

I. The 3rd Hour Exam:

Last year's third exam (and comprehensive exam) is on the web site as is the answer key. Do not use it as a guide to what the exam will cover. Feel free to bring sample answers to me or to your TA. You should integrate the concepts (below) that we covered in the last part of the course with the lectures, handouts, readings, and discussions. You will be responsible for examples and details on this part of the exam. Last year there was a two part final, this year we just have three hour exams. Our exam this year will be comprehensive to the degree we are still using concepts and ways of thinking from the rest of the course. There will be no questions requiring details from the first two parts of the course.

II. General Overview of Course Ideas:

There are four components to the course: (1) adaptationist, cost/benefit thinking and the concept of reproductive selfishness, (2) major theories and concepts, (3) testing theories and hypotheses, and (4) shifting perspectives. The **concepts of cost/benefit thinking and of reproductive selfishness** are central. Examining many existing behavioral phenomena from this new perspective has revealed behaviors previously unknown and expanded our understanding of the evolution of behavior. Two general issues about selection and adaptation (design) have dominated the course: (1) selection as external factors versus selection as the behaviors of others, and (2) the interplay of competition and cooperation for animals involved in reproductive and social interactions. Be prepared to work with these issues in answering questions about reproductive and social behavior.

Cost/benefit thinking has been examined through **five major theories**. Alcock and I have built on this core. **All 5** theories may also be on the 3rd exam in the context of understanding social behavior (group structure and dynamics).

- 1) **COMMUNICATION THEORY** - The evolutionary dynamics of sending and receiving information. Optimal design. Cooperation versus manipulation.
- 2) **ESS THEORY** - The way of thinking about alternative behavioral solutions, co-existing behaviors, and frequency dependence. We focused on animal contests, but you should be able to recognize and work with the concept of frequency dependence (think about OSR for example).
- 3) **OPTIMALITY THEORY**: The cost/benefit way of thinking. Costs = time, energy, risk of dying, and lost reproduction. Benefits = survival and increased reproduction now and later.
- 4) **SEXUAL SELECTION THEORY**: How the basic theory influences things like things like parental care, mating systems, and social behavior. How ecological factors influence sexual selection and mating systems. This topic became complex as we shifted from the Trivers view of parental investment to one that included influence over reproduction and then added other factors that influence operational sex ratio. You need to know all the parts (nothing was excluded as perspectives changed).
- 5) **INCLUSIVE FITNESS THEORY**: How does it help explain aid-giving and social behavior and what are its limitations? Inclusive fitness (with all the adding and subtracting) focuses on the dynamics of rare alleles and reduces to a simple rule of thumb (Hamilton's rule) for our use. Remember that this theory also raised the issue of conflict (parent-offspring and sibling conflicts). This theory helps explain but may not fully explain social cooperation.

The **testing of ideas and theories** is central to the course. You should retain and be able to use the basic ideas about direct and indirect tests of hypotheses. You should be able to distinguish proximate and ultimate causes and to tell weak tests from strong ones. You should be especially good at suggesting alternative hypotheses (explanations) and ways to test them.

III. Here is a question that will be on the third exam. (Some in parts of other questions.)

Many people are still not clear on the nature of the perspective shifts that were part of Journal 5. Since they represent a key part of the course, I am going to provide some more information to help in thinking about them. Note that the intent is to give you broad questions that will aid in integrating and understanding the material in the course. These shifts occurred at various times and places in the course. On the exam, you will find the opportunity to demonstrate what you have gained from a close look at the nature of and consequences of these shifts. Be prepared.

Note the outline below is not something to memorize. It is the starting point for your exploration. Feel free to ask for feedback on your ideas. We will not, however, provide the "answers" for you. The shifts are not mutually exclusive. Given the overlap, look for unique features of related shifts. "What happens" means what is gained, what is revealed, what is cleared up and what is different.

What happens when we shift our focus or way of thinking from:

- *Mammals (and/or birds) TO fish and/or insects as research subjects*

“As research subjects” -- what might be gained from working on insects or fish versus mammals:

Additional shifts:

What is it about features of their biology that cause us to see things differently from our mammal or vertebrate centric perspective? Especially interesting are those new perspectives that can then be linked back to a new way of seeing mammals.

What changes when we think about various theories (e.g., parental investment) in the context of one or the other groups of animals. Would we change anything or expect anything different? E.g., are their “kinds of animals” biases? Think back to the innate-learned debates too.

- *The perspective of parent TO The perspective of the offspring*

What is the nature of parent-offspring conflict and its basis? How does this shift relate to the next one? It is all about shifting cost/benefit ratios – what are some of the generalities and details? How similar are they for the shift from male to female perspectives?.

- *Short term costs and benefits TO long term costs and benefits*

How might looking only at short term costs and benefits bias our view or interpretation of what is going on? Might short term view put more emphasis on one sex? What are the trade-offs involved with the shift – what problems arise when we make it and how might we reach the best compromise?

- *Measuring fitness as number of matings TO Measuring it as number of surviving offspring*

Yes, it is a shift to a more accurate measure of fitness. It also reflects some of the short to long term perspective (matings → surviving young). What is there besides accuracy of fitness measurement? What might we miss by looking at matings only? What insights might we gain at considering offspring that survive versus ones that are born? What about the issues of offspring quantity and quality?

- *A focus on males TO A focus on females*

There is overlap with previous two and the next one here. Think of it in terms of how reproductive behavior evolves. What different designs or expectations are there from the two sides of the shift? How might one view or the other limit our understanding? What are the results of the shift? What kinds of things have we learned about males and females?

- *Selection as the environment TO Selection as the behavior of conspecifics*

Major shift in the course. Where does selection come from? How is reproductive selfishness manifested in interactions with species. Is the dynamics of how selection works different? Think about optimality (selection = environment) and game theory (selection = actions of others). Do we miss things that go on within species that we only consider as happening (or being favored) between species? Does the shift also involve selection = death versus selection = not reproducing?

- *High parental investment TO high degree of influence over reproduction*

This shift was dealt with fairly clearly as the flip side to parental investment. Value of shift is expansion of information of what really is going on. Remind yourself of where we saw this shift add to our understanding and look for other ways in which it might. Use this one as a guide to thinking about the others

Here is an additional one that came up in lectures:

- *Relatives as bearers of copies of genes TO relatives as competitors.*

Be cooperative - study together. Argue with each other. Try the discussion questions at the end of chapters in Alcock. There are also questions on lecture handouts and handouts for discussion sections that might also appear on the exam. Brainstorm, brainstorm...!