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Personality in Non-human Animals

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Abstract

Over the past decade, research on animal personality has flourished in numerous disciplines ranging from Behavioral Ecology and Developmental Psychobiology to Genetics and Comparative Psychology. The broad appeal of animal studies is that, in comparison with human studies, they afford greater experimental control, more options for measuring physiological and genetic parameters, greater opportunities for naturalistic observation, and an accelerated life course. Past research has established that personality (a) exists and can be measured in animals; (b) can be identified in a broad array of species, ranging from squid, crickets, and lizards, to trout, geese, and orangutans; and (c) shows considerable cross-species generality for some dimensions. The wave of new studies is shedding fresh light on traditional issues in personality research (How do early experiences affect adult personality?), raising novel questions (What are the evolutionary origins of personality traits?) and addressing practical problems (Which dogs are best suited to detecting explosives?).

Fred has consistently proven to himself to be more aggressive than Frank; he makes more threats than Frank does, he physically pushes others, he even kicks and punches them, and is more reluctant than Frank to retreat from an altercation. Terry is bolder than Tim; when out and about looking for something to eat, Terry is not as bothered as Tim by venturing into new places to find food or taking unfamiliar routes to eat or even by the presence of threatening characters in the vicinity. Most people would by happy to characterize the differences between Frank and Fred and between Terry and Tim in terms of personality traits like aggression and boldness. However, some people might hesitate to use such terms upon learning that Frank and Fred are fruit flies and Terry and Tim are trout. Yet, recent research on behavioral regularities in fruit flies (Edwards, Rollmann, Morgan, & Mackay, 2006) and trout (Wilson & Stevens, 2005) has identified precisely such consistent individual differences in behavior in these two species.

Studies like these are pushing psychologists to consider where the boundaries of personality lie; by increasing the phylogenetic reach of personality, animal studies are opening numerous new research opportunities and raising many new questions about the origins of personality

traits. The aim of this article is to survey the state of the field, describe the opportunities afforded by animal personality research and summarize some recent directions the field has taken.

Defining Animal Personality

Even in the human domain, no single definition of personality would satisfy all researchers; but one definition that captures most phenomena studied by personality psychologists is: 'Those characteristics of individuals that describe and account for temporally stable patterns of affect, cognition, and behavior.' Human-personality psychologists focus on a broad array of constructs, including temperament and character traits, goals, personal projects, abilities, attitudes, moods, and life stories. Most animal personality studies focus on just a subset of these constructs: behavioral traits.

Some animal researchers have used terms like 'temperament' or 'behavioral syndromes' in lieu of 'personality'. In human developmental research, temperament is usually defined as the inherited, early appearing tendencies that continue throughout life and serve as the foundation for personality; however, even this definition is not adopted uniformly (McCrae et al. 2000). The term 'behavioral syndrome' has gained recent popularity in the field of behavioral ecology (Sih, Bell, Johnson, & Ziemba, 2004); its definition (suites of correlated behaviors expressed either within a given behavioral context or across different contexts) very closely matches the concept of personality in humans.

Thus, the different labels refer, with only slight variation of meaning, to the same class of phenomena. Behavioral ecologists' use of terms like temperament and behavioral syndromes instead of personality partially reflects the terminology already familiar in that field, but it has also been used to avoid the anthropomorphic associations of the 'P-word'. Weinstein, Capitanio, and Gosling (forthcoming) recently presented three reasons for sticking with the term, 'personality'. First, it is confusing to create new terms without a compelling conceptual reason to do so. Second, using the term personality facilitates connections with the enormous existing literature on personality in humans. Third, it is not useful to adopt the term 'temperament' for nonhumans because doing so entails a priori assumptions (e.g., about traits being inherited and appearing early) that almost certainly are not true; it is increasingly clear that individual differences in adult animal behavior are a function of both biological tendencies and experience, as is the case with humans (Weinstein et al., forthcoming). Fortunately, with increased usage the term personality appears to have lost much of its unsavory associations, so much so that it is even appearing in articles in such establishment journals as *Nature* (e.g., Wolf, van Doorn, Leimar, & Weissing, 2007) and *Proceedings of the Royal Society* (e.g., Fidler et al., 2007).

