Evolutionary Psychology

MIT, Brain & Cognitive Sciences 9.250

Evolution of Mind

Harvard U., Psychology 2250

Spring 1999

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Frank Marlowe Talk, and class reading and discussion--2/17/99

By Jeff Stewart

Contents:

Part 1

Required Reading:

Hawkes, Kristen (1992) Sharing and Collective Action, in Smith, E. A. & Winterhalder, B. ***Evolutionary Ecology and Human Behavior***. N.Y.: Aldine de Gruyter

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Premise:

There is enormous variability in the way food resources are acquired and shared in hunter-gatherer and subsistence cultivation societies.

Problem:

How can the variability be measured and explained?

Proposal:

Evolutionary ecologists suggest that cost/benefit analyses, developed from Game Theory, offer a framework for understanding the variability.

Question:

Are the underlying characteristics of, and assumptions about the human groups in question commensurate with their associated representative elements used in the game theory matrices?

Brief Outline of the Paper

9.1 Introduction

- [see Premise/Problem/Proposal above]
- overview of topics

9.2 Two Meanings of Reciprocity

- reciprocity in ethnology
  - Mauss '25--giving and receiving gifts constitutes social contracts
  - Levi-Strauss '49--giving and receiving=fundamental human social rule
  - White '59 and Polanyi '57--social relationships affect transfers
  - Sahlins '65--synthesis of above, plus empirical observations:
    - much giving is not really reciprocal
    - "generalized reciprocity"=one-way giving (kin and close friends)
    - more distant social ties require more literal reciprocity
- reciprocity in evolutionary ecology=Trivers '71, "reciprocal altruism"
  - short-term cost in sharing exchanged for delayed, larger return benefits
    - thus sharing is really self-interest
  - in unconditional sharing, "free riders" may net biggest return

prediction: free riders will increase when sharing is unconditional

BUT--IF ethnological reciprocity says that one-way giving is the rule (except at the social periphery)--THEN reciprocal altruism, based on self-interest and checks on free riders, cannot account for the one-way giving observed.

PROBLEM for discussion:

- Does it make a difference whether we characterize reciprocity as 1.) interpersonal exchange, or 2.) a form of economic integration (as Sahlins describes it)?

9.3 The Problem of Collective Action

- evolutionary ecology focuses on fitness costs and benefits to individuals
- Olson '65 says that the self-interest of individuals may fail to provide the benefits needed by all members of the social group--and this is the problem of collective action
- Samuelson '54--goods may be private or public
- Sahlins '68 and '72 appears to suggest that foragers want little and have all they want ("original affluence"), and that sharing is central to this situation.
  Thus: food becomes a collective (public) good, and subject to the problem of collective action and free riders
  Thus: free riders benefit, but <u>all</u> benefits are reduced
  So: why share and end up with less?
- Hawkes proposes 3 types of (observed) strategies that might provide the opportunity to investigate explanations for that question
  1.) just get what you can eat now
  2.) get more and then share it
  3.) get more and then save it for the future

PROBLEMS for discussion:

- Do you agree that hunter-gatherers actually "want little"?
- Hawkes attributes "zen affluence" to the "fact" that free riders are responsible for setting the standard of living low. How would you explain that?
- Does the term "work" appear problematic in Hawkes's interpretation?

9.4 The Economic Logic of Evolutionary Ecology

- how are behavioral patterns (sharing) maintained in view of ever-present trade-offs?
- how are behavioral patterns maintained in view of the fact that one can never be certain what the other guy will do?
- predictions for sharing fall under 4 types of explanation
  1.) kin selected altruism--helping kin leads to the benefactor's inclusive fitness [Hawkes will not consider this in the present paper]
  2.) reciprocal altruism--short-term cost yields later, bigger benefit, but free riders need analysis
  3.) immediate mutual benefits--share work/food now, but free riders need analysis
  4.) manipulation--benefits are shared with others because the cost of not doing so is high

9.5 Interdependent Costs and Benefits: Three Models

- game theory will help to analyse trade-offs and conflicting interests, as well as make some clearer account of how free riders function
- illustrative example of a strategy (game)

harvest per gardener varies with number of gardeners

2 are better than 1--should they let a third join?

Each of the 2 gardeners got b/2 benefits from the garden; they can anticipate getting b/3 benefits after the third one has joined them. But what of the cost of trying to exclude the new member? She may be meddlesome--or worse. And if she gets to join, she may turn out to be a free rider. The two gardeners have a collective action problem that the Prisoner's Dilemma game addresses.

		Gardener 2	
		Keep her out	Let her in
Gardener 1	Keep her out	3	1
	Let her in	4	2

The numbers above represent one way to imagine a payoff structure for gardener 1, according to the actions of gardener 2, for a particular time. In this mathematical space/garden, G1 has a high-to-moderate payoff in all decisions except where she has to undertake the onerous job of keeping the third gardener out all by herself.

Here is the payoff structure for the classical Prisoners Dilemma, where the first number in each box is amount of years of imprisonment for prisoner 1, and the second number the same for prisoner 2.

		Prisoner 2	
		Rat	Don't rat
Prisoner 1	Rat	5, 5	0, 10
	Don't rat	10, 0	.5, .5

Most commentators stress that if the rational choice is made by each prisoner, he will rat. But hey, these guys are criminals, maybe mafiosi--so in the real world, in order to avoid being killed on the outside for ratting, they'd probably keep their mouths shut, do the half year of time, and get out--"irrational," but alive. Unfortunately, dour game theorists predict that, given one shot at a decision, most of us would be self-interested--and rat. Obviously, a better game is needed.

How about tit-for-tat (TFT)?

In TFT, a player first cooperates, then, in the plays that follow, she does what her opponent just did. To avoid getting stuck in an endless loop of non-cooperation, a variant of TFT allows a player to return to cooperation. But there still is a problem--with more players, delayed payoffs are less likely to persist. So how can a game structure capture different kinds of payoffs?

- Maynard Smith said that an evolutionarily stable strategy (ESS) is a strategy that can dominate a game--and thus become advantageous.

  Chicken is an example of an ESS from Hawk vs Dove games

  Hawk does better than Dove in a population of Doves

  Dove does better than Hawk in a population of Hawks

  Therefore, a mixed strategy (Chicken) may offer a payoff in both situations

  However, when the goods are public goods, and the cost is not great, the only ESS is unconditional cooperation, or Dove--if the cost is greater, then Prisoner's Dilemma or Chicken must be the game

  Smith introduced another strategy called Bourgeois

  you play Hawk if you arrive first at a food source

  you play Dove if you arrive later

  Bourgeois plays Hawk or Dove equally

winning half its fights with Hawks, always with Doves, and half the time with other Bourgeois-->this is the only ESS in this game

Hawk, Dove, or Bourgeois may all be an ESS, depending on the conditions at the beginning of the game

- sometimes, when foods are easily divided and one individual has already eaten their fill, "tolerated theft" is allowed, because the cost of defending the remainder is disproportionate to its lessened value

PROBLEM for discussion:

- Hendricks-Jansen (1996, ***Catching Ourselves In The Act***) has called into question some of the constructs used in analyses like these. He refers to them (after Meehl) as "actuarial approaches," because "they abstract away from the concrete, individual behavior and treat it as a statistical phenomenon." He goes on to say (p. 48):

> Actuarial predictions are useful for predicting the occurrance of generalized, heterogeneous, folk psychologically inspired classes of outcome or behavior, like 'academic success,' 'recidivism,' 'altruism,' or a 'dove strategy.' In behavioral ecology, predictive theories of this type use notions of cost and benefit, by analogy with the economic notion of utility, but linked to the Darwinian concept of fitness....[T]he explanatory entities in these [predictive] theories are statistical entities. There are many different ways to land back in prison, and countless individual manifestations of a dove strategy....The danger is that, having resorted to statistically defined categories of behavior like the dove strategy, the scientist will be tempted...to project these actuarial notions back into the animal--in other words, to assume that the individual creature is actually following or using a dove strategy, implemented by some internal mechanism that would correspond to that description....Natural selection does not ***design*** behavior....

What do you think--is Hawkes resorting to functionalist reification?

9.6 Discounting, Different Kinds of Benefits, Lumpiness, and Asymmetries with Special Reference to Sex

- this section concerns additional variables (and how new matrices might be structured)
- time--longer delays lower the value of the anticipated return
  - the future is uncertain
  - the "earned interest" grows steeper, and a reciprocator might spend the return on a more immediate benefit
- other benefits may accrue from, say, being a superlative hunter
  - yet they are still subject to free rider and long-delay problems
- the nature of goods may bear upon collective action problems
  - a giraffe kill is "lumpy" and unpredictably won
    - these are more likely to be widely shared
    - these are subject to "critical mass" effects, where type and number of participants is crucial--e.g. the weakest link of a hunting party may cause all to fail
- asymmetries may develop from consistent distinctions--like gender--and lead to collective action problems

9.7 Some Applications of Evolutionary Ecology to Patterns of Food Sharing

- other variables predicting whether sharing or storing better reduces variance in risk of failure (Winterhalder '86; Cashdan '85) involve:
  - synchrony of foraging effort
  - individual variation in effort over time
  - distance of food source

mobility of food source

- Hawkes discusses Basarwa, Aché, and !Kung San groups according to the strategic games presented. She concludes (p. 297):

> Features of local ecology such as the lumpiness of resources, the way they are encountered in both space and time, the effects these have on the costs and benefits of sharing versus not sharing, the costs and benefits for alternative subsistence strategies, the opportunity costs of foraging or farming, and the extent to which these differ according to sex differences, may all affect the payoffs for work....Details of local circumstances set the constraints and the trade-offs: the costs and benefits for possible alternatives.

PROBLEM for discussion:

- Why does the above paragraph sound as though a multiple regression model, or some other statistical device, could better account for the variability in food sharing than a series of decision-strategic games?

Part 2

Points raised during discussion of required reading (paraphrases)

Hauser--Reciprocal altruism [RA] in the evolutionary world is proposed as a mechanism to explain altruistic behavior between non-kin--it has this one agenda, and it is out of the kin domain completely.
Pinker--There is still a lot of unconditional giving to non-relatives to be accounted for--and there is always an ambiguity about how much "credit" to extend before you expect return, so I wonder how much of what looks like unconditional reciprocity, or giving, involves some implicit long-term feedback, so that if you got into trouble, the person you aided ten years before would come to your help?
Hauser--Part of the problem is that if you look at the details of RA as it is laid out by Trivers, there actually are not any quantitive data to test the ideas. Trivers has left open what the time-lag is, and whether the giving or receiving has to be equal--of course, you may go cross-currency, and that is not discussed at all. I give you some food and later you help me in a war--is that reciprocal? I don't know. To my knowledge, there are no actual data from any society.
Fitch--There are many situations in which whatever paybacks there are take a long time. And once you introduce the fact that there can be other kinds of benefits to giving, the giving can be an end in itself. Just by giving, you can enhance your status and get other things.
Hauser--We need to ask Frank about the data concerning hunters' access to wives--the initial data were very weak on that. It looks like one possible benefit is men's access to women, but they have not actually documented that.
Pinker--It also raises the question of what is in it for the women, if they do not actually get more meat out of it.
Hauser--The other question it raises is that, unlike the case of vampire bats, where the critical period is about 60 hours, the Ache can go for long periods without getting anything. What is the threshold? And how critical is it? There has been very little evidence in animals for reciprocal altruism. The example that has actually stood out is vampire bats. There is a much higher likelihood that a bat will regurgitate to a bat that has regurgitated to it in the past. Bats live together in social groups for long periods, so there is the opportunity for repeated giving--and they clearly recognize each other individually. And bats who fail to regurgitate will not get help when they ask for it. But there are huge questions left--like are there other currencies for exchange, blood for grooming, say. Do young animals receive more? In primate studies they have been looking for these kinds of things, bit it is pretty hard to experimentalize it. It is often very difficult to quantify the actual costs and benefits.

Hauser--the reason why game theory analysis was a useful tool, even though I think the number of studies that empirically provide the data for the matrix are extremely few, is that it got behavioral ecologists to think differentlyabout things--like alternative strategies for achieving a possible goal, and if there are multiple ways, in what way could you get stability in those strategies, will one die out? And if so, why? So it forced behavioral ecologists to look not just at local instances of behavior in a population, but to think about it in the long term. So even though very few studies have gone out and sought values to put into the matrices, it helped with the design of research programs. There is a recent paper in Nature which did take the game theory and RA work further by saying that you don't have to have fixed payoffs. There may be a graded continuum of options where you can cooperate a little bit. And that can have quite different dynamics. It does not pigeon-hole you into either a cooperator or a non-cooperator.

Part 3

FRANK MARLOWE TALK--Notes

Marlowe studies the Hadza, hunter-gatherers from Tanzania.

- we will focus on stinginess by looking at food sharing among hunter-gatherers
- food sharing varies with the type of food, but there is a lot of food sharing going on
- background on the Hadza: they use bows and arrows to hunt many types of game; men do a lot of night hunting in the dry season, sleeping near watering holes in wait for game; houses, during the dry season, basically consist of windbreaks made of broken branches; men spend a lot of time making arrows (and cigarettes)--they pound nails into arrows, and for larger game they use poison arrows; women spend a lot of time processing food in camp, and grooming--most people are not aware that humans groom--women do more grooming than men; women dig tubers just about every day; the Hadza are extremely laissez-faire with children; boys get their first bows at the age of 2 or 3, and they target practice a lot; the Hadza, unlike some hunter-gatherers, do not have very elaborate rules about butchering meat--in fact, they neither make nor follow many rules about anything; meat is distributed by each household getting equal amounts relative to the number of individuals; in small camps, people ofter eat communally, whereas in larger camps families are more likely to eat together; the Hadza lifespan can last well beyond 65 years
- hypotheses proposed to explain food sharing and cooperation in general
  1.) nepotism--short-term cost; inclusive fitness gain
  2.) tolerated theft--what remains after you have eaten has more value to others, less to you
  3.) reciprocity--
    a.) tit-for-tat--I'll give you something now, you give me something later
    b.) trade--reciprocation, but not in kind
  4.) mutualism--no temptation to defect (as in Prisoner's Dilemma)--the payoff is greater for cooperation
  5.) showoff--not so much about explaining the distribution of food as it is about the motivation, and may overlap with, say, nepotism; hypothesis (after Hawkes) is that men are motivated to go hunt because they are paid back in some other currency, like extra mating opportunities or other, subtle, social benefits
- focus on reciprocity--the problem, of course, is maintaining cooperation. One way of getting at the problem of looking at motivation and the pattern of sharing is to use matrix games, like the Ultimatum Game and the Dictator Game. They allow examination of:
  1.) fairness
  2.) cooperation
  3.) punishment
  4.) spite
  5.) altruism
- The Ultimatum Game--start with a $100 pot; decide how you want to allocate the money, in units of $10, between your partner(whom you will never see, and who does not know who

you are) and yourself. Then your partner will be asked if they accept the amount--if they accept it, the amounts allocated are given out; if they reject it, both of you receive nothing. There is an equilibrium to the game because at each step it is clear what you should do as a rational player:

1.) responders want to maximize their own payoff
2.) proposer ought to maximize their expected payoff, by assuming #3
3.) proposers expect responders to obey #1

You should propose 10%--and responders should accept it

- Ultimatum Game results across many cultures:
mean offer is about 40%; the mode is between 40% and 50%, usually 50%; offers of 20% usually have a 50/50 chance of being rejected
- Ultimatum Game results for the Hadza:
mean offers 33%; the mode 20%; where n=55; rejection rate of 24%
The mode is quite meaningful--it is lower than the mean, which is unusual because it is usually the other way around.
Looking for effects:
    none for age or gender
    small effect for configuration [playing in Land Rover (!) with currency stacks]
    small effect for comprehension--a few just did not get it [Note: offers were higher from those who understood better]
    big effect for camp population size
        smaller groups (10 to 15 people) offered less--but this did not allow them to fare any better than the larger camps

One conclusion:

The Hadza are "good game theorists," but the picture is complicated by the population effects--the small groups are less generous, but they have to share more often. It may be that the requirement of more sharing is directly related to the lower generosity--"donor fatigue."

- The Dictator Game--same as the Ultimatum Game, but the partner cannot accept or reject, they just get what is offered. So what is rational here is to offer 0%. What usually happens is that the mean offer is 15% to 25%, and the mode is 30% to 50%.
- Dictator Game results for the Hadza:
mean 20%, mode 10%
no age effect
some gender effect, with females offering less
large camp population effect--offers are smaller in smaller camps
- On population size as a variable in the games--the effect of the camp that a given player was in had more importance than whether it was a home camp or not for that individual. [Most people would behave differently in a room with 30 people than they would in a room with 3 people.]
- Other ways of looking at sharing--
calculating caloric intake in relation to gender/work, etc.
amount of food brought into camp by gender
    males = 40.2%; females = 59.8%

daily foraging returns by gender
    males = 1771 Kcal; females = 1980 Kcal [Note: males forage longer than females, yet return with less--are they eating while foraging?]

what about scroungers? is there a correlation with population size?
    fewer male than female scroungers in larger population

there are more "superproducers" in larger populations
foraging by marital status:
    single people--no difference
    married--higher female foraging return (# children: no effect)

hunting reputation
    correlated with higher number of children
    correlated with younger wives

an important point: nepotism confounds many results

- **Marlowe's conclusion**: tolerated theft is the best explanation for the pattern of sharing seen: you really do have to turn over food when others see that you have it! And it is difficult to hide anything in a small camp. Reciprocity does not look like the best explanation. The strongest factors, then, are just seeing what someone else has--and gossip. In large camps, the cost of having gossip spread about you can be great, and there is not much of a cost to spreaders of gossip.

Lecture by Prof. Irv DeVore
Notes prepared by Elizabeth Kensinger

Discussion before Irv DeVore's lecture
1. New York Times article by Natalie Anger– highlights the ignorance of the field of evolutionary biology, and the misunderstandings of its assumptions and goals.

2. Summary of main topics in the articles (see class handout, included on pages 5-9).

3. Does Universality imply innateness?
- We concluded that NO, universality does not imply innateness.
- There can be other explanations for universal traits:
  One suggestion: If something changes very slowly across time, it could remain a universal trait simply because there hasn't been enough time for it to change.
- However, there are ways to deduce that a universal trait is innate:
  Innate mechanisms are "quirky" in their design features
  Innate mechanisms appear early in life – "poverty of the input" argument (Chomsky)
  Look at those without environmental input and see their responses (e.g. look at blind and deaf children's facial expressions of emotion)

- Even for traits that are not innate, there is still probably an **innate learning mechanism** that ignores some information and pays attention to other information.
- An important reversal: there can be **plasticity in an innate mechanism**, therefore, innateness does not have to imply universality (at least manifested universality)

4. Discussion on innate physics: If we put monkeys into space, would they still assume the law of gravity (i.e. is knowledge of gravity innate)?
- Can do the experiment, based on the idea that an environment inconsistent with innately assumed laws (e.g. gravity) should be harder to learn.
- Prof. Hauser's experiment: a red ball goes along a ramp and then goes up into the air. Ask if monkeys will 1) be surprised to see the red ball go up after training and 2) generalize to a blue ball (or will there just be the assumption that "it's a weird red ball".)

- The point was raised that since gravity is stable in the environment, it might be a "waste" to make knowledge of gravity innate; more useful hard-wired knowledge might include less easily learned information.
- On the flip side, laws of gravity (just like the law "snakes are scary") may need to be hard-wired to prevent a one-time fatal mistake (especially if you're a monkey high up in the trees)
- Evidence supporting the idea that the laws of gravity are not innate: babies only have a tenuous grasp of gravity.

Main Points in Irv DeVore's lecture: Is Social Science a Science? If Not, Why Not?

- Science defined as "the process of gathering empirical data and generating testable hypotheses"

[some background explaining the lack of integration between the social/behavioral sciences]

- At one time, anthropology was somewhat integrated with psychology (incl. social psychology), human needs and linguistics (in the US) and with archaeology, paleontology and comparative anatomy (in Britain). However, anthropologists resisted these attempts for integration.
- In the US, anthropologists took the strong view that social facts are only explained by other social facts, and that the psychological influences should just be ignored.

[reasons Anthropology has not become a "science" as defined above]

Problems with Data Collection:

- No consistent data-gathering methods.
- In part, because of the lack of shared data-gathering methods, the quality of the database is poor. There is a little data on lots of cultures, but the same things are not looked at in all cultures.
- Galton's problem: If choose cultural samples to compare, how do you know your samples are independent?
- Anthropologists have followed the humanist interpretive tradition rather than the scientific tradition. (Anthropology has been the study of one culture by one person without much replication).
- Often the anthropologists in the field have stayed for a short time (Mead stayed for 6 months). Within this short period of time, you don't see everything (e.g. homicide in New Guinea) and may therefore incorrectly determine that it does not occur (in New Guinea, entire villages are burned and all men are killed, but this only happens every 7-8 years).

Problems with Assumptions and Biases of the Anthropologists:

- Field workers have traditionally been unmarried, young, and probably influenced by their own world views (Mead, in her early 20s, probably reacted differently to interviews with grandfathers than someone older, with more experience parenting, etc, would have)
- Anti-Nazism sentiment influenced people to look for ***cultural*** explanations for human differences. Anthropologists were fixated on finding these cultural race differences.
- Because of this fixation (bias), Mead and others had a filter on: Mead only saw that men gossiped and wore make-up, but she did not see that they also had to put their masks on and go to war.

[how Anthropology could become a science]

- Need multiple people, with different expertise to do fieldwork (ethnologists, people with training in child development, archaeologists, anthropologists).

DeVore used such a team to study the Bushmen (!Kung). Each team was there for about 6 months, and teams would rotate (Team 1 would train Team 2, etc).

While there were still criticisms of the research (in part due to a claim that DeVore and colleagues never made – that the Busmen = the human E.E.A.), the study was much more scientific than previous studies.

Similar teams have been used to study the Pygmies, again focusing on bringing together multiple people from a variety of fields to conducting research over a substantial period of time.

