

THE HUMAN BEHAVIOR AND EVOLUTION SOCIETY

Meeting for the Year 2000, June 7-11 at Amherst College

Note: Abstracts are after the Program listing. To view the abstract of a particular presentation or poster, do a search for the author's name.

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PROGRAM

WEDNESDAY, June 7

7:30 AM to 12 AM, check in/ registration/HBES desk open in Valentine Lobby. People arriving

after 12 AM must get their packet, dorm key and information at the Security and Physical

Plant Service Building, which is building number 59 at position C1 on the Amherst College

map at <http://www.amherst.edu/Map/campusmap.html>.

5 to 9:45 PM, Opening Reception, Valentine Quadrangle & Sebring Room (dinner available at

Valentine Hall, 5 to 7 PM).

THURSDAY, June 8

7 to 8:30 AM Breakfast served at Valentine

8:00 AM Poster presenters may set up in Sebring Room, Valentine Hall (room open all day).

Morning Plenary (Kirby Theater)

8:25 AM Welcome, Introduction: Jennifer Davis

8:35 AM Plenary Address: Paul Sherman, Spices and morning sickness: Protecting ourselves from

what eats us.

9:25 AM Break

Morning Paper Sessions 9:50 to 11:50 AM (6 talks)

- 1.0 Cognitive architecture and specializations, 6
 - 1.1 Cory G. Consilience and the predictive value of the reciprocal modular brain.
 - 1.2 Lieberman D, Tooby J, Cosmides L. In search of cues governing kin recognition and incest avoidance.
 - 1.3 Brown WM, Moore C, Humphrey T. Has subtle cheating influenced the adaptive design of altruist-detection cognitive architecture ?
 - 1.4 MacDonald K, Geary DC. The evolution of general intelligence: Domain-general cognitive mechanisms and human adaptation.
 - 1.5 Pereyra L. Function variation of the hazard management algorithm.
 - 1.6 Hammond M. Arouser-arousal conversion rules: The neurophysiology and evolution of diminishing marginal utility.
- 2.0 Parental Investment, menopause. Chair: Elizabeth Hill, 6
 - 2.1 Hill EM, Craig AS, Hannah ME. Variation in parental economic investment among a midlife U.S. cohort.
 - 2.2 Bereczkei T. Maternal trade-off in treating high-risk children.
 - 2.3 Holden C. Matriliney as female-biased parental investment: a comparative African study.
 - 2.4 Sear R, Mace R. Matrilineal kin improve the nutritional status and survival of children in rural Gambia.
 - 2.5 Friedman BX. Reduced paternal investment and the evolution of menopause
 - 2.6 Marlowe F. The patriarch hypothesis: An alternative explanation of menopause.
- 3.0 Mate attraction I: General, symmetry, waste-hip ratio. Chair: Elizabeth Cashdan, 6.
 - 3.1 Kniffin K, Wilson DS. What is good is beautiful
 - 3.2 Gangestad SW, Thornhill R, Quinlan RJ, Flinn RV. Men's fluctuating asymmetry, attractiveness, and reproduction in a rural Caribbean village.
 - 3.3 Gray PB, Marlowe F. Fluctuating asymmetry among a foraging

population: The

Hadza of Tanzania.

3.4 Phelan J. Heterozygosity decreases fluctuating symmetry:
evidence from fruit flies
and humans.

3.5 Campbell L, Stewart M, Manning J, Simpson JA. Men behaving
dominantly: Intrasexual
competition, emergent leadership, and the male waist-to-hip
ratio (WHR).

3.6 Cashdan E. A woman's view of waist-hip ratios: Trade-offs in
androgen and estrogen-
dependent traits.

4.0 Cultural evolution I: models and memes, 6. Chair: William Irons

4.1 Irons W. Three models of culture

4.2 Burnham TC. Genetic evolutionary economics: would natural
selection favor a selfish
Homo
economicus.

4.3 Keckler CNW. Evolution of traits related to population density
in a heterogeneous
metapopulation: an application of the "cornucopia principle"
to changes in human
political propensities

4.4 Brody J. Active Darwinism offsets mismatch.

4.5 Auger R. The meme is not the message.

4.6 Beahrs JO. Meme transmission: mutual suggestion as the
default presumption.

Luncheon Meeting, lunch served at Valentine, 11AM to 1:15 PM

12:00 to 1 PM, **Publication Committee**, Valentine Hall, Terrace Room
(downstairs)

Afternoon Plenary (Kirby Theater)

1:10 PM Introduction: David Buss

1:15 PM Plenary Address: Douglas Kenrick, Can one ever be too
wealthy or too chaste?

Laboratory experimentation and the search for psychological
mechanisms.

2:05 PM Break

Early Afternoon Paper Sessions, 2:30 to 3:50 PM (4 talks)

- 1.0 Symposium: Providing evidence for psychological mechanisms. Organizer and Chair: Jeff Simpson.
 - 1.1 Simpson JA, Gangestad SW. Validation of special design and selective history:
 - Theoretical terms and “damn funny coincidences”.
 - 1.2 Li NP, Bailey JM. Trade-offs and psychological mechanisms: Experimental methods and mate preferences.
 - 1.3 Schaller M, Neuberg S. How social psychologists' minds work: Implications for evolutionary inquiries.
 - 1.4 Cosmides L, Tooby J. Social exchange: Converging evidence for special design.
- 2.0 Symposium: Evolutionary analysis in law. Organizer and Chair: Owen Jones.
 - 2.1 Jones O. Evolutionary analysis in law: Prospects for applied evolutionary psychology.
 - 2.2 Judge D. When gender-blind law isn't: Demography, sex differences, and legal outcomes for women and men.
 - 2.3 Thomson JA. Darwin goes to court: Principles of an evolutionary forensic psychiatry and psychology.
 - 2.4 McGinnis J. Constitutive law and the human constitution.
- 3.0 Symposium: The embodied capital theory of human life history evolution. Organizer and Chair: John Bock; discussant: Bobbi Low.
 - 3.1 Kaplan H, Gangestad S, Mueller T, and Lancaster J. Embodied capital and the co-evolution of brains and longevity.
 - 3.2 Lancaster J, Kaplan H, Hill K, and Hurtado A. A theory of human life history evolution
 - 3.3 Bock J, Kaplan H, Johnson S, Lancaster J. Embodied capital and fertility in traditional and modern societies.
 - 3.4 Lam D, Anderson K, Kaplan H. Determinants of educational outcomes among urban Xhosa in Cape Town, South Africa.
- 4.0 Cultural evolution II: theory and group processes. Chair: Rick O’Gorman, 4.

4.1 O’Gorman R. Superior recall of normative social information: an evolutionary hypothesis.

4.2 Hilton A. “Group evolutionary strategies” of Anabaptists: distinctiveness, survival, and ethnic relations.

4.3 Thompson NS. The evolution of emergent group properties.

4.4 Kameda T, Nakanishi D. Cost/benefit analysis of “conformity bias” in cultural transmission: an evolutionary game model.

Late Afternoon Paper Sessions, 4:10 to 5:50 PM (5 talks)

1.0 Symposium: The organization of literary meaning. Organizer and Chair: Joseph Carroll.

1.1 Scalise Sugiyama M. Food for thought: The role of narrative in human subsistence.

1.2 Easterlin N. Archetypes, ambivalence, and literary meaning in Hans Christian Andersen's 'Little Mermaid'.

1.3 Jobling I. The hero story as a human universal: Using evolutionary psychology to understand literary universals.

1.4 Storey R. Evolution of amusement laughter obscured by representation of humorous behavior.

1.5 Carroll J. Scenarios of female mate choice in five novels of female development

2.0 Panel discussion: Evolutionary Demography. Organizer: Kimber Haddix. Participants: K. Haddix, M. Borgerhoff Mulder, H. Kaplan, J. Bock

3.0 Symposium: Homicide and the mind. Organizers: John Thomson and Owen Jones.

3.1 Duntley JD, Buss D. The killers among us: A co-evolutionary theory of homicide.

3.2 Wrangham R. An ape perspective on human intra-specific killing.

3.3 Chagnon N. Most anthropological evidence doesn't support homicide modules.

3.4 Buss D, Duntley JD. Reply and Discussion.

4.0 Mate attraction II: Facial attractiveness. Chair: Robert Montgomerie,

4.1 Bullock HL, Montgomery RD. Multiple components of facial attractiveness.

4.2 Cruikshank C, Anderson NK, Johnston VS, Giddon DB.
Predicting perceived body
from face morphology.

4.3 Franklin M, Johnston V. Hormone markers and beauty.

4.4 Penton-Voak IS, Perrett DI, Little AC, Burt DM, Tiddeman B.

Male facial

attractiveness: correlates of facial symmetry.

4.5 Silverman I, Tombs S, Fisher ML. Pupillometry: A sexual selection approach.

Dinner meetings, 6:15 to 7:30 PM (dinner served at Valentine, 5 to 7 PM)

6:15 to 7:30 **Student dinner**, Valentine Hall, Mezzanine

6:15 to 7:30 **Executive Council**, Valentine Hall, Terrace Room

(downstairs)

Evening Poster Session, Sebring Room, next to Valentine Hall. Presenters set up from 8 AM on.

Break down posters by 5 PM Friday (next day).

7:30 –9:30 PM Poster Session

FRIDAY, JUNE 9

7 to 8:30 AM Breakfast served at Valentine Hall

Morning Plenary (Kirby Theater)

8:30 AM Introduction: Steven Pinker

8:35 AM Plenary Address: Marc Hauser, Why humans are the wrong species in which to study the evolution of human intelligence.

9:25 AM Break

Morning Paper Sessions, 9:50 to 11:50 AM (6 talks)

1.0 Symposium: Developmental and evolutionary origins of conceptual knowledge. Organizer:

HBES Program Committee. Chair: Steven Pinker.

1.1 Boysen ST “ I before e, except after c”: Pushing the parameters of primate cognition.

1.2 Keil F. Association vs. causation in conceptual development.

1.3 Spelke E. What makes humans smart?

2.0 Evolution of life histories I: theory, risk, reproductive expenditure and birth order. Chair:

James Jones, 6.

- 2.1 Jones JH. Human evolutionary demography: A life cycle analysis.
- 2.2 Chisholm J, Burbank V. Evolution and inequality.
- 2.3 Chen YC, Wang XT. Sexual selection and the perception of health and environmental risk.
- 2.4 Davis JN. Birth order and the effects of maternal age on maternal investment.
- 2.5 LeGrand E. Enhanced apoptosis of infected cells as a benefit of the anorexia of infection.
- 2.6 Zvoch K. Life histories and expected educational investment: Mortality-induced variation?
- 3.0 Evolution and functions of emotions I: Sexual jealousy and guilt.
Chair: David Buss, 6
- 3.1 Buss DM. The dangerous passion: The co-evolution of jealousy and infidelity
- 3.2 Bleske AL, Buss DM. Mate encroachment and jealousy.
- 3.3 Cousins J, Gangestad SW. Threats of female infidelity, male proprietariness and violence in dating couples.
- 3.4 Fisher ML, MacKewn A, Czernochowski D. Guilt and adultery: An adaptationist approach.
- 3.5 Bennett KL. Guilt regarding sexual and emotional fidelity.
- 3.6 Brown S, Demarest J. Sex differences in jealousy: The role of emotional involvement in sexual infidelity.
- 4.0 Mating efforts and tactics I. Chair: Randall Grometstein, 6.
- 4.1 Bartlett M, Grometstein R. Mating effort and self control theory.
- 4.2 Conlan S, Buss DM. Mate expulsion tactics.
- 4.3 Grometstein R., Bartlett M. The marginalization of mating effort in our modern society.
- 4.4 Whybird R, Mealey L. Sociosexuality and sociosexual signalling.
- 4.5 Steadman M, Cvorovic M. Ancient Greek promiscuity ?
- 4.6 Beroldi G, The NLSY79, father absence and evolution

Luncheon meeting, 12 to 1 PM (lunch served in Valentine, 11 to 1:15 PM)

Business Meeting I, 12 to 1 PM, Valentine Annex

Afternoon Plenary (Kirby Theater)

1:20 PM Introduction: Eric Smith

1:25 PM Plenary Address: Herbert Gintis, Strong reciprocity and human sociality: game theoretic models and empirical tests.

2:15 PM Break

Early Afternoon Paper Sessions, 2:40 to 4:20 PM (5 talks)

1.0 Symposium: Reciprocity and human sociality: theoretical models and empirical tests

Organizer and Chair: Herbert Gintis.

1.1 Alvard M Cooperative big game hunting.

1.2 Ensminger, J Learning cooperation in the market--evidence from experimental economics in Kenya.

1.3 Smith EA. Signaling generosity and willingness to punish.

1.4 Marlowe F. Sharing among Hadza hunter-gatherers.

1.5 Patton JQ. Social contracts, ultimatums, and reciprocal fairness in the Ecuadorian Amazon.

2.0 Panel Discussion: The use of evolutionary biology in understanding religion:

Promising beginnings and/or dangerous directions? Organizer: Dan Kriegman. Moderator: Irvan DeVore. Discussants: K. MacDonald, J. Hartung, R. Wrangham.

2.1 Kriegman O. Evolutionary analysis of intergroup conflict and coalitional aggression:

Positing universal human psychological mechanisms for group formation and conflict.

2.2 Kriegman D. Kevin MacDonald and the Jews: Hard medicine to swallow, or a delicious gift to Saint Stephen (J. Gould)?

2.3 Reply and Discussion: MacDonald K, Hartung J, Wrangham R.

3.0 Evolution and function of emotions II: Empathy and grief. Chair: Paul Wehr, 5.

3.1 Korchmaros JD, Kenny DA. Emotional closeness as a mediator of the effect of genetic relatedness on altruism.

3.2 Michalski RL, Shackelford TK. Adult attachment, kinship and mateships among older

- adults.
- 3.3 Thompson B. The influence of evolved psychology on human perceptions of non-human species.
- 3.4 Wehr P. Bereavement as a function of reproductive value: Evidence from spousal and offspring loss.
- 4.0 Mating tactics and mate choice. Chair: Todd Shackelford, 5.
 - 4.1 LeBlanc, Buss DM, Shackelford TK. Number of children desired and preferred spousal age difference: Context-specific mate preference patterns across 37 cultures.
 - 4.2 Abraham JN. Does sexual selection exist? An ecological theory of sexual dimorphism in animals .
 - 4.3 Ward D, LeBlanc G, Shackelford TK. Preventing, correcting, and anticipating female infidelity: Three adaptive problems of sperm competition.
 - 4.4 Schmitt DP. The desire for sexual variety as a tool for understanding basic human mating strategies.
 - 4.5 Josephson SC. First wives and the nature of polygyny

Late Afternoon Paper Sessions, 4:40 to 6 PM (4 talks)

- 1.0 Symposium: The battle for human nature: A thirty years' war. Organizer: Ullica Segerstrale.
 - 1.1 Irons W. Tales from the front: How the thought police banned my human sexuality course.
 - 1.2 Chagnon N. The Noble Savage has no biology and evolutionists who think so should be repudiated.
 - 1.3 Segerstrale U. Politics by scientific means and science by political means: critical strategies in the sociobiology debate.
 - 1.4 Fetzer J. Future conflicts in evolution and psychology.
- 2.0 Symposium: Reproductive effort: Trade-offs in mating and parenting. Organizers and Chair: Mary Shenk, Geoffrey Kushnick.

- 2.1 Kushnick GC. Parent-offspring conflict models: prospects for use in human behavioral ecology field studies.
- 2.2 Anderson KG. The life histories of American stepfathers in evolutionary perspective.
- 2.3 Shenk, M. Evolutionary and economic determinants of dowry inflation.
- 2.4 Nolin D, Alvard M. Resource sharing and growth of offspring in Lamalera, Indonesia.
- 3.0 Linguistic evidence of social evolution, 3
- 3.1 Jones D. Toward an evolutionary psychology of kin classification: Group nepotism, markedness and optimality theory.
- 3.2 Jordan F, Gray R. Rigorous tests of adaptive hypotheses: are language phylogenies the answer ?
- 3.3 Schuldberg D, Guisinger S. Female choice in the evolution of language: Evidence from an analogue study of sperm donor preferences.
- 4.0 Evolution of life histories II: fertility, pregnancy, and maternal investment. Chair: Beverly Strassman
- 4.1 Valeggia CR, Ellison PT. Breastfeeding behavior, maternal energetics, and duration of amenorrhea in Toba women of Formosa , Argentina.
- 4.2 Strassman BI. Does Dogon fertility maximize female fitness.
- 4.3 Fessler DMT. Progesterone-induced immunosuppression and sex differences in meat consumption.
- 4.4 Mace R, Sear R. Twin mothers as supermums: analysis of the fitness of mothers of twins using demographic data from rural Gambia.
- Banquet and Keynote Address** (Alumni Gymnasium and Kirby Theater)
- 6:15-6:45 PM Refreshments, Alumni Gymnasium
- 6:45-8:00 PM Banquet, Alumni Gymnasium
- 8:25 PM Introduction, Irven DeVore (Kirby Theater)
- 8:35 PM Keynote Address: Ecology and phylogeny in the human ape: Towards an integrated evolutionary psychology. Richard Wrangham

SATURDAY, June 10

7 to 8:30 AM Breakfast served at Valentine Hall

Morning Plenary (Kirby Theater)

8:30 AM Introduction: Irven DeVore

8:35 AM Plenary address: Richard Potts, The adaptive crunch: Habitat instability as the context of early human behavioral evolution.

9:25 AM Break

Morning Paper Sessions, 9:50 to 11:50 AM (6 talks)

1.0 Symposium: Hominid transitions (organizer: HBES 2000 Program Committee. Chair: Irven DeVore.

1.1 Laden, G. With this handaxe, I thee wed? The origin and evolution of human pair bonding and food sharing may be visible in the archaeological record.

1.2 Significant others: Chimpanzees, bonobos and the five cherished myths of human behavioral origins.

1.3 Robson S. Meat eating and human encephalization.

1.4 Deacon T.

2.0 Religion, religious experience and moral systems. Chair: Thomas Moore, 6.

2.1 Moore T. Placebos, faith and morals: Or why religion ?

2.2 Goldberg R. Selection advantage of religious fasts.

2.3 Schloss JP. Historical oscillations of religious zeal as cheater detection mechanism:

Religious revivalism as costly or hard to fake signalling.

2.4 McClenon J. Content analysis of an anomalous experience collection: Evaluating

evolutionary perspectives.

2.5 Navarette CD. The evolution and function of moral reasoning: A synthetic view.

2.6 Wiebe RP. Criminal behavior, reproductive fitness and moral responsibility.

3.0 Evolutionary psychology: models, variation, social influence, fear and parental investment. Chair: James Boster, 6.

3.1 Ketelaar T. Is Affect simply an algorithm for representing Utility ? Evidence for an

emotional basis to the "Losses loom larger than Gains" effect.

3.2 Colarelli SM, Yang C. G^I Directly testing the assumption of frequency superiority, with some

implications for social influence.

