**Gouzoules - Animal Behavior: Psychology / Biology 320 - Fall 2010**

# Incorporating Sustainability Issues into the Teaching of Animal Behavior

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The course Animal Behavior (Psychology / Biology 320) provides an overview of major research areas in the field of animal behavior. The behavior of animals is analyzed from an evolutionary and comparative perspective. Specific topics include orientation and migration, genetic and environmental influences on behavior, aggression, courtship and mating strategies, parental behavior, foraging, predator-prey relationships, communication, and social organization. Sustainability issues have clear and important relevance to many of the topics covered in this course, yet no textbook in the field even mentions the word sustainability. There are many points in this course where sustainability content can be emphasized. A few examples follow.

Human modifications to foliage, topography, temperature and humidity gradients, and ambient light, to name but a few, have the potential to alter the ways in which animal signals are transmitted by increasing excess attenuation or degradation of signals (Rabin et al. 2003). These alterations can influence the conservation of rare or ecologically important species by reducing the effectiveness of their communicative systems. In particular, the detrimental impact of human generated noise on animal behavior has been well documented (e.g., Slabbekoorn & Peet 2003; Brumm 2004; Brumm & Slabbekoorn 2004; Patricelli & Blickley 2006; Bateson 2007; Nowacek et al. 2007; Weilgart, 2007). Sea turtle hatchling disorientation in the presence of artificial light sources has clear and direct impact on conservation and information derived from behavior and sensory studies on the turtles' visual systems has been directly incorporated into U.S. sea turtle recovery plans (Rabin et al. 2003).

Chemical pollutants have become dangerously common in the environment and a number of these are known to interfere with hormones and other vital neurological and physiological mechanisms that regulate natural behavior (Zala & Penn, 2004). Endocrine-disrupting chemicals have harmful effects on a wide range of behaviors, including sexual and other reproductive behaviors, activity, motivation, communication, aggression, dominance, learning, and cognitive abilities. In some species these effects appear to be strong enough to impact continued survival. Extinction threatens sustainability as it may affect critical and or economically valuable ecosystems and the loss of animals, plants and microorganisms of known or potential value to our species (e.g., Conover & Munch, 2002).

Evolutionary theory underpins the entirety of the Animal Behavior course and, increasingly, has been recognized as crucial to understanding many issues in sustainability. Fir example, in February 2007, the Institute of the Environment at UCLA hosted a conference entitled ‘Evolutionary Change in Human-altered Environments: An International Summit to Translate Science into Policy’. It included presentations by more than 40 prominent evolutionary biologists and conservationists on a variety of issues, including: (i) habitat disturbance and climate change, (ii) exploitation and captive breeding, and (iii) invasive species and pathogens. The conference resulted in reports that identified or suggested ways that evolutionary science can be integrated into conservation policy, planning practices, and management and these were published in 2008 in a special issue of the journal *Molecular Ecology*. There is clearly increasing awareness of how important areas of research in evolutionary biology relate to sustainability and conservation.

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For many students, one of the most interesting research areas in animal behavior concerns altruism. Since the mid-1960s, evolutionary biology has emphasized that most behaviors that might appear altruistic in animals are actually self-serving from an evolutionary perspective. Major theoretical work and empirical research centering on kin selection and reciprocal altruism support this modern Darwinian view. The question of the existence and evolution of true altruism among humans is a fascinating one. It is also highly relevant to a number of issues surrounding sustainability which, of course, requires self-restraint at various organizational levels including nations, communities and individuals. It is likely that for most of human evolution, a truly long-term perspective on resource usage was irrelevant. The extent to which human culture, cognition and behavior can respond to the relatively recent challenge of sustainability represents an important set of issues for students to consider and the integration of the relevant literature (e.g., Simon 1990, 1993, 1997) into the content of a course on animal behavior should make for particularly pertinent and thought-provoking material.

**References**


Bishop, R.C. (1993). Economic efficiency, sustainability, and biodiversity. *Ambio* 22: 69-73.

Brumm, H. (2004). The impact of environmental noise on song amplitude in a territorial bird. *Journal of Animal Ecology* 73: 434-440.

Brumm, H.& Slabbekoorn, H. 2004. Acoustic communication in noise. *Advances in the Study of Behavior* 35: 151-209.

Conover, D.O. & Munch S.B. (2002). Sustaining fisheries yields over evolutionary time scales. *Science*, 297: 94–96.

Hendry A.P., Farrugia T.J., & Kinneson M.T. (2008). Human influences on rates of phenotypic change in wild animal populations. *Molecular Ecology* 17, 20–29.