- Need a standardized way to gather data so can have a consistent, cross-cultural database.

This type of consistent data gathering has allowed some very good cross-cultural studies to take place (DeVore highlighted two: homicide rates; and personality traits of boys and girls).

Discussion Following Irv DeVore's lecture

1. What happened to cognitive anthropology? Why did it have such a dismal history despite the interest in human thought?

Disinterest in really being united

- "have become so interested in the icing, have forgotten the cake, which is universality in human nature"
- At one time, sociology, clinical psychology, social psychology, and social anthropology were all linked in the "Social Relations Department" at Harvard. However, these departments were pulled apart by politics and internal disagreement.
- The field of cognitive anthropology that did develop was very boring. It was focused on linguistics, and did not touch on mental mechanisms.

Anthropology is more interpretive/less scientific than Cognitive Psychology; thus difficult to unite

- It is hard for anthropology to be scientific rather than interpretive. For example, it's hard to study adolescence because that age group doesn't want to be around adults, so all information comes from ritual ceremonies (first menses, etc).
- Anthropologists still think of themselves as "a reader of the [cultural] text". As a reader, your interpretations are based much more on your own problems/worldview than on the culture you're "reading".
- It is impossible to study a culture without having some effect on that culture (the human Heisenburg effect), although there are some ways around the problem (use scan samples; appear suddenly before anyone knows you're around; trick people into thinking you're studying one person when really you're looking at another's activities).

Cognitive Psychology has had its own motives

- Psychologists usually go to other cultures to overthrow the currently accepted ideas in a certain psychological domain (usually trying to overthrow the idea of human universality). They are not looking unbiasedly for either universality or relativism.

2. Does Anthropology attempt to make predictions?

- No. It would be nice (e.g. when want to intervene with economic planning, want to know the effects), but prediction is not really a goal.
- Anthropology has borrowed tools of evolutionary biology to make some predictions (e.g. women cannot both be promiscuous and expect paternal investment in the child, because the man will be leery that he's really the father). However, Anthropology does not really have its own predictive tools.

3. How do Anthropologists really know what they are looking at?

- Definitely a problem (e.g. with facial expressions, fear and constipation look similar)
- Must understand what interactions are important (e.g. behavior of one male baboon will dramatically change when another male comes onto the scene; if only looked at the male's behavior in isolation, would miss these important interactions.)
- Must have something to separate one act from another (e.g. defecating vs. praying).

- Examples of important interactions/difficulty of interpretation:
    1. friendships in primatology

Why would the male choose to take care of babies that weren't his? Turns out that when males switch troops, after making peace with the males, they must make peace with the females (so they can reproduce) and they do this by taking care of the babies.

2. Kalahari debate

Were the !Kung always hunter-gatherers? May have been pastoralists and become hunter-gatherers when they lost their land to the Bantoo. This fact could change the way in which we think of the !Kung if their hunger-gatherer lifestyle was a more recent adaptation. (The case of the !Kung is not as clear cut as with other groups, such as the Hadza, who have been hunger-gatherers as far back as any records go, and for whom attempts to take up farming have failed.)

4. (for Marlow) Any ideas as to why hunting success is related to reproductive success?

- Better hunters may be able to move into new camps and be welcomed.
- Hunting success is also proportional to success at other types of foraging, so may be a benefit in provisioning with smaller game, and things like honey. These other foods are more likely to be kept within the family rather than being shared.

Summary of Background Readings for Irv DeVore, 2-24-99
by Elizabeth Kensinger

***The Adapted Mind, Evolutionary Psychology and the Generation of Culture* (1992) Eds. Barkow JH, Cosmides L, Tooby J**

Purpose: To critique the current social sciences model (SSSM) and to propose a new model (ICM) that would allow for the integration of the social/behavioral sciences with the natural sciences. The ICM recognizes the importance of evolutionary influences on the development of human nature.

Introduction

The authors suggest the following ways to improve the behavioral and social sciences:

- the various disciplines within the behavioral and social sciences are too isolated
- they should follow the principle of **conceptual integration**, recognizing their mutual consistency and preventing the proposition of theories that violate principles in other behavioral and social sciences
- focus on the **mechanisms** that connect the selection pressures with the sociocultural behavior
- focus on the **adaptive problems** in the environment (those that effect reproduction, either directly or distally) and the psychological mechanisms that natural selection might have selected to solve those problems
- Can approach the problem from both directions (Figure 1.1):

Adaptive Problem

informs hypotheses about the design of psychological mechanisms	informs theories about the adaptive function of psychological mechanism

Psychological Mechanism

Questions:

What are some reasons why the social/behavioral sciences have remained isolated from the natural sciences? (chapter 1 offers some suggestions)

Do you agree that the behavioral and social sciences should be linked in the same way that disciplines within the natural sciences are linked?

Are the theories in the behavioral and social sciences well enough developed to promote the idea of mutual consistency?

The authors also present the logic behind their proposed model (the ICM):

- psychological mechanisms evolved in response to the demands within the E.E.A.
- thus, at the level of psychological mechanisms, there is a universal human nature when a new design feature arises (through mutation), and solves some adaptive problem (causing incr. reproduction), and is passed on to offspring, this design will increase in frequency within the population
- this analysis leads to an understanding of how and why the nervous system came to have its current functional properties

Chapter 1

Why have the social and behavioral sciences remained isolated from the natural sciences?

1. Afraid to accept the link between the mental and physical world
   - Darwin's unity of the mental and physical world (both molded by natural selection)
   - A computer's "mental" capabilities
   - These sciences have kept the mindset that culture is "independent of the laws of biology and psychology" (Murdock, 1932, pg. 200; cited pg. 22)

2. The social sciences still do not follow the same type of tightly regulated "scientific inquiry" and is instead plagued with generalizations, and ungrounded theories (the next paper highlights some of the problems with behavioral/social science research)

3. The Standard Social Science Model (SSSM) has also served to isolate the behavioral/social sciences from the natural sciences by assuming that "culture" and thus the "individual mind" remain unconnected with other sciences.

A Walk Through the SSSM:

- Notice that: humans show within-group similarity and intergroup differences
- From this observation comes the following considerations:

Step 1. Human intergroup differences are not attributable to genetic differences. Infants from all groups have the same design and the same potential.	Problem: NONE, this is true.
Step 2. While infants are the same, adults in the various groups are different with regard to their behavior and mental organization.	Problem: the fact that adults have different characteristics than infants does not mean those traits are culturally derived. Breasts appear with age but are not culturally dependent.
Step 3. The complex behavior and mental organization seen in the adult is absent in the infant. Therefore, the adult must "acquire" these traits.	Problem: Assumption that it is either nature or nurture; no interaction. Nature/nurture are not along one continuum.
Step 4. These traits are acquired from the social world from examples set by others in the local group.	
Step 5. These cultural and social influences are external to the individual. They precede the individual. Thus, the individual (the mind) did not create them; rather, they created the individual (the mind).	Problem: Culture is not always external to the individual; there can be an interaction between the individual and the culture (adolescent tumult as rejection of imposing cultural values?)
Step 6. Culture is what organizes and shapes human life. It is "extrasomatic" or "extragenetic" (pg. 27). Even human thinking becomes external through the use of symbols. Then the question becomes: What creates the culture?	
Step 7. It is not the individual that creates the culture. The source of the organization is the culture itself. "[w]hen the individual has been eliminated, society alone remains"	Problem: as case studies show, universality may be the rule, rather than the exception (at least at the level of the mechanism)
Step 8. The generator of organization is a set of emergent processes determined at the group level. Phenomena at the sociocultural level are caused by other phenomena at the sociocultural level. Supports the idea of relativism: with the culture's influence on the human mind, there should be more ethnic diversity than human unity.	Problem: the mind is prewired in some ways; not all mechanisms interact strongly with the environment (as evidenced in twin

Step 9. Human nature cannot generate significant organization. Human nature is simply the ability to contain culture. The human mind is "an empty vessel waiting to be filled by social processes" (pg. 29). **Step 10. Psychology studies learning: the "capacity for culture" (Spuhler, 1959, pg.29)**	studies) It is untrue that "the specifics that we learn are in no sense predetermined by our genes" (Rindos,1986, p.315; cite p.28).

Major problem with model: General mechanisms are unable to perform many complex tasks.

- Psychological functioning does come with some content- specific information and is programmed to solve adaptive problems.
- These mechanisms may only learn from cultural influences within certain bounds (e.g. could not learn a language that did not conform to universal grammar).

Questions:
Is the basic assumption of intergroup differences and within-group similarities valid?
How is this assumption reconcilable with the idea of universality (consider levels of analysis)?
Do you agree with the proposed problems with the SSSM?

The SSSM has shaped people's assumptions about culture and its influence in human life (key assumptions are listed below; see pgs. 31-32 for full description):

Assumption 1. Human groups are characterized by "a" culture.
Assumption 4. Unless other factors intervene, the culture is perfectly replicated from one generation to the next.
Assumption 5. The child learns the culture, thus allowing its accurate replication.
Assumption 6. The child's acquisition (learning) of the culture is called socialization, which is the imposition of that culture on the child by the group.
Assumption 7. The child is a passive recipient of that culture and is the product of that culture.
Assumption 10.Learning is a powerful enough explanation for culture.

The Model to Replace the SSSM (Integrated Causal Model; ICM):

1. the human mind is made of evolved information-processing mechanisms
2. these mechanisms are adaptations produced by natural selection
3. these mechanisms are functionally specialized
4. to be functionally specialized, mechanisms are structured in a content-specific way
5. these content-specific mechanisms generate elements of human culture, incl. language, behavior
6. this cultural content is then either adopted or modified by the mechanisms in other members of the population
7. this adopting/modifying establishes population-level processes
8. these processes are located within a certain environment

Questions:
How have the SSSM assumptions influenced social/behavioral science research?
Is the logic behind the ICM valid?
Does this new model eliminate all of the problems found with the SSSM?
Does this model allow for the various social/behavioral science disciplines to become integrated? Does it allow for their integration with the natural sciences?

Brown DE. *Human Universals.*

Purpose: A discussion of six cases that originally were thought to prove the relativism of human nature, but have since been brought into question, lending support to the idea of human universality.

- **relativism** = "the theory that conceptions of truth and moral values are not absolute but are relative to the persons holding them" (American Heritage dictionary)

Chapter 1: Rethinking Universality: Six Cases

1) Margaret Mead concluded in ***Coming of Age in Samoa*** (1928) that **adolescence** is not a time of turbulence in Samoa; thus western adolescence is cultural, not biological. Mead argued that Samoans were more laid back (with "lack of deep feeling"; pg.15), more relaxed about sex, and had less individualism to lead to jealousy, and that these factors led to a less tumultuous adolescence.
   - Refuted by Freeman -- adolescence is as stressful in Samoa.
2) In ***Sex and Repression in Savage Society*** (1927) Bronislaw Malinowski claimed that the **Oedipus complex** was particular to patriarchal societies. Among Trobriand Islanders (matrilineal), there was no Oedipus complex; instead boys felt hostility to their mothers' brothers (rather than their fathers) and desired their sisters (rather than their mothers). The Oedipus complex was thought to stem from family influences on the mind, and therefore different families could have different influences.
   - Refuted by Spiro. He reanalyzed the data and argued that they had an Oedipal complex even stronger than Western culture's (they deny the role of the father in reproduction and believe a spirit child enters the mother's womb, allowing Oedipal possession of the mother and elimination of the father
3) Benjamin Lee Whorf claimed that the Hopi had no sense/a very different **sense of time**. This conclusion was based on the fact that the Hopi language had no reference to time, and by the assumption that language shaped one's "worldview".
   - Refuted by Malotki in 1970s. Hopi sentences do have tense/time, and Hopi's have a sense of time.
4) In ***Sex and Temperament in Three Primitive Societies*** (1935), Mead claimed that the Tchambuli in New Guinea had reverse **male and female temperaments**, with the females being the dominant bread-winners and men being the less responsible, emotional person. The roots of female dominance stemmed from three factors: 1) women were economically productive, 2) women showed solidarity, 3) women were not emotional. Men, on the other hand 1)spent time doing art, 2) bickered over petty things and 3) were more likely to have psychological problems.
   - Refuted by Gewertz, who restudied the Tchambuli in 1974-5. Men are aggressive and women submissive. Women are bread-winners, but have no control over produce exchange.
5) Weston La Barre (1947) believed that **facial emotions** varied across cultures, as did Birdwhistell.
   - Refuted by Ekman and Izard. They showed, through judgement studies, that facial emotions are universal, not only among cultures with interaction with one another (e.g. Japanese and American), but also among cultures isolated from one another.
6) Harold Conklin (1955) and others argued that **color classification** and semantic understanding of color was not universal.
   - Refuted by Berlin and Kay. It is true that different languages classify colors in different ways. However, it is not true that different languages parse up the spectrum in different ways. There are no more than 11 different main colors, and regardless of how many of those colors a language has, people still parsed color chips in a similar way (e.g. stereotypical "red" is the same whether you have 11 color words or only black, white, and red).

Questions:

What were the main problems with these studies leading to their questionable conclusions?
Does the refutation of these studies prove that there are human universals?

Can human behavior be judged without bias from the observer?
How can we separate differences at the evolved mechanism level from those at the manifestation level?
Do you believe that moral (or other) externalities have greatly influenced scientific exploration into human behavior?

How the arguments in *The Adapted Mind* relate to the cases in *Human Universals*

- Mead, Whorf, and other anthropologists went into their fieldwork with the SSSM assumptions that individuals are greatly molded by the environment in which they live, and that their culture can dictate everything from their worldview to gender roles to color categorization.
- In actuality, culture must influence the individual within bounds that are determined by a shared evolutionary background (constrained development). Thus, we would expect, along with some relativism (group differences), to find much universality (group similarities).

- The case studies highlight a point raised in ***The Adapted Mind:*** It is important to separate questions about our ***evolved*** design for handling a problem (our mechanisms; e.g. does everyone have the same species-specific mechanism for classifying color, emotion? for determining gender roles under certain conditions?) from questions at the ***manifest*** level (our behavior; e.g. does everyone have the same labels for color, emotion? the same gender roles?).
- While questions are often directed at the latter level, the former is often more interesting/useful to investigate. Our behavior can be different depending on the situation, while our mechanisms can remain the same (similar division as between genotype and phenotype).

- One example is not enough to remove a mechanism from the "universal" group. Almost everything is somewhat variable (Would we remove eye color, hair color, etc, from the "biologically determined" side and switch it over to "socially determined" if we rigidly followed this advice?). We must avoid the tendency "to exaggerate the exotic character of other cultures" (Bloch, 1977).

And relating to last week's lecture…
- ***The Adapted Mind*** argues that culture as the only explanation for human nature eliminates many other useful explanations (economics, ecological adaptation, human universals, etc). Last week we saw that economic game theory can be a useful tool for understanding some aspects of human performance; thus, we cannot ignore other explanations aside from "culture".

Questions:
Do you think the influence of the SSSM perpetuated the relativism mindset characteristic of the six case studies?
Does the refutation of these cases invalidate the SSSM?
In empirical research, is it possible to conduct a study of the evolved design, or must we resort to looking at the manifest design?
Do the behavioral sciences have any hypotheses/theories about how the two levels relate? If we know the evolved design and we know the environment, can we predict the manifestation?

Marcel Kinsbourne
By Brian Hare

Awareness of One's Own Body: An Attentional Theory of Its Nature, Development, and Brain Basis.

Questions addressed:

- Is there a specific structure in brain (localized neuronal representation) in charge of awareness?

- Or is awareness a product of the sum of all info from different body parts and if so how might shifts of attention between different body parts be organized?

- Does attention to different body parts and shifting attention have anything to do with self awareness (self-consciousness)?

- if so, how might awareness of self develop?

Outline

1) **Impairments of Bodily Awareness** = suggest problem with traditional argument for specific brain structure in charge of "awareness"

a) lays out 3 types of disorders. Says problem w/ Bonner's (1905) explanation b/c no data to back up hypothesis that only spatial representation of body parts loss w/o sensation loss.

b) puzzling imbalance exist that would not be predicted if specific brain structure existed. High # of cases of left neglect (where patients forget about or deny existence of left extremities) but no other forms. If lesion of the body image structure causes left neglect why no other forms of neglect when other parts of this central structure damaged in areas corresponding to other parts of the body?

c) asserts there is no specific structure in brain for controlling body image

2) When do you pay attention to the nature of your body parts?

a) for the most part body parts & motions are run by unconscious machinery and not experienced in consciousness. Although sensations of novelty to body parts give info about environment to conscious self, the body parts themselves are still not attended to by conscious self

b) Only when things go wrong do we become aware of body parts: analogous to peripheral vision- only attended to when something out of ordinary catches attention.

c) limit to amount of body / body motion that can be brought to conscious attention.

3) How does one focus attention on a body part?

a) comparison of visual vs. bodily attention

b) explains idea for how one attends to unilateral body part

4) Why no local autotopagnosias?

a) if you lesion neurons that make body parts work you do not lose awareness of there existence

b) There are few examples (of local autotopagnosias) that point to the correlation b/w lesions and problems in different body parts which would point to structure in brain responsible for awareness (except finger agnosia but only one clear case pg. 210)

5) Is there a general Autotopagnosia?

a) Presence of symptoms for autotopagnosia not convincing that person ONLY having problems identifying there bodies. These same people showing symptoms of autotopagnosia also have problems identifying body parts and parts of objects external to body.

b) Also some people may have word category aphasia and simply cant name / categorize anything or certain things very well and don't qualify as autotopagnosia.

6) opposing processor imbalance and impaired body awareness

a) should not assume body is centrally represented or expect partial autotopagnosias

b) attending to body parts is under opponent processor control

c) most frequent case of neglect in left hand b/c right hand so efficient an attractor of attention (what about south paws?)

7) What explains the indifference and denial Syndromes?

a) selective denial of hemiplegia – ownership of body part acknowledged, but never used. it is suggested that person losses ability to intend to move them = cannot conceive of moving limb thus they do not move the limb.

b) some forms of hemiplegia involve disproportional disuse of a limb but not denial (I do that...handedness). It is suggested that vestibular stimulation (defined in vocab section) might help correct

8) To what does one attend when one attends to the body?

a) many questions revolving what happens when body part brought into consciousness.

- Does attending to a body part bring proprioceptive sensations into consciousness?

- In order to attend to a body part do you have to be aware of its position?

b) when body part disavowed: proprioception and visual information at odds in reverse way as in "Phantom Limbs" (which are created by a functioning mechanism for intending to move a limb (bringing it into awareness) that are unmatched by lack of movement feedback)

c) movement of limbs is dominant in perception of body parts. illustrated with vibration experiments which made people feel body parts violated laws of physics

d) image of body in brain doesn't stop people from perceiving body in impossible ways (if it exists)

e) static (opposed to moving) visual stimuli has little effect on body sensation.

f) change in how body part feels can change how it is visually perceived.

9) A body scheme acquisition device. What is a BODY SCHEME?

a) analogous to a "language acquisition device" there exist a device to acquire a body scheme.

b) cruel cat experiment = locomotion depends on neural maturation not practice = body scheme?

10) A body image acquisition device. What is a BODY IMAGE?

a) children acquire sense of self when it becomes selectively able to selectively attend to its individual body parts in the somatosensory.

b) Vision (as Neisser 1978 suggest) is not important to acquisition (blind kids)

c) Experience may not be necessary to develop body image / somatosensory representations: if Amelic (never develop limb) infants really have phantom limbs.

11) The self as emerging from background body sensation

a) amelia teaches us that only attention to one's "representation" (whatever that means) of a body part is necessary to identify a body part as existing and as one's own.

b) ability to attend to ones body parts **essential** precursor to developing concept of self (self – consciousness).

c) the ground "the ever present background" may be the basis for constructing continuity of the "experiencing self"

d) suggest steps of developing self with the final one being the realization of the self as "mental"

e) not all body parts can be attended at once. sense of self originates from each body part when being attended to feeling as if IT possessed the rest of the body (the background buzz of somatosensory info).

f) visual field / attention analogous to somatosensory. Phantom limbs are part of the confused background buzz which means no change since injury in overall perception from somatosensories perspective.

12) body sensation, episodic memory and the self

a) background sensation and awareness of one's body (feeling and potential for action) is encoded into episodic memory. This encoding of body sensation ear marks a real memory. These same sensation will not be encoded when scene imagined (Why not...cant you imagine your sensation?)

b) infants may be more sensitive to body sensation / awareness and have a different encoded body image in memory than as an adult. Only if an adult can return to this previous state of body sensation can memories from infancy be retrieved (possibly explaining infantile amnesia).

13) how are body parts represented

a) body parts that are kept in attention more = more prominently represented (what does that mean?)

b) to corroborate: blind children and phantom limbed people represent moving body parts more.....(in drawings?)

c) body representation = degree of action -> joints also most prominently rep

14) conclusions

a) "Disordered bodily perception results from spatial disorganization of attentional shifts or from their extreme lateral bias."

b) awareness of body guided by knowledge of relationships b/w body parts NOT by some central structure containing a representation of the body

c) focusing attention on a separate body part is key to categorizing it as "self"

d) more specifically Somatosensory attention is key and without may lead to disowning body part

e) When infants can focus attention on selective body parts they can develop a "sense of self

Marcel Kinsbourne & Cognitive Evolution 3/3/99

I. Chewing up the article
II. Discussion with Marcel

1) Brian's Speal:

Investigate persons "awareness" that body part are her own, underlying mechanisms, and how this relates to self awareness by looking at impairments of bodily awareness: Agnosias

- Is there a specific structure in brain (localized neuronal representation) in charge of awareness?

puzzling imbalance “left neglect” = no brain structure (lesions)

If lesion of the body image structure causes left neglect why no other forms of neglect when other parts of this central structure damaged in areas corresponding to other parts of the body?

- how are body parts represented

c) proprioception & movement of limbs is dominant in perception of body parts. Not Vision!

vibration experiments - people feel body parts violated laws of physics

blind people drawing and propriception can change vision

a) amelia (wi/ Phantoms) teaches us that only attention to one’s “representation” of a body part is necessary to identify a body part as existing and as one’s own = no experience necessary.