3.3 Brase G. Directly testing the assumption of frequency superiority, with some

implications for social influence.

3.4 Fetchenhauer D. Why are women more afraid of crime than men

?

3.5 Boster J. Family values: What American parents want for their children.

3.6 Wang XT. In the eyes of the beholder: How men and women, tested in two cultures,

estimate each other's investment distributions.

Luncheon Business Meeting II, 12 to 1 PM, Valentine Hall, Annex

Student Workshop, 12 to 1 PM, Speakers: D.Buss, M.Daly, Valentine Mezzanine

Afternoon Plenary (Kirby Theater)

1:25 PM Introduction, Napoleon Chagnon

1:30 PM Plenary Address: Laura Betzig, Why the Pope's Catholic: A Darwinian history of the church.

2:20 PM Break

Afternoon Paper Sessions, 2:45 to 4:45 PM (6 talks)

1.0 Symposium: Darwinian history. Organizer and Chair: Laura Betzig.

1.1 Pinker S. The Blank Slate, the Noble Savage, and the Ghost in the Machine.

1.2 Wright R. Human nature and the direction of history.

1.3 Sulloway F. Darwinian psychohistory: Principles and prospects

2.0 Symposium: The nature of psychopathy. Organizer: M. Lalumiere. Chair: L.

Mealey.

2.1 Quinsey VL. Measurement and conceptualization of psychopathy.

2.2 Lalumière ML Developmental instability and psychopathy.

2.3 Skilling TA. Serious antisocial behavior in children: Evidence of an underlying taxon

2.4 Harris GT. Psychopathy as a viable strategy: Empirical tests with sex offenders.

3.0 Aggression, homicide and dominance striving. Chair: Viviana Weekes-Shackelford, 5.

3.1 Dyson-Hudson R. A Darwinian study of homicide

3.2 Hiraiwa Hasegawa M, Hasegawa T. Homicide in Japan during the 1990's.

3.3 Shackelford TK. Reproductive age women are over-represented among perpetrators of husband killing.

3.4 Weekes-Shackelford VA, Shackelford TK, Buss DM. Wife killings committed in the context of a "lovers' triangle".

3.5 Rommel W. Analytical sociology and the need for evolutionary psychology.

4.0 Evolution and function of emotions III: Health, depression, self esteem, and patriotism. Chair: Lee Kirkpatrick, 6.

4.1 Curtis V. Dirt, danger and desire: motivating healthy behavior.

4.2 Hanson R. Showing that you care: The evolution of health altruism.

4.3 Henriques GH. Depression as a behavioral shutdown mechanism: Disease or evolved defense strategy.

4.4 Pillmann F. The social competition hypothesis of depression: a review of current evidence.

4.5 Kirkpatrick L, Valencia A, Waugh C, Webster G. Domain specificity of self esteem and aggression.

4.6 Price M. Evolutionary psychology of patriotism.

Memorial Session for William D. Hamilton, 1936-2000 (Kirby Theater)

5:10 PM Introduction: J. Tooby. Speakers: R. Dawkins, M.J. West Eberhard,

G. Williams, R. Trivers

6:00 PM Out

Barbecue, Competition Announcements , Valentine Quadrangle

6:30-8:00 PM Barbecue, Valentine Quadrangle

8:00-9:00 PM Roland Satterwhite, violinist, Valentine Quadrangle

SUNDAY, June 11

7 to 8:30 AM Breakfast served at Valentine Hall

Morning Plenary (Kirby Theater)

8:30 AM Introduction: Sarah Hrdy

8:40 AM Plenary Address: Robert Trivers, Intragenomic conflict and

mental evolution.

9:35 AM Break

Morning Paper Sessions, 9:50 to 11:50 AM (6 talks)

1.0 Symposium: Infectious causation of mental illness. Organizer and Chair: Paul Ewald.

1.1 Torrey FE. Infections, cats, and schizophrenia.

1.2 Cochran GM. Evolution and infectious causation of mental illness.

1.3 Leckman JF. Obsessive-compulsive disorder: Evolutionary and developmental perspectives.

2.0 Cognitive architecture and specializations II. Chair: Robert Kurzban, 6

2.1 Tooby J, Cosmides L. Resolving the debate on innate ideas.

2.2 Barrett HC. Evidence for two modes of biological reasoning.

2.3 Pound N. Sex differences in mental rotation: the importance and evolutionary significance of intrasexual variation.

2.4 Duchaine BC. Face-specific impairments in a case of developmental prosopagnosia: neuropsychological evidence for an evolutionarily specialized face-recognition system.

2.5 McBride D. Accounting for paradoxical brain size and IQ differences among races and sexes.

2.6 Kurzban R, Leary M. Evolutionary origins of stigmatization: The functions of social exclusion.

3.0 Coalitions, conflict and cooperation, 4

3.1 Hess N. Female coalitions and gossip: two experiments.

3.2 Kunstmann AL, Rohde PA, Euler HA. Reconciliation: primatological concepts tested in humans.

3.3 Ziker J. Food sharing among indigenous hunters of the Russian arctic: Behavioral models and preliminary evidence.

3.4 Stewart M, Campbell L, Manning J, Simpson J. The role of personality in predicting emergent leadership in an intrasexually competitive situation.

Lunch, 11 AM to 1:15PM

TALK ABSTRACTS

Thursday, AM. Plenary Address: Paul Sherman

Sherman P1 Spices and morning sickness: Protecting ourselves from what eats us

Two mechanisms, one cultural and the other physiological, protect us against foodborne microorganisms and phytotoxins. The former involves cooking with spices. Usually spices are considered solely as flavorings, but they also have antimicrobial properties deriving from secondary compounds that defend the plant against its biotic enemies. We use these natural pharmaceuticals to help cleanse food of pathogens and retard food spoilage. Prior to widespread refrigeration spice use was more prominent in hot climates (where foodborne illnesses are prevalent) than cool climates and in meat dishes (which spoil rapidly) than in vegetable dishes. However many phytochemicals have negative side-effects as carcinogens, teratogens, and abortifacients. Individuals whose tissues are rapidly growing and differentiating are most susceptible (i.e., embryos and children). In addition, gestating women are adaptively immunosuppressed, to avoiding rejecting the "foreign" tissues developing within them. Pregnant women and their embryos thus are particularly vulnerable to foodborne parasites and pathogens. How can they protect themselves, especially when spice use is inadvisable? The answer is avoidance, mediated by the physiological mechanism of morning sickness. Food aversions during the first trimester, reenforced by nausea and vomiting, focus primarily on meats and only secondarily on vegetables. Miscarriages and fetal deaths are far less likely to occur to women who experience morning sickness than those who do not, and the greater the symptoms the better the pregnancy outcome. Traditional societies in HRAF with no evidence of morning sickness rarely eat meat or strong-tasting plants, instead consuming mainly corn. Pregnancy-induced (and ontogenetic) shifts in liking and disliking meats and spices, mediated by morning sickness, balance nutritional needs against dangers of ingesting food borne microorganisms and dietary pesticides.

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Thursday AM Paper Sessions

1.0 Cognitive architecture and specializations

1.1 *Cory G¹* **Consilience and the predictive value of the reciprocal modular brain**

This paper builds upon ideas put forth in the author's *The Reciprocal Modular Brain in Economics and Politics* (Kluwer Academic/Plenum 1999) and *Toward Consilience* (Kluwer Academic/Plenum to be released August 2000). It focuses on the predictive value of the conflict systems neurobehavioral (CSN) model and the reciprocal algorithms of behavior by the introduction of new material, which extends the concepts presented in the two books. The CSN model and related algorithms, derived from and building upon the work of Paul MacLean, are shown to have extensive predictive value applicable to evolutionary psychology, social psychology, and the evolution and functioning of our social, economic, and political systems. It proposes a common mathematical formula expressive of the brain's dynamic algorithms and the laws of supply and demand as well as the Invisible Hand of microeconomic theory.

¹The Center for Behavioral Ecology, 50 Airport Parkway, San Jose, CA 95110-1011
gcory@compaq.net

1.2 *Lieberman D¹, Tooby J², Cosmides, L²* **In search of cues governing kin recognition and incest avoidance.** The avoidance of sexual relations with closely related individuals was an important and recurrent selection pressure throughout our evolutionary history. The increased probability of expressed deleterious recessives and the decreased resistance to pathogens selected for cognitive mechanisms involved in the recognition of close kin and the inhibition of sexual relations between them during adulthood. Although a critical time period of the first three or four years during early childhood has been suggested for the development of a sexual aversion between siblings, the nature of the cues governing this process have yet to be examined. In order to explore the kinds of information computationally relevant for cognitive mechanisms dedicated to identifying and avoiding sexual relations with a sibling, we administered a questionnaire to undergraduate subjects.

Subjects were asked a series of questions regarding various childhood behaviors they engaged in as well as their age range during the time they resided with each sibling. Using a number of different instruments, subjects rated how disgusting they perceived various sexual acts with different family members. The data from this questionnaire will be discussed along with previous findings from a prior questionnaire.

1 Dept of Psychology, UCSB, Santa Barbara, CA, 93106
pathogen@mindspring.com

2 Ibid. tooby@sscf.ucsb.edu

1.3 *Brown WM¹, Moore C², Humphrey T³* Has subtle cheating influenced the adaptive design of altruist-detection cognitive architecture? Subtle cheating may be costly for altruists in partnerships based on a division of labour (e.g. friendships / pair-bonds). Detecting non-verbal cues reliably signaling commitment to cooperate could be an adaptive solution to subtle cheating (Trivers 1971; Frank 1988). Smile symmetry may be an example of a reliable cue signaling likelihood to future cooperation due to involuntary hemispheric mechanisms controlling the expression of genuine emotion (Gazzaniga and Smylie 1990). In the first experiment 38 undergraduate perceivers were presented icons representing benevolent and malevolent facial expressions that had symmetrical or asymmetrical smiles. Resources (i.e. lottery tickets) allocated to icons and the amount of resources participants predicted that icons would give away was measured. Benevolent-looking icons were judged by perceivers to deliver more and received more resources. Also, asymmetrically smiling icons received 13% fewer resources than icons with symmetrical smiles. In a second experiment video-stills of self-reported altruists and self-reported non-altruists smiling naturally in a cooperative situation were presented to 50 undergraduates. Regardless of altruism level participants predicted that females would give more and subsequently received more resources than males. Interestingly altruistic males were better detectors of female altruism. Paternity uncertainty and subtle cheating in division of labour situations may have exerted selective pressures on the design of ancestral hominid cognitive architecture for altruist-detection.

¹Department of Psychology, Life Sciences Centre, Dalhousie University, Nova Scotia B3H 4J1

²*Ibid.*

1.4 MacDonald K¹, Geary DC² The evolution of general intelligence: Domain-general cognitive mechanisms and human adaptation. Recurrent adaptive challenges of the EEA are optimally solved by domain specific mechanisms specialized to handle specific types of input. We conceptualize the EEA as consisting of both recurrent and non-recurrent problems, the latter leading to the evolution of domain general mechanisms designed to produce adaptive responses in novel and complex (unpredictable) environments. Evolved motivational systems, ranging from children's curiosity and playfulness to systems embedded in the five-factor model of personality (e.g., status seeking, love, safety) enable the evolution of domain-general cognitive mechanisms. Motivational mechanisms solve the frame problem (i.e., the problem of assembling task relevant solutions, and the need for logically viable criteria of success [i.e., achieving evolved motives—**NOT** achieving fitness maximization]). Goals solve the frame problem by, e.g., directing attention to existing knowledge relevant to evolved goals and devising appropriate strategies, including strategies based on past experience, to attain them. Whereas domain specific mechanisms are effortless and unconscious, activities facilitated by general intelligence are typically conscious and effortful. Data will be presented suggesting that general intelligence has four overlapping functions: (1) attainment of evolved goals in unfamiliar and novel conditions characterized by minimal prior knowledge (fluid intelligence); (2) attainment of evolved goals via complex knowledge and expertise acquired throughout life (crystallized intelligence); (3) facilitating the use of biologically primary, domain specific cognitive competencies in ways unrelated to their evolutionary function (e.g., facilitating the development of reading by integrating domain-specific adaptations underlying language to perform the non-evolved, biologically secondary task of reading); (4) enabling decontextualizing and abstracting processes that inhibit evolved heuristics of folk psychology, folk biology, and folk physics, thereby enabling the development of formal logic, mathematics, and science which can in turn be utilized to achieve evolutionary goals.

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1.5 *Pereyra L* **Functional variation of the hazard management algorithm.**

In this preliminary study, two factors affecting the ease of activation of the adaptation for reasoning about hazards are addressed: risk-taking propensity, and vulnerability/loss significance. Performance on Wason selection tasks that used precaution rules was used as an indicator of the ease of activation of the adaptation. The first two experiments (N=64, N=46) compared performance between undergraduate high and low risk takers and between men and women. The third experiment (N=24) compared performance between pregnant and non-pregnant women. Results showed significantly better performance on precaution rules for high risk-takers and pregnant women. The conclusions are that this reflects a greater ease of activation of the hazard management algorithm for these two groups. Possible explanations for this increase in activation and future lines of investigation will be discussed.

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1.6 *Hammond M* **Arouser-arousal conversion rules: The neurophysiology and evolution of diminishing marginal utility.** Our expanding knowledge of the neurophysiology of the brain has demonstrated the underlying mechanisms for the arouser-arousal conversions at the heart of diminishing marginal utility. This conversion barrier depreciates the arousal impact of increasingly strong arouser packages. The dynamics of these neural mechanisms highlight the logic in the natural selection of these rules to frame the expansion or contraction of so many human interests. These conversion rules also suggest how there may be a number of extraordinary behavioral outcomes with the human exodus from our evolutionary context of origin. Under those conditions, certain interests will expand differentially because of their capacity to attack the conversion barrier. These rules then become a part of our biological heritage still shaping behavior today.

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2.0 Parental investment, menopause

2.1 *Hill EM¹, Craig AS¹, Hannah ME¹* **Variation in parental economic investment among a midlife U.S. cohort.** Parental investment theory has been developed in both behavioral ecology and economics. We analyzed variation in parental economic investment using the Wisconsin Longitudinal Study (WLS), a long-term study of persons first interviewed as high school seniors in 1957. Most respondents (74%) have children (range 0-14, mean=2.96±1.70). Financial transfers to children that exceeded \$1000 in amount were recorded; 5027 of 8493 respondents made such transfers, for education, house down payments, new businesses, or medical expenses. We analyzed respondents who had exactly three children in 1992 (n=1074 Men and 1179 Women). Some of these families had both biological (n=1991) and non-biological children (n=88, adopted, step, other). Biological children received 0.9 year more education than did non-biological children of the same birth order. Examining only biological children, investment varied by birth order, in that a decrement occurred for those born third (average years education=14.4 for 1st, 14.2 for 2nd, and 13.4 for 3rd; average monetary transfer=\$8241 for 1st, \$8306 for 2nd, and \$6843 for 3rd). Female children received less than males, except for third-born women. Investment in education (i.e., human capital) and monetary transfers followed similar patterns. These results provide evidence of differential investment among children, even when number of children is held constant. (Supported by NIA R03 AG16142)

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2.2 *Berezkei T¹* **Maternal trade-off in treating high-risk children**

Trade-off exists between current and future reproduction, that is the continued investment in offspring previously produced, and the need to preserve resources for future reproduction. Low birth weight and the infant's health status are expected to strongly influence the child's reproductive value and, thus, the maternal decisions on the amount and timing of investment. In one study, non-Gypsy Hungarian mothers have been found to breastfeed their healthy infant of normal birth weight for a longer period of time and give birth to the next child later. Those with a

low birth weight and/or unhealthy infant terminate lactation earlier and shorten birth spacing. Another study has revealed that Hungarian Gypsy mothers particularly are at risk of having low birth weight infants whose mortality rate is very high. As a possible response to that reproductive cost, they shortened birth spacing, gaining 2-4 years for having additional children. Because of relatively short interbirth intervals, by the end of their fertility period, Gypsy mothers with one or more infants of low birth weight had significantly more children than those with normal birth weight delivery. The former appears to compensate handicaps associated with birth weigh deficits by having a larger number of closely spaced children, as a shift form qualitative from quantitative production of offspring.

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2.3 Holden C' Matriliny as female-biased parental investment: a comparative African study Under matrilineal inheritance, a man's wealth is transmitted to his sister's sons. Why this occurs is a long-standing puzzle in human sociobiology. Past explanations have focussed on the risk of non-paternity among men's own putative offspring. Hartung (1985) showed that matriliney was adaptive for grandmothers, but not for fathers, under moderate levels of paternity uncertainty. This leads to the question of how a female strategy with costs to males can survive in societies where males are usually dominant. Here, I will focus on the possible role of female-biased parental investment, a previously neglected aspect of matriliney. Under some conditions, daughter-biased parental investment may be adaptive for both parents. Inheritance to daughters leads to matriliney (inheritance *through* daughters) by the second generation. Female-biased parental investment is adaptive if the risk of non-paternity among sons' children outweighs the additional reproductive benefits of wealth for sons. This is more likely to occur in societies with little inherited wealth. This was tested on a cross-cultural African sample, using a comparative method that controls for non-independence among populations. Results of two demographic surveys are also presented, comparing wealth inheritance and reproductive success in a matrilineal Malawian population (where daughters inherit land) and in a patrilineal Kenyan population. The benefits of inherited wealth appear to be identical for males and females in the Malawian population, consistent with the hypothesis that daughter-biased inheritance will be favored where this is

the case.

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2.4 Mace R¹, Sear R² Matrilineal kin improve the nutritional status and survival of children in rural Gambia. Hypotheses for the evolution of human female life history characteristics have focussed on the social nature of human societies, which allows women to share the burden of child-care and provisioning amongst other members of the kin group. We test the hypothesis that child health and survival probabilities will be improved by the presence of kin using a longitudinal database from rural Gambia. We find that the presence of mothers, maternal grandmothers and elder sisters significantly improves the nutritional status of children. There is also evidence that the reproductive status of the maternal grandmother influences child nutrition, with young children being taller in the presence of non-reproductive grandmothers than grandmothers who are still reproductively active. The only kin to increase the survival probabilities of children (apart from mothers) are maternal grandmothers. Paternal grandmothers and male kin, including fathers, have negligible impacts on the nutritional status and survival of children.

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2.5 Friedman BX¹ Reduced paternal investment and the evolution of menopause

Human females are probably unique among primates in that their limited egg supply triggers the permanent cessation of menstruation (i.e., menopause) well before the end of their maximum life span. G.C. Williams (1957) proposed that menopause evolved because ancestral middle-aged women gained more in terms of reproductive success by investing in extant genetic relatives than from continued direct reproduction (the “grandmother hypothesis”). Because middle-aged women faced greater risks of maternal death during pregnancy and their

offspring's infancy than did younger women, offspring of middle-aged women may not have received the needed level of prolonged maternal investment to survive to reproductive age (Williams, 1957). I propose a novel hypothesis involving reduced *paternal* investment as one evolutionary impetus for menopause. Reduced levels of paternal investment—due to men's defection, death, and their desire for young women—were additional costs associated with continued direct reproduction in ancestral middle-aged women, and thus an additional impetus for the evolution of menopause. Discussion will focus on why previous research has not supported the grandmother hypothesis and why future research should consider reductions in paternal investment as a plausible cause of the evolution of menopause.