Nowacek, D.P., Thorne, L.H., Johnston, D.W. & Tyack, P.L. (2007). Responses of cetaceans to anthropogenic noise. *Mammal Review* 37: 81–115.

Patricelli, G. L. & Blickley, J. L. (2006). Avian communication in urban noise: causes and consequences of vocal adjustment. *Auk* 123: 639-649.

Rabin, L. A., McCowan, B., Hooper, S. L. & Owings, D. H. (2003). Anthropogenic noise and its effects on animal communication: an interface between comparative psychology and conservation biology. *International Journal of Comparative Psychology* 16: 172-192.

Simon, H.A., (1990). A mechanism for social selection and successful altruism. *Science* 250: 1665–1668.

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Simon, H. A. (1997). A mechanism for social selection and successful altruism. *Models of bounded rationality* 3: 205-16.

Slabbekoorn, H. & Peet, M. (2003). Birds sing at a higher pitch in urban noise. *Nature* 424: 267.

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Zala, S.M. and D.J. Penn, D.J. (2004). Abnormal behaviours induced by chemical pollution: a review of the evidence and new challenges. *Animal Behaviour* 68: 649–664.

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***ANIMAL BEHAVIOR***

**Psychology / Biology 320 - Fall 2010**
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*Text*:

* J. Alcock (2009) *Animal Behavior: An Evolutionary Approach*, 9th ed. Sinauer Associates, Inc. Sunderland, MA. Also available as an eBook (ISBN 978-0-87893-344-0): www.coursesmart.com.

*Additional readings*:

* Articles on LearnLink (listed here by author's name and marked "*").

| ***Date*** | ***Topic*** | ***Readings*** |
|---|---|---|
| 8/27 | Introduction; Evolution and Darwin | Bowler *, ch.1 |
| 9/1 | After Darwin: Romanes *et al.* | " " |
| 9/3 | Comparative Psychology | |
| 9/8 | Ethology | chs. 4 (109-110); 3 (69-70) |
| 9/10 | Ethology | Goodenough_ch_2 * |
| 9/15 | Neuroethology & Physiology | ch.4 (112-130) |
| 9/17 | Neuroethology & Physiology | ch. 5 (172-180) |
| 9/22 | Orientation & Navigation | ch. 4 (137-147), 8 (261-273) |
| 9/24 | ***** **FIRST EXAM** ***** | |
| 9/29 | Biological Clocks | 5 (153-170) |
| 10/1 | Behavioral Genetics | behav_genetics2.pdf * |
| 10/6 | Behavioral Genetics | " " |
| 10/8 | Evolution of Learning | goodenough_learning *, ch. 2, 3 (97-105) |
| 10/13 | **FALL BREAK** | |
| 10/15 | Evolution of Learning | " " |
| 10/20 | Ecology and Behavior | ch. 6 |
| 10/22 | Ecology and Behavior | ch. 6 |
| 10/27 | Evolution of Social Behavior | chs. 1, 7 |
| 10/29 | ***** **SECOND EXAM** ***** | |
| 11/3 | Altruism and Cooperation | " " |
| 11/5 | Aggression | ch 8 (274-283) |
| 11/10 | Aggression | " " |
| 11/12 | Sex & Reproduction | chs. 10, 11 |

| ***Date*** | ***Topic*** | ***Readings*** |
|---|---|---|
| 11/17 | Sex & Reproduction | chs. 10, 11 |

| | | |
|---|---|---|
| 11/19 | Parental Care | ch.12 |
| 11/24 | Communication | ch. 9 |
| 11/26 | **Thanksgiving Break** | |
| 12/1 | Communication | " " |
| 12/3 | Cognitive Ethology | Griffin_cog_ethology * |
| 12/8 | Human Behavior/Evolutionary Psychology | ch. 14 |
| 12/14 | ***** **FINAL EXAM** ***** | 8:30 - 11:00 a.m. |

***Course Synopsis***

Early Directions and Approaches. Prior to publication of Darwin's *Origin of Species* (1859), animal behavior did not exist as a separate discipline. Darwin's work generated a great deal of interest in the idea that human beings might be better understood if more were known about the behavior of animals. The first major issue tackled was the evolutionary continuity of mental experience. The most significant contribution here came from Romanes. As a body of literature concerning animal behavior began to develop, controversies emerged (e.g., nature vs. nurture). I summarize this early work, noting that many of the areas of contention are still around (sometimes masquerading under different names), and some that were once considered dead (such as the question of animal awareness) have re-emerged.