- Origin of the self

b) ability to attend to ones body parts **essential** precursor to developing concept of self (self – consciousness).

a) children acquire **sense of self** when they becomes able to **selectively attend** to its individual **body parts in the somatosensory realm**.

e) sense of self originates from each body part when being attended to feeling as if IT possessed the rest of the body (a background proprioceptive buzz)

b/c not all body parts can be attended at once.

Possible topics for discussion.

It is suggested that knowledge of how we attend to body parts may help us understand something about self awareness and self consciousness: does it?

ie ants or scratching animal.

- Other approaches to study “self awareness” and “consciousness”

1) animals – self directed behaviors / mirror recognition = tool to explore body?

2) Neisser 1988 – need more than info about body for “self awareness”

- self as social agent = shame, embarrassment, shyness = a child around 2 realizes that others have perceptions of them

- self referential language

2) Class Discussion:

Do we buy Marcel’s argument that there is no central structure responsible for Body Image?

- Is it possible that lesion data is skewed towards left neglect simply b/c areas of the brain responsible for body image of the left side are relatively unprotected from lesions relative to other parts of the body image structure? e.g. lesions occur at higher rates near arteries.

- brain is extremely plastic and is able to reorganize itself in somewhat surprising ways (ie Homunculus). Therefore many damaged systems/ functions may be rerouted to other areas of the brain and never show up as neglect.

- probably unlikely given that some body parts (such as lips) have huge representations yet never show neglect. In addition likely that everything that can go wrong with the human brain has and most likely would have been detected by scientist.

3) Amelia and its importance to Kinsbourne argument...is it robust?

- what is the dependent measure?

- children are interviewed after they are able to talk. It seems indeed that they truly feel they have a limb even though they never even began to develop one! Sample still small, but fascinating

4) Is the ability to attend to ones own body part(s) an essential precursor to the developing concept of self? What is Kinsbourne's "self" ?

- social insects can categorize what belongs in their colony and what doesn't

- chimps when presented with a mirror conduct self directed behavior by looking to parts of their body that they previously only felt through proprioception and were unable to see without the mirror.

- Do either of these have anything to do with "self awareness" or "consciousness"

- A taxonomy of "self" is suggested where there is a gradation and increasing complexity. Immune response, song bird recognizing its own song, chimpanzees and self directed behavior but all these fall short of "consciousness"

- Self as social agents a measure of self awareness? Shy children perceive are "aware" that others are aware of them and are sensitive to this. In addition in many cases they use self referential language talking about how they effected some situation or person.

- Problem with shyness as measure is that it is difficult to tease apart shyness and fear. It is possible that children are not aware of how others perceive them, but act "shy" simply because they are afraid. BUT there are many instances where children are simply embarrassed around people they are extremely familiar with eliminating fear hypothesis.

- Wouldn't we expect all animals to have a "sense of self" as discussed in Kinsbourne's paper? How can we learn anything about "self consciousness" from body "image"?

- Agnosia patients vs. Neglect patients!!!

    - Agnosia patients DENY body part is there own = Beliefs!
    - Neglect patients simply dot feel / are unaware of appendage
    - Thus tapping into Agnosia points to the fact that body image may be important factor in "self awareness"

- maybe evolution of self goes something like this: body awareness, emotional awareness, mental state awareness

- play in animals, play "acting", and role reversal: does that show a deeper understanding of self?

II. Discussion with Marcel

Body Image vs. Body Schema

Body schema – allows us to move one part of the body without having to pay attention to that part of body

Body image – conscious of body, can "meditate" on it, conscious off it.

There is no static representation of body in brain or any body image structure in brain

Many people in the past have thought that people represent world in static way in brain. But world ever changing and only limited amount of attention available so inefficient & unrealistic that there is some

reality representation in brain....just as there is no body rep. In brain. Just to much to pay attention to all at once. Only represent things that are being attended to or that are novel and stick out in environment. Body image is treated exactly as such. Only represented are the body parts which are currently being attended to. Anticipation "novelty" of experiences plays a role in attention and enables us to get away with simpler representation in or brain of enviro or body. So must have enough of expectation to elicit awareness of mismatch either of environment or body.

Expectations for neglect: partial vs local representation – in both cases would expect a wide variety of neglect that have never been observed.

By looking over long periods of time at how brain can and cant be damage you can gain insights on how it works. I.e. no aphasic person scrambles word order.

In many cases it is difficult to draw to many conclusions from lesion patients b/c they may exhibit several types of disorders that make it difficult to eliminate alternative hypotheses.

Is it possible though that there is a representation of our bodies in the brain but due to efficiencies sake it does not resemble a human body one to one? I.e. you know you have a right hand and you know where your left hand is and what it is by contrasting it to the right hand. I.e. if you lose right hand then you also lose left (subsequently not noted as side biased neglect) whereas if only left damage only see effects on left = left neglect.

Seems something similar is reality.

It is suggested that laterality may explain the bias in neglect cases as well. Right hemisphere control "broad" attention in people while left hemisphere control narrower more detailed attention. In left neglect always right hemisphere damage responsible.

Much feeling that there needs to be better behavioral measures of neglect and agnosia without reliance or total reliance on language.

Activation imbalance may be the key to understanding neglect and the fact that a gradient exist: lady with left neglect...is neck part of body? She says "yes", Is elbow for same reason part of your body? She says "maybe", Is you hand yours? She says, No! = gradient (in addition no one who recognizes hand disowns more proximal on body part such as forearm.

Attention is the key! Stimulation of inner ear is the key piece of information helping attention hypothesis. Without stimulation (control) people struggle with balance. If inner ear is stimulated then it increases activation level and thus attention = they recover balance.

But interesting the subjects do not respond to the "significance of what they experience" = they still are unaware of there problem and simply cant remember what it was like to be "fixed" during stimulation.

Just as there is a fixed language acquisition there is also predisposed body image acquisition. Attention "readiness for access" once it is under control by child = body image develops.

Interesting interpretation of the meltzoff experiments with babies "imitating" experimenters facial experiments = proposed simpler explanation is that babies tongue sticking out behavior is a perceptual activity. Babies are unable to inhibit any of their responses and always do exactly what they are thinking. So there is no dissociation between their thoughts, what they perceive, and how they behave.

Vocabulary

Asomatognosias – neurophysiological deficits in bodily awareness

Autotopagnosia – inability to specify a part of the body by naming it or indicating them when named: three types – local, general, & partial (what's diff?)

Anosognosia – inability to recognize that a body part is ones own or that its function is impaired (sometimes called "denial).

Amelia – limbs never began to develop

Hemiplegia – Paralysis of one side of the body

Proprioceptive- sensory stimuli originating from tendons / muscles

Ipsilesional stimulation – ipsi (same-side) lesional stimulation

vestibular stimulation – stimulation of sensory system in middle ear that responds to body position and movement

unilateral – one sided

Episodic Memory – (vs semantic / procedural memory) stores info about events (when, where, what) and there relationship to other events.

Somatosensory system – neural system pertaining to the tactile sense, including touch, kinesthesia, pain, and proprioception.

Kinesthetic / Kinesthesis – Perception of movement or position of the limbs and body: commonly used to refer to the perception of changes in the angles of joints.

Synesthetic / Synesthesia – ability to perceive a stimulus of one sense as a sensation of a different sense. sound produces color

Amblyopia – dimness of vision without obvious impairment of the eye itself

Opponent processor control –

body scheme – see below

body image – see below

Self, Awareness, & Self Awareness –

Reading Summary

Darwin, C. ***The Descent of Man***, Part 1, Chapter 3, "Comparison of the Mental Powers of Man and the Lower Animals-continued"

I. Introduction

A. The belief held by Darwin and others is that the ***moral sense*** or ***conscience*** stands as the most important of the differences between man and the "lower animals".
B. He states that although many writers have discussed man's moral qualities, the issue has never been approached from the perspective of natural history, i.e. biology and comparative psychology.
C. Darwin's primary proposition is that "***any animal whatever, endowed with well-marked social instincts … would inevitably acquire a moral sense of conscience, as soon as its intellectual powers had become as well, or nearly as well developed, as in man***."
    1. He offers three arguments to support:
        a. Social instincts lead animals to experience pleasure, sympathy, etc. in the presence of certain other members of the species.
        b. As the brain becomes more highly developed, animals have an increased ability to experience unpleasant memories of times when instincts, including the social instincts, are not satisfied.
        c. With the development of language, it is possible to express the wishes of the community, and the expectations of how individuals should behave for the common good.
D. As prosocial behavior is encouraged by the wishes of the community, individual ***habit*** reinforces the tendency to continue to engage in these moral behaviors.
E. Even though the evolution of the brain might lead to a moral sense in all animals, the exact nature of that moral sense might differ across species.

II. Sociability

A. Using many examples of observations from nature, Darwin illustrates the many ways in which some animals species exhibit social behavior, such as:
    1. Warning each other of danger
    2. Hunting/gathering food in packs; sharing food
B. Darwin debates the distinction between sympathy and love. Although he says animals can certainly feel love for one another, he questions the extent to which they can sympathize with each other's pleasure or pain.
    1. Herds of animals expelling sick or wounded members are examples where animals do not show sympathy.
    2. Animals aiding each other when in danger (or in some instances, aiding human masters) illustrate the presence of sympathy in some species.
C. He proposes that prosocial behavior in animals might be accompanied by the same sense of satisfaction or pleasure which humans feel. This feeling of satisfaction probably grew out of the positive feelings associated with parental or filial affection, via the process of natural selection.
D. Darwin points out that sympathy in animals and humans is not experienced for any individual, but is experienced only (or at least most intensely) for members of one's group or family. He articulates a group selection theory, saying that those groups that have the most sympathetic members are most likely to flourish.
E. It is possible that instincts, or behavioral tendencies, might come into conflict. An example is the conflict between the parental instinct to protect one's young, and the instinct to migrate at certain times of the year. Natural selection can explain why one instinct wins out: The behavior which is most beneficial to survival will be the one which is most frequently performed.

III. Man a social animal

A. Living in a social environment is the natural state for humans. Although it is true that some groups are often in a state of warfare, this is because in man, like in animals, the social instinct is only extended to certain members of the species.
B. An important question is whether or not prosocial behavior in humans is inherited or learned through experience. Darwin believes that this is one way humans differ from other animals:
    1. In "lower" animal species, prosocial behavior, like all behavior, is guided by inherited instincts.
    2. Although humans probably have some inherited prosocial instincts, our behavior is largely determined by higher-level cognitions, such as wishes, desires, etc.

IV. The more enduring social instincts conquer the less persistent instincts

A. The central question of the chapter is: Why do we as humans feel that one behavior is more appropriate than another? In other words, why to we feel that moral behavior should be displayed more than selfish behavior, and why do we feel guilt, regret, or remorse when we choose to engage in the selfish behavior?
B. Darwin makes a distinction between moral behavior in humans and apparently moral behavior in other animals: "A moral being is one who is capable of comparing his past and future actions or motives, and of approving or disapproving of them." In other words, our ability to reflect on and evaluate our behavioral decisions sets us apart from other animals.
    1. This ability to reflect (self-awareness) is thus the key to understanding the moral belief that prosocial behaviors are more appropriate than selfish behaviors.
        a. Humans are continually concerned with evaluating how our actions are perceived by others.
        b. A combination of instinctive sympathy and learned knowledge about what is considered socially appropriate determines the nature of our self-reflection, and creates the moral sense.
C. More often than not, the instinct to act selfishly wins out. When we reflect back on our behavior, we are likely to experience shame, repentance, or remorse. The strength of these feelings are determined by:
    1. The strength of the violated social instinct
    2. The strength of the selfish instinct and the desirability of the selfish option
    3. Judgment of other people
    4. Strength of religious belief

V. The strictly social virtues at first alone regarded

A. Darwin points out that which behaviors are considered virtuous or moral can vary greatly across cultures. In general, he considers the moral sense of "savages" and uncivilized tribes as less highly developed than that of civilized human. He gives several reasons for this:
    1. As a rule, that which is good for one's social group is considered virtuous. Thus, the less well-developed moral sense of "savages" is due to the fact that they sympathize only with members of their own tribe.
    2. Their powers of reasoning are not well-developed enough to recognize the benefit the tribe will receive from certain moral behaviors.
    3. They lack a powerful ability of self-command, which comes from instruction, religion, and the repeated practice of inherited habits.

VI. Concluding remarks

A. In both humans and other animals, social instincts have evolved to increase the reproductive success of the species, not to increase the general happiness of the species.
B. In humans, these social instincts are reinforced by the oral and written desires of other members of the community.
C. The extension of sympathy to larger and larger communities is due to the development of larger and more complex societies.
D. Mental development is also responsible for a greater moral sense. Thus (Darwin optinistically predicts) as humans continue to evolve virtuous behavior should triumph over selfish instincts.

VII. Summary

A. "The difference in mind between man and the higher animals, great as it is, certainly is one of degree and not of kind."

B. In other words, human morality and other cognitive capabilities are an evolutionary outgrowth of social behaviors found in other animal species.

A modern approach to morality:

Moral Intuition and Fantasy Dilemmas

• The basic idea behind the modern evolutionary approach to morality in humans is that at least certain aspects of our moral beliefs and intuitions have a biological basis. In other words, the principals of evolutionary biology (for example the concept of inclusive fitness) might shed light on many of the behavioral tendencies that we consider moral.

• Several moral issues have been addressed in the study of moral intuition, including:

1. **Number** – Should the number of individuals who are affected by a decision influence the nature of the recommended action? (i.e. You have the option of saving the life of 1 person or 5 people)
2. **Action and omission** – Is it more permissible to let someone die than to kill the person?
3. **Social contracts** – A number of social contracts can affect the morality of a behavioral decision, such as:
    a. Whether a promise has previously been made to help one individual over another.
    b. Personal rights and ownership
    c. Costs and benefits to society
    d. Biological associations – Do we feel a moral obligation to kin, or to members of our own species?

• One way to explore this idea of a biological-based morality has been through the use of **fantasy dilemmas**, hypothetical situations aimed to assess people's intuitions about moral decisions. For example:

> You have access to a lifesaving drug. There is one individual who will die if he does not receive all of the drug. There are five other individuals each of whom only need one-fifth of the drug to survive. Who do you choose to give the drug to: the one person or the five people?

An empirical study of moral intuition: Petrinovich, O'Neill, & Jorgensen (1993)

Method:

• Participants had to make decisions on two different classes of fantasy dilemmas.

1. **Trolley problems**. Example:

    A trolley is hurtling down the tracks. There are five innocent people on the track ahead of the trolley and they will be killed if the trolley continues going straight ahead. There is a spur of track leading off to the side. There is one innocent person on that track. The brakes of the trolley have failed and there is a switch which can be activated to cause the trolley to go to the side track. You are an innocent bystander. You can throw the switch saving the five innocent people, which will result in the death of the one innocent person on the side track. What do you do?

2. **Lifeboat problems**. Example:

    A ship has sunk and there are six survivors on a lifeboat. Because of limits of size, the lifeboat can only support five individuals and you must decide what to do. Five of the six are normal adult human beings and the sixth is a collie dog. One individual must be thrown over to drown. What would you do?

    a. Throw the dog over
    b. Draw lots among the humans and throw the losing human over
    c. Draw equal lots and throw the loser among all six over

• Participants were presented with different varieties of these two dilemmas, varying on a number of dimensions. The dilemmas were constructed to allow the dimensions to be compared in importance with one another. The dimensions were (all examples are in reference to the trolley problem):

1. **Action-Inaction**: All the dilemmas were constructed to allow the participant to act (throw the switch) or avoid acting (let the trolley continue on its path) to see if this dimension was important in and of itself.

2. **Numbers**: The number of individuals on the tracks were varied. Example One: Five people versus one person. Example Two: Five people versus your brother.
3. **Social contract**: Varied the individuals' involvement in the situation. Example: Innocent bystanders on the track versus railroad employees working to repair the track.
4. **Nazi**: Included as a dimension to examine the effect of an abhorrent philosophical perspective. Example: Nazis on one track and innocent individuals on the other.
5. **Inclusive Fitness**: The degree of relatedness between the participant and the people on the track. Included biological relatives as well as friends and members of the same social group.
6. **Elite**: Individuals who have attained a high status in society. Example: innocent bystander on one track, famous scientist working on a cure for cancer on the other track.
7. **Species**: Example: One human on one track, five gorillas on the other track.
8. **Endangered**: Matched with species dimension, compared endangered species versus nonendangered versus humans.

Results:

• Across two different studies, four different subject populations were compared: three different groups of U.S. psychology students and one group of Tiawanese students.

• A number of differences were found across groups in terms of personal beliefs on issues such as abortion, birth control, capital punishment, medical experimentation, religious affiliation, etc.

• On the moral dimensions manipulated in the fantasy dilemmas, however, there was very little difference across groups. Regardless of sample, individuals made very similar decisions. In other words, individuals favored members of their own species over other species; family (and friends) over strangers; found it more morally acceptable to let someone die than to kill; preferred to save more rather than fewer; utilized social contract information in their decisions; and condemned those who were Nazis. Elitism and Endangered had no effect on decisions.

• The overall order of importance of the dimensions was: Species, Inclusive Fitness, Action-Inaction, Numbers, and Social Contract, Elitism (Nazi and Endangered were not included in the Taiwanese sample). All of these, except Elitism, mattered in determining the outcome of the dilemmas.

Conclusions:

• The differences which were found on measures of personal belief were uncorrelated with responses on the fantasy dilemmas, suggesting that the nature of moral intuition lies at a deeper, more fundamental level than personal belief. The authors of these studies conclude that the universality of the response patterns on these fantasy dilemmas suggest at least a partial evolved, biological component to human morality.

QUESTIONS FOR DISCUSSION

1. What are the limitations of the fantasy dilemma methodology? Some possibilities for discussion include:
   - Limited participant sample (even with cross-cultural data, all are students)
   - Paper and pencil, questionnaire methodology (response bias?)
   - How much can we generalize from these responses to actual behavior (and how much does this matter)?
2. How convincing is this data in terms of addressing issues of biology and evolution? Can a sociocultural explanation account for these results?

3. How much of real-world morality can we map on to the universals proposed by the moral intuition research? Do the differing responses on questions of personal belief imply that real-world moral decisions might show greater variability than suggested by these proposed universals?

4. Are there additional types of evidence that might help illuminate the link between biology and morality?

References:

Petrinovich, Lewis. (1995). ***Human evolution, reproduction, and morality***. New York: Plenum Press.

Petrinovich, L., O'Neill, P. & Jorgensen, M. (1993). An empirical study of moral intuitions: Toward and evolutionary ethics. ***Journal of Personality and Social***

Psychology, 64, 467-478.

Pinker – Comments on the Evolution of Morality and Altruism

- Any adaptionist argument must include an analysis of the adaptive value of the trait ***PRIOR*** to examining organism. Thus our question here is: what evidence is necessary to say morality is adaptive?
- An inclusive definition of morality: morality = altruism, or behavior that benefits other at a cost to the self.
    - When would this pay off? By definition, this kind of morality cannot evolve if benefits and costs are calculated solely in terms of reproductive success
- Two explanations for the presence of altruism:
    1. kin selection/inclusive fitness
        - the unit of analysis is the gene
        - **C < Br –** condition necessary for altruism to occur

          C=cost to self

          B=benefit to other

          r=coefficient of genetic relatedness
        - this analysis suggests that what is altruistic at the level of the organism is selfish at the gene level.
        - evidence: a good deal of altruism is directed to kin
    2. reciprocal altruism
        - The ultimate benefit to the self is greater than the immediate cost; in other words, it pays to help those who can help you in return
        - But what about the cheater problem? Those who cheated – received others' altruistic behavior without reciprocating – would have the evolutionary advantage and would ultimately dominate population.
        - To deal with this, it is helpful for organisms to have cognitive mechanisms that help them recognize other individuals, remember others' past behavior, and only reciprocate to those that help them.
        - In other words, organisms should have built-in ***cheater-detection mechanisms***
- The Prisoner's Dilemma argument
    - A PD game played only one time will always result in selfish behavior, but an iterated PD game, where the same participants play each other multiple times, can result in cooperative outcomes
    - Hamilton and Axelrod help a Prisoner's Dilemma tournament, where scientists were encouraged to enter computer programs that used various strategies.
    - tit-for-tat strategy – the winning strategy in the tournament; cooperates on first move, reciprocates on all subsequent moves.
        - It has since been shown that tit-for-tat is not necessarily the best strategy, since success depends on the nature of the opponent strategies. Still, the best strategies have all involved some degree of reciprocal cooperation.
- The gains-in-trade argument
    - If a resource has diminishing returns, it can benefit to give up some of that resource for a gain in another resource.

- So: How does tit-for-tat and other aspects of reciprocal altruism map onto the social and moral emotions?
    - Cooperate on the first move ---> sympathy, liking
    - Thereafter reciprocate ---> anger (if they defect)

      ---> gratitude (if they cooperate)
    - If you screw up and use the wrong strategy ---> guilt, shame

- One theory: Maybe animals don't display moral emotions because they never find themselves in a Prisoner's Dilemma situation

- Ann McGuire has proposed that we have an evolved tendency to believe we are helping others less than we actually are

- Culture of Honor theory – Richard Nisbett

Some Comments/Questions Raised During Discussion

• Emotional experience is an essential ingredient to feelings of morality. This emotional experience appears to only exist in humans, and could explain why only humans display morality.
• To fairly test for morality in animals, ecological validity is necessary; in other words, studies must be conducted in the wild.
• Kohlberg's stages of moral development in humans suggest that there is a continuum of moral behavior and understanding
    • Perhaps animals can attain the lower levels of morality, but not the higher?
    • Maybe worth testing in low IQ humans, to see what understanding of morality they exhibit
• Possible examples of moral behavior in animals?