 Social and Personality Psychology Compass 2/2 (2008): 985–1001, 10.1111/j.1751-9004.2008.00087.x

State of the Field

Research on individual differences in animals has a distinguished yet patchy history. An early landmark was Nobel Laureate Ivan Pavlov's series of studies of dogs a century ago (Pavlov, 1906); his research program identified four basic types of personality based on three properties of the nervous system: Force, Equilibrium, and Mobility. Pavlov was quick to recognize the insights the variation afforded into the qualities of the individual animals' nervous systems (Pavlov, 1928). Yet research on animal personality fell out of favor for most of the 20th century despite seminal contributions from such pioneers as Robert Yerkes (1939) and Donald Hebb (1946).

However, the past 5 to 10 years has seen a resurgent interest in animal personality. Research on the topic has flourished in numerous disciplines including, Ethology, Behavioral Ecology, Endocrinology, Developmental Psychobiology, Primatology, Psychoneuroimmonology, Zoo Management, Wildlife Management, Animal Welfare, Veterinary Science, Biology, Genetics, and Comparative Psychology (for reviews, see Gosling, 2001; Gosling & Harley, forthcoming; Mehta & Gosling, 2006, forthcoming; Weinstein et al. forthcoming). A PsycINFO search for articles listing animals as the population and 'personality', 'temperament', and 'behavioral syndromes' as keywords confirmed the recent rapid rise of work on animal personality: The last 5 years (2002–2006) saw more than double the number of articles published than in the previous 5 years (1997–2001). And the number of articles appearing in the last decade (n = 189) substantially exceeds substantially the number of articles published over the previous century (n = 118). In fact, research on animal personality is growing so rapidly that the topic has even generated several stand-alone conferences.

Given the burgeoning empirical and theoretical work in animal personality, it is a curious fact that the one area in which it has continued to languish is mainstream personality psychology. I have yet to definitively identify the source of the resistance, but one likely possibility is that the existence of personality in animals, who do not have rich cognitive structures, challenges theories of personality that depend on social-cognitive mechanisms such as self-knowledge and explicit beliefs about situations. In the meantime, as a subset of personality researchers wrestle with the question of whether it is even possible for animals to have personality, a growing cadre of researchers in other fields are forging ahead with studies that are contingent on the existence of personality. Beyond the obvious irony of the situation lies the more serious consequence that much of the animal research is being done by researchers without a strong background in personality theory and measurement.

Foundational Findings

The recent rapid growth of research on animal personality is based on the foundation laid by several key findings, which are summarized below.

 Social and Personality Psychology Compass 2/2 (2008): 985–1001, 10.1111/j.1751-9004.2008.00087.x

Personality exists and can be measured in animals

When I first began my own research, I was repeatedly faced with doubts about the very existence of personality in animals. The concerns ranged from philosophical arguments regarding the uniqueness of humans to methodological concerns about the perils of anthropomorphism. Therefore, much of my early work focused on reviewing the past literature to see what had been learned about personality in animals and evaluating the viability of the personality concept in non-human individuals (Gosling, 2001).

Gosling, Lilienfeld, and Marino (2003b; see also Gosling & Vazire, 2002) evaluated the evidence pertaining to the existence of personality in animals. Explicitly drawing on the lessons learned from the debates concerning the existence of personality in humans (Kenrick & Funder, 1988), Gosling et al. (2003b) considered three major criteria that must be met to establish the existence of personality traits: (a) assessments by independent observers must agree with one another; (b) these assessments must predict behaviors and real-world outcomes; and (c) observer ratings must be shown to reflect genuine attributes of the individuals rated, not merely the observers' implicit theories about how personality traits co-vary. On all three criteria, animal-personality research met the standards expected of human-personality research. Moreover, numerous studies have demonstrated temporal stability in personality traits (e.g., Capitanio, 1999; Stevenson-Hinde et al., 1980; Uher et al., 2008). Together, the research provides strong evidence that personality does exist in animals.

Personality traits had been assessed in a variety of species, such as rhesus monkeys (Stevenson-Hinde & Zunz, 1978), hyenas (Gosling, 1998), and octopuses (Mather & Anderson, 1993), but no research had explicitly compared assessments of humans and animals in a single design. Therefore, Gosling, Kwan, and John (2003a) examined, side-by-side, the accuracy of personality ratings of 78 dogs and their owners. Gosling et al. used parallel procedures and instruments to compare the ratings in terms of three accuracy criteria: internal consistency, consensus, and correspondence. On all three criteria, judgments of dogs were as accurate as judgments of humans, again suggesting that personality differences do exist and demonstrating that personality traits can be measured in animals. These findings are consistent with the growing body of research measuring personality in individual species, further supporting the viability of assessing personality in animals.