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2.6 *Marlowe F*¹ **The patriarch hypothesis: An alternative explanation of menopause**

Menopause is puzzling because life-history theory predicts there should be no selection for outliving one's reproductive capacity. Adaptive explanations of menopause offered so far turn on women's long-term investment in offspring and grand-offspring, all variations on the grandmother hypothesis. Here, I offer a very different explanation. The patriarch hypothesis proposes that once males became capable of maintaining high status and reproductive access beyond their peak physical condition, selection favored the extension of maximum life span in males. Because the relevant genes were not on the Y chromosome, life span increased in females as well. However, the female reproductive span was constrained by the depletion of viable oocytes, which resulted in menopause. Data from contemporary foragers, the archeological record, the genetics of longevity, and life history research are used to support the hypothesis.

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3.0 **Mate attraction: general, symmetry, waste-hip ratio**

3.1 *Kniffin K*¹, *Wilson DS*² **What is good is beautiful**

We present findings from three different experiments testing a model of

beauty in which physical attractiveness (PA) appears to vary within groups of familiar people as a function of other traits such as the perceived effort people invest in shared tasks or the degree to which people are liked or disliked. Our experiments differ significantly from past studies of PA because stimuli were rated for PA—and other traits, when appropriate—by both strangers and familiars of the stimuli. Our findings suggest that PA is influenced by personal interactions and relationships. Because the majority of past studies of PA are based on strangers' ratings of strangers, their research designs cannot detect this result. Instead, those studies tend to conclude that it is some static measure of PA that can influence how people are perceived for other traits such as the degree to which someone might be liked or disliked. Such studies may have great importance for people living in “societies of strangers,” but we argue that the design of our experiments, which do not rely upon strangers' ratings, allows us to test PA in environments more similar to those thought to constitute the Environment of Evolutionary Adaptedness (EEA).

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3.2 Gangestad SW¹, Thornhill R², Quinlan RJ³, Flinn RV³ Men's fluctuating asymmetry, attractiveness, and reproduction in a rural Caribbean village. Across a variety of species, males who possess developmental stability, as evidenced by low fluctuating asymmetry (FA), appear to possess a mating advantage. This research examined men's mating attractiveness in relation to FA in a rural village on the Caribbean island of Dominica. On 68 men, FA was measured on 9 traits and composited into a single index. Four dimensions of mating attractiveness of each man were rated by individuals familiar with the men. Through principal component analysis, these ratings were reduced to two variables, Partner Quantity and Investing Mate Attractiveness. FA significantly predicted (negatively) both components of mating attractiveness. FA also correlated negatively with measures of men's social power, education, psychological adjustment, income, and relatedness to other members of the village. Regression analyses revealed that men's Partner Quantity was substantially and positively

associated with a broad dimension reflecting social power, education, and psychological adjustment. This dimension may partly mediate the effect of developmental instability on partner quantity, though FA significantly predicted partner quantity independent of it. These results augment previous findings on FA and men's mating attractiveness in other populations.

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3.3 Gray PB¹, Marlowe F² Fluctuating asymmetry among a foraging population: The Hadza of Tanzania. We present the first data on fluctuating asymmetry (FA) in a foraging population, the Hadza of Tanzania. We compare Hadza FA with FA of college students in New Mexico. We found Hadza FA to be significantly higher than US FA. Female FA was higher than male FA among the Hadza, but not among the US sample. Hadza FA increases with age, unlike US FA. We discuss possible influences on FA across the lifespan.

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3.4 Phelan J¹ Heterozygosity decreases fluctuating asymmetry: evidence from fruit flies and humans. We report results from experimental investigations into the relationship between heterozygosity and fluctuating asymmetry (FA) in both fruit flies and humans. First, in a five-fold replicated, three-generation inbreeding study of initially outbred *Drosophila melanogaster*, we measured the degree of wing asymmetry as a function of heterozygosity changes. Fruit fly populations showed continuous, significant increases in FA as they became more homozygous. We also hypothesized that heterozygosity and FA should be similarly related in humans. Using racial/ethnic background as a proxy for heterozygosity, we found a significantly lowered degree of FA among biracial individuals relative to individuals whose parents were from the same racial/ethnic background.

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3.5 *Campbell L¹, Stewart M², Manning J³, Simpson JA⁴* **Men behaving dominantly: Intrasexual competition, emergent leadership, and the male waist-to-hip ratio (WHR).** This study examined how men with different waist-to-hip ratios (WHRs) behaved in one of two group contexts: when an attractive woman observed the group interaction (in an intrasexually competitive situation) or when no female observer was present (in a non-intrasexually-competitive situation). The WHR is a potential marker of male viability (Singh, 1995), with WHRs in the .90-.95 range related to superior health. The WHR is partly heritable, and women rate WHRs in the ideal range as more attractive. The WHR may, therefore, be an honest indicator of health status. Men were randomly placed in 4 person groups and asked to solve a given problem (a leaderless group discussion paradigm). In 22 of these groups an attractive female "observer" was present. These group interactions were unobtrusively videotaped, and lasted approximately 30 minutes. It was hypothesized that men with WHRs in the ideal range would behave in a more socially dominant fashion than men with WHRs outside of this range, but only in the intrasexually competitive situation. Two sets of trained raters observed each group interaction and coded each participant's behavior on a number of theoretically relevant dimensions. Results revealed that men with WHRs in the ideal range behaved both more leaderlike and more socially dominant than other men, but only in groups where the female observer was present. Men with attributes that signify greater health, then, are more likely to behave in a more dominant fashion toward other men in an intrasexually competitive situation.

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3.6 *Cashdan, E¹* **A woman's view of waist-hip ratios: Trade-offs in androgen and estrogen-dependent traits.** Since low waist-hip ratios (WHR) in women are associated with higher fecundity, why do so many women have high WHRs? I argue that the variance results because the hormonal profile producing a higher WHR has compensating advantages. Data from the Standard Cross-Cultural Sample show that in most societies women must obtain resources for their children directly from

their own labor and efforts. The greater muscularity and assertiveness associated with high androgen levels should help in these endeavors. A new analysis of previously-collected data shows that women with high androgen/estrogen ratios are more likely to act on their competitive feelings and are more likely to compete using verbal aggression. Such women should be more successful in competing directly for material resources, even though they may suffer a cost in fecundity.

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4.0 Cultural evolution: models and memes

4.1 *Irons W¹* **Three models of culture** This paper addresses the vexing problem of how to incorporate culture into evolutionary studies of human behavior. Three models are reviewed: (1) the imitation model which portrays culture as a separate set of replicators which reproduce as a result of human beings imitating one another without regard to the adaptiveness of the behavior imitated, (2) the culture as guide to adaptive behavior model which assumes that human beings selectively imitate culture traits which tend to enhance fitness, and (3) the culture as raw material for constructing manipulative messages model. For simple shorthand, these can be referred to as the parasitic meme model, the symbiotic meme model, and the germ-warfare model. I propose that each of these models is valid for certain parts of culture. Culture is heterogeneous in the way it is transmitted from one generation to the next and in its function in human communities. Human psychology is also heterogeneous in the sense that human minds contain different learning and decision-making algorithms for solving different problems or guiding different areas of behavior (some would describe these as different modules). Different algorithms guide different aspects of culture and the resulting patterns of interaction of human nature and culture can fit one or another of these models. The formal aspects of language fit the parasitic meme model. Technological knowledge fits the symbiotic meme model, and many forms of ideology fit the germ-warfare model.

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4.2 *Burnham TC* Genetic evolutionary economics: would natural

selection favor a selfish Homo economicus? Economists and biologists have long grappled with the apparent contradiction of altruism in a naturally selected world. Mainstream economic models are built upon an assumption of narrow self-interest where agents maximize individual outcomes without regard for the effects on others. We review experimental data demonstrating that humans exhibit both altruism and spite in economic settings. We seek a resolution to the conflict between economic theory and actual human behavior by modeling the genetic origin of interpersonal components of preferences in a bilateral cooperative setting. A variety of behaviors that are considered paradoxical within the standard economic framework are predicted by a model where agents maximize genetic payoffs. The optimal attitude towards cooperative ventures is parameterized by the genetic relationship between individuals and by the population size. For interactions between individuals who have a particular coefficient of relatedness, the standard economic assumption is the limiting case of the genetic model as the population becomes arbitrarily large.

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4.3 Keckler CNW¹ Evolution of traits related to population density in a heterogeneous metapopulation: an application of the “cornucopia principle” to changes in human political propensities. Human foragers have inhabited widely divergent environments, even more in the past than the present. When selection favors a trait in one subpopulation, and disfavors it in another, the subsequent frequency of that trait depends on the relative size (and r) of the respective subpopulations. Consequently, contemporary species traits (i.e. of humans) are weighted towards those once favored in the “good” rather than “bad” ancestral environments, when magnitudes of selection are equivalent. I report a metapopulation simulation examining some implications of this principle for the evolution of traits connected to human social dominance. Some hypothesize these traits undergo a period of negative selection in low-density environments. Using Kelly’s worldwide survey of effective temperature as a proxy for environmental quality and population density, I estimate the weighted selection coefficient of dominance behavior for an idealized metapopulation of pre-domestication

foragers. Results indicate it may be unwise to dismiss high-density complex foragers as anomalous and irrelevant to human nature. The relative evolutionary significance of selective conditions in high-density environments increases further under two reasonable assumptions: (1) an expanding metapopulation colonizes and fills good environments before nearby marginal ones, and/or (2) the continual production of migrants from high-density zones swamps genes adapted to a low-density strategy. Attention is given briefly to the interaction of simulation results with demographic bottlenecks and post-domestication expansions. The overall model indicates forager egalitarianism is more likely to be part of a broader conditional strategy rather than a consequence of special design.

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4.4 *Brody J'* **Active Darwinism offsets mismatch**

Variable genes and niches are often not in synchrony from moment to moment and there will usually be some degree of “mismatch” between these two partners. However, the disparity between human nature and human culture seems particularly great for the past 10K years. On the other hand, “active genotype-environment correlation” (active Darwinism) states that “individuals seek or create environments correlated with their genetic proclivities.” We usually develop tools that are consistent with our evolved natures and diverse cultures reflect genetic as well as environmental diversity. When there are disasters --- as there always have been --- we use our tools differently or find another tool next time around. The Titanic did not stop our making fast ships; we now steer them differently. Further, complex outcomes like culture result from recursive processes wherein each computation produces the input for its next repetition (e.g., compound interest). Culture at any one moment is an expression of genetic interests applied and reapplied to a chain of systematically modified niches over generations. Life’s diversity varies with the diversity and size of a niche. Technology often multiplies both characteristics and high technological variability offers more options to serve human differences. Mismatch is not an outcome from technology but arises from (1) inaccessibility to its options, (2) imposition of one individual’s (species’) choices on another, (3) and failure by humans to balance long and short term consequences of their decisions. Genes, culture, and cognitive executive functions often compensate for these breakdowns.

4.5 *Aunger R'* **The meme is not the message**

Memes are hypothetical units of cultural transmission which replicate through social learning (Dawkins, 1976). The “jumping meme” hypothesis is that memes leap from brain to brain in the form of signals. Memetic information in brain-code must be converted to signal-code and back again to make this trip. However, there is typically a loss of information associated with translation between coding systems. This means a meme must be (at least partially) reconstructed by the recipient brain from an insufficient and/or noisy stimulus. Memetic content is unlikely to survive intact over numerous iterations of idiosyncratic reconstruction by different minds. I propose, in contrast, that memes replicate like prions. Prions are a class of proteins that, with the aid of a catalyst, cause another molecule of the same class to adopt an infectious shape like its own through contact. I argue, similarly, that memes are a class of neuronal ensembles with states, which can cause other ensembles to acquire their state. In the memetic case, however, it is the catalyst rather than replicator, which moves. I hypothesize that social signals are catalysts rather than memetic phenotypes. Contact with a catalyst is sufficient to cause an existing neuronal ensemble, with the help of local resources, to assume a state resembling that of the memetic ensemble in the source brain. This view is consistent with leading linguistic theories (Chomsky, Sperber) regarding the informational poverty of communicative stimuli, while providing for long-lasting cultural traditions through specific, high fidelity replication.

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4.6 *Beahrs, JO'* **Meme transmission: mutual suggestion as the default presumption**

“Memes” are “second replicators” whose differential replication is widely believed to underlie cultural evolution. “Mimetics” presumes that memes are transmitted through simple imitation, relatively independent of concurrent genetic selection. This theory explicates such seeming anomalies as the evolution of language, proliferation of false/irrelevant/destructive beliefs, “true” genetic altruism, and illusory

aspects of human selfhood. As science, it is problematic in being self-reinforcing: able to postdict many cultural phenomena after the fact, but failing to yield specific unambiguous falsifiable predictions in advance. The same anomalies also yield to an alternative explanation that is fully gene-centric, does yield specific predictions, and has been proven viable in recent computer simulations: i.e., indirect reciprocity. This alternative predicts that human communications all have honest and deceptive components. Its scope extends, with one hypothesized added step: within certain limits, two or more individuals recognize one another's deceptions but tacitly agree to respect them, act as though deceived, and thereby "ratify" their shared deceptions. We can then predict emergent tension between topics that are open versus taboo in social settings, and that these will correlate with individuals' so-called "conscious" and "unconscious." This hypothesis has already been tested and confirmed by over two centuries of otherwise paradoxical data from hypnosis research, with the added step corresponding to what we call mutual suggestion. I argue that indirect reciprocity with mutual suggestion is the default presumption for how human memes propagate, against which purely mimetic alternatives like simple imitation must be differentiated and tested.

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Thursday PM, Plenary Address: Douglas Kenrick

Kenrick, D1 Can one ever be too wealthy or too chaste?

Is it true that, as the Duchess of Windsor claimed: "One can never be too rich?" Or is there an optimum amount of wealth, above which one faces diminishing returns, or even a reversal of mating fortune. The possibility of nonlinear functions also arises for other questions about mate value, including the optimum number of sexual partners (one bit of advice from a women's magazine, for example, is to "always tell a man 3"). Beyond prurient interest value, such questions actually have theoretical significance. Although psychologists adopting an evolutionary perspective like to talk about context-sensitive psychological "mechanisms," we often use methods that examine only the extremes of judgment, or statistical analyses that enforce assumptions of linearity. This can be an important problem because we thereby ignore nonlinear and nonmonotonic changes

in judgment that could provide useful clues about underlying decision mechanisms. A good example comes from work on vision, where a noticeable bump in the curve for dark adaptation was a crucial clue that led to the discovery of separate rod and cone systems. I discuss the relevance of such an approach to understanding nonlinear functions we found in judgments of potential mates as a function of income or numbers of prior sexual partners. At a more general level, I discuss some biases that naturalistic researchers sometimes hold against laboratory experiments in psychology, and why those biases are road-blocks to progress in fully understanding behavior. Unnatural experiments can in fact be useful tools in the search for underlying mechanisms.

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Thursday Early PM Paper Sessions

1.0 Symposium: Providing evidence for psychological mechanisms (organized J. Simpson)

One of the most important issues facing evolutionary psychology is how to demonstrate that psychological mechanisms have properties of “special design” (i.e., evidence that a trait effectively serves a particular function with specificity economy, and precision, and does not serve other functions in similar ways). Evidence for special design is a telltale sign that selection has occurred, and it can reveal the precise function of a trait (i.e., the specific benefits that could have led to its selection). Indeed, evidence for special design actually is evidence about evolutionary history. This symposium contains 4 talks that address these issues. Simpson and Gangestad discuss classic notions of adaptationism and suggest that psychological adaptations that are “damn funny coincidences” are often likely to be evolved adaptations. Li and Bailey discuss two experimental methods designed to disentangle characteristics people consider most crucial in a mate from those that are less crucial. They suggest that people are equipped with psychological mechanisms to choose mates to the extent that they have the ability to make rough calculations on the marginal reproductive benefits of various mate characteristics. Schaller and Neuberg reveal how thinking like an experimental social psychologist can inform and strengthen evolutionary

explanations of human behavior. They focus on three elements of social psychological thinking, providing examples from research on intergroup vigilance and intragroup stigmatization. Finally, Cosmides and Tooby illustrate how evidence for special design has been found in converging lines of evidence regarding cognitive adaptations for social exchange.

1.1 *Simpson JA¹, Gangestad SW²* **Validation of special design and selective history: Theoretical terms and “damn funny coincidences”**. In his classic exposition of adaptationism, Williams (1966) proposed that adaptation is revealed through evidence for special design--evidence that a trait (or suite of traits) efficiently and effectively serves a particular function and does so with specificity, not serving other purposes in similar ways. Evidence for special design is not only telltale evidence that selection has been at work. It also may reveal the precise function of a trait, the specific benefits that led to its selection. As such, evidence for special design is evidence about evolutionary history, which cannot be directly observed at present. We discuss evidence for special design as an instance of more general notions within philosophy of science, namely, evidence for unobserved theoretical terms. First, we discuss the empirical meaning of claims about unobservable entities. Second, we discuss the epistemological impact of specific evidence for such claims. As Williams himself noted, a special design argument is an informal argument about the probability that a trait would have evolved to have the qualities it does if it did *not* have a purported function. Philosopher of science Wesley Salmon has argued that a Bayesian-frequentist view of the impact of evidence places high weight on the impact of “damn funny coincidences”, that is, evidence expected by a particular theory but with very low a priori probability if the theory is wrong. We suggest that the most powerful pieces of evidence for special design, the historical events this evidence purportedly reveals, and psychological adaptations are “damn funny coincidences” and we discuss some examples.

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1.2 *Li NP¹, Bailey JM²* **Trade-offs and psychological mechanisms:**

Experimental methods and mate preferences. Women rate creativity as important in a mate. But what if getting a more creative partner comes at the expense of losing a high income? Previous researchers have asked participants to their state preferences for mate characteristics one at a time. While results have been illuminating, tradeoffs routinely made among the characteristics have not been explored in depth. This research introduces two experimental methods to disentangle characteristics people consider most crucial in a mate (what people most prefer when overall choice is constrained) from those that are less crucial. In considering women for long-term mates, we found that men consider physical attractiveness a necessity, and women consider resource acquisition a necessity. Once sufficient levels of necessary characteristics are obtained, people become more interested in luxuries. Sex differences are most apparent when choices are most constrained, and less so as restrictions on overall choice are relaxed. For short-term mates, both men and women treat physical attractiveness as a necessity that takes precedence over other characteristics. From an evolutionary perspective, it may make sense that people are equipped with psychological mechanisms to choose mates as if they have the ability to make rough calculations on the marginal reproductive benefits of various mate characteristics. Similar to potential mates, researchers often face trade-offs. More naturalistic data have advantages, but experimental methods have a unique advantage in forcing people to make normally implicit trade-offs. We discuss how different methods can complement one another in studying mating preferences.