4. Rats – Will press a lever to aid another rat suspended from the ceiling

    • Could because the sound of the other rat is aversive – if this is controlled for the result is the same.
5. Monkeys – Will deprive self of food to prevent shock to other monkey

• <u>Fantasy Dilemmas</u>
    • Is it too big a jump from this evidence to proposing inherited mechanisms?
        • Reaction time studies have perhaps narrowed the gap – the same results are obtained if participants are forced to act quickly, without cognitive deliberation.
    • Are all these decisions merely a matter of descriminating between ingroup/outgroup?
• Many real-world moral debates revolve around the issue of where to draw the line between the ingroup and outgroup – slavery, abortion, etc.

The Evolution of Parental Imprinting

What's parental imprinting?

- **Ecological View:**

  Ecological Phenomena:

  - Mice with maternally derived gene have less nutritional demands on mothers than those with paternally derived gene.
  - Altruistic behaviors that benefit kin (e.g. warning cries, support in fights) would be more strongly favored by animals with maternally derived gene than by those with paternally derived gene.

Ecological definition of genomic imprinting

The phenomena that gene changes its pattern of expression depending on whether it is maternally or paternally inherited is called genomic imprinting.

Evolutionary benefit of this asymmetry

Genes that expressed in an individual's soma do not leave direct descendants but are selected to promote the transmission of copies of themselves via the individual's germline.

The individual's maternal genes have a 50% chance of being present in the half-sib. Therefore, maternal genes will be selected to forgo a benefit for their own individual if this benefit is associated with a cost that is more than twice as great for half-sib. On the other hand, the individual's parental genes are absent from the half-sib, and will be selected to take the benefit no matter what the cost to half-sib.

- **Biological View: the nature of imprinting**

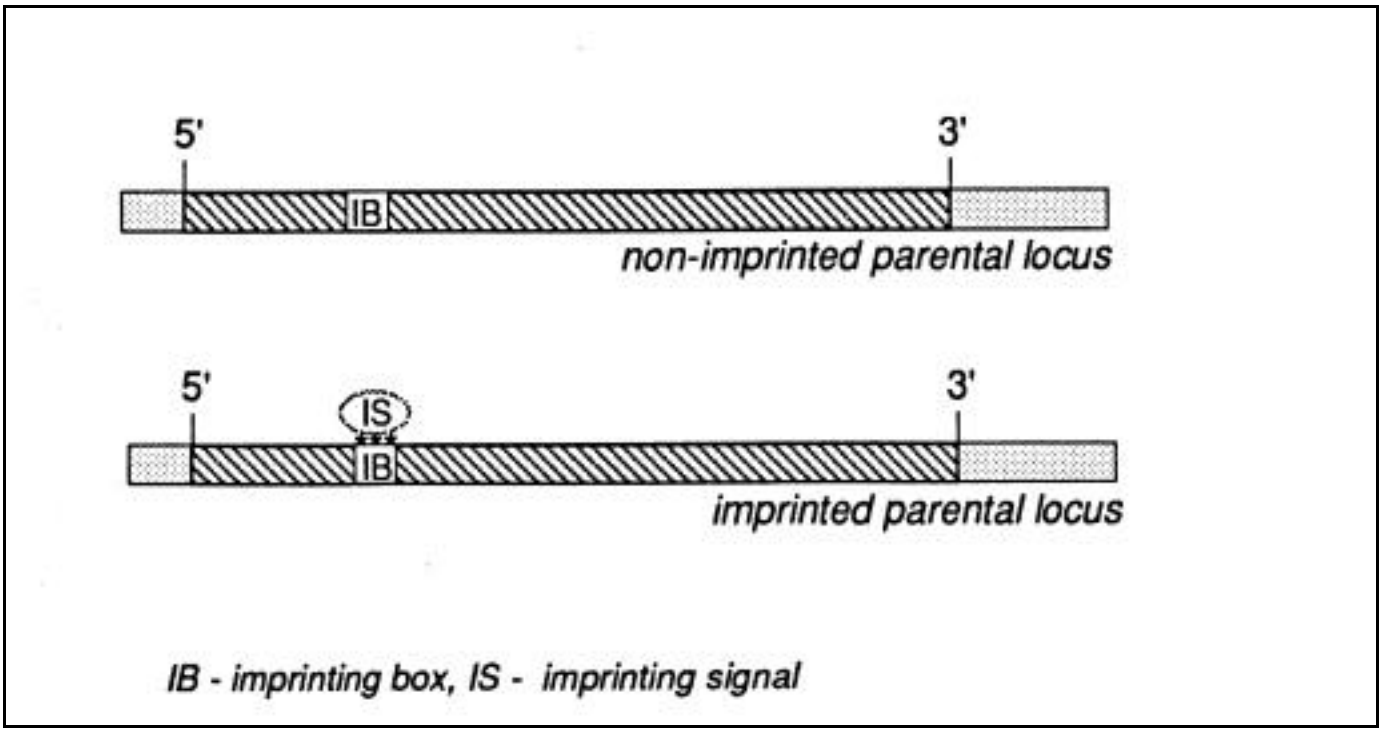

Figure 1: The biological process of imprinting

The maternal and paternal alleles of an imprinted gene contain imprinting boxes, but only one parental allele inherits an imprinting signal from the gamete and is the “imprinted” allele. Once the imprinting signal is bound to the imprinting box, the locus is said to be imprinted even if this does not immediately result in a functional difference between the two parental loci. Functional difference only arises when the diploid cell produces regulatory factors sensitive to the presence of absence of the imprinting signal.

Two criteria for the imprinting signal are that it should be restricted to one parental chromosome, and be inherited from one parental gamete.

Hypothesis on Parental Imprinting:

- **The genetic-conflict hypothesis**

  Contents: A gene from one individual will value the reproduction of another individual in proportion to the probability that this individual carries a copy of gene direct descent from a common ancestor (Hamilton, 1964). The maternal and paternal genes of the first individual may have different probabilities of being present in the second individual. These different values become a source of conflict when the expression of genes in the first individual benefits the first individual at cost to the second, or vice versa. In this case, maternal and paternal alleles can be selected to have different patterns of expression (Haig, 1992).

Prediction of genetic-conflict hypothesis: imprinting will primarily affect genes that influence the cost of an offspring to its mother, and that the effects of paternally expressed genes will increase the cost of an offspring whereas the effects of maternally expressed genes will decrease the cost. This prediction is strongly supported by the reciprocal imprinting of Insulin-like Grow Factor-II and IGF2r in mouse.

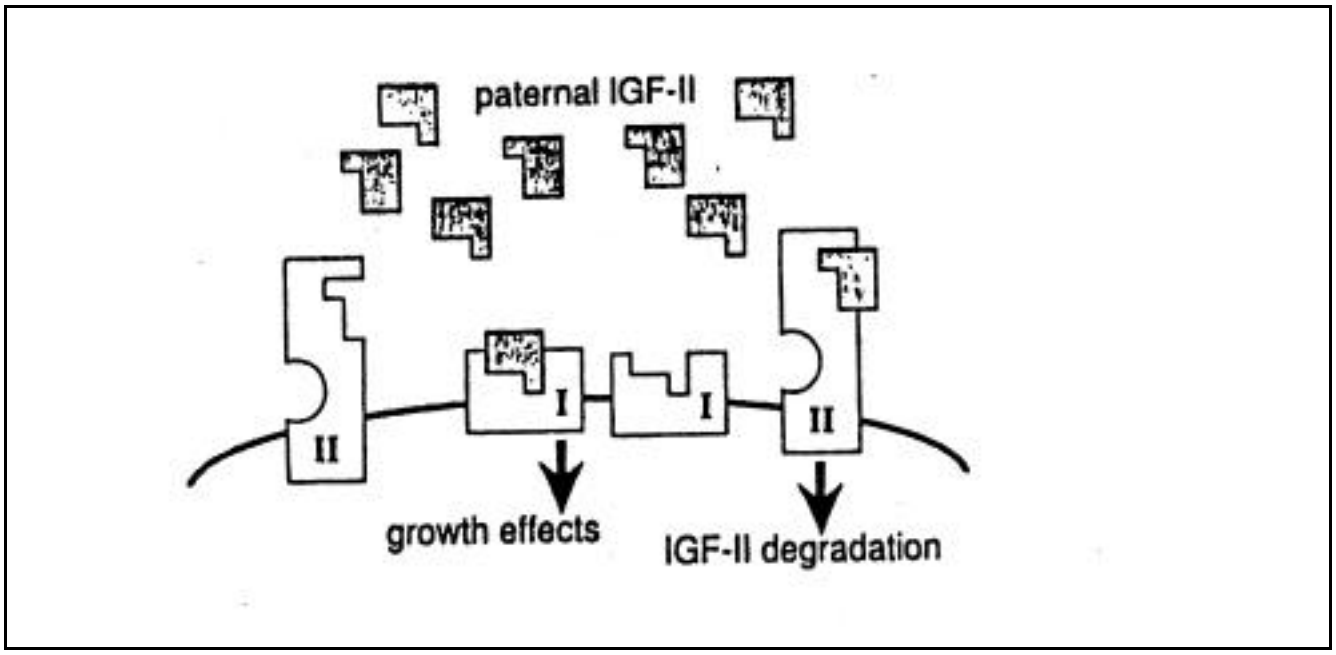

Figure 2: the reciprocal imprinting of Insulin-like Grow Factor-II and IGF2r

Deficits of this hypothesis: 1) The hypothesis has little to say about the mechanism of imprinting. 2) The similar ecological phenomena may base on totally different biological mechanisms.

Other hypothesis

❖ **Prevention of parthenogenesis (Solter, 1988):**

Parental imprinting eliminates the possibility of parthenogenetic reproduction.

Evidence: Mouse embryos without a paternal genome do not complete development.

❖ **Placentation (Hall, 1990):**

Imprinting is a consequence of the evolution of placentation because mammalian mothers have to tolerate the implantation of a foreign conceptus while restraining its growth (The placenta is the structure through which an embryo obtains nutrients from its mother).

❖ **Dominance modification (Sapienza, 1989):**

Imprinting is a consequence of a process of dominance modification; i.e., imprinting is selected against because functional hemizygosity at imprinted loci exposes loss-of-function mutants to selection.

❖ **Host defense (Barlow, 1993):**

Imprinting may have evolved in mammalian oocytes as an extension of the host defense role of DNA methylation.

❖ **Gene regulation**

The function of imprinting is to regulate gene expression and embryonic development.

Question for further discussion:

- What's the function (effects that are beneficial) and side-effect (effects that are neutral or harmful) of gene with imprinting?
- How can a purposeless process (natural selection) produce purposeful structures and function (adaptation) in the example of imprinting?
- How can creature implicitly or explicitly "know" the probability of its gene distribution?

Recorded by Liu, Jia

David Haig

THE EVOLUTION OF GENOMIC IMPRINTING

0. Abstract

Mothers and fathers pass their chromosomes to their offspring in pairs, one from the mother and one from the father. Most of the time the two genes are equally active. But a few genes, the imprinted ones, are different. They carry a biochemical label revealing their parental origin and the chemistry of the fetus decides which one will be turned on. A “battle of the sexes theory”, also called “evolutionary theory of genomic imprinting” or “genetic-conflict theory”, proposed by Harvard biologist David Haig, suggests mothers and fathers have different strategies for ensuring the future success of their offspring. In its simplest form, the expression of paternal alleles increases the cost of the offspring to its mother whereas the expression of maternal alleles reduces the cost to the mother. Furthermore, in its more general form the theory applies to all interactions among relatives that have different maternal and paternal coefficients of relatedness (as may arise from differential dispersal of the sexes).

1. Non-adaptive and adaptive explanation on decision-making

1) Problems on decision-making:

· Why do we find it hard to make decision?

· Why do our internal rewards and punishments have multiple currencies?

2) Basic assumption on decision-making:

- Decision-making is decentralized;
- Decision units have limited information;
- Decision units have simple outputs;
- Outputs integrate inputs from multiple sources;
- There may be ambiguity about source of inputs.

3) Non-adaptive explanation

Internal conflict is a maladaptive outcome of massively parallel processing.

Arrow's Impossibility Theorem (Arrow, 1952): There is NO consistent method of making a fair choice among three or more candidates. This remarkable result assures us that there is no single election procedure that can always fairly decide the outcome of an election that involves more than two candidates or alternatives.

The difficulty of decision-making is due to that one can hardly aggregate the preferences of the many members of society, and that problem will be exacerbated if one is unable to make interpersonal comparisons. Similarly, neurons may have different preference over alternatives because they have different information.

4) Adaptive explanation

Is the adversarial system of justice superior to the inquisitorial system? Or, constant debate (advocacy) may be the most efficient way to change one's mind as circumstance changes. However, the most attractive explanation is from "exchange rates" hypothesis lent from sociology and economy. That is, different currencies allow "exchange rates" to be adjusted by experience (guilt, fear, lust):

	Gr ee n	G u i	F e a

		I t	r
U t i l i t y (1)	X_1	Y 1	Z 1
U t i l i t y (2)	X_2	Y 2	Z 2

Choose (1) if Utility (1) is greater than Utility (2)

$$\text{Utility (1)} = \alpha X_1 - \beta Y_1 - \gamma Z_1$$

$$\text{Utility (2)} = \alpha X_2 - \beta Y_2 - \gamma Z_2$$

where α, β, γ are adjustable exchange rates.

Hamilton's rule (Hamilton, 1964): If an altruistic act has cost C to the donor and benefit B to recipient, the act increases the donor's inclusive fitness:

$$\gamma B > C$$

where γ means “coefficient of relatedness” (roughly, the probability that a gene in the donor is present in recipient). However, relatives often have different degree of maternal and paternal relatedness.

2. Evolution of genomic imprinting

Similar to the mental-conflicts of decision-making, a conflict between the interests of the maternal and paternal genes within an embryo does exist.

The term genomic imprinting has been used to refer to all cases where genes have differential expression depending on the sex of the parent from which they are inherited. Haig’s lecture presents a selective process that can explain the evolution of imprinting in mammals but does not address the underlying molecular mechanism.

Consider the relationship between a pregnant mouse and her litter. The more resources an embryo acquires from its mother, her larger it is at birth, and the more likely it is to survive and reproduce. However, the greater the nutrient demand of the pregnancy, the greater the cost to the mother’s potential future reproduction. This creates a conflict between the interests of the maternal and paternal genes within an embryo because the mother’s future offspring will sometimes have a different father. A similar argument applies if there is mixed paternity within litters.

Based on this adaptive model, the prediction is very clear. If a locus has preferential paternal expression it will function to increase the nutrient demands on the mother; preferential maternal expression reduces those demands. To support this prediction, Haig mainly provided three examples:

- **The reciprocal imprinting of Insulin-like Grow Factor-II and IGF2r in mouse.**

Mice that inherit a disrupted paternal copy of IGF2 are born small and remain small into adult life. However, mice that inherit a disrupted maternal copy are normal-sized. This evidence suggest that inactivation of the maternal copy of IGF2 was initially favored because this enabled mothers to produce larger numbers of offspring over the course of their reproductive lives.

IGF-II binds to two receptors in mammals. The type 1 receptor is responsible for most of the growth-promoting effects of IGF-II. The type 2 receptor has two binding sites one for mannose 6-phosphate residues the other for IGF-II. The principle function of mannose 6-phosphate receptors is to transport molecules into lysosomes. The maternally produced type 2 receptor can internalize and degrade paternally produced IGF-II in lysosomes before the growth factor can bind to its type 1 receptor.

- **Gynogenetic (2m:0p) versus androgenetic (0m:2p) mouse embryos**

The extraembryonic membranes and embryo of mouse are both derived from the zygote. The extraembryonic membranes of gynogenetic mouse embryos develop poorly, but early development of the embryo itself is more or less normal. However, androgenetic mouse embryos undergo litter embryonic development but have well-developed membranes. Both types of embryos abort. Similarly, human triploid fetuses develop a large placenta if the extra genome is paternal, but have little placental tissue if the extra genome is maternal.

- **Prader-Willi syndrome versus Angelman syndrome**

Several chromosome deletions in humans indicate that the expression of some genes in these regions depends on parental origin. The most striking example is deletion of 15q11-13.

Prader-Willi syndrome: paternal loss

Poor suck, long sleepers, mild mental retardation, and insatiable appetite (after 6 months)

Angelman syndrome: maternal loss

Thrashing tongue movements, short sleep period, severe mental retardation, and inappropriate laugh.

3. Conclusion:

The maternal and paternal genes of the first individual may have different probabilities of being present in the second individual. These different values become a source of conflict when the expression of genes in the first individual benefits the first individual at cost to the second, or vice versa. In this case, maternal and paternal alleles can be selected to have different patterns of expression.

4. Discussion:

Though Professor Haig's talk was very interesting and thoughtful, there is not much discussion based on the genomic imprinting. One reason should be that the facts involve the many details of molecular biology, such as Insulin-like Grow Factor-II and its receptor. To simplify this report, I just included the related discussion in the above.

What we talk about when we talk about play

Cognitive Evolution, April 14, 1999

Steve Most

On April 14, 1999, Boston College professor Peter Gray came to discuss his work and theories of play with the Cognitive Evolution class at Harvard University. Much of the conversation centered around the following five articles, which were assigned by Gray:

Gray, P. (1996). Incorporating evolutionary theory into the teaching of psychology. ***Teaching of Psychology, 23***, 207-214.

Gray, P. (1993, October 31). The freedom to learn. ***The Washington Post***, pp.xx

Gray, P. & Chanoff, D. (1984, May). When play is learning: A school designed for self-directed education. ***Phi Delta Kappan***, 608-611.

Gray, P. & Feldman, J. (1997). Patterns of age mixing and gender mixing among children and adolescents at an ungraded democratic school. ***Merrill-Palmer Quarterly, 43***, 67-86.

Vygotsky, L. S. (1978). The role of play in development. In L. S. Vygotsky, ***Mind in Society***. Cambridge, MA: Harvard University Press. (Original work published 1933.)

Both in class discussion and in subsequent discussion with Peter Gray, several underlying questions and themes emerged.

I. What is "play"?

A. According to Vygotsky (1933), play is <u>not</u> simply an activity that children find pleasurable. First, other, non-play activities give pleasurable feelings that are at least as great (e.g., sucking on a pacifier). Second, sometimes play is not pleasurable (as when children lose in a sporting game). Rather, play is an activity that often involves ***imaginary situations*** and implicit or explicit ***rules***.

B. The question emerged as to whether Vygotsky's definition of play was too narrow.

1. One question that was discussed was whether actions that simply go through the motions of play—whether or not they truly involve imagination, intentions or rules—should also be included under the definition of play.

2. In discussion with Gray, a more satisfying treatment of play emerged: rather than being viewed as a unitary construct or activity, play can be broken down more specifically into at least four different kinds.

a. Physical play, such as rough-and-tumble, chasing, and locomotor play. This type of play is functional and observed early in life.
b. Constructive play, such as building tools, shelters, or pretend objects.
c. Sociodramatic play, in which participants engage in pretend situations and fantasy. In humans, this type of play often emerges at about 2.5 years.
d. Games with formal rules. This kind of play involves games like chess, in which a set of explicit rules is followed.

3. Gray also stated that while he agrees with Vygotsky that imaginary situations and rules are common components of play, he believes the most important defining characteristic to be the intrinsic motivation involved in play. In play, the "means are more important than the ends." For example, one often embarks on a fishing trip for the purpose of obtaining food. Yet, one would not be satisfied—and in fact would be disappointed—if someone were to approach them and just give them some fish when they got to the stream.

II. Vygotsky explicitly states that "play is imagination without action" and that "imagination… is not present in the consciousness of the very young child, is totally absent in animals, and represents a specifically human form of conscious activity." This sparked much discussion of whether Vygotsky was justified in ruling out the possibility of play in non-human animals.

A. Once again, this issue depends on how one defines play. However, even Gray fell into the trap of neglecting to specify kinds of play. In answer to the question of who plays, Gray sketched out the outline, "humans>apes>monkeys>non-primates." Yet, he neglected to specify the kinds of play he was referring to. Similarly, he stated that children play more than adolescents, who in turn play more than adults. Yet, he failed to specify kinds of play.

B. In addition, class participants described personal observations and examples in the literature in which non-human animals appeared to engage in different kinds of play. In a couple of examples, the animals' behaviors even seemed to rely on imagination.

1. Panksepp has observed rough-and-tumble play in rats.
2. Polar bears have been observed to climb to tops of ice-slopes and slide down, only to climb back up to do it again.
3. Even more strikingly, a chimpanzee was observed to carry around a log as if it were an infant, even to the point that it built a nest for the log.
4. Regarding the involvement of rules in play, it was noted that non-human animals often behave in accordance with social rules (e.g.,

territoriality, dominance hierarchy), but that this does not mean that they are aware of the rules.

5. Interestingly, play is less often observed in adult animals than in young animals, but at all ages play activity increases around the presence of food. This is possibly because food tends to bring together large groups who otherwise might not socialize together often. It was noted that food often serves a similar function among humans.

C. It was agreed that there is great difficulty involved in trying to identify play activity in non-human animals, especially when one defines it in terms of motivation or imagination. This difficulty is less of an issue when one defines play in terms of its functionality.

III. What is the function of play?

A. The question arose as to whether play really needs to be functional at all. It was suggested that while some types of play might indeed be functional, it was possible that non-functional play could exist in animals as well.

B. Vygotsky believed that play allows children to figure out rules involved in social roles, to disengage meanings and motives from immediate perception, to develop self-control by demanding that they confront conflict between rules of the game and otherwise spontaneous action, and to disengage meanings and motives from actions.

C. Another idea that was discussed was that play could be functional even when the behavior's immediate goal was merely pleasure. For instance, a polar bear that enjoys climbing ice-slopes and sliding down them may only do so for physical pleasure. However, in the process the bear may be honing balance and motor skills needed to catch seals and other food.

D. Gray believes that play serves a biologically based need for education.

1. Natural selection has equipped animals not with full-blown instincts, but with tendencies towards certain species-specific behaviors that need to be practiced. This practice takes the form of play.
2. Evidence that play provides practice for species-specific behavior is that predatory animals and prey animals tend to engage in different play styles. For example, lion cubs tend to play at stalking and chasing while young herbivores tend to engage in play involving fleeing and dodging.
3. Furthermore, in monkeys play is often characterized by actions and skills that are important for monkeys' survival. These actions include leaping, dropping, suspending, climbing, bipedalism, and even deliberate falling from trees.

