invest more in their research methods. Otherwise, there is a risk that theories about the meaning and evolution of ‘personality’ differences will be developed on the basis of mere methodological errors.”

Scientific publication:

Uher, J. (2011). Individual behavioral phenotypes: An integrative meta-theoretical framework. Why 'behavioral syndromes' are not analogues of 'personality'. *Developmental Psychobiology, 53*, 521–548. (Download) DOI: 10.1002/dev.20544

Last update: 16.02.2014

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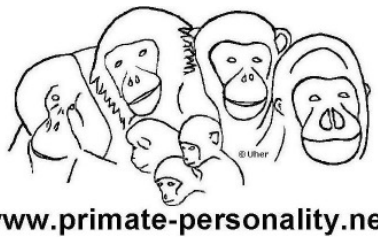

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