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1.3 Schaller M¹, Neuberg S² **How social psychologists' minds work: Implications for evolutionary inquiries.** Like pragmatic lay persons, scientists usually desire two things from explanations: (1) that they stand a chance of being correct, and (2) that they are in some way useful. Toward the first goal, scientists are compelled by explanations that are logically coherent and empirically verifiable. Toward the second goal, lay persons are compelled by explanations that are uniquely explanatory (where no 'simpler' explanation is available) and that facilitate the

discovery of novel phenomena.. In this talk, we reveal how thinking like an experimental social psychologist can inform and strengthen evolutionary explanations of human behavior. We focus on three paradigmatic elements of social psychological thinking, using examples from research on intergroup vigilance and intragroup stigmatization to illustrate how these elements can inform evolutionary hypotheses. First, social psychological thinking emphasizes the logical deduction of theories specifying causal relations between variables. This deductive approach (in contrast to mere explanation-seeking) leads to more careful articulation of processes linking the evolutionary past to contemporary behavior, enhances the range of opportunities in which to obtain verifying evidence, and facilitates the collection of evidence that is difficult to explain using alternative explanations. Second, social psychological thinking emphasizes attention to the social/environmental context of human behavior. This focus, when combined with deductive theorizing, can lead to complex hypotheses about specific contexts that trigger (or inhibit) evolutionarily adaptive psychological responses. Evidence for these complex predictions often is not obtainable through observational methods alone. This evidence can offer convincing support for evolutionary theories of human behavior, and can reveal phenomena undiscovered through other lenses of inquiry. Third, social psychological thinking encourages the identification of multiple processes that may all contribute to the same observed event. This approach may help curb unproductive and polarized debates between 'alternative' explanations that are logically compatible and complementary from an evolutionary perspective. We conclude that the social psychological style of theorizing and hypothesis-testing can lead to more convincing, more innovative, and more generative evolutionary inquiries into human behavior.

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1.4 *Cosmides L¹ & Tooby J²* **Social exchange: Converging evidence for special design.**

Those who observe behavior in situ often find laboratory experiments artificial and, therefore, irrelevant: decisions are made in the absence of

real consequences, eliciting stimuli seem to lack ecological validity, and the methods appear too constrained to capture the richness of human social life. Those who do laboratory experiments often find naturalistic behavioral observations informative, but too uncontrolled to decide among viable alternative hypotheses. In reverse engineering the human mind, we need all the constraints we can get. To demonstrate the existence of an adaptation, one needs to provide evidence of *special design*. Converging lines of evidence are needed to meet this engineering standard. We illustrate this point using cognitive adaptations for social exchange as an example. Naturalistic observations of social exchange behavior are not, by themselves, adequate for demonstrating special design because the same behavior (e.g., cheater detection) could, in principle, be produced by a variety of different cognitive mechanisms, some of which are not designed for this function. These alternative hypotheses have been ruled out by a convergence of laboratory methods: laboratory reasoning experiments, the discovery of neural dissociations, cross-cultural experiments, developmental data, and methods from experimental economics. But naturalistic observations in both humans and other animals were required as well. The distribution of social exchange across species rules out certain learning theories (such as operant conditioning); moreover, the diverse forms it takes in humans (but not in most other species) places constraints on the representational format of the cognitive adaptations that produce social exchange in humans.

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2.0 Symposium: Evolutionary analysis in law (organized by O. Jones)

At its most fundamental level, law is a mechanism for regulating human behavior. To encourage human behavior to move in directions it might not otherwise go on its own, law uses a combination of incentives, including rewards (such as tax credits) and punishments (such as incarceration). The effectiveness of law often depends on the model of human behavior on which legal policy-makers rely in tailoring incentive programs to various desirable or undesirable behaviors. That model cannot be complete without an evolutionary perspective on how and why

the human brain biases the probability of different behaviors as a function of variations in environmental conditions. This symposium will present several views on the benefits of thinking about legal issues from an evolutionary perspective.

2.1 *Jones O[1]*, **Evolutionary analysis in law: Prospects for applied evolutionary psychology**

Because it is charged by society with changing aspects of behavior in human populations, law is a potential arena for applied evolutionary psychology. Without doubt, however, there are more ways to misapply an evolutionary perspective than there are to apply it wisely. We know, for example, that descriptions of how or why people may behave as they do can never serve, alone, as justifications for their behavior. But because the normative goals of law are often already well-formulated (for example, the law is charged with trying to reduce the incidence of child abuse and sexual aggression) evolutionary thinking may help the law to achieve pre-articulated goals more efficiently. This talk will explore some of the ways by which evolutionary thinking might legitimately do that.

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2.2 *Judge D'* **When gender-blind law isn't: Demography, sex differences, and legal outcomes for women and men.** Legal transformations in America from the early colonial period to present included movement away from laws that were explicitly pegged to gender. In some cases, gender blind law preceded normative behavior - for example, intestate egalitarian inheritance between sons and daughters preceded normative equality by decades. Other such changes often occurred only after prolonged social agitation -- such as the case with married women's property acts. However, gender neutral law does not necessarily result in gender-neutral outcomes. When demographic processes are sex specific and/or the sexes exhibit inherently different behavioral preferences, gender blind laws may not result in similar outcomes for women and for men. In this presentation I discuss the often unintended outcomes that result from inherent sex differences interacting with "gender-neutral" legal structures. "Sex-specific" and "gendered" legal outcomes are distinguished because outcomes differ depending on the roles of particular individuals, and those roles, while typically falling to one or the other sex, may not be universal. Examples of gendered outcomes

include those resulting from property law, probate law and intestacy statutes, family law, and tort reform. A common basis of sex specific outcomes arises from the broad ramifications of male and female reproductive life histories. If the goal of legal reforms is equality of the sexes under law, true sex differences in demographic experience and in behavior must be explicitly recognized and incorporated into legal reform.

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2.3 Thomson JA¹ Darwin goes to court: Principles of an evolutionary forensic psychiatry and psychology. There is now a substantial body of work in evolutionary psychology and psychiatry about human nature and psychopathology that can be applied to forensic psychology and psychiatry. This new knowledge lends itself to basic principles which, if kept in mind by the forensic clinician, can act as a universal acid against illusions, bad theories, and wishful thinking about human nature. These principles protect the forensic clinician from either dehumanizing the defendant or minimizing violence. They broaden the formulation of a defendant's actions. Only if the expert witness can come to terms with some of the terrible aspects of human nature and their adaptive significance, can he or she offer objective assistance to a defendant, his legal counsel, and those empowered to render justice. The author will outline the basic tenets of an evolutionary forensic psychology and psychiatry and illustrate them with actual case material.

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2.4 McGinnis J' Constitutive law and the human constitution

This paper offers a framework for applying evolutionary biology to constitutional law. Serious thinking about constitutionalism has always revolved around the question of what is the nature of man. The Framers of the United States Constitution premised their work on their view of humans' innate self-interest, altruism, and inequality. Other social theorists from Rousseau to Marx defended their very different views of the proper constitutive mechanisms for society on the basis of different claims about these same human characteristics. Today evolutionary biology is providing us with the information to make a more independent and objective assessment of the elements of human nature relevant to

politics. Five windows of analysis--general evolutionary theory, the natural history of man, the anthropology of universal man, primatology, and the evolutionary study of the animal kingdom as a whole--can through a process of triangulation illuminate the disputes over conflicting political claims about human nature. By way of example, I suggest that these methods show that the Framers were more accurate than Rousseau in their assessment. Humans, like many other animals living in groups, have two innate modes of acquiring resources from other members of their species that live in proximity--through exchange or through their position in the social hierarchy. A good constitution provides mechanisms that encourage individuals to use the axis of exchange rather than the axis of hierarchy to obtain resources, because this leads to a more productive and less conflict ridden society.

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3.0 Symposium: The embodied capital theory of human life history evolution (organized by J. Bock)

Bock J¹ organizer, *Low B²* discussant **The embodied capital theory of human life history evolution.** Embodied capital theory has been developed by Kaplan and associates as a synthesis of life history theory from biology and capital investment theory from economics. By integrating parental investment in physical development and the functional abilities of offspring, and linking this investment to fertility and mortality patterns, researchers using this theory have addressed major issues in human life history evolution and have shown how an evolutionary approach can help to explain patterns of fertility and parental investment across and within societies. This set of papers represents four areas in which embodied capital theory has produced fundamental results. Kaplan *et al.* use the theory to show how brain size and function are co-evolved traits with longevity and how this has shaped primate evolution. Lancaster *et al.* propose that the shift to a feeding niche primarily composed of nutrient dense, hard to acquire foods is responsible for distinctive features of human life history, and that these characteristics represent a co-

evolved suite of traits which can be used to explain aspects of human social organization. Bock *et al.* use embodied capital theory to develop models of fertility behavior as the result of an interaction between ecological conditions and the evolved psychological, cultural and physiological mechanisms governing human parental investment and fertility. Lastly, Lam *et al.* apply embodied capital theory to modern reductions in family size and investments in education, and show that variation in fertility and parental investment in developed and developing economies is due to differential returns to education. Together these papers provide an overview of the ways in which embodied capital theory can help to understand the evolution of human life history and show how features of that life history are manifested differently in varied temporal and socioecological contexts. These papers also highlight the important contribution of embodied capital theory to understanding demographic transitions. Bobbi Low, who has written extensively on these and related topics, will be the discussant.

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3.1 Kaplan H^1 , Gangestad S^2 , Mueller T^3 , and Lancaster J^4 **Embodied capital and the co-evolution of brains and longevity.**

This paper introduces the embodied capital theory of life history evolution and summarizes its fundamental results. The embodied capital theory formally integrates life history theory from biology with capital investment theory from economics, treating the soma as a capital investment that requires time to produce and yields fitness returns in the future. The theory predicts that investments in somatic capital to increase future productivity co-evolve with investments in mortality reduction and longevity. The brain, especially the cerebral cortex, is a special form of embodied capital, because through learning, it transforms current experiences into future productivity and/or survival. The theory predicts that low mortality favors greater investment in brains and that larger investments in brains favor greater investments in survival and longevity. The theory is then applied to empirical data on brain size, ecology, group size and life history traits among nonhuman primates. The theory explains

the empirical data better than existing alternatives, such as those based on Machiavellian intelligence or diet alone. The implications of the theory for the evolutionary psychology of cognition and brain evolution are then discussed.

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3.2 Lancaster J¹, Kaplan H², Hill K³, and Hurtado A⁴ **A theory of human life history evolution**

Compared to other primates and mammals, there are at least four distinctive characteristics of human life histories: 1) an exceptionally long lifespan, 2) an extended period of juvenile dependence, 3) support of reproduction by older post-reproductive individuals, and 4) male support of reproduction through the provisioning of females and their offspring. We propose that a dietary shift towards high-quality, difficult-to-acquire food resources, that are nutrient dense and come in large packages, is responsible for the evolution of those life-history characteristics and the large brains upon which human cultural evolution relies. High levels of knowledge, skill, coordination and strength are required to exploit the suite of high-quality, difficult-to-acquire resources humans consume. This extended learning phase during which productivity is low is compensated for by higher productivity during the adult period. Since productivity increases with age, the time investment in skill acquisition and knowledge leads to selection for lowered mortality rates and greater longevity. The characteristics of the feeding niche, with associated food sharing, provisioning of juveniles, and tool use, may also lower mortality during the juvenile and early adult periods. This too, favors a longer juvenile period and higher investment in further mechanisms to increase lifespan. We present comparative data on the life histories, diets and age-profiles of production among hunter-gatherers and chimpanzees that supports this theory. We also show that the sexual division of labor can be explained by specialization in embodied capital investments in response to the demands of lactation and care of young infants.

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3.3 Bock J¹, Kaplan H², Johnson S³, Lancaster J⁴ Embodied capital and fertility in traditional and modern societies. Fertility and other demographic patterns have historically varied widely among human societies in relation to social, ecological, and economic systems. In this paper we examine how the payoffs to investment in embodied capital of offspring differ in traditional and modern societies. We propose that since humans lived as hunter-gatherers for the vast majority of their evolutionary history that human fertility and parental investment behavior should be well adapted to the foraging lifestyle, but there is no reason to expect that they will respond adaptively (in the sense of maximizing reproductive fitness) to today's novel circumstances. Therefore an evolutionary explanation of human fertility and parental investment has three requirements: it must be consistent with our general understanding of evolution by natural selection; it must explain the behavior of humans living under traditional hunting and gathering conditions characteristic of our evolutionary history with adaptive models; and it must be able to predict the pattern of modern responses to novel conditions. We use embodied capital theory to generate a model of the proximate physiological, psychological and cultural mechanisms produced by selection and how they would interact to determine fertility and parental investment behavior. We then generate predictive models of how those mechanisms would respond to conditions prevailing in the world today. These models are tested using data from people living traditional lifestyles in the Okavango Delta of Botswana and living in an industrialized society in Albuquerque, New Mexico, USA.

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3.4 Lam D¹, Anderson K², Kaplan H³ Determinants of educational outcomes among urban Xhosa in Cape Town, South Africa. The

application of embodied capital theory to modern reductions in family size and investments in education predicts that variation in fertility and parental investment in developed and developing economies is due to differential returns to education. This paper will test a model of children's rate of progress through school, using data from an low-income township school in Cape Town, South Africa. The model posits an effect of parental investment in children and the quality of school attended on children's rate of progress through school, which in turn affects their subsequent probability of passing a grade and of dropping out of school. Children who fail and repeat a grade, or who spend at least one year out of school before re-enrolling, will be behind for their grade and be older than the "typical" student. Once children fall behind in school, their odds of failing again and falling further behind increase, prolonging the time it takes them to reach a given level of education. These children can expect lower returns to the time spent in school, and are thus more likely to drop out altogether. The students sampled exhibit great variance in their previous educational histories; children within a single grade typically cover an eight year age range, primarily due to previous grade repetition. Our analyses show that children who are older for their grade receive lower grades in class, are more likely to fail at the end of the year, and are less likely to return to school the following year.

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4.0 Cultural evolution II: Theory and group processes

4.1 *O'Gorman R¹* Superior recall of normative social information: An evolutionary hypothesis. Social norms represent a cultural phenomenon that may have a biological basis. However, there is no definitive theory of norms (Turner, 1991) and little work has been done to empirically investigate norms (Cialdini & Trost, 1998). Norms result from psychological processes that may have been shaped by both individual and group-level selection: Behaviors and beliefs may spread through a

population due to individual-level social learning (Boyd & Richerson, 1985) while norms are by definition a group phenomenon and may present adaptive advantages to groups, resulting in group-level selection (norms also reduce within-group variance, further enhancing group-level selection). If norms exist due to group-selected traits then it follows that norm violations should be policed and it can be predicted that individuals should pay greater attention to normative social information than non-normative social information (i.e., individual behaviour). This hypothesis was examined by having participants read through a body of text and then tested on their recall of information. There were two forms of the text, counterbalancing the information presented as norms, so that any experimentally-salient information was presented to half the participants as a norm and to half as a non-norm. Thus, the design was repeated measures. There was a significant effect for presenting social information as normative. This finding supports the hypothesis that individuals pay attention to normative information and is suggestive that norms are facilitated by evolved psychological processes. It represents a theoretical bridge demonstrating how cultural phenomena may be facilitated by evolved psychological processes while retaining a learned component.

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4.2 Hilton A¹ Group evolutionary strategies” of Anabaptists: distinctiveness, survival, and ethnic relations. This paper examines, from the standpoint of “group evolutionary strategies”, several features of Amish and Hutterite Anabaptist groups: their demographic/reproductive history, migrations, genetic and cultural segregation from the wider society, inbreeding, social identity, within-group resource sharing, and interactions with surrounding ethnies. The success of these groups seems due to specific biological and cultural factors which function to encourage in-group altruism, based on a high degree of kinship and the practice of religio-cultural methods which minimize in-group conflict of interest and “freeloading”. This has resulted in a high degree of political self-sufficiency and a within-group economic division of labour. Their relations with out-groups have varied from extreme persecution to warm welcome, serious hostility arising not from visible difference but rather from conflicts of interest over resources and cultural incompatibilities.

Anabaptist cultural, religious, and moral values seem to mitigate hostility directed at them from out-groups in comparison to the experiences of other small ethnic/religious minorities.

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4.3 *Thompson NS*¹ **The evolution of emergent group properties**

In evolutionary psychology, the theory of group selection is often understood by critics and proponents alike as if the theory's only requirement is to solve the problem of altruism: i.e., to answer the question, "How could natural selection favor the evolution of group members that promote group interests against their own?" Many group selectionists meet this requirement by invoking trait-group selection. Two other requirements of a successful group selection theory are less often discussed: (1) it must explain how the evolution of undifferentiated constituents (such as "altruists") leads to emergent group properties such as "efficiency", "decisiveness", or "functional integration". (2) It must explain how emergent group characters get passed from generation to generation of groups. To solve all three problems at once requires a theory of the evolution of emergent group properties through the differential replication of alternative group types mediated by trait group selection.

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4.4 *Kameda T*¹, *Nakanishi D*² **Cost/benefit analysis of “conformity bias” in cultural transmission: an evolutionary game model.** One of the distinctive features of the human species is its evolved faculty for culture. Studies of psychological mechanisms underlying such cultural capacities can provide a rich interplay between psychology and anthropology. In a recent article, Henrich & Boyd (1998) reported computer simulations about social learning, indicating that “conformity bias,” a tendency to acquire the most common behavior exhibited in a group, can evolve robustly in an uncertain environment. This paper extends the Henrich & Boyd simulation further by focusing on the “asymmetry in information cost” between individual and social learning. In their original simulation, it was assumed that individuals can acquire environmental information, albeit imperfect, for no cost; social learning (whether to conform to others) is conceptualized to be an “add on” to

such free individual learning. However, this assumption may not hold in many realistic situations where cost associated with individual learning (e.g., information search) is much higher than cost for social learning. Such an asymmetry in information cost produces a Chicken-game like dilemma: If many others engage in costly individual learning in the group, then you are better off by just conforming to others without paying an additional cost for individual learning. Whereas, if many others follow such a strategy, then you would be better off by not conforming to others. We examine evolvability of conformity bias under the asymmetry assumption through a series of computer simulations. A partial empirical test of the hypotheses derived from this analysis is reported in Nakanishi & Kameda (this conference).

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Thursday Late PM Paper Sessions

1.0 Symposium: The organization of literary meaning (organized by J. Carroll)

The four papers in this symposium concern themselves with connecting adaptive behavior and literary representations. Our common starting point is a set of basic problems: What functions do adaptive models serve? How do represented behaviors compare with actual or primary behavior? How are elemental or universal human behaviors inflected by specific environmental and cultural conditions, and how do these inflections enter into literary meaning? Since mental models differ from person to person, how do literary representations cope with differences among characters, author, and audience? Scalise Sugiyama offers a direct adaptive explanation for models--the idea that representations contain information relevant to fitness--and she takes food acquisition as her test case. Easterlin emphasizes the way elemental fitness behaviors are radically inflected by cultural traditions such as literary genre and period. Storey proposes an adaptive explanation for amusement laughter and argues that literary representations dissociate laughter functions into conventionalized generic forms distinct from ordinary experience. Carroll argues that authors create literary meaning

by establishing relations among their own mental scenarios and those of their characters and audiences.