4. To Gray, the universality of play and its function of honing survival skills suggests a biological basis to it. In addition, there are certain characteristics of play that are extremely widespread, if not universal.
    a. Traits often involved in play include curiosity, drive for competence, modeling, and fantasy
    b. Curiosity and modeling, at the very least, are demonstrated in other animal species besides humans. One question that emerged was: what about the drive for competence and fantasy? One suggestion was that among bower birds the practicing of mating "struts" could reflect a desire for competence. However, a distinction was drawn between practicing a skill and demonstrating a <u>desire</u> for competence. A brief discussion followed, in which class participants tried to think of ways one might demonstrate a desire for competence in non-human animals. One hypothetical suggestion was that an experimenter could set up a situation in which he or she was able to control the speed with which an animal gained competence in a species-specific skill. Then one could gauge how degree of achieved competence affected the amount of practice in which the animal engaged.

E. The question arose as to whether play truly is adaptive. For instance, neither animals nor humans require play-experience to work their ways into their communities. It was suggested that it would be interesting to set up a situation in which the behavior and social functioning of animals that did have play-experience could be compared to those who did not.

IV. How does play serve an educative function in humans? Gray believes that play in hunter-gatherer groups and at the Sudbury Valley School provides a model by which to understand how play can serve educative needs.

A. While there is minimal explicit teaching on the part of adults, children learn through participation in community's activities (economic, political, and ceremonial)

B. Playmates tend to be of various ages, which has many benefits.
    1. Children have a "zone of proximal development.
    2. The range of activities in which children can take part increases. For example, younger children can take part in activities that ordinarily would be too daring without the help of older children. Meanwhile, older children can feel free to take part in more "childlike" activities without feeling embarrassed. This also gives them the opportunity to practice nurturing younger children.
    3. Children who are behind their peers in terms of social or academic skills can find equals in their community.
    4. Reduces the potential of becoming a social isolate. For example, there are no social isolates (as far as Gray and

Feldman observed) at the Sudbury Valley School. This finding mirrors observations by Suomi and Harlow that socially inept monkeys are better able to develop social skills when interacting with younger monkeys.

5. Age-mixed play is less competitive than age-segregated play, since there would be no point in trying to outdo someone who is younger and less capable than one's self. It also allows for more practice with complementary roles rather than reciprocal roles. For example, children are more likely to have the opportunity to play both teaching and learning roles, as well as caregiving/caregetting and leading/following roles.
6. Gray stated that people writing from an evolutionary perspective often focus on aspects like status and competition. However, from an evolutionary standpoint, children were never segregated by age—they always had older and younger children around.
    a. Hauser pointed out that in primate groups, however, reproductive cycles often coincide, thus leading to large groups of same-age children.
    b. However, Gray pointed out that this did not necessarily mean that the monkeys segregated themselves by age.

Helen Tager-Flusberg & Kate Sullivan (1999)

Are children with Williams Syndrome spared in theory of mind?

Synopsis of Reading

Some researchers have argued that Williams Syndrome (WMS) children are spared in acquisition of theory of mind. This claim is based on the fact that WMS children have relatively good language skills, excellent face processing abilities, and strong social interest. Furthermore, work by Karmiloff-Smith and others on older WMS subjects suggests that they can successfully pass at least first-order theory of mind (TOM) tests. In three experiments comparing WMS children to age-, IQ-, and language-matched children with Prader-Willi (PWS) syndrome and children with non-specific mental retardation (MRU), Tager-Flusberg & Sullivan found that WMS children exhibit similar performance to the controls. Rather than using their results to disconfirm the original hypothesis, the authors argue for a theoretical split between social-cognitive and social-affective components of a theory of mind.

Preliminary Discussion

* Implications for evolutionary psychology are not clear, and the data presented in the paper are not directly relevant.
* Given different populations of children with characteristic mosaics of deficit and function, what could a general category like mental age mean?
* In Experiment 3, the experimenter labels 4 photographs of an individual as happy, sad, angry, and scared. The children then have to sort photographs of new individuals into the four piles. Does this experiment tap "emotion matching"? If so, then this result undercuts the authors' claim that the social-affective component of TOM is spared in WMS individuals.
* Although the authors claim that "the data from WMS research suggests that this syndrome involves selective sparing only in the latter [i.e., social-affective] component", what their data actually suggest is that WMS individuals are not spared in standard TOM tests relative to control groups. The citations they use to support the former claim consist of one study with adults (suspect for the reasons they adduce in their Introduction), one unpublished study they wrote, and two book chapters on face processing (which were presumably not peer reviewed). Rather than attempting to extend the model the authors propose, we should probably reserve judgment until we have some evidence for it.

Tager-Flusberg (T-F) Presentation

* Developmental perspective
  - o TOM/mindreading has evolutionary significance: it is adaptive for interactions in a socially complex world
  - o involves a metarepresentational capacity
  - o dissociable from other kinds of representational systems
* Cognitive development

    - Little emphasis on a componential analysis of TOM
    - emphasis on false belief
* Developmental cognitive neuroscience
    - neurodevelopmental disorders as "experiments in nature"
    - focus on individuals
    - insight into underlying genetic and neurobiological substrate
* Autism
    - complex genetic disorder
    - limbic system and medial temporal lobe impairments (among others; these are interesting for T-F)
    - some autistic people can pass false belief tasks; linked to acquisition of sentential complements like "John thought that X", where X is an embedded proposition
* Williams Syndrome
    - mirror image of autism?
    - Karmiloff-Smith: sparing of false beliefs; problems with her studies: older subjects, lack of age- and language-matched control groups, used real people instead of dolls in experimental manipulations
* T-F, Boshart, Baron-Cohen study (J Cog Neuro 1998)
    - WMS comparable to normals, and significantly better than PWS on Eyes task
* Empathy study
    - Experimenter bangs knee and feigns distress, while ostensibly doing something else. Autistic children walk away, and PWS children laugh or withdraw. WMS children comfort, help, observe.
* Componential model of TOM
    - Cognitive/Linguistic: mental reasoning, develops in preschool, tied to language and other cognitive systems, not spared in autism or WMS, (speculation) orbito-frontal cortex
    - Person/Affective: mental perception, develops in infancy, core domain, impaired in autism but spared in WMS, (speculation) amygdala/medial temporal cortex
* Implications for evolution
    - core domain
    - ability to perceive mind in self and others
    - view people as intentional and affective
    - important for regulation of social interaction
    - foundation for complex social reasoning

Questions and Answers

* Q: Since the experimenter has to present the pictures of eyes to WMS subjects (because WMS people won't do computer based experiments) and since WMS people are very socially interested, can we rule out a Clever Hans kind of explanation?
  A: Can't rule it out, but don't think it is likely.
* Q: Experiment 3 seems like an emotional perception task, whereas the banging-the-knee results seem like they could be explained as responses, rather than perceptions.
  A: Experiment 3 hangs with language, rather than with emotion. Subjects can't respond to the knee banging in a rote way, but have to perceive the event.
* Q: Could WMS subjects be aware of strategic use of emotions, deception, and so on?
  A: That would involve complex reasoning, which they can't do.
* Q: Can WMS distinguish shame smile from happy smile?

A: Don't know.

* Q: Cross-cultural work? Reports of Quechua children failing false belief tasks; no verb for 'to believe', but something like 'to assent to' instead.
  A: Failure of the experimenter's imagination. Think of some other way to test it, and it will show up.
* Q: Can evolution cause you to change your work, rather than just supporting something you already thought up?

Dan Weiss
Psych 2250
April 21, 1999

Functional Neuroimaging of Human Visua Recognition

Kanwisher, Downing, Epstein & Kourtzi

I. Review of the Paper

Part 1. Introduction

3. A question about the organization of visual recognition: Are different kinds of visual stimuli recognized in the same basic way or are there different algorithms involved for recognition of different classes of stimuli such as faces, objects and words.

4. Evidence for modular structure of visual recognition.

5. Basic model: Early Vision (features, edges, contour)– Shape Analysis – Matching to stored visual descriptions – Accessing Semantic/ Conceptual Representations

Evidence for these different stages comes from various neuropsychological sources:
Apperceptive agnosia – fail to recognize objects because they cannot represent shape.
HJA – cannot discriminate real familiar objects from possible but nonexistant objects. Very good at drawing objects from memory though.
Optic aphasia – can match to stored descriptions, but cannot provide any information at all about objects that have been correctly classified as real.

a. Evidence for Category-Specific Mechanisms for Visual Recognition
a. Prosopagnosia seems to be selective for faces.
b. Agnosia for objects without impairment of face processing.
c. Alexia – impairment for word recognition. Note: this impairment may have particular significance because reading has arisen very recently so it is unlikely to be innately specified.
d. Topographic agnosia – patients unable to recognize previously familiar places.
e. Other dissociations may include animate/inanimate

There is some dispute as to the meaning of these dissociations. Warrington and Shallice (1984) have suggested that the differences may be due to the types of experiences we have with the different categories (e.g., animals are usually seen whereas artifacts may be directly manipulated).

Part II. The modular structure of visual recognition – evidence from functional brain imaging.

This section focuses on contributions of functional brain imaging studies to our understanding about regions of the ventral pathway that may be specialized for different categories of visual stimuli.

a. Lateral occipital complex (LO) responds more strongly to stimuli depicting shapes than stimuli with similar low-level features that do not depict shapes.
b. Fusiform face area (FFA) – seems to be selectively involved in the perception of faces (though not exclusively).

1. So what exactly does FFA do with faces?
face recognition vs. face detection – Inverted faces, normally more difficult to process, do not show any reduction in activity. Likewise edge maps (line drawings) of faces disrupt recognition of faces but still has strong FFA response. This is evidence for face detection. However, could be both.

e. Could expertise plus within-category discriminations activate FFA? This

remains a possibility, though studies with words, human hands, the backs of heads and bodies without heads may cast some doubt on this theory.

f. FFA and prosopagnosia – hard to tell whether prosopagnosia occurs because of damage to the FFA. Functional scans on prosopagnosic patients with no damage visible on anatomical scans showed no FFA. However, some normal subjects lack FFA as well.

c. Parahippocamal Place Area (PPA) – Fortuitous finding. PPA showed much greater activation for scenes than either faces or objects.

3. PPA response seems to be driven by information about the layout of local space. Generally responds more strongly to buildings than to other objects, though not as strongly as it does to full scenes.
4. Imaging studies suggest that PPA activity does not covary with either successful or attempted place recognition.
5. May play a role in memory encoding, but this is not clear.

d. Animals and Tools – There may be an area in the left medial occipital lobe that is more responsive to animals.

e. Biological Motion – Patients with impaired motion processing can still identify biological motions from point-light displays.

f. Perception of letters and words – Possible region of extrastriate cortex responsible for recognizing words and pseudowords, though this is still subject to debate. In general, it seems that there is little consensus on the presence of specialized regions of cortex dedicated to visual recognition of letters and/or words. As mentioned earlier, this subject is particularly interesting in its evolutionary implications.

Part III. Current Issues

A. Implications for Visual Recognition

What are the implications of modularity? Does the selectivity of different stimulus classes imply that distinct processing mechanisms are involved?
An alternative hypothesis suggests that visual cortex contains a large number of stimulus-selective regions but that the underlying computations of each region are similar. In support of this hypothesis, a recent study found a region of extrastriate cortex that responded more strongly to chairs (a pretty arbitrary category)than faces or houses.

d. Origins of Cortical Specialization – Does the modular organization of visual recognition arise from experience-dependent self-organizing properties of cortex or are the specializations innately specified? Hard to answer since both are plausible.

An alternative view is that cortical specialization will arise only for perceptual tasks which have been of longstanding importance over evolutionary time. Example of Pinker's modules based on evolutionary considerations (e.g., dominance, love, relatives, etc.).

C. Can fMRI inform cognition?

1. Discovering functional components – Imaging studies can inform whether two mental processes are distinct or share underlying mechanisms. Also can inform about basic components and what each of them does.
2. Pinpointing the stage of processing at which a particular phenomenon occurs – identifying at what stage of processing a mental process occurs.
3. Using fMRI signals as markers for particular processes – using differential response in a selective region of cortex to preferred vs. non-preferred stimuli along the lines of single unit recordings.

6. Summary of discussion before speaker

The discussion that occurred before the speaker started with a brief review of Kanwisher's paper (see above). The presenter then brought up the importance of establishing that the cortical specializations were in fact not an epiphenomenon of how the brain self-organizes. One study brought up in the paper (Ishai et al., 1997) reported finding an area that responded more strongly to chairs (an arbitrary category) than to faces or houses. This is troubling for those who would like to claim that the specialized areas are

important in that they reflect distinct processing mechanisms. This point was addressed by Kanwisher in her talk (see below).

The second part of the discussion focused on the question of what is sufficient evidence to show that something is innate. One student suggested that innate areas in the brain should be more fixed in location. After extended discussion, the group decided that this was not necessarily the case. In fact, fixedness may arise because of common environmental factors.

The group concluded that converging evidence from different sources may be the best approach to establishing innateness (though even this may not be definitive). The types of evidence mentioned included: universality of a trait, perhaps seeing a fixed location in the brain, timing cues (e.g., trait is evident right after birth. Note that even this has problem because the fetus gets sensory input). In addition, we should be able to make specific predictions about which species should have the brain area (e.g., one could predict that bats would not have a face area, at least those species that rely on echolocation).

7. Kanwisher Presentation

Kanwisher started her talk by defining modularity as “somewhat distinct functionally dissociable units”. Hauser posed the question of whether modularity is synonymous with domain specificity. Kanwisher proposed that “the crux of modularity is domain specificity”. Kanwisher that modularity is a good place to start investigating in order to understand a system. Further, modularity has interesting evolutionary implications.

In addition to presenting some of the material from the paper on FFA, Kanwisher also presented a recent study that showed that there was no difference in FFA activation when subjects are shown the same four faces over and over versus new faces every time. This is further evidence that FFA is not involved in face recognition alone.

One question was raised during the talk about why the FFA did not show high levels of activation when subjects are presented with schematic faces (see Figure 4 in the paper). This is particularly troublesome given the postulation that the FFA is involved in face detection. Kanwisher admitted that this finding was troublesome. She pointed out that there was greater activation for edge map faces (which are difficult to recognize). This was promising in that the FFA was at least able to produce large responses to impoverished stimuli.

Some of the new material presented included an experiment that begins to ask the question of whether the categories are formed through experience or whether evolutionary origins might underlie the types of categories formed. The experiment consisted of showing subjects eight different classes of stimuli. Some categories had evolutionary relevance (e.g., food) while some did not (e.g., chairs). The findings replicated previous findings for the FFA and PPA. None of the other categories produced activation in a fixed location (though food and animals came close). Kanwisher pointed out that the activation for the proposed area seemed to far toward the back of the head (indicative of early processing) and this did not make sense. Chairs did not have a category in contrast to the Ishai et al. (1997) study.

Finally, a question was asked about whether the fact that there are no brain-damage patients with selective impairments for the chair category is sufficient evidence that the basis for these categories is

evolutionary. Kanwisher replied that in a perfect world that would be the case. However, she pointed out that neuropsychologists do not check for deficits in arbitrary categories such as chairs and thus it was necessary to test for them.

8. Post-talk Questions

The first question was whether we could use functional imaging to ask evolutionary questions a priori rather than doing the studies and then ascribing evolutionary relevance afterward. The example of tools was brought up. We may predict areas of the brain dedicated to processing information related to tools in humans and possibly chimpanzees, but not New World monkeys. Kanwisher responded that she was planning on doing a tool condition, but there was question about what types of tools should be shown. The group reached a consensus that a tool area should be adapted for current implementations such that modern tools could be used in the study.

Another category that was considered was snakes. Previous research with primates (e.g., Sue Mineka's research with rhesus monkeys) has provided some evidence that there may be some innate predispositions to fear snakes (even though experience is necessary).

The discussion then turned to the relationship between prosopagnosia and the FFA. It turns out that the coils are placed in the back of the head, and thus the high resolution scanning is restricted to the back portion of the head. So, it is difficult to determine areas that may be affected in the front of the brain. Still Kanwisher looked at some prosopagnosics that had shown no damage in anatomical scans. She found that there was no FFA in those patients. However, some normals do not have an FFA (about 10% of subjects). This led to questions about the implications of not finding a FFA in such a large percentage of the population. Kanwisher explained that she thought that this was perhaps an artifact of the scanning procedure. She is planning on rescanning some of these subjects to determine whether they have a FFA. Still, Kanwisher felt that it wouldn't be problematic if no FFA was found in 10% of the population because the processing may just be more dispersed. Some people may have broader circuits. Regardless, if it is found that these people do not have FFAs then behavioral studies would be essential.

Towards the end of the discussion a student asked about the possibility that there are differences in processing live faces versus two dimensional representations of faces. Kanwisher doubted that this would matter. However, she did suggest that static versus active might be important. Thus, using a video tape of a face instead of still pictures might be interesting.

A question was asked about whether there may be differences in processing familiar versus unfamiliar faces. Kanwisher admitted that this was an interesting question. However, because it is confounded with attention (it is more interesting to look at faces of known individuals), it would be difficult to test.

Finally, Kanwisher pointed out that there is evidence from mapping epilepsy patients with electrodes that there may be small areas in the frontal lobe that respond selectively to faces. These areas would not be picked up on a scanner because they are too small.

The following is a report on memes by Amy Wiseman and Juliana Pare-Blagoev concerning issues and discussion from class with Susan Blackmore and Dan Dennett on 4/28/99. The first 3 pages (excluding this page) is what was distributed in class to promote discussion, page 4 is a poem by Juliana, pages 5-16 is the meme paper and pages 17-20 is a transcription of much of the classroom discussion in outline form. (We weren't sure if you'd want to include our outline in what is distributed to everyone or not, but not all of it could make it into the paper).

Vocabulary/nuts and bolts issues

- What is a meme? Is the concept behind the word "what" a meme? Is a physical law, such as $E=mc^2$ a meme? Is the scientific method a meta-meme? How about religious thought? Once I stop thinking something, is it still a meme? Is an unthunk (thank you, Dr. Seuss) thought a meme?
- Blackmore writes: (pg. 6) "Only when an idea, behavior or skill is passed on by imitation does it count as a meme".
- What does she mean by imitate?
- Does she mean conscious imitation, because animals imitate their parents even if this imitation appears to be predicated on instinct instead of conscious choice.
- We actually do more than imitate in this non-conscious sense; we innovate. Sometimes not imitating is better.
- Although Dennett introduces the concept of meta-meme, Blackmore's argument about imitation drove us to ask: Is the algorithm "do the opposite of what my parents want" a meta-meme?
- What exactly is the genotype/phenotype distinction of memes? (pg. 3. Dennett, 1998). What does he mean, "a meme is an information-packet with attitude"? (pg. 2, Dennett, 1998)
  - Can something without physicality be a unit of replication?

Mixed memetic metaphors:

b. First, memes are like individual genes in that they are replicators
c. Then they are like viruses in that they have a tight relationship between phenotype and genotype
d. Then they are like symbionts in that they invade a human and can be classified into one of three fundamental categories: parasites, commensals, or mutualists.

f. Switching from metaphor to metaphor allows the author to switch between which characteristics of the source (e.g. gene, virus, or symbiont) are “necessary” for memes to be proven to exist. Metaphors are slippery slopes.

Framework for Discussing the Broad Issues:

6. What are questions that a science of memetics would try to answer, and what are competing theories that try to answer the same question memetics purports to answer?
7. What is the practical value of pursuing such a science (regardless of whether it turns out that memes are a metaphor, are an actual something, or that it can’t be established which is true).
8. Can memetics be a science--does it present testable hypotheses?

Memetics Question One:

Cultures evolve (i.e. change over time) - what patterns are there to this evolution?

- Dennett describes the traditional - rational actors model vs. the non-traditional - Meme model
- Could social psychology provide another competing model and are there still others? Are we dependent on memes for explanation?
- Do memes challenge the notion that culture is ultimately constrained by genetic factors? Is a really long leash a la E. O. Wilson the same thing as not being constrained?
- What would the time course of memetic evolution be?

Memetics Question Two:

Why do we do things that have no obvious evolutionary benefit? or that are detrimental in terms of the continuation of our genes?

9. Memetics suggests if you can’t identify the advantage to the organism for a given behavior (music, religion) consider that an “outside” force is influencing the organism and that “outside” force is benefiting from the organism’s behavior. (e.g. ant parasitized by the fluke; humans parasitized by the meme).
10. Is the explanation of music (or other behavior that has no obvious evolutionary benefit) which relies on memes more satisfying than one that considers music to be a byproduct of evolution? Are attempts to look for an evolutionary explanation for all behaviors worthwhile? Can't some behaviors (even very complex ones) be spandrels?

Memetics Question Three:

What is the relationship between memes and consciousness?

11. How literally does Dennett mean the statement “And whether or not in the long run (millions of years) this infestation will be viewed as mutualism or commensalism or parasitism, in the short run (the last few millennia) the results have been spectacular: the creation of a new biological type of entity: a person.” ? (pg. 6 of Dennett, Oct. 1998).
    12. i.e. does consciousness rely on memes? (see also our questions below about memes in the non-human animal world).
    13. Does Dennett mean that ideas/memes/information-packets with attitudes created people or that people created them? Does he postulate that they both spontaneously generated each other?
    14. Could memes exist without people?
15. Blackmore (pg. 2) writes that Dawkins agreed “we got our brains for biological (genetic) reasons but now [that] we have them a new replicator has been unleashed and it need not be subservient to the old. In other words, memetic evolution can now proceed without regard to its effects on the genes.” Blackmore later assumes a distinction between the brains we got for biological (genetic) reasons and the minds we have for memetic reasons. "If memetics is true then the memes have created human minds and culture just as surely as the genes have created human bodies.” (pg. 3).
    16. Does her distinction between brains (developed from genetically driven natural selection) and minds (created by memes) contradict itself?