One ongoing debate has concerned whether personality is best measured by coding an animal's overt behaviors, or by obtaining subjective ratings of broad traits by knowledgeable observers (e.g., human caretakers). The two methods reflect different resolutions to the supposed trade-off between quantifying personality in terms of objective behaviors and using humans to record and collate information more subjectively. Behavior

 Social and Personality Psychology Compass 2/2 (2008): 985–1001, 10.1111/j.1751-9004.2008.00087.x

codings, which are the preferred method for biological researchers, have been used more often than ratings; in one review, 74% of animal-personality studies had used behavior codings to assess personality, and only 34% had used trait ratings (Gosling, 2001). However, recent direct comparisons of the two methods suggest that ratings are superior to behavior codings for capturing personality traits because rating methods are more reliable, are not as subjective as is widely assumed, and are generally much more practical (Vazire et al., 2007). Thus, trait ratings are well-suited for detecting consistencies in animals' behaviors, the very foundation of personality (see Vazire et al., for extensive discussion of this issue). Of course, where time and resources permit, both methods should be used.

Personality traits have been identified across wide range of taxa

In the most comprehensive review to date, Gosling (2001) identified 187 personality studies of one kind or another in 64 different species. The species studied were far from representative of the species in existence – 84% of the studies in the review focused on mammals (29% primates, 55% non-primates), 8% focused on fish, 4% focused on birds, and the remaining 4% were divided among reptiles, amphibians, arthropods, and mollusks. Since then, however, many more species have been studied, including Orangutans (Weiss, King, & Perkins, 2006), greylag geese (Kralj-Fiser, Scheiber, Blejec, Moestl, & Kotrschal, 2007), perch (Magnhagen, 2007), lizards (Cote & Clobert, 2007), squid (Sinn, Gosling, & Moltschaniwskyj, 2008), and field crickets (Kortet & Hedrick, 2007). It should be noted that researchers in other fields often do not explicitly conceptualize the consistent individual differences in behavior in terms of personality with the result that many relevant studies are missed by literature searches relying on terms like 'personality', 'temperament', and even 'behavioral syndromes'.

Some traits show more cross-species generality than others

A large number of personality traits have been identified in animals, but are there any that show particularly strong cross-species generality? It can be argued that basic personality traits will appear across multiple species. Most empirical studies of animal personality focus on just a single species so cross-species commonalities must be identified by combining studies. One review summarized the evidence for cross-species commonalities in personality in 19 factor-analytic studies, representing 12 different species (Gosling & John, 1999). The review included studies using both personality ratings and behavioral codings, and the findings were organized in terms of the human Five Factor Model plus dominance and activity.

The dimensions of Extraversion, Neuroticism, and Agreeableness showed considerable generality across the 12 species included in the review. Factors related to Openness (usually curiosity or playfulness) were identified

 Social and Personality Psychology Compass 2/2 (2008): 985–1001, 10.1111/j.1751-9004.2008.00087.x

in all but 4 of the 12 species. Other factors showed less cross-species generality. For example, dominance emerged as a clear separate factor in 7 of the 19 studies and a separate Activity dimension was identified in just two studies. Chimpanzees were the only non-human species with a separate Conscientiousness factor, which included the lack of attention and goal-directedness and erratic, unpredictable, and disorganized behavior typical of the low pole in humans; this finding is consistent with the fact that both humans and chimpanzees have relatively developed frontal cortices, the area of the brain responsible for higher executive function like making plans and controlling impulses (Beer, Shimamura, & Knight, 2004).

In making cross-species comparisons, question inevitably arise about the equivalence of traits in different species. How can it be determined that what appears to boldness in squid or trout or chimpanzees is in any way similar to boldness in humans? To solve this challenge, cross-species researchers can draw from the lessons learned by cross-cultural researchers (Gosling & Harley, forthcoming). A comparative researcher asking whether the apparently sociable behavior of a rhesus monkey reflects the sociability that we know in humans is analogous to the cross-cultural emotions researcher asking whether the apparently angry expression of a hitherto isolated group of humans reflects the anger that we know in our own culture. The solution to determining cross-cultural equivalence of anger expressions is examining what comes before and after the expressions and, where possible, looking for commonalities in underlying physiology. Likewise, an animal researcher can examine the apparently sociable behavior in the context of what comes before and after the behavior and, where possible, if it shares physiological, biological, and genetic commonalities with human sociability. Researchers can use this procedure when they encounter unfamiliar species or when they want to establish cross-species equivalences empirically.