1.1 *Scalise Sugiyama M[1]* **Food for thought: The role of narrative in human subsistence**

In previous papers, I have proposed that narrative emerged in human prehistory as a kind of virtual reality: by simulating the human environment, it enables us to acquire information useful to survival and reproduction without undertaking the costs and risks of first-hand experience. Two classes of information integral to the pursuit of fitness are subsistence and social information. If narrative is indeed a means of storing and transmitting such knowledge, we would expect the stories of our Pleistocene ancestors to be brimming with it. Unfortunately, they left no records for us to examine. A facsimile is at hand, however: the oral traditions of modern foragers, whose living conditions approximate those which produced the *Homo sapiens* mind. This paper presents the results of a survey of story collections from four geographically and culturally distinct foraging societies: the Apache, Crow, Selknam, and Yanomamo. Approximately 600 stories were analyzed for subsistence information content (social information content will be analyzed in a companion study). Results suggest that, indeed, hunter-gatherers use narrative as a conduit of subsistence-related information.

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1.2 *Easterlin N¹* **Archetypes, ambivalence, and literary meaning in Hans Christian Andersen's 'Little Mermaid'** Much sociobiologically informed literary interpretation implicitly assumes that psychological norms shaped by the ancestral environment will provide direct keys to the meaning of cultural artifacts, including literary works. This view is problematic because it leaves out current environmental influences. Using the specific example of Andersen's "Little Mermaid," this paper demonstrates that environmental (i.e., cultural) influences are fundamental in shaping meaning in a literary text. Any story has numerous universal features, and in the case of this tale two such features are the maiden figure and basic narrative structure, yet these universal features are not correlated with fixed meanings. The maiden-mermaid (and, earlier in Andersen's tale, the child-mermaid) do

indeed elicit interest because they are connected with universal adaptive and developmental issues such as fertility and sexual receptivity, helplessness, power, etc. However, drawing on mermaid lore, this essay demonstrates that symbols like the mermaid, though dependent on universal formal properties, only gain meaning in their specific cultural context. Attention to Andersen's cultural/historical period and to the story itself suggests that the mermaid's outsider status is her most meaningful quality, and that the story's preoccupation with the relation of outsider to dominant group as well as its ambivalence about self-other relationships is consistent with literary romanticism, itself the product of the massive industrial, social, and political shifts consequent on the Enlightenment.

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1.3 *Jobling I'* The hero story as a human universal: Using evolutionary psychology to understand literary universals. The usefulness of evolutionary psychology and sociobiology for the study of literature is that, by enabling us to understand the universal architecture of the human mind, they enable us better to describe and account for literary universals, that is, those aspects of narrative that appear cross-culturally. One such literary universal is the story of the hero, in which a superhumanly strong man who represents a moral ideal defeats an incarnation of evil. As I show through an examination of three examples of hero/villain stories drawn from unrelated cultures: the Grimm folktale, *The Two Brothers*, the African epic *Sundiata*, and the Blackfoot Indian "Blood-Clot-Boy". This type of story is rooted in our evolved mental architecture in several ways. Sociobiologists like Richard D. Alexander and Robert Trivers, along with social psychologists, have argued that people have a tendency to overestimate their altruism and ability to control the world, or, to use Trivers' word, their "beneffectance". They have hypothesized that we engage in this type of self-deception because it is adaptive. Alexander says it is adaptive to deceive oneself about the extent of one's altruism because believing oneself to be altruistic helps one convince others that one is, and people are more likely to want to form mutually beneficial cooperative relationships with people who are altruistic than with those who are not. Furthermore, Shelley Taylor and Jonathon Brown suggest that people who believe that they can control the world make more of an effort to control it than those who do not. The

reason for the universal popularity of the hero that he represents our fantasy of a supremely beneficent self, one that is able to conquer all adversaries and who behaves with perfect altruism. Moreover, we attribute good and evil natures to the hero and villain, respectively. These attributions are caused by the mental tendency called “essentialism” by Gelman et al. which disposes us to believe that objects have an internal, innate, and unchangeable essence which causes them to be what they are. Beyond this, the attribution of an evil essence to the villain is motivated by our tendency to demonize those who are in competition with us. As Krebs and Denton have argued, this type of demonization is adaptive because it gives moral justification to aggressive action against them.

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1.4 Storey R[1] Evolution of amusement laughter obscured by representation of humorous behavior. A new scenario for the evolution of amusement laughter is proposed. Such laughter, I argue like many theorists, is always in response to the perception of a mastered (or masterable) incongruity, signaling either appreciation of the well-mastered (Laughing with@) or ridicule of the ill-mastered (Laughing at@). The signal evolved from the vocalizations accompanying ancestral primate play, which themselves sustained fitness-enhancing behaviors involving resolutions of incongruity. I propose that for human beings amusement laughter proved adaptively advantageous primarily in the teaching of offspring, especially when that laughter was qualified by the unambiguously positive bonding signals, including both smiling and laughing, that evolved from the primate fear-grin. Finally, I argue that the difficulties in deriving an adaptive function for amusement laughter have had their origins in the representation, both pre-literary and literary, of human comic behaviors, representations that dissociate the two different laughing signals in ways rarely encountered in social life.

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1.5 Carroll J¹ Scenarios of female mate choice in five novels of

female development

A relatively naive form of sociobiological literary criticism consists in examining fictional texts and pointing out that the characters follow certain basic patterns of behavior in areas such as survival, status seeking, mate selection, reproduction, parent-child interaction, and nepotism. Psychologically more sophisticated interpretive efforts have extended this list to include other topics in mainstream psychology such as the theory of emotions, development, and individual differences in personality. The most advanced form of sociobiological criticism integrates the analysis of represented behavior with the analysis of specifically literary structures such as verse forms, the organization of narrative, tonal organization, the use of symbolic motifs, and the manipulation of point of view. I shall argue that this latter category--point of view--has a special status. Literary representations are communicative acts, and meaning is always meaning for some specific person, from some specific point of view. Drawing on Antonio Damasio and E. O. Wilson, I shall designate literary representations as “scenarios” or interpretive models of reality, and I shall argue that literary meaning emerges out of the interaction from among three sets of scenarios: the author’s own (generally privileged) version of truth and reality; the versions formulated by the characters depicted, and the version implicitly attributed to the putative audience. The author negotiates with the divergent and often conflicting meaning systems of his characters, and he or she negotiates simultaneously with the expectations, values, sympathies, and antipathies of his or her putative readers. To illustrate these claims, I shall be comparing five novels that depict the personal development of young women: Austen’s Pride and Prejudice, Bronte’s Villette, Cather’s O Pioneers!, Bennet’s Anna of the Five Towns, and Hardy’s Tess of the d’Urbervilles. These novels have been chosen to illustrate specific differences in the authors’ relations to their subject.

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2.0 Panel Discussion: Evolutionary Demography

Participants: Kimber Haddix, UC Berkeley; Monique Borgerhoff Mulder, UC Davis; Hillard Kaplan, Univ. New Mexico; John Bock, Univ. New Mexico.

Topic: This workshop is to be a forum for a discussion about the contributions that human evolutionary ecology stands to make to the field of demography. We will begin by reviewing the many areas of overlap between the two fields, both topical and methodological. We will follow with a discussion of the main areas of research (both current and future) in human evolutionary ecology that stand to bear on demography, including on fertility transitions, embodied capital/economic evaluations of the costs and benefits of children within the family, and male-female conflict and its impact on fertility transitions. We will also discuss the obstacles to collaboration with demographers, and possibilities for overcoming them. Finally we will discuss specific predictions that evolutionary ecologists can make about key demographic patterns, and the general utility to demography of a predictive theoretical framework like human evolutionary ecology.

3.0 Symposium: Homicide and the mind (organized by J. Thomson)

Thomson J¹, Jones O² **Why do humans kill other humans?**

Murder is as old as man. There have long been theories of homicide attributing its occurrence to social learning, culture, and psychopathology. The most widely known evolutionary analysis views homicide as the extreme, not necessarily intended, end of a continuum of normal violent responses to conflict, which shares common motives, causes, and risk factors with non-lethal violence. David Buss and Joshua Duntley, in contrast, see murder's ancient history, persistence, patterns, and prevalence as evidence suggesting mechanisms in the mind specially designed to yield the death of a human. Buss and Duntley propose mechanisms that are sensitive to a range of environmental inputs. Particular situations trigger the emotions that fuel the deadly behavior. Their proposed homicidal mechanisms are calibrated by experience, and they contain cost-benefit computations, self-assessment procedures, decision rules, and deception capacities. And, as part of their support for the idea that homicide is sufficiently pervasive to constitute both an adaptation and a selection pressure, they observe specific anti-homicide mechanisms of the mind. This symposium will focus on the theory and evidence for specific homicide mechanisms of the mind. The two researchers will present their theory and their latest empirical research.

Two commentators and the audience will respond, evaluate, and discuss.
Is the theory sound? Does the evidence support it?

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3.1 *Duntley JD¹, Buss D²* **The killers among us: A co-evolutionary theory of homicide**

Why do humans kill other humans? We argue that existing theories of homicide provide inadequate answers to this question. We propose a comprehensive co-evolutionary theory of homicide that details a number of specific psychological adaptations selected to solve unique adaptive problems. These include adaptations to kill rivals, opposing coalitions, infants, stepchildren, and mates. Homicidal fantasies provide not merely a window into killer psychology, but are central functional components of our psychological homicide adaptations. Cognitively costly premeditation's about killing are triggered by evolutionarily recurrent adaptive problems for which homicide was a possible solution, and serve to mobilize attention, produce cognitive simulations (scenario-building), evaluate costs and benefits, rehearse strategies of enacting a kill, and motivate actual homicides. Because of the dramatic fitness costs to victims (it's bad to be dead), selection has forged co-evolved psychological anti-homicide adaptations. Some killer adaptations, such as those that motivate killing to prevent getting killed, are simultaneously anti-homicide adaptations. Killer psychology, in turn, co-evolved to be sensitive to social contexts in which the costs to the killer were minimized. After presenting new empirical studies that support specific predictions from the theory, we address objections to the theory, including (1) that the costs of killing would have been too high for a psychology of homicide to have evolved; (2) that homicide occurred too infrequently to be acted upon by selection; (3) that there were many alternative strategies other than killing for solving the same adaptive problems; and (4) that killings are more parsimoniously explained as epiphenomenal byproducts of evolved mechanisms designed for non-lethal coercive control.

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3.2 *Wrangham R*¹ **An ape perspective on human intra-specific killing**

Ape-human comparisons can help evaluate the evolutionary status of design for killing.

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3.3 *Napoleon Chagnon*¹ **Most anthropological evidence doesn't support homicide modules**

Ethnographic evidence on the conduct of violence/warfare in the remaining, well-studied, unacculturated tribesmen is scant, but what there is indicates that conflicts between individuals and small groups of individuals (local groups, bands) usually becomes intentionally lethal only within a range of reasonably well understood cost/risk/benefit situations. Growing amounts of archaeological evidence for prehistoric homicide does not necessarily support a homicide module hypothesis.

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3.4 *Buss D, Duntley JD* **Reply and Discussion**

4.0 **Mate attraction II: Facial attractiveness.**

4.1 *Bullock HL*¹, *Montgomerie RD*² **Multiple components of facial attractiveness**

Humans use various criteria to assess potential mates yet little is known about how these traits interact to provide an overall assessment of attractiveness. We investigated the interaction between two facial traits known to influence attractiveness: fluctuating asymmetry (FA) and chin length. A number of studies have shown that facial symmetry is considered attractive to both sexes. A surge in circulating androgen levels in males at puberty causes an increase in jaw size. Jaw size becomes a sexually dimorphic characteristic, leading to the prediction that long chin lengths are attractive in males and short chins in females. We tested how both traits combine to give an overall assessment of attractiveness by digitally manipulating each trait on a number of facial images of both

sexes. Viewers rated the attractiveness of 10 images that were manipulated to produce varying chin lengths and levels of asymmetry. Results indicate an interaction between chin length and FA in both sexes. However, not all of the individual predictions for each trait were supported. We discuss the implications of our findings in the context of ideas about multiple cues in mate choice.

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4.2 *Cruikshank C¹ Anderson NK², Johnston VS³, Giddon DB⁴*

Predicting perceived body from face morphology. Evolutionary theories espouse physical attractiveness as a biological adaptation directing sexual preference towards fecundity. Female facial morphology, body fat distribution and symmetry have been shown to correlate to attractiveness and act as markers of overall fitness and fertility. If facial cues predict body morphology, then it was hypothesized that judges would be able to correctly match pictures of a face to its body. From 32 color, full-length images of nude females, 12 were selected to vary in waist-to-hip ratio (WHR), hair color, face/body shape. Identifying marks were camouflaged using PhotoShop. Heads were separated from each body and reproduced separately. The front and back views of each body were displayed side by side as one image. To reduce the cue of neck width, images were surrounded by a black border. The 24 images were standardized for size and gray scale level and printed. Packets containing 12 heads and 12 bodies were prepared. Anthropometric measures were obtained from each of the 24 images. Fifty judges, completed three tasks: 1) select the body that "Most Likely" and "Least Likely" matched each head; judges could use a body more than once, 2) rate attractiveness of each head and body on a nine-point Likert-type scale, and 3) match "Most Likely" body to heads using each body only once. Overall, judges' accuracy was not above chance. There were no differences in accuracy across gender, age, or ethnic groups. Matching of head to bodies was related to attractiveness; there was a significant correlation ($r = 0.75$) between attractiveness ratings of the head and attractiveness of most frequently matched bodies. Intra-individual correlations between attractiveness of heads and bodies matched to that head varied from slightly negative to highly positive in Task Three. Correlations between

attractiveness of heads and bodies of the correctly matched original stimulus images was $r = 0.24$. Analyses of anthropometric data may determine influence of asymmetry, WHR, and proportional measures.

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4.3 *Franklin M¹, Johnston V²* **Hormone markers and beauty.**

Unlike research on female facial beauty, the experimental literature on male facial attractiveness is highly inconsistent. Different experimenters have concluded that the attractive male face is (1) an average face, or (2) a masculinized face, or (3) a feminized face. Others have concluded that symmetry, hormone markers, and the menstrual phase of the observer, are important variables that influence male attractiveness. This study was designed to resolve these issues by examining the facial preferences of 42 female volunteers at two different phases of their menstrual cycle. Preferences were measured using a 40 second quicktime movie (1200 frames) that was designed to systematically modify a face from an extreme male face, through an average male face, an androgynous face, an average female face, to an extreme female face. Each volunteer was required to note the frame number corresponding to the following faces: An average male, average female, attractive male, attractive female, dominant male, dominant female, good father, good mother, intelligent male, intelligent female, masculine male, feminine female, healthy male, healthy female, and "Pat." The results indicate that females exhibit (1) a preference for a male face on the masculine side of average, (2) a change in male-face preference over their menstrual cycle, and (3) no change in female-face or other-face preferences. The results are interpreted as support for a hormone marker theory of both male and female facial attractiveness.

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4.4 *Silverman I¹, Tombs S², Fisher ML³* **Pupillometry: A sexual selection approach**

We hypothesized that response to pupil size is determined by the interaction between sex of viewer and target, such that males are most attracted by large pupils in females and females by medium size pupils in males. Our rationale was that the opportunistic reproductive strategies of males are best served by absolute female sexual interest and arousal, while the selective strategies of females predispose them to favor more moderate sexual attentions. The latter assumption is based on the notions that females can readily obtain mating opportunities without extreme interest and arousal on the part of potential partners, and such fervid reactions by the male may foretell excessive needs for control and dominance and/or attempts at forcible copulation. The hypothesis was partially confirmed. As predicted, the relationship of attraction to pupil sizes, classified as small, medium and large, was linear positive for males viewing females, but showed an inverse U shaped function for females viewing males. Differences between medium and large pupils for females viewing males, however, did not reach or approach significance. Two subsequent studies replicated these findings and suggested possible reasons for the dichotomy in pupil size preferences among females.

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Friday AM Plenary address: Marc Hauser

Hauser MD¹ **Why humans are the wrong species in which to study the evolution of human intelligence.** In this talk I argue that evolutionary psychology has unfortunately developed a case of historical aphasia Q a mental disease that afflicts practitioners who forget that much of the theoretical strength of their discipline comes from some other, historically prior field. In this case, evolutionary psychologists have forgotten about work on nonhuman animals, and the theories and empirical findings that have been derived. To show why evolutionary psychologists must take the work on animals seriously, I discuss three relevant problems. Each problem, which is of direct relevance to understanding the human mind, can only be addressed by studying animals. The first problem focuses on the general claim that some

cognitive property X is special to humans. Here, I discuss the "speech as special" problem, and provide data on nonhuman primates. I argue that there are no special mechanisms underlying speech perception, and that what makes spoken language special has nothing to do with the underlying perceptual (auditory) mechanisms. The second problem is a close relative of the first, and is generically described as "language is necessary for representation or thought X". Thus, many cognitive scientists have claimed that having a theory of mind depends on language. In this part of the talk I focus on the capacity for number representation, and show that the basic building blocks are shared among all animals. What is necessary is to show how language alters this basic biological foundation, and gives us the culturally constructed representation of number. The third problem focuses on dissecting neurocognitive architecture, and in particular, on how studies of animals can inform our understanding of the functioning of the prefrontal cortex. I argue that studies of animals are often better suited for such problems because of the extent to which we can directly control the experiences that animals confront, and thus, assess the extent to which a capacity is innately specified.

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Friday AM Paper Sessions

1.0 Symposium: Evolutionary and developmental origins of conceptual knowledge (organized by the HBES Program Committee)

1.1 *Boysen ST* “ I before e, except after c”: Pushing the parameters of primate cognition

Complex behaviors in nonhuman primates suggestive of cognitive-demanding phenomena and possibly requiring representational capacities, such as attribution or deception, have been tantalizing, but largely based upon anecdotes from studies in the wild. More recently, several attempts to demonstrate such cognitive abilities under captive conditions, with appropriately rigorous methods, appear promising, although failures and failures-to-replicate have been reported. The Ohio State University's

Comparative Cognition Project has been exploring a range of representational modalities with our 9 chimpanzees, including numerical skills, categorization, attribution, and chimpanzee food bark vocalizations. Preliminary data from sequential processing studies will be discussed, as will results from recent experiments on chimpanzees' comprehension of scale models, in which sex differences in spatial skills between males and females can be demonstrated. In addition, provocative new findings on discrimination of species-typical chimpanzee vocalizations in a cross-modal, auditory/visual discrimination task will be presented. Acoustic analyses of food bark vocalizations provide evidence for productive and receptive capacities of chimpanzees to extract categorical and specifying information about both food type and value. The implications for these data for comparing ape and human cognitive evolution are raised for discussion.