Questions Blackmore believes memetics answers:
Given the brain's high energy consumption in relation to its size, and the danger a large cranium poses during childbirth, Blackmore asks: "Why are our brains so big?"

g. She proposes that theories which rely on genetic advantage need an alternative "based on memetic advantage" (pg. 8). Once hominids gained the ability to imitate and develop simple language (both through biological reasons) a second replicator was born - memes. Now because of sexual selection, the hominids who make better meme hosts (i.e. those with big brains) are favored in this change of selection pressures. In this analysis, memes are changing the selection criteria for genetic fitness and the memes are driving the physical (genetic) evolution of hominids and ultimately humans.

g. Why does this theory have more weight than one which ultimately appeals to genes? What is lacking in the gene-based theories which requires the existence of a second replicator to adequately explain differences in human and animal neurophysiology and function?

6. In the fuzzy space between the ability to imitate and the birth of the second replicator, what exists? Were memes "there" all along? In what sense were they "born".

e. Blackmore seems to argue that for biological reasons we got brains that were significantly different from animal brains (i.e. giving us the ability to imitate, the ability to speak) but that the biological/genetic forces would not for some reason be adequate to explain our further development.

<u>Questions about the memes in the non-human animal world:</u>

a. Do other animals have memes? If not, why not?
b. In the way that memes are defined (i.e. by imitation [Blackmore] or information-packets [Dennett]) it is unclear whether animals have them.
c. Blackmore: "only when an idea, behavior or skill is passed on by imitation does it count as a meme" (pg. 6) --When a parrot imitates the behavior "Polly wanna cracker" is that a meme?
d. Dennett: "a meme is an information-packet with attitude"? (pg. 2, 1998) Is remembering where your nut or seed is buried an information packet with attitude?
e. It seems that consciousness, not memes, is the gap between other animals and us. If animals do have memes, then how could memes give us consciousness (preferentially) as Dennett suggests? We just have awareness or our memes--and so what?

To scream! The impossible meme…

With apologies to Gilbert, Sullivan and the rest of the Pirates of Penzance
With apologies to Cervantes, and the rest of the Men of La Mancha

Juliana Paré-Blagoev

THE ORIGINAL
(plus the typos fresh from the web-site for the Pirates of Penzance)

I am the very model of the modern Major-General.
I've information vegetable, animal, and mineral!
I know the kinds of England,
and I quote the fights historical -
from Marathon to Waterloo in order categorical.

I very well acquainted to with matters mathematical.
I understand equations,
both the simple and quadratical.
About binomeal theorum I am teaming with a lot of news!
With many cheerful facts about the square of the hypoteneuse.

THE MODEL	THE LATEST MEME
There's anitmony, arsenic, aluminum, selenium	I am the very model of a modern replicable meme
And hydrogen and oxygen and nitrogen and rhenium	I've melody and rhythm and a very snappy rhyming scheme.
And nickel, neodymium, neptunium, germanium	I might not help the host who's mind released me from her brainy brine
Europium sirconium, lutetium, vanadium	But if I do the chances are her grade might raise a tiny mite
And lanthanum and osmium and astatine and radium	And though you'll do your best to keep me out you can't successfully fight
and gold and protactinium and indium and gallium	the nasty nature of this meme that circles round and makes you scream
And iodine and thorium and thulium and thallium	It stays with you indelibly, not caring for fidelity.

SETTING THE STAGE: DAWKINS AND THE SELFISH GENE

In The Selfish Gene, Richard Dawkins set forth his insight that evolution is driven by selective forces on genes, not organisms. At the end of the book, as described by Susan Blackmore,

> [Richard Dawkins] suggests that Darwinism is too big a theory to be confined to the narrow context of the gene. So he asks an obvious, if provocative, question. Are there any other replicators on our planet? Yes, he claims. Staring us in the face, though still drifting clumsily about in its primeval soup of culture, is another replicator - a unit of imitation. He gave it the name “meme” (to rhyme with “dream” or “seem”) and as examples suggested “tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches.
>
> In just those few pages he laid the foundations for understanding the evolution of memes. He discussed their propagation by jumping from brain to brain, likened them to parasites infecting a host, treated them as physically realised living structures, and showed how mutually assisting memes will group together just as genes do. He argued that once a new replicator arises it will tend to take over and begin a new kind of evolution. Above all he treated memes as replicators in their own right, chastising those of his colleagues who tended always to go back to “biological advantage” to answer questions about human behavior. Yes, he agreed, we got our brains for biological (genetic) reasons but now that we have them a new replicator has been unleashed and it need not be subservient to the old. In other words, memetic evolution can now proceed without regard to its effects on the genes. (Blackmore, 1997)

INTRODUCING DENNETT AND BLACKMORE

Among the many scholars and writers who have taken up the cause of memetics, are Dan Dennett and Susan Blackmore. Dennett proposes that memes are information packets that collectively make up culture. Building on Richard Dawkin’s insight that evolution is driven by selective forces on genes, not organisms, Dennett argues that the memes themselves can benefit (or not) from cultural evolution and that the cultural information packets (the memes) drive cultural evolution. Dennett intends for the science of memetics to answer the "Who Benefits" question raised when humans do things (for example Stupid Human Tricks) that pose no obvious evolutionary advantage. Dennett makes provoking philosophical claims regarding the nature of human consciousness by suggesting it is ultimately based on an infestation of memes.

Interpreting Dennett’s and Dawkin’s work as well as offering her own approach, Blackmore writes that the science of memetics proposes a unit of replication (the meme). The meme operates under the constraints of the evolutionary algorithm; therefore, it has rules of heritability, exhibits variation, and is shaped by selective forces. Blackmore tries to show how a theory of memetics answers important questions about human nature such as “Who am I?”, Why are our brains so big?” and that old favorite, “Why do we talk so much?”.

GOAL OF THE PAPER

This paper does not provide an extensive review of the theories proposed by Dennett and Blackmore; instead, it focuses on the key issues that emerged from class discussion of the theories. Where

possible and appropriate the differences between their two approaches are highlighted. However, many issues overlap, and it was not always possible to draw clear lines delineating who espoused which arguments. Issues discussed in class and included here are: What is a meme? Can memetics be considered a science? What is the mechanism of meme replication? Are memes unique to humans? What does the artificial selection argument add to memetics? What is the relationship between memetics and cognitive psychology?

WHAT IS A MEME?

One of the key issues emerging from discussion and consideration of the readings was the question of what exactly is a meme? Susan Blackmore offers that a meme is "that which is imitated." This definition does not offer tight criteria for determining whether something is a meme. For example, there are many varieties of an archetypal joke such as the light bulb joke

e.g.:

Question: "How many memeticists does it take to screw in a light bulb?"

Answer: "None, but it takes a whole host of memes."

That light bulb joke is a variation on a general theme, but in writing this variant, what has been imitated? On some level it could be considered to imitate humor very generally, or more specifically, humor at an outsider's expense. Alternatively, each different light bulb joke could be a separate meme. Does it matter for the theory of memetics, that the size and scope of the unit of replication is so variable? Does it matter that this variability contributes to a problem of fidelity? What does a meme have to retain to be the same meme?

For Dan Dennett, a meme is a packet of cultural information. Here again there is no clear line to establish the boundaries of a meme. Functionally, Dennett likens a meme to a symbiont that invades its host and can be helpful, harmful or neutral. He also likens memes to viruses, suggesting they show a tight relationship between genotype and phenotype. None of this allows one to confidently identify a given meme candidate. Still, it is not certain that the lack of a clear definition of a meme is a crushing blow to the idea of memetics. As Pinker pointed out, Darwin correctly developed the theory of evolution without a picture of what the gene was.

However, not having a clean definition as in Darwin's case, differs from not having a narrow definition. On the surface, Blackmore's definition of what made a successful meme (one that is either beneficial to the host or one that 'demands' replication) seemed precise. But when the discussion led to specific examples, and the answer was always "that which is imitated, that which is replicated", it seemed

that the definition of a meme was quite broad. In the realm of music, anything from a four-note jingle to an entire symphony fit the definition as long as it was what was eventually replicated. By defining memes broadly, the definition easily captures the phenomena--it perhaps even captures too much.

CAN MEMETICS BE CONSIDERED A SCIENCE?

Dennett and Blackmore want to use this broad definition to propose a science of memetics. For Dennett, memetics is an explanation of cultural evolution, and for Blackmore, it explains how humans have such large, computationally complex prefrontal cortices. To be a scientific theory, memetics should make testable predictions for future events. Dawkin's theory of the selfish gene, for example, led to testable hypotheses that corroborated his theory. The problem with memes is that what Blackmore and Dennett gain in plausibility with a broad definition they lose in precision. In fact, Blackmore's definition could not provide predictions for what would be replicated if, for example, one listened to a popular rock song. There are so many possibilities of what might be catchy to imitate that catchiness cannot predict what becomes the meme. What becomes a meme can only be determined after the song (or some portion) becomes replicated. Being able to point to an action and terming it an instance of imitation is very different from seeing an act and predicting what about it will be replicated. The classroom example of Hauser "imitating" a student's actions beautifully demonstrated that imitation is a rich activity, requiring a high level of complexity. Seeking a "knock-down" experiment, Blackmore suggested that her linking of big brains and memes would be somewhat substantiated if neuroimaging studies could show that it takes more energy to imitate than to act. She acknowledged that this would not be sufficient; in fact, there is some question as to whether it would actually help corroborate her theory of memetics at all.

To be a science, the memetic theories should generate testable hypotheses. Pinker suggested one possible line of inquiry. If it could be shown that brain size and cultural transmission by imitation coevolved that would at least show a correlation between the two. Although, as Blackmore points out this would be very difficult to achieve logistically, it is an interesting thought experiment. Blackmore goes beyond coevolution to say that imitation by memes caused the complex brains. Even if correlational evidence were found, it would still not establish a causal link between them.

Dennett argued that for memetics to be a scientific theory of cultural evolution, one needs to show historical prediction, that is, show that history unfolded as would have been expected using the memetics theory. This too fails, as identical retroactive predictions of history could be made based on different rationales, and there would be no way to reliably falsify or test them

WHAT IS THE MECHANISM OF MEME REPLICATION?

In discussion, Hauser pointed out that a distinction must be made between the method or machinery of replication and the unit of replication itself. Blackmore's definition of a meme: "that which is imitated" blurs the line between the machinery and the meme. According to Blackmore, memes began existing when the human brain was "big" just enough to be able to imitate. Non-memetic, genetic pressures were initially responsible for brains evolving to a point where they are capable of imitating. It was after that point, Blackmore posits, that memes became responsible for further evolution. According to Dennett, there needs to be some critical volume of memes before memetic evolution can take off. If memes provide a sustained and steadily increasing advantage to the host, conditions will thereby exist to have the host continue to evolve in a way that maximizes that benefit. From that point forward (ability to imitate and/or critical meme mass), memes have been the not so silent muse pushing humans to create things that are better at replicating memes, i.e. that replicate them with greater speed, volume and fidelity. According to Blackmore, memes are (perhaps blindly) responsible for the creation of everything from the stylus to the scroll to the satellite. The printing press, the PC and the pop charts, all are examples of human efforts bent to memetic ends to expand and improve upon the machinery capable of replication.

ARE MEMES UNIQUE TO HUMANS?

Ascribing human inventions to memetic influence is a strong claim on its own; Blackmore pushes it further, however. In response to the question of why memes are not present in animals, Blackmore suggests that the path to achieve replication through technical means was more direct and easily achievable than the path to achieving replication in animals. The ability to imitate is what "makes humans unique…generally speaking" and the ability to imitate is expensive (i.e. the brain accounts for approximately 2% of human body mass but consumes approximately 20% of the body's energy). Blackmore argues that it was simply a path of least resistance that memes followed towards Technicolor instead of towards turtles that can imitate.

Blackmore postulates that songbirds that mimic the songs of other species are not showing memetic replication. However, since this process of mimicking is a homoplasy to human speech, if humans have memes, one might expect the same process to hold up in songbirds. Blackmore argues that bird brains are not big enough to allow real imitation. The constrained imitation of a small subset of possible inputs does not make for memetic imitation. This would be an instance of competition between memetic and genetic evolution; big-brained birds might be too heavy to fly. If these songbirds have homoplastic song imitation machinery, they theoretically should have had memetic evolution of songs and perhaps a more developed prefrontal cortex. One could imagine they could evolve an altered design that compensates for big brains

and still allows them to fly. Losing the ability to fly but gaining the ability to imitate should be a good enough trade off to influence genetic evolution.

In addition to the problem for Blackmore's theory that mimicking songbirds do not have memes, it is also a problem that imitation does appear in encultured apes. Dennett explained that it takes both the proper machinery and the appropriate selective environment to create imitation in a species, which implied that apes had the machinery but needed the human cultural environment to use it. If this is what he meant, it suggests a prediction that if a critical mass of memes could be built up within a group of apes, eventually there would be memetic evolution and thus cultural evolution. An experiment of this sort might also provide information about the issue of memetic fidelity. Presumably, there would be similarities between the ways meme evolve in apes and the ways they are purported to have evolved in humans. Because humans presumably have evolved over time to be better meme replicators, it is conceivable that memes would be replicated with less fidelity in apes initially than they are currently replicated in humans.

Invoking the work of John Maynard Smith, Dennett suggested that the lack of fidelity in meme imitation is to be expected. Citing Smith's work, Dennett argues that initially, genes were not replicated with high fidelity, and that the ratio of replication to mutation rate was much higher early in evolution than it is now. The change over time towards the development of better (more accurate) replicators such as computers is therefore only natural. Fitch argues that fidelity in computers is a separate issue from fidelity in humans and that one has little to do with the other. Additionally, the relationship between copying fidelity and blending inheritance still needs to be addressed. Blackmore indicated she had an argument for why blending inheritance was not a problem for her theory. Unfortunately, the authors of this review were unable to adequately capture what that explanation might be. Blending inheritance remains a problem for memetics. Without a way to track the survival of a given meme, it is impossible to show an evolutionary process driven by a selfish meme.

The descriptions and discussions Dennett and Blackmore offer regarding what memes explain do not seem to simplify or clarify. The complexity of memetics diminishes its utility. Pinker suggested that it might be better to use cognitive psychology to explain complex and messy imitation given that the simplicity and elegance of the evolutionary algorithm does not seem to be present in the aims or actualities of memetics thus far.

THE COMPARATIVE VALUE OF MEMETICS, GENETIC BYPRODUCTS AND COGNITIVE EVOLUTION

Certainly, although genetic natural selection is a valuable and thorough explanatory tool it cannot explain all things. Blackmore suggests that although a genetic and memetic explanation may sometimes

overlap, there are examples where the behavior we imitate contradicts what would be good for survival of the genes' host. In those cases, she suggests, memetic selection is acting to the benefit of the meme. Once memes have influenced the host's behavior, they thereby influence the survival of the host and whether its genes succeed into the next generation. Dennett also argued directly against genes having an exclusive say in human behavior: cultural transmission is not genetic transmission, and so a non-genetic explanation is called for. Two possible sources are memes and genetic byproducts. The next question was how to separate out memes from genetic byproducts. Dennett answered that something is a meme, not a byproduct, if it lasts a long time. It is unclear to the authors why this might so.

Memetics relies on the evolutionary algorithm and what is known about genes for whatever precision it offers. However, in many ways the connections between memes and genes fail, especially in that memetic evolution hinges greatly on the need for artificial selection. In natural selection, mutations occur randomly over time in genes. This leads to random variations in gene expression and in the long run different survival probabilities and changes in gene pool ratios. To be valid, natural memetic selection must show random mutation. In practice, human intentionality seems to be a powerful driving force behind memetic mutation. Blackmore shied away from making the connection to genes precisely to avoid this difficulty. However, in abandoning a mechanistic model that requires random error, memetics becomes Lamarckian and, Pinker argued, loses its power. In genetic evolution, a parent's avid love of baseball does not increase the chances of their child having a knack for finding the sweet spot when stepping up to the plate. In Lamarckian memetic evolution, a parent's intentional efforts to cultivate the meme of baseball love can influence a child's feelings towards (or against) the sport. Introduction of directed thinking can pose a problem for memetics and suggests that cognitive psychology may be the place to look for explanation of cultural evolution.

Continuing to support the use of cognitive psychology, Pinker raises the concern that there is no way to distinguish between psychology and directed thinking. Dennett counters that if the memetic approach is right, memetics does not require a psychological explanation. We do not need to purport a mind to explain memes because we are not conscious agents, simply meme hosts. This statement is difficult to evaluate, again, because it is not testable. Also, it is indistinguishable in some ways from a scenario that describes humans as the sum of neural firing patterns.

In a further attempt to show psychology might not be necessary, Dennett proposes a research project that involves mutation of memes via computers and removes psychology. However, it is not clear psychology can be removed because even if a program runs seEMIngly independently, there is always a

human programmer's mind behind the program. Dennett offered the interesting example of EMI (Experiments in Musical Imagination) programmed by David Cope which was ostensibly developed using an evolutionary algorithm. (It may be so, but within the context of the class, that claim was not substantiated). EMI is able to analyze musical styles and produce compositions virtually indistinguishable from those that might have been the work of the original composer. Certainly, this is impressive and interesting. However, as Pinker points out, EMI doesn't create music using memetics - there is no generation of copying with an accumulation of copying errors. Further, if memes were real, EMI's innovation would be analogous to genetic engineering because of the programmer's intent. Genetic engineering is not natural or even artificial selection in that the variation is not random with respect to the outcome. The human creativity that is behind EMI is partly random, but a larger component is directed. Blackmore's response to this was that at the most basic level, memes are blind to the outcome, at the base level, thoughts are random, and then we do mental selection on them.

Dennett proposed that the issue here is a perspective error. Just as in genetic evolution, in comparison to the whole space of possible genome connections, the ones that are actually combined and expressed are very close to the local lineage. Pinker countered that cultural transmission is not just moving in small steps. He offers the example that the difference between the first and second Brandenburg concerto is large; it is not just a matter of a few notes. In response to the criticism that this example looks at phenotypic, not memotypic space, Pinker replied that the memotypic discussion relies on the complexity of human psychology.

Dennett again suggested that this might well be an issue of perspectives. On the one hand there is an argument that the brain is very intelligent and very creative, on the other, the memeticist argues that the brain is a selective environment in which items compete for replication and dispersal. The question to be answered is: Over time, which ideas get expressed? The simple answer is: those ideas that dominate the individual's brain. Dennett offered that a problem such as changes in pronunciation is an example of a "brain product" that is better explained by memes than the brain being creative. Pinker agreed that pronunciation changes are not a genetic byproduct and therefore need a different explanation. However, he noted that positing broadly that such changes can be explained in terms of historical forces does not in itself show memetics provides the explanatory model.

Thus, cognitive psychology yields a rich explanation of human minds and offers testable hypotheses. Memetics, on the other hand, sometimes yielded contradictory explanations and failed the requirements to be a science. However, if the connections to genetics are not taken too literally, memetics

is an attractive metaphor to describe how ideas change over time. In fact, memetics raises some interesting possibilities about the idea-generator and the idea-generator's conscious awareness. Our subjective experience as gene host is that of being the director of our actions. Our genes have a great influence in our actions, yet we do not directly sense the gene's control. In the same way, perhaps conscious thought appears to be driven by us, the meme hosts, but in fact the memes might direct our actions and even provide us with a sense of consciousness for their benefit. Whether or not this alternative explanation for consciousness is correct, it is a mind expanding thought exercise. Perhaps most importantly for the meme, by opening up minds to new ideas, the meme, "meme" is sure to be around for a long time regardless of its lack of explanatory power.

The following is a running dialogue among Dan Dennett (D), Susan Blackmore (S), Tecumseh Fitch (F), Marc Hauser (H), Steve Pinker (P) and the class of Cognitive Evolution. The dialogue was separated by topic and the issues are discussed more fully in the paper.

Introduction information
B: What does memetics tell us about human nature? "that which is imitated" is a meme and "that which is replicated" decided what the meme is (mixed machinery and selected item)
Big brains means something more abstract -complexity, not big in terms of size (i.e. big prefrontal cortex)
We recognize that Dennett and Blackmore have different thoughts and intents when it comes to memetics but in class these distinctions were not always clear, thus we write this more for or against memetics in general.

Is it a science?
H: How do you falsify the claim that memes lead to bigger brains?
B: "I don't know" --wants to see the difference between imitating and acting in a PET scan but admits that it doesn't falsify the whole thing (argument expanded in imitation and animal later)
H: Still wasn't satisfied
B: Admits needs new way
P: Suggestion: if can show coevolution of increased brain size and cultural transmission (imitation) then this at least would show a correlation between the two.
H: What test would make this a science?--we want predictability, not explanatory, power
D: "historical prediction" based on memetics history unfolded as would have expected (doesn't rule out other explanations); also a good memetic explanation of religion would argue for memes (still explanatory and doesn't rule out other explanations)
H: Which is why Hauser, still frustrated, comments that Dawkin's Selfish Gene provided predictions that have since been tested and found to be correct. We want that for memetics…A good point that wasn't satisfactorily addressed…

Fidelity
Ratio of replication to mutation rate
Blending inheritance is not copying fidelity yet Blackmore argues that a blend forms a meme.
D: Initially gene replication wasn't good; cites John Maynard Smith
B: Don't deal with mutation --it is a replication issue (too much comparison to genes)
F: argues that fidelity in computers (connected to imitation in computers issue) doesn't match fidelity in human brains, so you still have to answer the question about how brains got so big and the answer is genes.