Ethology. I next discuss the contributions of early ethologists such as Lorenz and Tinbergen. The ethological emphasis on the natural functions of behavior is highlighted. The concepts of innate releasing mechanisms, fixed action patterns, and sign stimuli are described as are other major areas of early ethological study such as imprinting and drive.

Neuroethology & Behavioral Endocrinology. Modern ethology maintains an interest in the natural behavior of animals. Many of the conceptual tools that appeared so nebulous in their original forms, e.g., innate releasing mechanisms, are now better understood in physiological terms. Feature-detector cells in the nervous system explain most IRMs. I provide a detailed example of how developmental, mechanistic (physiology), functional, and evolutionary questions are compatible (in fact *necessary*) for complete explanations of behavior. One example is the co-evolution of the auditory systems of bats and moths, and I show how the sensory world in each species is tailored to meet demands imposed by the other species. Animals are sensitive to *relevant* stimuli in their environments.

Orientation, Navigation, & Biological Clocks. How animals orient themselves in their environments and find specific locations and destinations, sometimes over great distances as in migration, is next discussed. While we have unraveled some of the mysteries of how animals get about, this topic is one where many questions remain unanswered. Biological clocks are discussed from ecological and mechanistic perspectives.

Behavioral Genetics A critical issue in any discussion of the evolution of behavior is whether or not behavior has a genetic basis. I discuss evidence from hybridization studies (crickets, love birds, dogs and bees), artificial selection (*Drosophila*, dogs and other domesticated animals, fish), molecular approaches (Benzer's use of gynandromorphs and fate mapping to isolate the site of a mutation's effect on behavior), and more recent tools such as gene manipulation studies. It is important to note that while the difference between two behaviors can be attributed to a single allele, this is not the same as concluding that the behavior itself is governed by a single allele.

Evolution of Learning. Learning has long been one of the most fascinating and, at the same time, challenging topics in animal behavior. A major problem has been lack of understanding of learning at the level of the nervous system, although in recent years knowledge has rapidly increased on this topic. We examine different

kinds of learning, variation in learning among various kinds of animals, and how approaches that integrate learning and genetic bases for behavior can help understand complex behavior such as song acquisition in birds.

Ecology and Behavior. Behavioral ecology is described as an attempt to understand behavior as a set of solutions to problems imposed by the environment. Problems include finding food, mates, rearing offspring, and avoiding predation. The "best" solution to a specific problem may not be evolutionarily possible because of constraints due to other problems that must also be dealt with. The apparent influence of food type and the distribution of food in the environment on most other aspects of an animal's existence (including sociality, mating system, predator defense) is illustrated with studies of birds and ungulates.

The Evolution of Social Behavior; Altruism & Cooperation. Why do animals live together in groups? If animals are competing for access to limited resources such as food and water, why is it that only rarely do species go extinct as a result of exhausted resources? Lack's 30 year study of reproductive output in a population of great tits is used to illustrate how individuals actually maximize the number of surviving offspring by not over-producing in any one year. The group selectionist arguments of the early ethologists are contrasted with current ideas about the levels at which selection takes place.

If reproductive self-restraint for the good of the species is illusory and illustrative, how do evolutionary biologists explain other apparently altruistic acts among animals? The problem of sterile castes in insects plagued Darwin and remained unresolved for years. Modern theoretical contributions such as inclusive fitness, kin selection, and reciprocal altruism are suggested to be partial solutions. Examples of behaviors that seem to be influenced by relatedness (such as agonistic aiding in primates) are provided. A discussion of the mechanisms of kin recognition is also included.

Aggression and Competition. The question of why animals show aggressive behavior is discussed from an evolutionary perspective. Different classes of aggression (e.g., inter-sexual, intra-sexual, parental, peer, infanticide, territoriality) are illustrated and the costs and benefits associated with each class are discussed. The use of game theory as a means to understand aggressive strategies and the intensity of aggression is considered. The thrust of this mathematical approach is that it does not make sense to understand the fighting strategies of individuals without first considering how others in the population are behaving.

Sex and Reproduction. Why did sexual reproduction evolve? Why the disparity between males and females in terms of the costs of reproduction? What are the consequences of the differences between males and females in reproductive potential? These questions led Darwin to the idea of sexual selection, which we consider in detail. Different mating systems are described (monogamy, polygyny, etc.) as are environmental factors that are correlated with them.

Parental Care. Forms of parental care across the animal kingdom are described. Environments that have promoted the evolution of parental care are characterized and contrasted with those in which parental care is rare or nonexistent. The degree of male participation varies from species to species and, in some cases, depends upon particular environmental conditions. Trivers' theory of "parent-offspring conflict" is considered.