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1.2 *Keil F'* **Association vs. causation in conceptual development**

There are now several demonstrations in humans that first order associations and correlations among perceptual features are inadequate to model many aspects of everyday cognition. There appears to be a sensitivity to the causal structure of the world that overrides mere associative information. This pattern of results has led to the proposal that humans possess intuitive theories of the causal structure of the world. These theories have been described either as sets of rule like propositions or as image like mental models of reality. A closer look at everyday causal understanding, however, suggests that it has neither the rigor of sets of rules nor the detailed vividness of mental models. There are good reasons why causal understanding should not have either of these properties, reasons that acknowledge the shallowness of adult understanding and the implausibility of such models in early development. These reasons are supported by a series of studies with adults and children. The question then remains as to how humans do override associative patterns and partially grasp the causal structure of the world. Two possibilities are considered: a higher order set of associative relations such as are seen in reduced dimensional spaces, and the use of domain specific skeletal causal schema. Evidence for the schema is

presented. These schema appear to not only be developmentally primitive but also to have components that might be seen in other primates. One particularly revealing task involves intuitions about how elements of understanding are clustered in the minds of others. A non verbal version of this task is discussed as well as its possible extension to preverbal humans and other primates.

1.3 *Spelke E*¹ **What makes humans smart?**

I'll be addressing this old question with some new data from studies of spatial and numerical representations in human infants, children, and adults. These studies are based on a tradition of research on navigation and foraging in birds and mammals, and they suggest that space and number may depend on strikingly similar core cognitive systems in different species, including humans. Distinctive features of human cognition may arise from some of the distinctive ways in which we combine the representations delivered by these systems.

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2.0 Evolution of life histories: theory, risk, reproductive expenditure and birth order

2.1 *Jones JH*¹ **Human evolutionary demography: A life-cycle analysis.**

Using a broad sample of human populations, I constructed age-classified population models, and calculated fitness sensitivities and the convexity of the selection gradient on age-specific vital rates. Despite tremendous diversity in the ecological, economic, and demographic environments of the populations, a number of generalities emerge regarding selection on the human life cycle: (1) Pre-reproductive survival is the trait to which fitness is most sensitive, regardless of the demographic schedule of the population, (2) Selection on both survival and fertility decrease with age, though at different rates, (3) Fertility contributions to fitness are always less than survival contributions. Calculation of the quadratic selection gradient for each population reveals several novel observations regarding the evolution of the human life cycle. These include: (1) An increase in fertility at any age makes selection fall off more rapidly with age, (2) an

increase in survival probability at age i decreases the sensitivity of fitness to further improvements in survival at that age and improvements at other ages become more important, (3) An increase in survival at age i increases the sensitivity of fitness to fertility in the next age class and reduces the sensitivities of all prior fertilities, (4) selection on most life cycle traits will increase that trait's correlation with most other life cycle traits. These results help make sense of some of the peculiarities of the human life cycle, and have implications for predicting the course of demographic transitions. Furthermore, these results have a strong bearing on the psychology underlying reproductive decisions.

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2.2 *Chisholm J¹, Burbank V²* **Evolution and inequality**

Many social scientists are still wary of evolutionary theory on the grounds of genetic determinism and insensitivity to the historical contingencies affecting inequalities associated with race, class, and gender. Although baseless, evolutionists must address such fears because they continue the balkanization of knowledge and ultimately threaten public acceptance of our only scientific theory of life. Our goal in this paper is thus to further consilience and the role of evolutionary theory in public affairs by showing how and why evolutionary theory is naturally concerned with the inherently biosocial phenomenon of inequality. We first review complex adaptive systems theory to show that because of environmental risk and uncertainty the cost of failing to avoid a fitness cliff is always greater than the benefit of setting the stage for some future good fitness move. After a brief overview of the tradeoff between current and future reproduction in evolutionary ecology we argue that when the future is objectively risky and uncertain the optimal reproductive strategy will often be to avoid fitness cliffs by maximizing current reproduction. Because of the well-known tradeoffs between reproduction and survival and health (i.e., costs of reproduction)--and because inequality is a major source of environmental risk and uncertainty—we argue that any attempt to use evolutionary theory to understand human reproduction, health, or well-being must include considerations of inequality.

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2.3 Chen YC¹, Wang XT² Sexual selection and the perception of health and environmental risks. Using hypothetical dilemmas, Wilson, Daly, and Gordon (1998) demonstrated that men, as a result of sexual selection, are more likely than women to discount health risks and environmental hazards in pursuit of present material and social benefits. We examined how this presumably universal sex difference in the willingness to tolerate health hazards and environmental degradation was manifested in a collectivist culture. In a first experiment, four hypothetical dilemmas incorporating two levels of financial incentive and two levels of health risk, were presented to the participants recruited in Taiwan. The overall pattern of choices revealed that men were clearly monetary incentive-oriented, whereas women were more concerned about health risks. Unlike Wilson, Daly, and Gordon's Canadian participants, more Taiwanese men than women chose to avoid the personal health risks at the cost of monetary profit in the higher-risk and lower-incentive situation. This effect disappeared in a second Taiwanese experiment where the risk manipulated was environmental degradation rather than personal health. Men were more profit seeking than women in both incentive situations. These results were analyzed in a framework of sexual selection based on life-history differences between men and women in their life-span expectancy and in reproduction. We hypothesized that a shorter life span and higher variance in reproductive fitness in men may lead to a greater amount of discount of future benefits in the face of present gain. However, this discounting function may be weakened in a collectivist culture where reproductive variance among men may be minimized by extended kinship, intermarriages, and a more stable social network.

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2.4 Davis JN¹ Birth order and the effects of maternal age on maternal investment

Evolutionary theory suggests that older mothers, by virtue of their own

declining reproductive value, may invest more heavily in their later children than their younger counterparts. This prediction has been used to partially explain why some birth order effects show u-shaped patterns, in which both older and younger children appear to be favored. Analysis of the Child Development Supplement of the Panel Study of Income Dynamics, a large scale, nationally representative, and longitudinal data base of children and their families in the United States, suggests that older mothers do, in fact, attend to their children more. Nevertheless, even when these age effects have been factored out u-shaped birth order effects persist for measures of parental warmth and affection. This is a puzzling finding for current birth order theory.

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2.5 *LeGrand E'* Enhanced apoptosis of infected cells as a benefit of the anorexia of infection

A major paradox in medicine is why there is reduced appetite (anorexia) and apparently inefficient metabolism in the face of infection, just when nutrient resources should be needed to mount a strong defense. Many have considered this process leading to wasting to be a metabolic derangement, one to be aggressively combated. However, since this programmed reaction is induced by the individual's own cytokines as part of the acute phase response, it is almost certainly a defense. While some have suggested that nutrient deprivation may deny resources to the pathogens, it is unclear why the individual would not be harmed as much as the pathogens. An explanation for this paradoxical self-deprivation rests on the linkage of two recently appreciated phenomena: 1) nutrient restriction promotes apoptosis (cell suicide) and 2) apoptosis is an important generalized defense against cell pathogens. Nutrient restriction, acting as a systemic pro-apoptotic stimulus, may preferentially induce the early suicide of infected cells (which are already altered by virtue of their infection). Thus nutrient restriction can offer protection by simultaneously limiting nutrients to both the host cells and the pathogens.

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2.6 Zvoch K¹ Life histories and expected educational investment: Mortality-induced variation? Mortality pressure has been shown to influence life histories both across (Promislow & Harvey, 1990) and within species (Austad, 1993). Exposure to high mortality environments disposes individuals, either obligately or facultatively, toward pursuing a life course strategy that favors early reproductive expenditure over long term somatic investment. Recent study of human response to mortality risk suggests that similar life course adjustments occur in our species. Subject to risky, unstable environments, human females begin reproducing at an earlier age and human males lower risk acceptance thresholds (Wilson & Daly, 1997). Drawing on the rich theoretical framework that guided these prior investigations (i.e., life history theory), the present study explored adolescent expectations of future educational attainment. Expecting heightened mortality exposure to incline adolescents to discount the profitability of pursuing intermediate or advanced levels of education, the current study, using data from a nationally representative sample of eighth grade students, assessed both contextual and individual influences on educational expectancies. To separate the effect of local context from the influence of individual-level factors, data were analyzed with multilevel modeling techniques. After controlling for familial SES, child achievement, parental support, and several school-level factors, community context, an aggregate of within-community SES scores, remained uniquely related to adolescent expectations. Supplemental analyses indicated that adolescents with low initial expectations were more likely to drop out of school, begin sexual activity, and reproduce earlier than their peers with high educational expectations. Discussion of results will focus on the benefits of discounting the future when mortality risks are high.

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3.0 Evolution and function of emotions I.

3.1 Buss DM¹ The dangerous passion: The co-evolution of jealousy and infidelity. Jealousy poses a paradox. It's an emotion tethered to long-term love, but it also can lead to abhorrent acts of violence and murder. Prior attempts to explain jealousy have invoked neurosis, psychosis, immaturity, character defect, capitalism, western culture, and

patriarchy. In evolutionary perspective, however, jealousy may be an exquisitely designed complex of human psychology that has a crystalline adaptive logic. It evolved to repel rivals, prevent infidelity, deter defection, protect paternity, preserve love, and in delimited circumstances, to motivate the killing of mates or rivals. Jealousy and infidelity, according to this theory, are co-evolved passions, inexorably linked over evolutionary and ontogenetic time. As jealousy evolved, infidelity got driven underground, producing contrapuntal selection pressure that enhanced sensitivity to increasingly subtle signals of betrayal. What is often diagnosed as “pathological jealousy” may represent manifestations of evolved solutions to the signal detection problem, given an uncertain social world, a chaos of probabilistic cues, intentional subterfuge, and the potentially catastrophic reproductive costs linked with failing to detect actual infidelities. Once jealousy evolved, however, it could be exploited by partners for purposes other than those for which designed, such as testing the strength of the bond and increasing perceived desirability, establishing a spin-off co-evolutionary spiral. The Dangerous Passion showcases a decade of research on jealousy and infidelity to support this co-evolutionary theory, and offers a solution to the apparent paradox of jealousy.

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3.2 Bleske AL¹, Buss DM² **Mate encroachment and jealousy**

The authors report a two-stage study on jealousy evocation in the laboratory. In stage 1, participants and their romantic partners attended group sessions in which they completed a brief personality inventory, the Sociosexual Orientation Inventory, an assessment of relationship stability, and an assessment of mate value. In stage 2, participants returned to the laboratory with their partner. Couples waited in a partially enclosed room where they were unobtrusively videotaped. As the couple sat on a couch waiting for the experiment to begin, an attractive confederate of the experimenter entered the room, acted lost, asked the opposite-sex member of the couple for directions, and proceeded to flirt with him or her. The study provided an experimental test of the following predictions: (1) men experience more emotional upset in response to high status than to low status rivals; and (2) women experience more emotional upset in response to provocatively dressed rivals than to non-provocatively

dressed rivals. Researchers also predicted that (3) perceived discrepancy between self and partner mate value, (4) perceived probability of a partner's future infidelity, and (5) dispositional jealousy would be related to greater upset in response to being exposed to a flirtatious rival. Videotapes of couples were coded by blind raters. Results provided support for some of the hypotheses. Discussion highlights the advantages and disadvantages of conducting experimental studies to test evolutionary hypotheses.

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3.3 *Cousins AJ¹, Gangestad SW²* **Threats of female infidelity, male proprietariness and violence in dating couples.** Relative mate value, and the extent to which women sexualize men other than their partners, were hypothesized to lead to male dating violence via male proprietariness and male dependency, two dimensions of male mate retention tactics. The study assessed 121 dating couples, who were given questionnaires that asked for information about the couple's relationship, mate value and violence in the relationship; separate measures were given to each partner. Using structural equations modeling, we found that the extent to which women sexualized men other than their partner influenced male mating tactics. Men whose partners reported greater sexualization of (e.g., flirtation with) other men, and were perceived by the male partners themselves to do so, exhibited higher levels of proprietariness, which in turn was associated with relationship violence. Relative mate value of the couple was not linked with male mate retention tactics or male dating violence. More specifically, males with lower mate value were not more likely to have high levels of proprietariness or dependency, or to be violent. This finding is contrary to Figueredo's (1993) study on married women, which found that competitively disadvantaged males were more likely to batter their wives.

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3.4 *Fisher ML¹, MacKewn A², Czernochowski D³* **Guilt and adultery: An adaptationist approach.** It has been well established across human cultures and history that women tend to be more severely chastised for

adultery than men. Based on the notion that guilt is an evolved mechanism with the adaptive function of discouraging behavior that may harbor negative consequences, the main hypothesis of the present study was that women would experience more guilt about committing adultery than men. Following this adaptationist approach, we contended further that less guilt would be experienced when the circumstances of the adulterous relationship were consistent with the sex-specific, fitness enhancing, mating strategies appropriate to the individual. Thus, predictions were that females would feel less guilt about committing adultery with a wealthy rather than an attractive partner while males would show the reverse relationship. Hypotheses were tested in terms of subjects' responses to scenarios depicting the situations above. Consistent with the hypotheses, women reported more guilt than men about committing adultery, and men reported less guilt when the partner was attractive rather than wealthy. Women, on the other hand, reported equivalent feelings of guilt in both circumstances.

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3.5 Bennett KL¹ Guilt regarding sexual and emotional infidelity

Research on infidelity has focused almost exclusively on the emotions and responses of victims, while little attention has been given to the emotions and responses of cheaters or perpetrators. To explore this aspect of infidelity, individuals were instructed to imagine situations in which they are unfaithful to a partner and then report information about guilt feelings. Guilt is considered to be an emotion that motivates the perpetrator to compensate for cheating. In general, the degree of guilt felt by a cheater should be related to the fitness costs incurred by the victim of the cheating. Because the costs associated with different types of infidelities are not the same for men and women, sex differences in guilt were predicted in a way that parallels the adaptive logic of jealousy. That is, women should have greater levels of guilt for the sexual aspects of infidelity and men should indicate more guilt for infidelities that involve a lot of emotional attachment. No sex differences were found for this hypothesis, but an interaction between sex and number of extrapair partners (EPs) emerged for guilt feelings. The nature of the interaction is such that for men, but not women, guilt varies as a function of EPs.

Specifically, men who report few EPs have high sexual guilt and men who have had many EPs have lower sexual guilt. For women, the nature of guilt feelings associated with perpetrating an infidelity does not depend on number of self-report EPs. Thus, the relationship in men between EPs and guilt drives the interaction. These findings are discussed in terms of an evolution of sex differences in sexual strategy and the function of guilt.
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3.6 Brown S, Demarest J' Sex differences in jealousy: The role of emotional involvement in sexual infidelity. The purpose of this study was to examine the impact of emotional involvement in a situation involving sexual infidelity on various feelings of jealousy. Subjects were given one of three scenarios describing sexual infidelity by a hypothetical mate. In one, the partner argues that it meant nothing (no commitment), in a second, the partner reveals strong emotional feelings for the third person (commitment), and a third scenario does not say (unstated). Men were expected to exhibit the same amount of jealousy in all three conditions since men should always regard sexual infidelity as very upsetting due to paternity uncertainty. Women were expected to have the most jealousy in the commitment scenario since this situation would suggest the greatest likelihood of loss of resources and future parental investment. Jealousy was assessed on a 10 point rating scale for five different emotions (Jealous, Distressed, Upset, Angry, Betrayed). Of the two hypotheses, the first was supported while the second was not. All three scenarios produced the same amount of jealousy, although the commitment scenario yielded more intense Anger reactions than the no commitment scenario. In general, women had more intense emotional reactions than men, but this differed significantly only for the Upset ratings. Also, there were significant differences in the ratings of the five emotions, with the lowest ratings given for "Jealousy" and the highest ratings given for "Betrayed." This study raises conceptual and methodological questions about research on jealousy, especially the predictions drawn from an evolutionary framework.

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4.0 Mating efforts and tactics I

4.1 *Bartlett M¹, Grometstein R²* **Mating effort and self-control theory**

Several theorists (Rowe 1996, Harpending and Draper 1988, Rushton 1985) have proposed a connection between mating effort strategy and antisocial behavior. Criminologists are also interested in antisocial behavior. The leading criminological theory (Gottfredson and Hirschi, 1990) proposes that most crimes and analogous behaviors (drinking, smoking, promiscuity, increased susceptibility to accidents and illness) spring from a single cause. This cause, according to Gottfredson and Hirschi, is low self-control, the elements of which include impulsiveness, immediate and easy gratification of desires, the thrill of risky behavior and few long-term benefits. Gottfredson and Hirschi emphasize the description of all these behaviors but suggest only socialization as a cause. They pay no attention to individual differences. We propose that there is a convergence between evolutionary and criminological theory. We show that Gottfredson and Hirschi are describing phenotypes; the evolutionary theorists we have mentioned are suggesting underlying causal mechanisms that produce these behaviors.

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4.2 *Conlan S¹, Buss D²* **Mate expulsion tactics**

Mate expulsion occurs cross-culturally and was likely a recurrent feature of our evolutionary past. It is plausible that the adaptive problems for which mate expulsion was a solution have also been recurrent over evolutionary history. We hypothesize that men and women possess evolved psychologies designed to: (1) recognize the contexts in which mate expulsion was necessary to solve an adaptive problem; and (2) initiate a successful mate expulsion strategy. Many of the adaptive problems for which mate expulsion was a solution were likely similar for both men and women. For example, we predict that both sexes would have used mate expulsion when a sufficiently more desirable partner could be obtained. Because men and women have also faced different adaptive problems, we also generated sex-linked predictions. For example, we predict that both sexes would have used mate expulsion when the desires inherent in the initial mate selection were violated.

However, because these desires differ for men and women, the specific violations, which trigger mate expulsion, are predicted to differ. Because men and women confronted different adaptive problems in short-term versus long-term mating contexts, we also generated sexual strategy-linked predictions. We conducted a number of studies to examine the specific predictions derived. Discussion will focus on the logic of our predictions regarding the contexts and tactics of mate expulsion and the results of our studies testing those predictions.

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4.3 Grometstein R¹, Bartlett M² The marginalization of mating effort strategy in our modern society. Harpending and Draper (1988) describe simple societies characterized by either mating effort or parenting effort. They suggest that in modern complex societies, the lowest SES groups be characterized by mating effort, whereas the upper SES groups are characterized by parenting effort. We suggest that the model of mating effort strategy assists in understanding a significant portion of the crime committed in the U.S., particularly street crime in poor urban communities. We propose that our modern parenting effort culture is a result of increasing social complexity. We demonstrate that a historical social process (industrialization) has promoted a parenting effort culture among the middle classes and has led to the increasing marginalization of mating effort strategy. Following Linda Mealey's (1995) emphasis on early intervention and methods of channeling antisocial behavior into prosocial activities, we offer policy considerations.