Why Study Animal Personality?

With the foundations of animal personality well supported, researchers have reaped the numerous benefits afforded by animal studies. Mehta and Gosling (2006) recently classified these benefits into four broad categories, which are summarized below.

Greater experimental control

Animal studies permit numerous avenues of experimental manipulation that are not possible in humans. Relative to human researchers, animal researchers are able to exercise greater control over the environments of their subjects. Thus, animal studies provide excellent opportunities to examine environmental factors, such as rearing practice, on the development of personality. For example, in a study of female piglets, those

individuals raised in poor environments (an indoor farrowing crate) were more aggressive as adults than individuals raised in enriched environments (an outdoor pasture with a half-open farrowing crate; De Jonge, Bokkers, Schouten, & Helmond, 1996).

Animal studies also permit a range of genetic manipulations. Technological advances in molecular biology allow animal researchers to remove or insert particular genes from an animal's DNA. Currently, the genetics of laboratory mice are relatively well understood, making them the primary target of genetic manipulation studies. Both knock-out mice (those missing a specific gene) and transgenic mice (those in which a gene has been inserted) have been used to investigate the effects of genes on personality traits (e.g., Chiavegatto et al., 2001).

The role of the endocrine system in mediating personality expression can be examined by manipulating hormone levels. Through techniques such as castration, injection, or capsule implantation, researchers are able to systematically study the relationship between hormones, biological processes, and behavior. For example, in one recent study, rabbits injected with testosterone increased their marking, digging, and defensive behaviors, but only the highest-ranking rabbits in each social group increased in aggressive behavior; this finding suggests that testosterone has an effect on aggression in rabbits, but the effect is moderated by social rank (Briganti et al., 2003).

Animal studies are also more suitable than human studies for pharmacological manipulations. Recent advances have allowed scientists to develop synthetic chemicals that can either enhance (agonists) or block (antagonists) the functioning of neurotransmitters (e.g., serotonin) and hormones (e.g., testosterone) in animals. Such drugs have helped researchers examine the specific mechanisms by which neurotransmitters and hormones affect personality traits. For example, in one study, hamsters injected with a vasopressin antagonist into the anterior hypothalamus decreased in aggression (Ferris & Delville, 1994), suggesting that vasopressin plays a role in the expression of aggressive behavior. Future research in animals is likely to combine multiple methodologies (e.g., genetic, hormone, and pharmacological manipulations) to test complex models of gene, neurotransmitter, hormone, and environmental relationships.

Greater ability to measure physiological parameters

In human studies, biological processes normally remain a black box, but animal studies can uncover details about the chains of biological events that lead to the ultimate expression of traits. Such techniques generally require decapitation and examination of brain areas, which are not possible in humans.

 Social and Personality Psychology Compass 2/2 (2008): 985–1001, 10.1111/j.1751-9004.2008.00087.x

New techniques have made it possible to measure various physiological parameters, such as hormone receptor binding and genetic expression, in animals but not in humans. As a result, mechanisms by which biological processes influence personality traits are rapidly being discovered. Relative to human studies, it is generally easier to measure neurotransmitter or hormone concentrations because these data are normally collected through intrusive access to cerebral spinal fluid, blood, or specific brain areas.

Another important advantage of animal research is the ability to obtain detailed quantitative and molecular genetic information (Gosling & Mollaghan, 2006; Willis-Owen & Flint, 2007). As part of a large-scale project examining free-living and captive great tits (Parus major), Fidler et al. (2007) demonstrated how animal studies can combine personality measurement under standardized conditions with selection experiments to control the confounding effects of genetic epistasis, genotype environment interactions, and environmental factors; supporting human research, Fidler et al. found an association between variants in the Parus major orthologue of the human dopamine receptor *D4* gene and novelty-seeking behaviour in both selected and unselected lines. The findings suggest that an association between *Drd4* gene polymorphisms and animal personality variation pre-dates the divergence of the avian and mammalian lineages.

In light of the increased opportunities to measure physiological variables in animals, human personality scientists can look to animal studies to inform their theories on the physiological factors associated with individual differences. As technological advances continue, animal researchers will only increase in their ability to measure physiological parameters and broaden their understanding of the complex, interactive biological processes that influence personality.