Animal Communication. I begin with the problem of defining communication, then move on to a consideration of the different modalities involved and why particular modalities are more prominent in some species than in others. The relationship of environment to modality is discussed. The traditional ethological view that animal signals have their origins in behaviors that served very different functions is traced back to Darwin's principle of antithesis. Ritualization is discussed. I then talk about how animal communication has been viewed in comparison to human language. Finally, I present recent data that suggest rudimentary parallels between some of the ways animals (in particular, primates) employ vocalizations, and some features of language.

Cognitive Ethology. For years it was taboo for scientists to claim that intelligence of some sort, and perhaps even self-awareness, might guide the behavior of at least some animals. Recently there has seen a major change in our understanding of (and attitudes about) the animal mind. We will look at attempts to train animals in artificial

languages (chimps, dolphins, sea lions) and studies that explore how animals classify and view their social and physical worlds. Armed with this new evidence on animal cognition we will consider some of the key issues in animal ethics and welfare.

Evolutionary Psychology. We consider applications of evolutionary theory to human behavior. I begin by reviewing the different ways evolutionary theory has been used in the study of animal behavior: historical, evaluative (functional), correlational and predictive uses are illustrated with examples from the previous lectures. In human sociobiology, the predictive approach is most common. Topics such as child abuse and rape are considered. I examine the premises behind the predictions (e.g., fitness enhancement), discuss the adequacy of the operational definitions employed, and evaluate the data various investigators have presented.

***Study recommendations***.

There are many names - both animal and human! - discussed in the text and in the lectures. You will be expected to be familiar with the names of people who have made *enduring major contributions* to the study of behavior. These are scientists who have pointed the way for the field or whose work has had a *significant impact* in the direction research took. Darwin, Romanes, Lorenz, and Tinbergen are good examples. I will mention many scientists' names when discussing particular studies over the course of the semester, but you will not have to associate them with their work. In exams, I will always refer to names and specific studies together (for example, "Seyfarth and Cheney's study of vervet monkey alarm calls") and you will need to recall the nature of the work. I will not expect you to know scientific names of animals since we'll be considering many over the semester; common names will do (e.g., not *"Macaca mulatta"* but, instead, "rhesus monkey"). When referring to a specific study, however, you should be able to recall the species of animal by its common name (e.g., "rhesus monkey," *not* just "monkey").

In studying for exams, *always put first emphasis on lecture material*. Use the lectures *as a guide for what to emphasize* in the readings. Sometimes the readings will provide additional examples of points I make in class. At other times, the readings will focus on information not discussed in class. While I will try to point out such times to you as they come along, the best policy is to ask if you are uncertain about what material in the readings you are responsible for.

*Failure to take an exam at the scheduled time without prior permission to reschedule the test, whether due to illness, conflicts, or negligence, will result in a 15% penalty. If you are too sick to take an exam, be sure to call my office number (404-727-7444) before the test and be prepared to document your illness.*

The three exams will be composed of computer-graded questions (true/false, multiple choice, etc.). The emphasis is on *specific information* about animal behavior and approaches to understanding it. No questions will be answered during exams and reading skills and a vocabulary commensurate with a 300-level course at Emory are assumed. The three exams in the course will be weighted in the following manner:

- your highest score on the 3 tests will contribute **40%** of your course total
- your lowest score on the three will contribute **25%** of your total
- your middle score will contribute **35%**

The letter grade scale is:

| | | | |
|---|---|---|---|
| **A** | **92 -100** | **B+** | **86 - 88.99** |
| **A-** | **89 - 91.99** | **B** | **80 - 85.99** |

| | | | |
|---|---|---|---|
| **B-** | **77 - 79.99** | **D+** | **62 - 64.99** |
| **C+** | **74 - 76.99** | **D** | **53 - 61.99** |
| **C** | **68 - 73.99** | **F** | **52.99 - 0** |
| **C-** | **65 - 67.99** | | |

**Note: the final exam for the course is scheduled for Monday, December 14, from 8:30 - 11:00 a.m. Make your travel plans accordingly and check for conflicts with other exams immediately.**

Anyone taking the course as S/U (pass/fail) must take the final exam in order to achieve a passing grade. There will be no extra-credit opportunities: grades will be based on your performance on the exams.

Finally, don't hesitate to stop by my office if you have problems with the material, or simply wish to talk - especially about animal behavior!

**Office hours:**

**Dr. Gouzoules (389 Psychology): Tuesdays 4:00 – 5:00 and Thursdays 1:00 - 2:00, or by appointment (psyhg@emory.edu).**