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4.4 Whybird R¹, Mealey L² Sociosexuality and sociosexual signaling

As measured by Simpson & Gangestad's "Sociosexual Orientation Inventory", the term sociosexuality refers to individual differences on a continuum of sexual style, attitudes and behaviors, the extremes of which have been labeled as "restricted" versus "unrestricted". High scores on the SOI reflect a preference for having multiple partners and casual sex with relatively low interpersonal commitment (unrestricted); low scores

reflect a preference for having fewer partners, each with a longer and greater level of commitment (restricted). SOI scores have commonly been interpreted as measures of an individual's mating strategy. If this view is justifiable, then SOI scores should correlate with other sexual preferences, attitudes, and behaviors in a meaningful way. Furthermore, they should correlate with scores on various measures of social and sexual tactics and signals, as well. We correlated SOI scores of 128 participants (83 female, 45 male) with scores on two other scales and 233 individual items that, based on evolutionary and ethological premises, we thought might be related to sexual tactics and signaling. Results support the idea that the SOI is a measure of sexual strategy and that different tactics are used to pursue different strategies.

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4.5 *Steadman M¹, Cvorovic M²* **Ancient Greek promiscuity?**

Following the argument made by one of the authors of *A Natural History of Rape* (Palmer) -- that rape is a byproduct -- we assume that a similar explanation holds for non-reproductive sex in general, including pornography, child molesting, bestiality, prostitution, homosexuality and masturbation. Such behavior would be a consequence of selection for male sexual eagerness due to significantly less parental investment in the past. Here we argue that the key element in restraining such behavior is ancestral: traditions that discourage promiscuity. We have selected ancient Greece to illustrate this thesis.

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4.6 *Beroldi G¹* **The NLSY79, father absence and evolution**

The National Longitudinal Study of Youth 1979 (NLSY79) is an on-going study using a national (USA) probability sample of (initially) 12,686 14-21 year olds and the females' children. They were interviewed annually until 1994 and biannually thereafter. Hispanics, blacks and economically disadvantaged whites were over represented for statistical reasons. Along with the gathering of life history data, an extensive and respected

battery of assessment devices is used. The NLSY79 is easily and inexpensively available on CD-ROM and has good technical support. There are published bibliographies, which list around 2000 studies that have used the NLSY79. In 1997 a new sample (the NLSY97) of 8,700 12-16 year olds was started which can provide comparison data for the NLSY79. I am using the NLSY79 to test hypotheses about father absence from the evolutionary literature. This includes Draper & Harpending's works Belsky, Steinberg & Draper's works and the empirical literature that flowed from both. I will present the results of this investigation.

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Friday PM Plenary Address: Herbert Gintis

Gintis H' **Strong reciprocity and human sociality: Game theoretical models and empirical tests.** Experimental economists and other social scientists have documented an important form of human behavior that has been inadequately analyzed by behavioral scientists. In public goods, ultimatum, and other games where players gain from cooperative behavior, agents have a predisposition to cooperate and to undertake costly punishment of defectors, even when this behavior cannot be justified in terms of traditional game-theoretic equilibrium and learning concepts assuming selfish preferences. In non-experimental settings (i.e., real life) similar behaviors are commonly expressed in actions such as revenge and some forms of collective action We call this 'strong reciprocity.' Strong reciprocity is distinguished from Robert Trivers' reciprocal altruism and tit-for-tat behavior in repeated games by the fact that strong reciprocity does not depend on the prospect that prosocial behaviors will be repaid by their beneficiaries.

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Friday Early PM Paper Sessions

1.0 Symposium: Reciprocity and human sociality: theoretical models and empirical tests (organized by H. Gintis)

1.1 *Alvard M*[1] **Cooperative big game hunting**

The Prisoner's Dilemma (PD) has dominated game theory research on cooperation because it presents challenging obstacles to cooperation while at the same time provides a good model for understanding reciprocity. The PD, however, is not the best paradigm for understanding all types of cooperation involved in large game hunting. Models of synergistic mutualism differ from the PD in the relative payoffs for cooperators and defectors. Mutualism is favored when *not* cooperating inflicts a cost on the cheater. Mutualism more closely matches the payoffs common to cooperative big game hunting. I present payoff data from a study of the cooperative hunting practices of traditional Indonesian whale hunters of the village of Lamalera. Traditional whaling vessels are manned by crews of eight to 14 or more. Prey are dispatched with ~6m long bamboo harpoons tipped with iron points. The primary prey are sperm whales and ray. The alternative to whaling is hook-and-line or net fishing with small boats called *sapã*, accomplished alone or in teams of two. The data support the hypothesis that cooperative big game hunting at Lamalera is mutualistic. Analysis of 863 whale hunts indicates that returns from cooperative whaling are greater than *sapã* fishing. Noncooperative *sapã* fishing returns are ~0.36kg/hr per person (N =800 fishing trips). Cooperative whaling returns are ~0.67kg/hr and 0.0kg/hr if attempted alone. Strong norms of share distribution ensure equity for hunt participants. The implications are discussed in terms of other hypotheses to explain hunting such as Costly Signaling Theory.

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1.2 *Ensminger, J* **Learning cooperation in the market--evidence from experimental economics in Kenya**

This paper is based upon recent data from experiments run in Kenya with the pastoral nomadic Orma. We know from innumerable experiments carried out in the US and other developed societies that individuals demonstrate more cooperation, trust, and fair-mindedness than would be predicted by game theoretical assumptions. Generally, however, experimental economists have not paid a great deal of attention to the demographic characteristics of the individuals who play some strategies over others. This paper presents data from the ultimatum bargaining

game and the dictator game, which together give us a picture of the degree to which people are opting for fair play over narrow economic self-interest. The most striking finding is that those who have cash income from wage work or trade tend to play disproportionately more fair-mindedly. The theoretical argument presented here for such behavior turns on the greater advantages of reputational effects in the market, which reward trustworthiness and cooperation. In such a climate, those who develop a reputation from fair-mindedness may be signaling their trustworthiness and cooperative character. Further, it is argued that such characteristics are difficult to “shut off” even in the context of an anonymous one-shot game with no reputational consequences.

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1.3 *Smith EA*¹ **Signaling generosity and willingness to punish**

Individually costly cooperation and enforcement of cooperative norms has been documented repeatedly in experimental and ethnographic contexts. These findings cannot be explained through standard forms of conditional reciprocity, but a variety of alternative explanations are currently under investigation. One such alternative involves costly signaling, wherein individuals honestly advertise their underlying qualities via acts whose costs (or benefits) are quality-dependent (e.g., lower-quality signalers pay higher marginal signal costs). I outline a game-theoretical model in which the costs incurred by acts of unconditional cooperation and punishment of non-cooperators serve as signals of the actor's ability or motivation to bear the costs of cooperation or punishment of non-cooperators. Observers benefit by using this information to make strategic decisions concerning interactions with signalers, as well as from the collective goods (including enforcement of prosocial norms) included in the signal. Signalers benefit via these changes in observer behavior. This model generates a number of predictions, including: (1) generosity signals underlying qualities or abilities that are valued in allies or mates, or that deter competitors; (2) partners (and third parties) use signals of generosity as an assay of commitment to an ongoing cooperative relationship; (3) punishment of non-cooperators signals qualities and intentions in a manner similar to the first two predictions; (4) punishment establishes a reputation that deters future free-riders; (5) increased group

size enhances signaling benefits (by increasing the size of the audience, and hence broadcast efficiency).

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1.4 *Marlowe F¹* **Sharing among Hadza hunter-gatherers**

Compared to most animals, humans exhibit an unusually high degree of cooperation. One example is the extensive food sharing typical of hunter-gatherers. Explanations for this food sharing include 1) nepotism, 2) tolerated theft, and 3) reciprocity of three types: a) not-in-kind trade, b) showing off/costly signaling, and c) delayed, in-kind exchange. If reciprocity was important over a long period of human evolution, we might expect norms of fairness to be fairly universal. To test this I conducted an experiment, using games that measure one's propensity to share, in an egalitarian hunter-gatherer society, the Hadza of Tanzania. In these games, the Hadza made less generous offers than people in state-level societies, and offers were lower the smaller the camp. Here I evaluate the explanations for food sharing in light of these results and data on Hadza foraging, which reveal something about motivation. I argue that several factors are involved and that tolerated theft is responsible for much of the outside household food sharing among foragers.

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1.5 *Patton JQ¹* **Social contracts, ultimatums, and reciprocal fairness in the Ecuadorian Amazon.** Analysis of cross-cultural data for the ultimatum game indicate that proposers in the game are generous beyond what rational economic logic would predict, supporting the notion of an innate logic based on reciprocal fairness. In this paper, data collected in 1998 are reported from Conambo, a tribal community in the Ecuadorian Amazon. Conambo is comprised of two ethnic groups who share a common hunting, fishing, gathering, and horticultural lifeway, but each group apparently plays the ultimatum game using different standards of reciprocal fairness. I argue that differences in performance are not due to contrasting cultural values, or economic factors, but to differences in coalitional structures. First, I present data on the strengths of social contracts within Conambo and use these data to define coalitional boundaries. Second, I report a significant positive correlation between average social contract strengths and the amounts offered by proposers

in the ultimatum game. And third, I present data to argue that the ultimatum game results correspond with observable patterns of cooperative behavior in Conambo. I conclude by arguing that coalitional differences in performance in the ultimatum game reflect different perceptions of trust, that is, members of the coalition with lower average social contract strengths have lower expectations that acts of cooperation will be reciprocated in the future which result in lower standards as to what offers in the game denote fair play.

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2.0 Panel Discussion: The use of evolutionary biology in understanding religion: Promising beginnings and/or dangerous directions ? (organized by D. Kriegman; discussants: R. Wrangham, J. Hartung, K. MacDonald)

2.1 *Kriegman O'* Evolutionary analysis of intergroup conflict and coalitional aggression:

Positing universal human psychological mechanisms for group formation and conflict

From our study of our closest primate relatives (Wrangham & Peterson, 1996) through all known human history (Keeley, 1996), coalitional aggression has been a central part of the story of our species. Virtually all authors who attempt to understand this tragic feature of our natural history posit a major role for religion and/or strongly held ideologies. Richard Alexander noted the ways in which religions helped define an ingroup and an outgroup. John Hartung has exposed the genocidal nature of the foundation of Judeo-Christian theology (the Bible) and its ingroup biased religious moral system. MacDonald has tried to develop an understanding of a specific religious grouping, Judaism, from an evolutionary perspective. Kriegman & Kriegman have presented a more general theory regarding the selective pressures created by coalitional aggression and the need for a mechanism--such as religion--to foster ingroup cooperation in the larger context of ongoing outgroup brutality. In this view, the innate tendency to form and adopt an ideology is a proximate mechanism by which humans form restricted identity groups. The specific characteristics, forms, and boundaries of these identity

groups are determined, in large part, by environmental pressures, including the existence and behavior of other groups. Brief summaries of these views will be presented and contrasted to provide a framework for discussion.

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2.2 *Kriegman D*¹ Kevin MacDonald and the Jews: Hard medicine to swallow, or a delicious gift to Saint Stephen (J. Gould)? In a recently published trilogy, Kevin MacDonald has attempted to apply an evolutionary analysis to understanding Judaism, anti-Semitism, and intergroup conflict. His controversial analysis concludes that Judaism is a "group evolutionary strategy," i.e., a set of ideological structures and behaviors that have resulted in (reworded slightly from MacDonald): (1) Jewish resistance to genetic and cultural assimilation with surrounding populations; (2) Jews engaging in resource and reproductive competition with gentile host societies; (3) high levels of within-group cooperation and altruism among Jews; and (4) eugenic efforts directed at producing high intelligence, high investment parenting, and commitment to group, rather than individual, goals. Anti-Semitism, within his theory, derives from the fact that: (1) Jewish cultural separatism results in both Jews and gentiles developing stereotypically negative attitudes toward outgroup members and the culture of the outgroup; (2) resource and reproductive competition between groups has been a common component of Jewish/gentile relationships; (3) because of Jewish within-group cooperation and altruism, as well as eugenic and cultural practices tending to result in high levels of intelligence and resource acquisition abilities among Jews, Jews are highly adept in resource competition with gentiles (MacDonald 1994). Can these conclusions be supported by the data and the theory? Is MacDonald's approach a reasonable application of evolutionary logic to intergroup conflict? Or is it an example, of precisely the kind of self-deception predicted by MacDonald's own theory when one group tries to "understand" the other? And, if so, is it just the kind of gift for which Stephen J. Gould lies in wait?

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3.0 Evolution and function of emotions II: Empathy and grief.

3.1 *Korchmaros JD*¹, *Kenny DA*² Emotional closeness as a mediator

of the effect of genetic relatedness on altruism. Inclusive fitness theory has been used to explain the overall pattern of altruistic behavior. However, this theory does not specify the proximal causes of the overall behavior pattern. The purpose of the present study was to increase the understanding of the proximal causes of the effect of genetic relatedness on altruistic behavior. In particular, emotional closeness was tested as a possible mediator of the effect of genetic relatedness on altruistic behavior. College students were presented with a hypothetical dilemma in which two of their family members of varying degrees of genetic relatedness and emotional closeness were in need of life-saving assistance. From participants' responses, "willingness to act altruistically" scores were computed for each of 5 family members. As expected, emotional closeness and willingness to act altruistically increased as genetic relatedness increased. Also as expected, willingness to act altruistically increased as degree of emotional closeness increased. Moreover, when controlling for the effect of emotional closeness, the effect of genetic relatedness on willingness to act altruistically, although still significant, was significantly weaker than it was when not controlling for emotional closeness. Thus, results showed that emotional closeness partially mediated the effect of genetic relatedness on willingness to act altruistically. It is concluded that emotional closeness and kinship are important proximal causes of altruism which suggests a more precise manner of measuring the effect of genetic relatedness on willingness to act altruistically than has been used previously and a more elaborate interpretation of altruistic behavior than previously premised by inclusive fitness theorists.

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3.2 Michalski RL¹, Shackelford TK¹ Adult attachment, kinship, and mateships among older adults. The current study examines adult attachment in a sample of older adults. 207 men and women with a mean age of 67.1 years completed a survey that included the Adult Attachment Questionnaire—a survey that is designed to assess various dimensions of adult romantic attachment. These attachment dimensions (avoidant, ambivalent, and secure) were related to several key variables such as

romantic relationship history, relationship satisfaction, life satisfaction, personality dimensions, and emotional closeness to and investment in kin. Discussion elaborates on the value of this older sample in elucidating several key features of attachment that have remained unexplored in previous research. Comparisons also are drawn between this sample and existing data with younger samples to illustrate the interrelationships of adult attachment, kinship, and mateships among older and younger adults.

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3.3 Thompson B¹ The influence of evolved psychology on human perceptions of non-human species. Past and present philosophers and animal rights activists have focused on the validity of the tendency of humans to set lower ethical standards for non-humans without attempting to explain why it occurs. Drawing on principles of evolutionary psychology and cross-cultural data I argue that there is a natural tendency to view non-humans with less empathy and lower ethical standards. This insight arises out of the realization that human mental adaptations developed while our ancestors existed as hunter-gatherers. Psychological adaptations, which produced a tendency to empathize with the animals, would have hindered our ancestors from effectively obtaining many of their basic needs. My own ethnographic research as well as that of others confirms that hunter-gatherers do not empathize with their prey nor do they extend their ethical threshold so that it includes these species. The question then becomes why have a significant minority of humans who have been removed from the hunter-gatherer lifestyle extended their ethics to many non-human species. I have hypothesized that this phenomenon must arise out of existing psychology, which evolved to regulate relations between humans. There are a variety of underlying psychological mechanisms, which may play a part in the extension of ethics between humans. I have examined those relating to empathy, kin selection, reciprocal altruism, and autonomy. A preliminary analysis based on an extensive survey of human attitudes towards animals indicates that kin selection and autonomy play a more significant role in the extension of ethics to non-humans.

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3.4 Wehr P¹ Bereavement as a function of reproductive value: Evidence from spousal and offspring loss. Proponents of an evolutionary explanation for bereavement suggest its intensity is ultimately tied to the deceased's reproductive value (as it relates to the survivor). Building on this premise, evolutionary principles were employed to guide predictions concerning various deceased/survivor pairings. Specifically, differences in male and female reproductive variability, male and female parent/offspring relatedness, male and female investment during pregnancy, and reproductive value over the life-course were considered. In light of the vast accumulation of literature already available, a meta-analytic procedure was adopted to examine sex and age effects in spousal and offspring loss. Results confirmed that a) compared to women, men suffer more following the loss of a spouse, b) compared to the elderly, younger individuals suffer more following the loss of a spouse, c) compared to men, women suffer more after losing a child, d) compared to losing a young child, parents losing older children suffer more, e) compared to men, women suffer more in the event of a miscarriage, and f) compared to miscarriages early in the pregnancy, women who experience a miscarriage later on suffer more. Non-evolutionary accounts for differences in bereavement are considered but, in addition to being less parsimonious, they fail to reconcile the data to a satisfactory degree.

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4.0 Mating tactics and choice

4.1 LeBlanc GJ¹, Buss DM², Shackelford TK³ Number of children desired and preferred spousal age difference: Context-specific mate preference patterns across 37 cultures

Men universally express a preference for youth in a long-term mate, presumably an evolved desire originating from the close and recurrent statistical association between a woman's age and her residual reproductive value (future reproductive potential). As a consequence, we hypothesized a positive correlation for men (but not women) between the number of children desired and preferred spousal age difference-a

context-specific shift in mate preference depending on whether the man is pursuing a "quality" or "quantity" reproductive strategy. We tested this hypothesis with data provided by 9,808 participants from 37 cultures located on six continents and five islands. Results confirmed the hypothesis, even after statistically controlling for preferred age at first marriage and current age of participant. Discussion notes limitations and focuses on other possible context-sensitive shifts in mate preferences.

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4.2 Abraham, JN¹ Does sexual selection exist? An ecological theory of sexual dimorphism in animals. Both male ornamentation and male combat result in increased male mortality. As population size is limited by a carrying capacity, increased adult male mortality will result in increased adult female survival, as well as increased survival for juveniles of both sexes. By choosing to mate with ornamented and/or combative males, females in polygamous systems therefore reduce intraspecific competition. Paradoxically, male fitness rises with increasing male mortality: because females are the limiting resource, average male fitness is inseparable from average female fitness, and they will vary in direct proportion to one another. In addition to offering an explanation under natural selection for phenomena that have traditionally been separated into sexual selection, this theory also offers new perspectives on peripheral problems such as mate location, resource guarding, leks, harems, and others. The implications for human behavior, particularly male combat, are clear.

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4.3 Ward D¹, LeBlanc G², Shackelford T³ Preventing, correcting, and anticipating female infidelity: Three adaptive problems of sperm competition. Sperm competition occurs when the sperm of two or more males simultaneously occupy the reproductive tract of a female and thereby compete to fertilize an egg. Sperm competition has been documented or inferred to exist in many species, including humans and birds. Female infidelity creates the primary context for sperm competition. In animals that practice social monogamy and in which there

is substantial paternal investment, males face costs associated with a female partner's infidelity. A principle cost is investing resources in genetically unrelated offspring. Female sexual infidelity and the resulting sperm competition generated several adaptive problems for males over evolutionary history. In humans and in birds, these include preventing female infidelity, correcting female infidelity, and anticipating female infidelity. It is proposed that males have evolved physiological and psychological mechanisms designed to solve these problems.