Imitation
H:Method/machinery of replication must be separate from unit of replication
B:meme what imitated and is method of replication (not separated)
Steve Most--implicit vs. explicit distinction in how imitation works
Juliana and Amy: nature of consciousness in imitation?
B: "makes humans unique…generally speaking"; novel act that wouldn't have been performed in the normal repertoire that is carried out only by observing another animal doing it, she also includes goal-emulation where it fits her definition
(new topic)D: we need a volume of memes to have memetics take off
B: adds that the memes have created all sorts of machinery (meme replicators) such as satellite dishes, computers and TVs to ensure meme survival
Juliana: why not animals, why satellite dishes instead?
B: It is such an expensive process to be able to imitate, it is easier to build up the ability in a species that can do it than to have other species do it.
F: need direct causal link--genes are directly responsible for making big brains
B: what were the selective pressures that made the brain big, yes genes did the actual process
D: it is memes exerting the pressure in that memes offer a survival skill where returns don't diminish quickly so it continues to have a selective pressure to increase brain size. (b/c need continuous selection pressure to fully develop the big brain)
A demonstration between Damian and Marc where the idea but not the exact movements were copied B: then argues that imitation is this complex process by which we pull out the semantic content--imitation is not unthinking one-to-one mimicking and comments that that's why we haven't been able to build a robot to do it.

What makes up a meme?
Have memes of different sizes

It's whatever gets replicated (B)
D: whatever is in the information packet
H: lightbulb joke--many forms, what's the meme?
Other: Eyeballs might be like lightbulb joke because basic form and variations on the theme but can always recognize an eyeball (joke)
B:also that which is imitated she also says that not everything is a meme-operant, private (subjective experience) and genetic stuff is not memes

Is Natural Selection Enough?
Coevolution of memes and big brains (humans)
(brains from genes, imitate, memes then drive genetic selection to favor bigger brains b/c it pays to be able to imitate well in genetic terms)
Only when can imitate well can we put stuff together in novel ways
P: does this buy you anything above and beyond genetic natural selection?
B: Because we don't have a heuristic for deciding what's useful, we imitate nonuseful things that memes are driving, and it is memetic selection that determines what genes succeed
Damien: need memes given that we have genes?
Are just genetic byproducts ?(Damien didn't say this explicitly)
Juliana: How do you separate the byproducts from memes?
D: If it lasts a long time it is a meme

Precision vs. Plausibility
Messy imitation is not constrained enough to have explanatory power
P: If memes are so complex it is better to use cognitive psychology to explain complex messy imitation
Precision: (B) criterion for successful meme; either benefit for host or one that 'demands' replication

Artificial Selection-special or not?
Where do things come from --our minds or random changes?
If Lamarck was right, we wouldn't need genetic naturall selection; since we have natural selection, Lamarck is superfluous. If there is natural selection in memes, then we don't need human intentionality; yet we have it so memes become unnecessary
Argument:
P: in order for memetics to be reasonable you must have a mechanistic model that requires random error, to B--you should take a harder line in comparing to genetics b/c otherwise what you've got is Lamarckian
D: Darwinian national selection includes the special case of artificial selection (i.e. human intentionality in meme selection is acceptable)
P:artificial selection presupposes human intelligence; in artificial selection , the source of change is still blind to the outcome; genetic engineering isn't natural selection

Animals and memes?
B:Birdsong, dolphins exceptions to humans only; if have true imitation it is considered a meme
H:What is it about the brain environment combo that allowed some apes to do imitation
D: The animal has to be in the appropriate selective environment in addition to having the basic machinery to get imitation
B: you have to have a big brain (the basic machinery) first, then you have a meme (goes against what she says earlier)
Brian: In the case of the enculturated apes, it looks like memes are neither helpful for them nor easily replicable--the only reason the apes are getting it is b/c of the brain environment combo (the characteristics of the memes don't relate to their being imitated)…so why would they be getting non-useful memes?
F: Mimidae are birds that can copy the songs of other species of birds and if memetics were true you would expect to see memes here but you don't…
B: answered that birds don't have big brains--birds don't have this ability-she didn't know a lot about songbirds but that it didn't meet the criteria for memes-birds don't have as much prefrontal cortex…
H: why are big brains necessary? (continued in philosophy section)

Philosophical implications of memes
H: Why are big brains necessary? Makes comments about prefrontal mediation…(goes into cognitive explanations based on our understanding of what a big prefrontal cortex means)
D: If the memetic approach is right, memetics doesn't need a psychological explanation--we don't need to purport a mind to explain memes--we are not conscious agents; we are meme hosts--neither argument is currently testable…because all we understand is that we are lots of neural firing…

You could imagine a research project that shows replication sites that involve mutation but not psychology: --between me and EMI (so we don't need psychology--except that someone had to program it--psychology)
See if you get a different pattern of mutation than you would get if it was between humans only. (J--we want to innovate in a way that represents us whereas EMI is programmed to innovate in a way that does not distinguish EMI's contribution from the original composer's)
B: David Cope (EMI designer) used the algorithm for evolution to create EMI which is innovation.
P: EMI doesn't create music using memetics (no generations of copying with accumulation of copying errors). if memes were real, EMI 'innovation' would be an example of genetic engineering b/c of the programmer's intent which is NOT natural or even artificial selection--variation is not random with respect to the outcome
B: at most basic level, the meme is blind to the outcome
P: in human creativity a small amount of thinking is random, but much is directed.
B: at the base level, thoughts are random; then we do mental selection on them.
D: tells Pinker he is making a perspective error --if you look at all the possible space of possible genome connections--you are restricted to being very close to your local lineage. Likewise, the same thing occurs in cultures--you can't get that far away from what you already have- most of the cultural space is unoccupied. Our interpretation: What looks like directed thinking is really the memes that come out when we're creative: the memes that are most likely to be expressed, they aren't thoughts that we've been directed to
P: but in cultural transmission it seems like you're not just moving one small step--the distance between concertos is large
Other: you're looking at phenotypic space here, not memotypic space
P: but the memotypic discussion relies on the complexity of human psychology
D: P, you want to say that the brain is very intelligent and very creative and the memeticist wants to say that the brain is a selective environment in which items compete for replication and dispersal. The question is: Over time, which ideas get expressed and the answer is : ideas that dominate the individual's brain? So the question is, are some of the brain's products more explainable in terms of memes or in terms of your arguments. Changes in pronunciation is an example that is better explained by memes than the brain being creative.
P: Yes, this is not a genetic byproduct. So you want to look and see if it can be explained by historical forces. And you still have the problem of not being able to look to memetics to look at what kind of pronunciation changes will get replicated.
H: thus you are looking at the science of advertising…
Amy: if memes want to stick around, why don't we see evidence of selective pressure to keep us from innovating so that old memes don't have to complete for mental space and replicating ability with new memes?
S and D's argument seems to be we needed to invent things to keep memes alive so we needed innovation for this (memes thus had a selective pressure on us to create better meme holders)

Paul Rozin

presented by M. Wilson

Handout:

Rozin and Fallon (1987) and Rozin (1996) focus on the psychological mechanisms of the disgust reaction. What might be the functional significance and evolutionary history of disgust?

"Disgust seems primitive and irrational, yet as a product of culture it is both uniquely human and apparently absent in young children." (Rozin & Fallon 1987).

Is disgust really so irrational, or do the patterns described by Rozin & Fallon largely make functional sense? While clearly subject to cultural variation, to what extent might it depend on evolved biases and predispositions? Is it really absent in children, and if so, why?

Functional Significance

Suggestion: The disgust response is largely a mechanism for pathogen avoidance.

Disgust is hard to extinguish or reason away, easy to establish, especially when related to feces, bodily fluids, rotting foods, flesh and strangers, easily transferred to similar or related objects, and transmitted by direct contact. Overall, this sounds like an excellent mechanism for avoiding parasites, bacteria and other pathogens.

Many seemingly irrational aspects of the disgust response result from the conservative nature of the mechanisms -- the costs of infection are high, and the costs of avoiding sterilized plastic cockroaches or dung-shaped fudge are low.

Other instances cited as irrational, such as some examples of "secondary disgust", seem like good pathogen avoidance strategies -- avoid flies, and don't eat dogs that eat feces or grasshoppers that live near the latrine.

Evolutionary History

When did disgust arise? Is it a cultural response to recent (last 10,000 years) increases in density of human populations? Or does it have deeper evolutionary roots?

Chimpanzees in the wild are fastidious -- they use leaves to wipe themselves clean of feces and semen. Is this evidence of disgust, or a disgust precursor?

Many wild animals avoid mating with close kin. Could the psychological mechanisms underlying such incest avoidance be related to the disgust response in humans?

Development

Why don't little kids find things disgusting? Rozin & Fallon argue that kids suffer from cognitive constraints. Nevertheless, given the importance of pathogen avoidance, it seems odd that kids don't automatically find feces and other dangerous objects disgusting. Kids show strong avoidance of plant secondary compounds (as in broccoli, spinach, jalepeño peppers), so it seems like biases for avoiding other potential hazards could be built in.

Summary of discussion:

Highlights from THE SPEAKER OF DISGUST

A play in 3 Acts by the class of Psych 2250 / 9.250

DRAMATIS PERSONAE

FM FRANK MARLOWE
MH MARC HAUSER
PR PAUL ROZIN, THE SPEAKER
SP STEVEN PINKER
TB TERRY BURNHAM
TF TECUMSEH FITCH
S1-S11 STUDENTS (names have been changed to protect the innocent)

ACT I: DISCUSSION WITH THE SPEAKER

SCENE: A seminar classroom in William James Hall. The Speaker is settling into his chair at the front of the room and talking about disgusting things.

PR: Apple juice in a new bed pan is totally rejected. Perfectly good apple juice, new bed pan, never been used, but people want nothing to do with it. Which reminds me of this movie -- have you seen it? There's this formal dining hall, everyone comes in dressed in their finest, but all the seats around the table are toilets. Everyone sits down, the men drop their trousers, the women hike up their skirts, and they do their business. Then one man says excuse me, gets up, and goes to a small room, closes the door behind him, takes some food from a cabinet in the wall and starts to eat. A woman knocks on the door, but he says "Sorry, occupied!"

[After a few more disgusting anecdotes, MH introduces the speaker and asks the first formal question]

MH: What do you infer from a universal character with respect to the development of that character and the mechanism underlying it?
PR: Is that representative of the narrow focus of these questions? Generally speaking, if something is universal it has some biological basis, but that doesn't have to be the case. Everyone knows the sun rises and sets each day, that's a universal, but it's not biological.
There's no need for the genetics to specify that sort of thing, that the sun rises and sets. Some environmental features are so salient it's impossible not to notice them. Regarding imprinting: why not build it in? If you're guaranteed to be in the presence of the right species, it's cheaper to build in a non-specific mechanism.
SP: It would be interesting to apply learning models from language to things like disgust. We know language isn't specified by genes, just as people vary in food preferences from culture to culture. Suppose you start with a negative bias, incorporate only things that your culture eats. But this is contradicted by the developmental data -- kids find nothing disgusting. There's a small list of things and parts of things around the world that area eaten. So perhaps when kids are weaned, there's a spontaneous contraction from "eat everything" to "reject almost everything," followed by a learning-based acceptance of what your parents and peers are eating.
MH: Does that suggest that food preferences depend on biological knowledge (division of the world into animal and non-animal)? That doesn't happen until about age 10 by Susan Carey's studies.
SP: Susan's criteria of biology includes plans AND animals -- that comes late, but animals come early.
PR: The transition Steve noted hasn't been documented outside the US -- it might be true, it just hasn't been documented. People just extend from the US to the rest of the world, but in fact, we don't even know about France.

Weaning naturally goes to 2 to 3 years of age. The last thing you want to do is have kids imprint on their first food -- milk -- 'cause there is no milk in the world, before dairy. There may be a critical period for learning food preferences, sometime between weaning and puberty. Sepolsky has recently written an article in some academic journal, maybe the New Yorker, motivated by the fact that he can't stand the music his lab assistants and kids play. He proposes there's a critical period -- you can't like a particular piece or style of music unless you hear it before about 30. I think that's true, because I like the Beatles -- I mainly listen to classical music, but I like the Beatles, and can't stand anything that came after them.
SP: Will you turn off that Smashing Pumpkins and put on some Iron Butterfly?

S1: Doesn't it seem odd that kids should have to learn to be disgusted by excrement when they start off with a revulsion towards plant secondary compounds, like broccoli, spinach and peppers?
PR: Well, disgust could well be a recent thing, a response to increased population densities in the settled towns and cities in the past 10,000 years or so. Animals don't find feces disgusting -- there's no need to until you get high population densities and high risk of pathogens.
S1: But chimps in the wild are very fastidious -- they wipe excrement and semen off with leaves.
PR: Don't tell me they wash their hands.
S2: Chimps in captivity spend all their free time playing with poop, smearing it on the walls...
S1: But that's in captivity.
PR: ***We're*** in captivity. Anyway, lots of animals eat their own excrement. Rats for instance.
SP: But is there any advantage to it in humans, with a different diet and digestive system?

[then followed a long discussion of sex and fetishes, golden and brown showers on the Internet]

PR: Isn't it odd that nobody fetishizes mucous? Nobody goes sucking each other's nose...
S3: If you set up a home page advertising this how many hits would you get?

PR: [Talks about reversal of disgust with mothers and lovers...]
SP: But then there's an adaptive account -- if the point is to avoid pathogens, you don't need to worry about your own spit or the spit of your lovers and kids.
PR: I like the argument but I'm not fully convinced... Like Marvin Harris, starting with some weird food thing and going on to a possible ecological explanation and then saying that's it! But there are plenty of reversals. In Byzantium, parents would remove their sons' testicles to get them into service for the upper class, 'cause the upper classes didn't want the servants sleeping with their daughters -- this obviously doesn't help their reproductive success, though it could help their inclusive fitness.
SP And it certainly makes sense from the fitness perspective of the upper class...
PR: But there are all these other things too. We spend a lot of time on these expensive activities that have no inherent value, like collecting root beer bottles for crying out loud. No other animal does this -- high motivation value to particular objects.

S4: Scatalogical humor can be a bonding experience -- I went to India and met my cousins. There were a lot of language barriers but we bonded over jokes about the bathrooms.

S5: Couldn't bower birds be an exception to the collection thing?
TF: Blue things for bower birds.
MH: Different species of bower bird start out with a predilection for collecting particular things.
PR: If I were Steve -- more creative and more committed to this kind of thing, maybe I could come up with some sort of adaptive explanation...
SP: It may be an artifact of a society that can mass produce things. In contemporary society lots of predilections can be satisfied that couldn't be elsewhere -- we have tendencies not modulated by previous selection.
PR: And <u>music</u> -- more separated from biology than anything else people do. My own account -- we have inputs that give us pleasure for making sense of the world -- music is a system that works on this -- the mastery of structure, the building of expectations. I love food, I love music -- I'm not upset by being driven by these things.

TF: Why doesn't anyone drink human breast milk? Would anyone here drink a nice cold glass of fresh breast milk?
S6: I would.
PR: There's always one weirdo.
S7: I've heard that once a woman begins to ovulate again, the milk no longer tastes as good.
PR: In a paper I wrote, Memories of Mammaries, the biological adaptations to weaning, I talked about how nursing is a wonderful system, you're being held, you've got mom, comfort, warmth, everything -- you don't need much additional incentive to get you to eat. Lactose, which is only found in milk, is the l<u>east</u> sweet tasting of disaccharides. Rats don't like lactose in water. There may be some pressure to get a less sweet sugar in there. If it was sucrose, milk would taste really sweet.
S7: My mother offered me some milk and I was like, "That's <u>disgusting!</u> You're my <u>mother!</u>"
PR: But Mrs. Schwartz next door is nursing too... why not her? I imagine that most Americans, if you took them to a barn, showed them a cow being milk, and then offered them a glass of the stuff right from the cow, they wouldn't touch it. Nobody likes warm milk. In the world as a whole there's no preference for cold

drinks, but Americans drink very few things at room temperature -- hot, or cold -- but not room temperature, not even water.
SP: It could be that running water is cooler than stagnant water...
PR: Maybe, but it's the exception that people like cold drinks. If we're arguing about universality, we need to look at what the 80% are doing, not the 20%. Like meat eating -- sure there are vegetarians and vegetarian cultures, but generally speaking, everyone likes meat, rates it as the most valuable food.
SP: Is there any culture that eats everything?
FM: The Hadza eat everything. They eat lots of rotten meat 'cause they scavenge. Especially before bows and arrows you'd have even more scavenging.
SP: What about something familiar, some alien food?
FM: The Hadza eat everything -- except insects...
PR: That's a big one!
FM: And reptiles. And they say they don't like fish, 'cause they're too snakelike. But the last time I was there they ate lots of fish from a new lake created by El Niño.
S8: I don't know about the Hadza, but the Ache don't know how to salt or dry meat -- maybe it's adaptive to take advantage of the big wind falls -- maybe there's on social advantage to eating snakes.
FM: But little kids hunt all sorts of small mammals. They just chase the snakes away... They tell outsiders they eat people too, 'cause they like to gross them out.
S8: An example of eating the whole animal in the US -- I don't eat pork products, but people who eat a lot of hot dogs are titillated by the idea that there are like two rat pellets per hot dog...
SP: I don't know about titillated -- I don't like to think about rat pellets in my Fenway franks...
PR: But maybe if they were made with bits of New York Yankees that would be a different story...

ACT II: DISCUSSION WITHOUT THE SPEAKER
SCENE: The same classroom in William James Hall, but The Speaker has departed.

S1: In their papers, Rozin and Fallon talk about the mechanisms for disgust. I thought it might be interesting now to talk more about the function and evolutionary history of disgust. What do people think about the possibility that disgust is entirely a matter of pathogen avoidance?
S8: When does disgust first arise? What do other animals do to avoid dangerous food?
S3: It's hard to distinguish disgust from distaste.
TF: Need to do the contamination experiment -- do animals avoid food that's touched a food they hate?
S9: We did the contamination experiment with Pinker the tamarin this morning. He hates raspberries -- makes a disgust face to them -- but he loves Fruit Loops. We touched a raspberry to a Fruit Loop, but he still ate the Fruit Loop.
TF: Well, he's always going to eat a Fruit Loop -- you have to give him a choice!

S3: Contamination may not be so universal -- in India contamination is more like electricity -- it can run up a pole, it doesn't have to be direct contact. I don't know, but my Hindu friends tell me that caste works rather differently than they describe in the paper. And another case is what about pre-germ theory ideas of contamination, when people thought disease was due to a miasma rising up, or some other mechanism.

SP: Ancient things like the kosher laws can help us here -- recognition of some real but invisible entity. What's actually stipulated in the kosher laws -- there is an aspect of contamination.
S10: The idea of unholiness -- the direct corollary to contagion -- no sex during menses, ritual aspects...
S11: And contact with a dead person -- you can't touch the dead person, or a menstruating woman. That's ancient, whereas the milk-meat stuff is more recent.
SP: Also laws about washing hands, ritual ablutions. The story I was told was that during the middle ages, the Jews living in ghettos didn't die as much from the plague, thanks to all that hand washing -- maybe leading to the stories of poisoning wells etc.
TF: And what about witches' potions -- put in as many disgusting things as possible -- eye of newt, tongue of toad -- and then drink it or use it for magic.

MH: What is it about our society that put a pressure to evolve this psychology of disgust?
SP: You mean our particular society, or as a species?
MH: As a species.
SP: Paul talked about omnivory -- broader range of foods and cognitive omnivory as well. The genes don't know what sort of food we'll run into.
TF: But if that's the case it's not restricted to humans, like that Paul Sherman slide -- coyotes eat almost anything, in contrast to the claim that carnivores have a fixed search image.
S8: You asked about witches' brews. I asked him earlier about fetishes and wasn't really satisfied with his answers -- one was basically Freudian, the other cultural. This seems like a really important issue.

S3: Catholics don't mind the gore in Jesus getting nailed to a cross and whipped and beaten and so on, but I can imagine this would be very disturbing to someone who didn't grow up with that.
SP: I'm not a Christian but in Quebec we all had Christian education, and I remember being horrified by the crucifixion story. Perhaps this is an example of benign masochism, like people's interest in tearjerkers, tragedies, and rollercoasters. Most aversive things can be maladaptive if they're too aversive, for example phobias.

MH: What's known about development of disgust, the transition from distaste to disgust?
SP Around 3-4 years of age kids wrinkle their noses...
S1: But the paper said kids didn't fully develop disgust response until they're 7-8.
SP: But if you look at the data -- full contamination emerges by 7-8, but avoidance of, say, a cockroach in a glass of orange juice is there by about 4.
TF: You need a theory of essences...
MH: And that's getting close to a theory of biology. And maybe you need cultural transmission...
S8: Anorexia -- you don't see in animals -- distinctly human -- you get a disgust for all food -- maybe due to human ability to represent things
TF: It'd be interesting to look at animals who have been sprayed by a skunk
S8: And allergies -- why don't people have a disgust response to something that gives them an allergic response?
S11: You'd need the counter-evidence -- food aversion -- one trial learning: I eat pizza, I get sick, I don't eat pizza again.
SP: Is there any evidence for a Garcia-like mechanism in humans?
S8: Chemotherapy -- kids eat ice cream before chemo and then don't like it anymore.
TB: Now they're giving people bland food before chemotherapy so that doesn't happen.
TF: A good therapy for peanut butter allergies would be to induce vomiting...
SP: That's actually the main treatment for alcoholism: a drug that makes you throw up afterwards -- Antabuse.
TF: Another example of disgust gone wild (like in anorexia) is OCD, obsessive compulsive disorder.
MH: And you see OCD in dogs too -- starts with a cleanliness obsession just like in humans (licking the paws) and the same drugs help to fix it. Seems to be the same neurobiology.
SP: Disgust can also be co-opted by moral sentiments -- Hitler's shirt. Can't boil it, can't autoclave it. The only thing that would make it wearable would be to have Mother Theresa bless it. Could be more group identification -- wearing the colors of the enemy.
S6: So like what about Hitler's T-shirt, something not his field jacket or uniform. If you washed it, ironed it --
S8: Would you wear it?
S6: Yeah, sure
ALL: [howls of disgust]

MH: Like meat eating and vegetarianism for moral vs. health vegetarians and whether they find meat disgusting.
SP: Yes, you'd expect the moral vegetarians to find food disgusting -- it's wrong to eat meat! Whereas the health vegetarians like the stuff, they just don't think it's good for them. And apparently, Hitler was actually a moral vegetarian.... And what about incest...
MH: Like in that village in Spain -- the couple who were brother and sister but separated at birth -- the incest was blessed by the Church...
SP: Lots of that in fiction -- like Oedipus and Jocasta, a single bit of information that totally changes your world and makes you do things like poke out your eyes.
S1: And incest avoidance is something where you might have a clear animal precursor…
MH: And there's also optimal outbreeding -- as in quail, where there's a mate preference for first cousins.
S1: As in the Japanese...
S4: I was just about to say in India...
TF: Working like philopatry, as a way to preserve co-adapted gene complexes...
SP: But is there any evidence for a psychological mechanism for that in humans? Prefer cross cousins over parallel cousins...
FM: Alexander has arguments -- paternity uncertainty and sororial polygyny make it more likely that you're more closely related to your parallel than your cross cousins [or vice versa]... But as far as the Westermark hypothesis -- in the Hadza, there's no avoidance of familiar non-kin. They see each other naked lots, stay in the same huts. They're playing together all day...