Greater opportunities for naturalistic observations

The observational opportunities afforded by animal research are far greater than those available in human research. Relative to humans, animals can be observed for greater periods of time, in more detail, in more contexts, and a greater variety of behaviors can be observed. The greater observational benefits are particularly true of captive animals, which are closely monitored sometimes from conception until death. However, scientists can also observe wild animals living in natural habitats and collect large amounts of behavioral and physiological data. Consequently, questions about how behavior and physiology change over time, across seasons, or in response to environmental triggers can be addressed.

By studying freely roaming baboons living in the Masai Mara National Reserve in Kenya, Virgin and Sapolsky (1997) uncovered links between testosterone levels, glucocorticoid levels, social status, and aggression. These researchers found that when the status hierarchy is stable, subordinate baboons have elevated glucocorticoid levels and suppressed testosterone

 Social and Personality Psychology Compass 2/2 (2008): 985–1001, 10.1111/j.1751-9004.2008.00087.x

levels relative to dominant baboons. However, they also found individual differences in aggressive behavior and stress responses among subordinate baboons. The subordinate baboons that aggressed against other baboons after losing a fight had higher testosterone levels and lower glucocorticoid levels than did those who did not aggress after losing. This finding suggests that individual differences in aggression affect stress responses (Virgin & Sapolsky, 1997). Moreover, the finding that displaced aggression relates to lower stress hormone levels suggests that social status and variations in aggression may have health implications for humans.

Accelerated life-span of animals

Longitudinal studies in humans bear heavy financial costs, have high dropout rates, and require waiting years and sometimes decades to answer the research questions of interest. Due to the shorter lifespan of many animal species, it is possible to conduct longitudinal studies, often multigenerational designs, that yield important insights in a timely manner and at a fraction of the cost of equivalent, comprehensive human studies.

In one study, prenatal pharmacological manipulations were conducted to assess their influence on the expression of aggressive behavior of male and female mice. The researchers found that a prenatal pharmacological inhibition of monoamine oxidase (MAO) increased aggressive behavior in adulthood (Mejia et al., 2002). These results are consistent with other studies linking MAO to aggression and suggest that perinatal MAO exposure may have an impact on the organization of the nervous system.

What Contributions Can Be Made by Research on Animal Personality?

Over the past 10 years it has been established that personality traits exist and can be measured in animals. Drawing on the methodological benefits of animal studies, researches have begun to make contributions to three broad domains, which are summarized below.

New ways to address longstanding questions

Animal studies will never replace research on humans altogether, but they do offer a number of powerful methods and unique opportunities for augmenting traditional human research. Thus far, much of the animal personality work in Psychology has used animal models to understand the biological and environmental bases of personality (e.g., Ray, Hansen, & Waters, 2006; Willis-Owen & Flint, 2007) and to examine how personality is related to various outcome measures (e.g., Capitanio et al., 1999; Pederson, King, & Landau, 2005). The studies have addressed questions that have long interested personality psychologists but have been difficult to tackle

 Social and Personality Psychology Compass 2/2 (2008): 985–1001, 10.1111/j.1751-9004.2008.00087.x

using human studies alone. These include examining the degree to which individuals behave consistently across situations, examining the interplay of biological and environmental factors on personality development, and exploring the impact of personality on health.

Malloy, Barcelos, Arruda, DeRosa, and Fonseca (2005) used mice to examine a series of questions at the heart of traditional personality research: To what extent do individuals behave consistently across interaction partners (so-called 'actor effects'; Kenny, 1994), to what extent do individuals consistently elicit behaviors from others ('partner effects'), and to what extent do social behaviors reflect factors idiosyncratic that particular combination of individuals ('relationship effects')? In more concrete terms, if Alice and Peter are engaged in a social interaction and Alice behaves aggressively towards Peter. How much of this act can be attributable to the fact that Alice is generally aggressive, how much to the fact that Peter generally tends to elicit aggression from others, and how much to the unique relationship between Alice and Peter?

The best way to address these questions is to measure the behavior of individuals as they engage in numerous social interactions. Malloy et al. (2005) ran just such a study, but instead of humans they used 80 mice, organized into 10 groups of 8. Using a round robin design, each mouse was observed interacting with every other individual in its group and then observed again a week later, yielding 56 dyadic interactions per group. Across an array of social behaviors, Malloy et al. estimated actor, partner, and relationship effects, all of which showed evidence for cross-situational consistency. Although such a study could have been done in humans, it would have required a huge logistical investment, and it would have been much more difficult to control extraneous factors for the duration of the research (also see Uher et al., 2008).