ACT III: THE SPEAKER SPEAKS

SCENE: A lecture hall in the basement of William James Hall. The students file into the hall, munching cookies and drinking coffee.

[The talk is a general overview of food-related studies, broadly following Rozin 1996. Included here are some of the main points, one-liners, book plugs, data, and other highlights.]

Main Point 1: Food is fundamental.

Book Plug 1: Guns, Germs and Steel by Jared Diamond

“Here is a cross section of California. You can also think of it as a graph with the x-axis as the domain of human behavior, and the y-axis as the number of psychology studies published. You get your hills and mountains, a lot of attention in some areas, but total neglect elsewhere. Those are the holes. Rozin goes for the holes. Food is one of those holes. Food is neglected, along with religion, leisure, sports, and money. But there’s lots of stuff on sleep!”

“There’s virtually no psychology of the mouth, one of only seven holes in the human body (don’t try to count them).”

“The last investigator interested in these holes was Freud. They rejected my paper saying you didn’t have any citations since Freud. That’s not my fault!”

“Now the mouth -- to hell with the other six!”

Some data:
People spend a lot of money on food.

Country	% Income spent on food
China	51
India	52
France	20
USA	13

There’s a low correlation between parent and child food preferences.

Main Point 2. Food is frightening; Americans overestimate the risk of food.

Book Plug 2: Medicine and Culture by Lynn Payer

“Americans are afraid of only two things: germs and communists. Now we’ve changed communists to fat.”

“Americans think that they’d be immortal if it wasn’t for germs, cigarettes and cholesterol.”

Why do the French have fewer heart attacks? They eat less and they weigh less.

Main Point 3. Food is a foundation system.

Book Plug 3: The Hungry Soul by Leon Kass

“Disgust has its own hole, and the most disgusting thing you can produce comes from another hole!”

“Don’t you hate it when you bite into what you think is going to be a cream chocolate, but there’s a nut in there instead? Wouldn’t it be better to have a box of chocolates where you can see what’s inside each one? But no one wants a used box of chocolates!” [shows slide of a fancy box of partially eaten chocolates, with insides clearly visible in each one]

The moral systems of the world can be divided into three categories. Educated westerners emphasize autonomy and rights, whereas in India community and divinity are more important. And each more system has it’s own associated emotion:

Rhetoric	Emotion
Autonomy	Anger
Community	Contempt
Divinity	Disgust

“Disgust is funny -- and not only with four year old boys.”

“I’ll have the filet mignon and a bottle of Chablis. And bring some shit for my fly.”

Rozin showed data supporting discussion that nausea and GI tract is better than skin reaction at making you dislike food.

Animals in Mexican villages who eat Mexican food every day (in the form of leftovers) prefer foods without chilies.

Vegetarianism and moralization -- cigarette smoking has been moralized. Fat is next.

What causes this? Protestantism. God gave us the body and it’s our duty to take care of it as best we can.

Possible Stages in the Evolution of Language

Ray Jackendoff

Presented by Jon Wilkins

Presented here is the discussion topics sheet that was handed out at the beginning of class on this day. It is followed by a synopsis of the lecture and discussions that took place during the class. For the sake (hopefully) of clarity, I have taken some liberty in the format of the presentation. The lecture and pre-lecture discussion that took place are not laid out as a dialog. Rather, they are presented in a single voice, hopefully with enough space given to opposing views. The post-lecture discussion is presented basically as a quasi-dialog (trialog?) between Prof.'s Hauser, Fitch, and Jackendoff based (somewhat loosely) on their actual comments. By and large, student comments are integrated into that format and attributed indiscriminantly to one of the three professors. I apologize in advance to everyone whose ideas I have misunderstood, misattributed, misrepresented, and just plain forgot.

Discussion Topics Sheet

Argument: Jackendoff presents an outline for the evolution of modern human language. Starting from a system in which symbols are used in a non-situation-specific fashion, he details the steps that would be required to generate the features of Bickerton's protolanguage, and the steps required in the evolution of this protolanguage into modern language.

Issues raised by the paper:

1) Adaptiveness of communication

Jackendoff is explicitly ***not*** trying to demonstrate the adaptive value of language. However, the selective forces acting on a system of communication are interesting, because they are frequency dependent in a way that is not true of most systems (***e. g.*** the immune system). Must we then invoke some form of group selection in order to explain the adaptiveness of incremental advances in language capacity? Or does this limit the "size" of the evolutionary steps in language that could result in an increase in fitness? If the primary role of language is to facilitate thought (a la Chomsky), does that allow more effective natural selection at the individual level?

2) Language fossils and subsumption architecture

Jackendoff supports most of his arguments with data from the "linguistic fossil record," including fragments of language from childhood language acquisition, adult second language acquisition, and compromised language situations. Under what circumstances is it reasonable to equate degraded or incomplete forms of language with evolutionary language precursors?

Ontogeny recapitulates Phylogeny

Jackendoff supports his evolutionary scheme partly with data from speech patterns of children. There seems to be an implicit argument of the ontogeny / phylogeny type. For example, very young children using one-word utterances, and slightly older children using grammar-poor sentences. Is this evidence that supports the theory, or is this evidence of an inappropriate argument by analogy?

Protophonology

Does the development of combinatorial phonology need logically to precede the use of an open, unlimited class of symbols? Jackendoff provides evidence for syllables being primary and phonemes being secondary. For example, syllabic alphabets have been invented many times, while a phonetic alphabet has been invented only once. Furthermore, children can count syllables before they can count phonemes. Is this evidence convincing? Does it mean that understanding of syllables preceded understanding of phonemes in evolution?

Second language acquisition

Does the fact that adult second-language learners acquire vocabulary, but not full grammar tell us anything about the evolution of language? (Besides the fact that vocabulary acquisition and syntax acquisition are separate mechanisms) This is in some sense a reversed ontogeny / phylogeny argument of the "last in, first out" type.

Compound nouns and the "head principle"

One "linguistic fossil" that Jackendoff points out is the rule in English for making compound nouns, where the second term is generally the head. (A doghouse is a type of house, not a type of dog.) Can we, by the existence of such a rule, infer a stage of language in which this sort of simple syntax existed? Or does this rule just follow from the adjective-placement rule of English, which is a part of the fully formed modern grammar?

3) Primate language capacity

Jackendoff compares many of the proposed stages of language evolution to communication in primates that have been specifically trained in language. If certain linguistic capacities are more easily learned by other primates than others, does this provide good evidence that these capacities would have been the first to develop in human ancestors? For example, if some primates can learn to concatenate words to generate new meaning, but can not form more complex syntax, does this mean that concatenation of words occurred as a distinct stage in language evolution?

Jackendoff states that he thinks that vocabulary learning in other primates is probably a task that requires high motivation and effort, akin to learning writing in Chinese. This is in contrast to vocabulary learning in humans, which appears to be efficient and relatively effortless. If the human language mechanism is distinct from that of other primates, what can studies of language learning in primates tell us?

4) Multiple use of cognitive frameworks

Jackendoff also alludes to a couple of instances of possible preadaptation. Is there a connection between comprehension of embedded structures in language and other hierarchically embedded human structures? Does our understanding of recursive linguistic structures rely on the same underlying cognitive mechanism as our understanding of hierarchically nested social groups? Another possible example of this cognitive borrowing is presented in the parallel construction of the proto-sentence [N [V N]] and the proto syllable [C [V C]]. In general, how reusable is a cognitive framework? Are these frameworks being co-opted at the biological level or at the cultural level (***e. g***. as in the work of Rozin and Kanwisher)?

Synopsis of the pre-Jackendoff discussion

Much of the first hour of discussion centered around the questions of the adaptiveness of language. In general, what is the possible connection between language and evolution? Is evolutionary linguistics a science? Or is any effort to apply evolutionary reasoning to linguistics doomed to result in nothing but Just-So stories?

First of all, Jackendoff claimed in his article that each of the steps in the evolution of language would be adaptive. Each of these steps would presumably result in an increase in the capacity of humans to communicate to one another, which should result in increased fitness due to more efficient execution of cooperative activities, for example, or more effective communication of cultural knowledge to offspring. However, it was pointed out that increased efficiency of communication should be adaptive for all social animals. Why is it, then, that humans are the only species to have evolved the capacity for language. In other words, if the adaptive advantages of language are so obvious, why hasn't the capacity evolved more than once independently, as is the case with vision?

There would appear to be two possible answers to that question. First, there could be something unique in the selective environment of human ancestors that would particularly favor the development of language. Suggestions for this type of uniqueness that arose in class included bipedalism and coalition forming. Bipedalism would result in decreases in certain physical abilities (running, for example), which might need to be compensated for by an increase in communicative ability. The formation of antagonistic coalitions might drive language development by favoring those individuals who were able to coordinate their coalitions the best. The problem with both of these suggestions, however, is that neither bipedalism nor formation of coalitions is unique to humans, and in neither case would it be easy to draw a ***causal*** connection between them and language.

The second possibility is that language capacity is somehow very difficult to find in design space. For a new trait to evolve, not only must it be adaptive, it must also arise somehow in the course of history. It could be the case that humans are the only species with language because some step in the evolution of language is an extremely unlikely event that has only occurred once in the history of the world. If we

accept this argument, we must then be wary of any adaptationist argument regarding any specific features of language. If language arose only once, there may never have been a time when there was competition between different language formulas. The specific form that language took may be much more the result of chance than of evolutionary fine-tuning.

We now return to the question: is evolutionary linguistics science? That is, can theories on the adaptiveness of language be tested? The major stumbling block here is that there are so many ways in which humans are different from other animals. It is therefore easy to find correlations, but difficult to unambigouously ascribe causation to any of them.

One area in which language evolution theories could be tested is in development. By looking at specific defecits, we could potentially build some sort of hierarchy of necessity (or at least falsify some bad hierarchies). One example from the discussion is William's syndrome. Children with William's syndrome suffer from a compromised capacity for theory of mind, but they have very elaborate language skills. From this we can conclude that theory of mind is not a necessary condition for language.

Some primate work suggests that it may be reasonable to propose that language comprehension preceded language production. Work with Bonobos indicates that they are capable of comprehending concatenation and possibly some sorts of abstract linguistic categories, although they do not use this skill productively. It was pointed out that a capacity to comprehend others (reading others' thoughts or intentions) might be adaptive even in the absence of intent to communicate. Comprehension preceding production is therefore consistent with both interspecies comparative data and with intuitive evolutionary reasoning.

Jackendoff Lecture

The Sociological Context of Evolutionary Linguistics

Linguists primarily study the nuts and bolts of individual languages, all of the agreements, word rearrangements, declinations, etc.. Because of this, they tend to be impressed most with the complexity and all of the idiosyncracies of language. The complexity that impresses the linguist, however, is not the same as the complexity that might impress, for example, a non-linguist second language learner. Most of the complexity that the linguist finds interesting comes in below the radar of the non-linguist. The non-linguist finds most of these things obvious; so obvious, in fact, that a child can learn them.

The fact that a child can learn language in spite of all of this "below the radar" complexity is central to the argument for innateness put forward by Chomsky. Chomsky's monumental contribution to linguistics is the idea of Universal Grammar (UG), which brings children to the table with a somewhat preset grammar, allowing them to learn all of the subtleties of language with what appears to be a paucity of effort.

Before discussing one of the limitations of Chomsky's concept of UG, we will define the three major components of grammar:

> **Phonology** - the sequence of sounds, including articulation, inflection, rhythm, and stress pattern.
>
> **Semantics** - meaning, both of words and phrases. This is the least understood area of grammar. Different linguists describe semantics in different ways, ranging from disembodied logical structures, to image-like concepts, and everything in between.
>
> **Syntax** - this includes parts of speech, rules for combining words, agreement, case marking, question formation, and so on.

In Chomsky's formulation of UG, syntax plays the central role, and phonology and semantics are secondary. This perspective has been adapted by most of the linguists in the Chomsky camp. This view creates a major stumbling block for any evolutionary explanation of language. If syntax is primary in language, how could it ever have come into being? Surely there was never a stage in which humans possessed disembodied syntax without words or meaning. Removal of this stumbling block has been hampered by Chomsky's own view on evolution. He has consistently dismissed any attempts to bring evolutionary reasoning to bear on linguistic issues, and has actively isolated himself and the rest of the field from other disciplines that might bring evolution-based insights to linguistics.

Bickerton's Big Insight

Bickerton's insight into the possible evolutionary origins of language has two parts. First is the idea that some sort of protolanguage existed. This might be some sort of language without syntax, involving simple concatenations of an open class of words. Second is the idea that protolanguage still exists as the

foundation of modern language. Protolanguage surfaces in cases where language is degraded, as in pidgins and in cases of certain types of brain defects.

A question was raised as to why we should expect protolanguage to be more robust than modern language. In other words, why is it that a genetic defect would be more likely to knock out syntax and leave protolanguage unscathed rather than the reverse? Jackendoff then suggested that we place that question on hold and address it later. However, this never really happened, and the inherent robustness of protolanguage remains an open question.

Jackendoff's Take on Bickerton's Insight

We can make the idea of a universal grammar fit together better with evolutionary theory if we remove syntax from its central role. We can treat grammar as made up of three equal players – phonology, semantics, and syntax – and the interactions between them. Protolanguage can then be viewed as a simple mapping between phonology and semantics. Syntax then occurs later in evolution and acts as a "supercharger" on the mapping between phonology and semantics. In protolanguage, meaning is conveyed primarily through sounds. With the addition of the syntax supercharger, additional meaning can be conveyed by more complex relationships between individual sounds.

Linguistic Fossils

Modern language is full of elements that are not fully integrated into the grammar. These elements seem to follow idiosyncratic usage rules. It is suggested that these elements may be linguistic fossils, remnants of the protolanguage that have survived as peripheral parts of modern grammar.

Examples of these linguistic fossils are one-word utterances such as "Ouch!" and "Wow!" The sentence, "The more you eat, the less you like it." contains two idiosyncratic structures "the more" and "the less." Each operates as a single unit of meaning with syntactic rules that are not a part of the mainstream grammar.

Compound nouns may be another linguistic fossil. There are on the order of 20 possible relations between the two components of a compound noun. Some of these are illustrated in the Jackendoff paper. Again, these compounds operate on less than full grammatical principles.

A final example is commentary adverbials such as "in my opinion," and "by the way." These can generally occur anywhere within a sentence. None of these "fossils" exhibits the clockwork properties that we have come to expect from a generative grammar. One explanation for their existence is that they are hold-overs from the simple grammar of protolanguage.

By contrast, the relationship between subject, object, and indirect object appears to be a well regimented system with a rigorous grammar. This could indicate that this structure is a more recent addition to the grammar of modern language.

Limitations of the Jackendoff Scheme

We can reason through some plausible stages in the evolution of modern language. (For example, use of words must precede concatenation of words.) However, this is not going to tell us anything about when these various innovations might have occurred. Nor will it necessarily shed any light on the evolutionary forces that drove the development of language and the elaboration of grammar. The scheme is merely an attempt to pick apart the incremental stages along the pathway from words to modern language.

Post-Lecture Discussion

MH – Where is the science? Is there anything here that is testable? What exactly can studies of cross-cultural variation tell us?

RJ – Currently there is an effort to build up a new concept of UG. Chomsky's original formulation was based on the familiar European languages and Japanese. Now people are trying to look at languages that we would consider much more exotic, like Lakota and aboriginal Australian languages. Some trends are coming out of these studies. For example, there seems to be a rough correlation between the amount of case inflection and the fixity of word order. Languages like English have little case inflection and very fixed word order, wherease languages like Latin have much more inflection and looser word order. Of course, there are exceptions to this trend. Also, some languages convey most of their meaning with morphology. There are languages where "I will probably catch some fish tomorrow" could all be one (long) word. Some aboriginal languages have almost no constraints on word order, and do everything with case markers. One of the

limitations of this system is that they apparently have almost no nested phrase structure. In a sense, you could look at that language as protolanguage with case markers.

MH – Could you test learnability of different elements of grammar by constructing artificial languages with different properties and look at how quickly or easily people were able to learn them?

RJ – This is done in a sense in the cross-cultural work. There is a lot of data from different languages about which elements of grammar kids learn most easily.

MH – By figuring out what is easy to learn, we might be able to get a clue as to what is easy to evolve. For example, you could take your artificial languages and try to teach them to chimps.

RJ – Linguistic variety in the world is already running that experiment in some respects. By looking at statistical distributions of different grammatical structures, we can see which ones are favored.

MH – But this does not address the question of what is not learnable.

RJ – We might get a clue about that from unlearnable precsriptive rules. For example, we have rules in English like "don't end a sentence with a preposition" and "don't say 'between you and I'" that people seem to be incapable of following in spite of social pressure to do so. Maybe it is that these are not a part of the grammar.

TF – Could you get rudimentary rules of word order flowing naturally out of the environment? For example, the "Agent First" rule could just be a mapping of temporal reality in the physical world onto word order. You first experience the agent, then the action, then the object. Just by doing a brain dump, you would generate the word order S V O.

MH – Then what would need explaining is those few languages that deviate from that word order.

RJ – A key innovation in the evolution of language is the ability to then abstract those categories (subject, object, etc.). In modern language you can replace a word with a phrase. For example, a subject can be "man," or "the tall, black man with one brown shoe." This innovation requires some sort of concept that tells you where the focus of the phrase is, that the phrase refers to a man and not to a shoe.

TF – But how could you argue that language had to have adverbs?

RJ – You can't. In fact, some languages don't have adverbs. What we do know is that the human language faculty has the capacity for adverbs. They are on the menu of components that a language can use. If the question is "why did we evolve the capacity for adverbs?" I'm not sure how you could ever answer that.

TF – But you could say that a language was bound to have the category of "Noun."

RJ – The basic concepts of "Noun" and "Verb" might come naturally to protolanguage. After all, most nouns are objects. But in modern language, the syntactic category of "Noun" has been abstracted away from the semantic category of "objects." We have all sorts of nouns like "party," "lightning," and "earthquake" that are semantically verbs.

TF – Modern language is so complex that you can turn just about anything into anything else.

MH – If you started to evolve language capacity in chimps, do you think that you would get anything for free? Do they have comprehension of categories such as object and action that could be used as proto-noun and proto-verb categories for language?

RJ – With chimps there is no evidence of any capacity for phrase use. Of course, maybe no one has ever tried to teach chimps phrases. But maybe you would need syntactic markers (such as ***a*** and ***the***) in order to distinguish whether or not chimps make linguistic category distinctions.

MH – Is there a doable science of the evolution of language?

RJ – No.

MH – In this class we have tried to distinguish between two uses for evolutionary reasoning. On the one hand, you can use evolution to explain results. But a more productive use of evolutionary reasoning is using it to make predictions and to fuel research. How can evolutionary intuitions help with the study of language?

RJ – Of course, most of what linguists do is nuts and bolts type of stuff. This is the equivalent of natural history in biology. And all of that is important.

MH – But can you use evolutionary thinking to inform how and where you look, the way that Darwin used evolutionary thinking to inform his study of natural history?

RJ – Where evolutionary thinking becomes useful is in choosing between alternate theories. We know that if a capacity exists, then it must have evolved. If the data that we collect suggests two different models of UG, we can ask if one of them fits together with evolutionary theory better than the other.

MH – Could you take some sort of game theoretic approach? Then you could pit two languages against each other.

TF – The problem is that if you compare two current languages, you are looking at two things that have diversified as a result of cultural evolution.

MH – But you could put together various artificial languages from different grammar components.

RJ – This is the type of thing that if happening when pidgins become creoles. The pidgin will have very simple grammar, possibly like that of protolanguage. Children who grow up speaking the pidgin, however, will create a new language (the creole) based on the pidgin, but this new language will have a full grammar. In this case novel grammar is generated within a single generation.

MH – The language goes from lacking formality to having formality.

TF – Some sort of critical mass is required in order to get generation of grammar like that.

MH – But the fact that you need a critical mass of people does not make an argument against innateness.

RJ – There is something about having a large number of people that gives the impression that language is something that is “out there” and must be internalized, that somehow the language exists in and of itself.

MH – Do the adult speakers of the pidgin ever pick up the grammar of the creole?

RJ – There are no instances in Bickerton’s work of parents learning the creole. In fact, the creole will tend to be grammatically unrelated to the parent languages. That is, the creole may contain grammatical elements that were not present in any of the parent languages.

TF – I have a question about the relationship between meta-cognition and the generation of novel words. Couldn’t you generate new words just through mistakes, like more of a Darwinian process, without any conscious meta-cognition? In other words, does meta-cognition necessarily have to precede an expansion of vocabulary?

MH – So, in order for a new word to spread, it would just need to be useful and memorable.

RJ – Some people try to examine this sort of question by looking at borrowing of words from one language to another in historical linguistics. However, it is important to remember that this is all done with modern brains using modern language, and doesn’t really have anything to say about evolution. That is actually something that it is really important to watch out for in discussions of evolutionary linguistics. It is important to keep historical language changes distinct from the biological evolution of language. A lot of people who write about these things mix the two up.