Animal studies afford numerous new options for investigating personality development and change. For example, Weinstein et al. (forthcoming) have highlighted to the opportunities afforded by animal research for examining the effects of development during the prenatal period. Personality is an emergent property of brain activity so, Weinstein et al. argue, it makes sense to examine the principal time in an organism's life when brain development proceeds most rapidly. Logistical difficulties in studying this developmental period reduce the amount of human studies that can be conducted. Non-human primate studies can play a vital role in research on this period because it is possible to experimentally manipulate conditions and to obtain samples (both behavioral and physiological) regularly and to follow animals longitudinally in a time frame that is considerably accelerated compared with that for humans. Schneider et al. induced prenatal stress in prenatal individuals by exposing pregnant females to randomly distributed noise bursts over a 10-minute period, 5 days per week for a few weeks. Compared with control animals, prenatally stressed animals showed impaired neuromotor development and attentional deficits at birth (Schneider, 1992a)

and a suite of personality differences assessed in the subsequent months and years (Clarke & Schneider, 1993, 1997; Clarke, Soto, Bergholz, & Schneider, 1996; Schneider, 1992b).

Cross-fostering designs are another powerful way of investigating biological and environmental influences on personality development. For example, Suomi's (1987) cross-fostering study in rhesus monkeys suggested that infants' responses to separation from foster mothers is best predicted by their inherited levels of reactivity, not their foster mother's reactivity or care-taking style (also see Benus & Röndigs, 1997; Drent, van Oers, & Noordwijk, 2003; Suomi, 1999). Of course, cross-fostering studies can also highlight the effects of environmental factors; studies of rats have emphasized the role of maternal care, rather than genetics, in the transmittal of some traits (Francis, Diorio, Liu, & Meaney, 1999).

Another important application of animal-personality research is to understand the effects of personality traits on health outcomes. Animal research is particularly well suited for investigating personality–health links because of the greater experimental control and the greater opportunities to measure physiological parameters in studies of animals relative to human studies. Not only can animal models reveal relationships between personality traits and health factors, but they can also detail the psychobiological mechanisms as well as the developmental processes that underlie these relationships.

In one study, Capitanio et al. (1999) examined the role of personality in moderating rhesus macaques' behavioral, neuroendocrine, and immunological response to simian immunodeficiency virus (SIV) disease. Their findings showed that monkeys' sociability predicts both behavioral responses to social manipulations (stable versus unstable conditions) and antibody response to SIV inoculation, which both in turn predict length of survival. Such a controlled and comprehensive study could not have been conducted with humans for practical and ethical reasons.

New questions

As the topic of animal personality has spread to new disciplines it has raised novel questions. For instance, researchers in Behavioral Ecology and Ethology are primarily interested in learning about the ecological and evolutionary implications of consistent individual differences in behavior (e.g., Bell & Stamps, 2004; Carere & Eens, 2005; Dingemanse & Reale, 2005; McElreath & Strimling, 2006). The existence of personality traits across a broad array of species raises the possibility of using phylogenetic methods to explore the evolutionary origins of a trait (Fraley, Brumbaugh, & Marks, 2005; Gosling & Graybeal, 2007). Using these methods, researchers can pinpoint the likely period during which various traits emerged and then infer the original function of those traits. For example, it was the discovery of a separate Conscientiousness dimension in humans

 Social and Personality Psychology Compass 2/2 (2008): 985–1001, 10.1111/j.1751-9004.2008.00087.x

and chimpanzees (but not in Orangutans or Gorillas) that permits phylogenetically oriented researchers to date the emergence of Conscientiousness to the period after the common ancestor to chimpanzees and humans diverged from the other apes (i.e., 7–10 million years ago).

Behavioral ecologists and others have also been asking foundational questions about the adaptive function of personality traits (often referred to as behavioral syndromes in the field of behavioral ecology; Nettle, 2006; Sih et al., 2004). As Sih et al. have noted, traits presumably reflect underlying genetic or physiological mechanisms that constrain the flexibility of individuals' behaviors. This constraint in behavioral flexibility can generate trade-offs, such that a certain personality characteristic may prove advantageous for an animal in one situation but not another. For example, highly aggressive individuals may be successful in defending their territories, but these same individuals may act too aggressively toward potential mates. Thus, differing environments (e.g., those with scarce vs. abundant territorial resources) may have supported individual differences in behavior during the evolution of a species. Evidence supporting this idea is provided by a Netherlands research group that has been conducting long-term studies of personality in a natural population of great tits (Dingemanse, Both, Drent, & Tinbergen, 2004; Groothuis & Carere, 2005).

Practical applications

Researchers in applied fields like Applied Ethology focus on practical issues like predicting working dog performance (e.g., Maejima et al., 2007; Svartberg, 2005) and applications in animal welfare and management (e.g., McDougall, Reale, Sol, & Reader, 2006; Watters & Meehan, 2007).

A number of organizations have adapted the principles of human personnel selection to identify individual animals well suited to performing various tasks (Jones & Gosling, 2005). For example, patrol or detection dogs must work in environments that are unusual, unpredictable, and noisy requiring individuals low on fearfulness. In one study of drug-detection dogs, personality trait scores obtained after 2 weeks of training predicted the dogs' detection success assessed after 4 months of training (Maejima et al., 2007). Specifically, 93.3% of dogs scoring high on desire for work (assessed at 2 weeks) passed the final detection test, whereas only 53.3% of dogs scoring low on desire for work passed the final detection test. Thus, this single dimension could be used as a selection criterion to improve the efficiency of the training program by concentrating resources on the dogs most likely to be successful.

Personality assessments of domestic animals have also been developed to help potential owners identify a pet that matches their needs (Coren, 1998) and to assist with adoption decisions at animal shelters; in one study, behavioral responses of animal-shelter dogs to an unfamiliar person entering their kennel correlated 0.64 with ratings of excitability subsequently

 Social and Personality Psychology Compass 2/2 (2008): 985–1001, 10.1111/j.1751-9004.2008.00087.x

made by their new owners after adoption (Ledger & Baxter, 1996). Such information is very useful in setting realistic owner expectations about a new dog and in matching dogs to suitable homes, both of which improve the rate of successful adoptions.

Conclusion

The past decade has seen a very rapid growth in research on animal personality. The growth is taking place across a wide variety of fields ranging from applied ethology, behavioral ecology, and zoo management to biology, primatology, and comparative psychology. Having established that personality exists in animals and can be measured, researchers have begun to exploit numerous benefits of animal research, such as the high degree of experimental control, the ability to measure a range of physiological parameters, the opportunities for naturalistic observation, and animals' accelerated life span. The wave of new studies is shedding fresh light on traditional issues in personality research (e.g., How do early experiences affect adult personality?), raising novel questions (e.g., What are the evolutionary origins of personality traits?), and addressing practical real-world problems (e.g., Which dogs are best suited to detecting explosives?). It seems that the field is finally realizing Pavlov's (1928) vision, in which he urged researchers from various backgrounds to combine their perspectives and proceed together to understanding individual differences. It remains to be seen whether mainstream personality, the one field notably absent from the current surge of work in this domain, will join the many other groups currently engaged in this endeavor.

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Short Biography

Sam Gosling does research on three broad topics. Based on empirical studies of hyenas, dogs, chimpanzees, and squid, he has focused on developing methods for measuring personality and identifying basic personality dimensions in animals. His work on everyday manifestations of personality has looked at how personality is expressed and perceived on the basis of various everyday contexts such as bedrooms, offices, websites, and music collections. Gosling also does work developing and evaluating ways of using the Internet to collect data in the social sciences. His work has been published in a broad array of journals including *Psychological Bulletin*, *Psychological Science*, *American Psychologist*, *Journal of Personality and*

Social Psychology, *Applied Animal Behaviour Science*, and *Animal Behaviour*. He is a recipient of the American Psychological Association's award for Distinguished Scientific Early Career Contribution to Psychology in the area of Animal Behavior and Comparative Psychology; he has held fellowships from the Center for Advanced Studies in the Behavioral Sciences in Palo Alto, the Peter Wall Institute for Advanced Studies, at the University of British Columbia, and the Humanities Institute at the University of Texas at Austin. He is currently an Associate Professor of Psychology at the University of Texas at Austin, where he has taught since 1999. He holds a BA in Philosophy and Psychology from Leeds University and a PhD in Social and Personality Psychology from the University of California, Berkeley.

Endnotes

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