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4.4 *Schmitt DP*¹ **The desire for sexual variety as a tool for understanding basic human mating strategies.** Different authors have proposed competing evolutionary theories of human mating. Some argue that both sexes possess a singular long-term mating strategy. Some contend that both sexes are essentially multiple maters. Others propose that men and women have evolved short-term and long-term mating strategies that are differentially pursued by each sex depending on theoretically derived dimensions of context. These pluralistic theories of human mating also explain that the sexes tend to differ in the quality and prominence of the short-term component of human mating, particularly the short-term desire for sexual variety. The current research was designed to empirically contrast these competing theories by focusing on sex differences in the desire for sexual variety. In Study 1 ($N = 1,049$), consisting of five separate samples, we found large and consistent sex differences in the desire for short-term sexual variety, even after employing statistical methods to control for skewed distributions and statistical outliers. Study 2 ($N = 192$) confirmed the results of Study 1 using an older, more mature sample. Study 3 ($N = 50$) again replicated these sex differences using an observer-based method of inquiry. Study 4 ($N = 94$) found evidence that short-term mating was generally unrelated to psychological dysfunction, and may be related to healthy personality characteristics in men. This evidence is interpreted as supporting pluralistic views of basic human mating strategies.

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4.5 *Josephson SC*¹ **First wives and the nature of polygyny**

Polygynous first wives are different from their junior cowives in that they choose to marry monogamously but end up in polygynous marriages. This happens because first wives remain with their husband when he takes a second wife, but it is not clear why they stay. A sample of reproductive histories from 19th century Utah shows that first wives faced two bad alternatives – stay and become polygynous or divorce and remarry. Both decreased their reproductive success, but polygyny is probably the less risky alternative. Men looking to become polygynous allow first wives a disproportionate share of resources to encourage them to stay. This has implications not only for groups with simultaneous polygyny, but also for when we should expect to see serial-monogamy polygyny.

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Friday Late PM Paper Sessions

1.0 The battle for human nature: A thirty years' war (organizer: Ullica segerstrale)

In the "environmentalist" climate of the mid-20th century, attempts to explain human behavior based on evolutionary principles met with hostility from parts of academia, although they often fascinated non-academics. After the 1960's popular ethological books, it was sociobiology's turn to be put on the Index. Beyond race and intelligence - two issues sometimes desperately connected to sociobiology by the critics - an especially sensitive issue was that of sex roles and behavior. Any scientific suggestion of innate sex differences was typically treated as a moral crime, or as representing "politics by other means." In anthropology, evolutionary reasoning touched on yet another taboo: that of the Noble Savage, with consequent condemnation of those researchers whose field studies suggested otherwise. But behind the moral and political upheaval also lurked cool-headed academic strategizing: for Gould and Lewontin, at least, the sociobiology controversy represented "science by political means." In a changed climate, the conflict about evolution and human behavior has now - at least in principle - moved to address serious scientific matters, and projected future disputes may involve such issues

as algorithms Vs epigenetic rules.

1.1 *Irons W'* **Tales from the front: How the thought police banned my human sexuality course.** This presentation recounts events that occurred at Northwestern University in the fall of 1988. A young woman associated with the Women's Center who was enrolled in my course "The Evolution of Human Sexuality" filed a complaint with the Dean's Office charging me with sexual harassment. I was called into the Dean's Office and handed a dated list of statements I had allegedly made in the course. The young women claimed these statements created a hostile and intimidating educational environment. The list was very imaginative and bore limited relationship to anything I had actually said. I was told to provide the Dean's Office with a written explanation of why I had said these things. I was also told that I should not try to discuss the issue directly with my accuser, and that I should not retaliate in any way. Eventually the charges were dropped, but Following University policy, a record of the accusations was placed in my personnel file. I never taught the course again. In my evaluation, this was a clear-cut instance of censorship

of ideas. I think it is especially strange that the ideas censored are ideas that only a minority of members of the Northwestern Community find objectionable. Why does the University put such power in the hands of a few ideologues? Whatever became of academic freedom?

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1.2 *Chagnon, N'* **The Noble Savage has no biology and evolutionists who think so should be repudiated.** My 35 years of field studies of the Yanomamö Indians ended in 1999 when I retired from UCSB. Intensifying chronic opposition to my research and especially my field research made it clear that the costs and risks of continuing far outweighed the benefits. Applying evolutionary theories to the behavior of ordinary people often draws sharp criticism and opposition from non-evolutionary academics, but applying it to the Noble Savage, as the Yanomamö have become, provokes often hysterical condemnation and active interference in attempts to conduct field studies, including provoking natives to violence. Published work also becomes the target of extraordinary, non-academic attacks, even in professional academic

journals. This presentation will briefly review the history and nature of the opposition to my research by some anthropological colleagues, Salesian (Catholic) Missionaries, the Academic Left, and most recently, local politicians and radicalized native Amazonian peoples in areas adjacent to or near the Yanomamö region in Venezuela and Brazil.

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1.3 *Segerstrale U* Politics by scientific means and science by political means: critical strategies in the sociobiology debate. It is now 25 years since the beginning of the sociobiology controversy. Critics like the Sociobiology Study Group (SSG) saw E. O. Wilson and other sociobiologists as doing "politics by scientific means," and the sociobiologists responded by turning this allegation back on the critics. But there is another interpretation of the activities of Wilson's two main scientific critics, Gould and Lewontin. Although they shared the political view of the SSG, for them the sociobiology debate was a way to pursue their own academic interests, in a move which might be called "science by political means." For Gould and Lewontin, academic controversy was a Trojan horse for introducing anti-adaptationist thinking into scientific discourse at a time when it had little intellectual support and might have been easily dismissed. Later, the Trojan horse could be dismantled and anti-adaptationist argumentation stand on its own.

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1.4 *Fetzer J* Future conflicts in evolution and psychology

As political and ethical conflicts surrounding sociobiology recede, many conceptual and theoretical conflicts remain. Developments in this domain represented by Sociobiology(1975), Genes, Mind and Culture (1981), TheAdapted Mind (1992), and Consilience (1998), for example, exemplify ambivalence over problems of biological determinism, theoretical reductionism, ad free-will/determinism, even while displaying a general tendency toward increasingly broad conceptions of gene-culture co-evolution, which permit distinctions to be drawn between lower species, whose behavior is largely determined by their genes, and higher species, whose behavior is strongly affected by their cultures. Extensions of sociobiology may be expected to accent the role of cognitive versatility by building upon distinctions between mentality, intelligence and rationality as

individual abilities that transcend even the role of culture. The tendency toward the invocation of Darwinian algorithms should shift back toward reliance on epigenetic rules as their theoretical strengths and weaknesses become adequately understood. The behavioral plasticity typifying the higher species will increasingly be regarded as a complex effect of individual cognitive abilities against a background of genetic and cultural factors predisposing specific organisms toward particular forms of behavior without thereby determining them.

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2.0 Symposium: Reproductive effort: Trade-offs in mating and parenting (organizers: M. Shenk, G. Kushnick)

Behavioral ecology contributes to the study of reproductive effort (the summed allocation of resources to mating and parenting) by examining the costs and benefits of allocatory decisions given prevailing physical and social environmental conditions. This approach assumes that human reproductive strategies have been shaped by natural selection to produce adaptive phenotypes in a wide range of contexts. The papers in this session represent theoretical and empirical applications of this perspective to a range of issues relevant to anthropology, demography, and evolutionary theory including parent-offspring conflict, stepfathering as mating effort, dowry inflation, and the relationship between parental investment and food sharing.

2.1 *Kushnick GC*¹ Parent-offspring conflict models: prospects for use in human behavioral ecology field studies. Parent-offspring conflict (POC) models provide a promising framework for understanding human reproductive effort, yet the difficulties of confronting the models with data have impeded progress on this front. In this paper, I modify an existing model of optimal interbirth interval to incorporate the logic of POC and show how such a model might be used in a human behavioral ecology field study. My discussion is guided by a characterization of POC models that reveals that only a specific class of these models may be profitably applied to the human case. My characterization of POC models focuses on the following questions: (a) is it a battleground or resolution model?; (b) if a resolution model, who wins?; (c) how is parental investment operationalized?; (d) is the conflict inter- or intra-

brood?; (e) what relevant parent and offspring attributes are included?; and, (f) what technique is used to find the optimal solution?

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2.2 *Anderson KG*¹ **The life histories of American stepfathers in evolutionary perspective**²

This paper presents an analysis of the characteristics of men who become stepfathers, and their subsequent fertility patterns and lifetime reproductive success. Because women who already have children are ranked lower in the marriage market than women without children, men who marry women with children (e.g., stepfathers) are likely to have lower rankings in the marriage market as well. Using retrospective fertility and marital histories from the Panel Study of Income Dynamics (PSID), I show that men who become stepfathers have lower levels of education, less income, and are more likely to have been divorced before and to already have children, all characteristics that lower their rankings in the mating market. Men with one or two stepchildren are just as likely to have children within a marriage as non-stepfathers, although men with three stepchildren show decreased fertility. Among men age 45 and older, stepfathers have lower lifetime fertility than non-stepfathers, although the difference disappears when men's age at first marriage is controlled for. Additionally, stepfathers have significantly higher fertility than men who never marry. The results suggest that some men become stepfathers to procure mates and fertility benefits that they would otherwise have been unlikely to obtain; for these men, raising other men's children serves as a form of mating effort.

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2Postdoctoral competition.

2.3 *Shenk, M*¹ **Evolutionary and economic determinants of dowry inflation**

In 1996, Hillard Kaplan published a general evolutionary model of fertility and parental investment which allows the generation of predictions regarding level of parental investment and fertility given information on the shape of the relationships of parental investment to child mortality and

adult income. This paper begins by presenting a modified version of Kaplan's model which incorporates investment in two sexes of offspring. Some general implications of this model for differential investment in sons and daughters are explored. The model is then adapted to the specific case of parental investment in urban South India. Predictions are generated regarding the level and type of investment in sons versus daughters, and the phenomenon of South Asian dowry inflation is discussed in relation to these predictions. Finally, some comparison is made with predictions generated from traditional economics models of dowry and investment in child quality.

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2.4 *Nolin D¹ Alvard M²* Resource sharing and growth of offspring in Lamalera, Indonesia

Studies of parental investment strategies often focus on resource allocation among existing or potential future offspring within the household. However, allocation of resources outside the household can have a positive effect on the fitness of offspring if there exists a system of reciprocal sharing between households that reduces household resource variance over time. If sharing is occurring then resource differences between sharing households should be reduced while those between different groups of sharers should be more pronounced, and these patterns should be reflected in the fitness of offspring. We test this hypothesis using anthropometric data collected in the whaling village of Lamalera, Indonesia during the active hunting season of May through August 1999 on children ranging in age from 0 to 18 years. Using genealogical and residence data to relate individual children to primary producers, we find that differences in children's rates of growth do not correlate with differences in their individual household harvests. However, the average rate of growth of children within a higher level grouping of households does strongly and positively correlate with the per capita harvest in those groupings. These findings agree well with data on food sharing in the village. This research was supported by grants from NSF (SBR-9805095) and the Office of the Vice President for Research, SUNY-Buffalo.

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3.0 Linguistic evidence of social evolution

3.1 *Jones D¹* **Toward an evolutionary psychology of kin classification: Group nepotism, markedness and optimality theory.** I present population genetic models showing that the effective coefficient of relatedness can be greater than Hamilton's "r" when individuals act together rather than separately to assist their mutual kin ("group nepotism"). This may help to explain why socially defined kinship often differs from biological kinship. One line of evidence regarding the evolutionary psychology of kinship comes from the anthropological linguistics of kin classification. I review findings regarding unmarked and marked (i.e. cognitively central and peripheral) kin categories, and show that "optimality theory," a new approach to rules of grammar, may also be relevant to kin classification. According to optimality theory, all languages are governed by a universal set of constraints; grammatical variation between languages results from differences in how constraints are ranked. Similarly, variation in systems of kin classification can be shown to result from variation in the ranking of markedness and other constraints. The resulting variation may allow different cultures to adjust kin classification to reflect differences in effective coefficients of relatedness resulting from "group nepotism." These results may fill some of the gaps between evolutionary, cognitive, and social anthropological accounts of human kinship.

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3.2 *Jordan F¹, Gray R²* **Rigorous tests of adaptive hypotheses: Are language phylogenies the answer?** Adaptive thinking is the central inferential device in evolutionary psychology. However, evolutionary psychologists have not routinely employed the phylogenetic tools used in biology to test their adaptive hypotheses. Whilst the arguments for an evolutionary approach to human behavior are well reasoned, rigorous tests of adaptive hypotheses are rare. One obstacle is that detailed phylogenies of human populations are not available. Darwin noticed the striking similarities between biological and linguistic evolution. Here we

demonstrate how human phylogenies can be constructed from linguistic data. A phylogeny of 77 Austronesian (Pacific) languages was constructed from a data set of 5185 lexical items. Language trees provide a powerful tool for testing adaptive hypotheses about human cultural evolution: an example from Pacific culture history will be presented. It is argued that evolutionary psychology should seize opportunities to subject adaptive hypotheses to the tools and tests of evolutionary biologists.

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3.3 Schuldberg D¹, Guisinger S² Female choice in the evolution of language: Evidence from an analogue study of sperm donor preferences. This paper argues for the contribution of sexual selection, specifically female choice, to the rapid evolution of language. Language may influence mating in two ways: As Pinker (1994) suggests, it can be a tool of seduction; more importantly, language indexes potential mates' intelligence or "quality". With relatively few reproductive opportunities females should be more concerned with genetic quality than are males. However, in many modern societies male monopolization of resources may force choosing wealth, accounting for some of Buss' (1989) findings. This study removes the factor of resources, allowing choices more related to fitness. Here we extend previous work, ascertaining the relative value of male articulateness on women's choosing a sperm donor. Fifty-seven women were given descriptions of four men -- described either as high or low on physical attractiveness or high/low on verbal intelligence -- and asked to suppose they wanted a baby and needed to choose a sperm donor, responding to all donor pairs. When given the opportunity, they overwhelmingly chose verbal over handsome men ($t [56] = 10.1, p < .0005$), with verbal ability or intelligence chosen 188 times and attractiveness 39. Data from 35 males indicates men may decide similarly if faced with choosing a sperm donor (other than themselves). Women value verbal intelligence more than looks in choosing a genetic father for their child, suggesting a mechanism for female choice's contribution to the rapid selection of language ability.

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4.0 Evolution of Life Histories II

4.1 *Valeggia CR¹, Ellison PT²* **Breastfeeding behavior, maternal energetics, and duration of lactational amenorrhea in Toba women of Formosa, Argentina.** The temporal pattern of breastfeeding is generally considered the single most important factor modulating the duration of lactational amenorrhea. However, this view does not consider the potential importance of variation in maternal condition, especially maternal energetics. According to an alternative hypothesis, the duration of lactational amenorrhea depends on the relative metabolic burden that lactation poses on the mother, which in turn is a function of both the intensity of the nursing pattern and maternal energy availability. The present study was designed to consider the joint effects of the temporal pattern of breastfeeding and maternal energetics on the resumption of postpartum ovarian function. Results from a longitudinal study of the postpartum resumption of fecundity in a Toba population in Argentina are presented. A village-wide reproductive survey provided data on women's reproductive history. Monthly anthropometric measures from 126 breastfeeding women were taken from childbirth until their third postpartum menses. Bimonthly home visits to 60 of those women, provided information on breastfeeding temporal patterns, calorie intake, energy expenditure, and menstrual status. Toba mothers were well nourished (mean BMI = 25.5) and they did not lose weight during lactation. Mothers breastfed their infants intensively. A highly caloric diet, coupled with low workloads, resulted in a highly positive energy balance. Average duration of lactational amenorrhea was 10 months. The mean interbirth interval is 25 months. These findings lend support to the hypothesis that a relatively low energetic cost of lactation favors a rapid return to postpartum fecundity, even when breastfeeding style is intense.

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4.2 *Strassmann BI¹* **Does Dogon fertility maximize female fitness?**

Life history theory predicts that when organisms reproduce so as to maximize their inclusive fitness they will face a trade-off between offspring number and offspring quality (Stearns 1992). The few explicit tests of life history theory in humans have, however, failed to demonstrate

diminishing returns to fitness from higher fertility. For example, in the Kung! Of Botswana, (Pennington and Harpending 1988) and the Ache of Paraguay (Hill and Hurtado 1996), lifetime reproductive success increased linearly with fertility. Here I report tests of life-history theory on a sample of 113 Dogon women, 55 of whom had completed their reproductive careers. I obtained the life history data during private interviews conducted in Dogon. The optimal lifetime fertility was 9.86 offspring which was close to the modal fertility of 10 offspring. Mean lifetime reproductive success was 8.45 +/- 0.29 offspring and the median fertility was nine offspring. In contrast with previous studies, the relationship between fertility and reproductive success was quadratic, not linear. I then excluded offspring born after a previous child who died at age < 24 months. This correction controlled for the influence of mortality on fertility (via the resumption of ovarian cycling after the death of a nursing infant). After this correction, the relationship between fertility and reproductive success remained quadratic. These data provide clear evidence for a trade-off between offspring number and offspring quality. Moreover, they are consistent with the hypothesis that the fertility behavior of women in this traditional agricultural population maximizes inclusive fitness.

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4.3 Fessler DMT¹ Progesterone-induced immunosuppression and sex differences in meat consumption. Fetal tissue, being only 50% related to the mother, constitutes an allograft, which elicits maternal immunological response. Pregnancy is therefore only possible through a suppression of maternal cell-mediated immunity, an effect that is triggered by elevated progesterone levels. During the first trimester, both maternal and fetal immunological defenses are at their lowest; as pregnancy progresses, this immunological vulnerability gradually decreases for both parties. The first trimester is thus a dangerous period for mother and fetus. Although there are limits on the degree to which selection is able to modify behavior so as to minimize exposure to intracellular pathogens during this period, one prominent avenue for infection, which can be avoided in a cost-effective manner, is the consumption of meat. Consistent with this assessment, meat is a prominent target of aversions developed by women as part of pregnancy

sickness. Moreover, evidence suggests that progesterone-induced immunosuppression is not confined to pregnancy, but also occurs during the luteal phase of nonconceptive cycles. Luteal phase nausea and dietary changes can thus be understood as a less extreme form of pregnancy sickness. Pervasive gender differences in aversions to meat, consumption of meat, and vegetarianism can therefore be viewed as consequences of hormonally mediated changes in the value of meat for women. Similar considerations are likely to play a role in sex differences in predation by nonhuman primates. Progesterone-induced immunosuppression may thus have set the stage for sex-specific foraging strategies, which constituted a preadaptation for a sex-based division of labor.

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4.4 Mace R¹, Sear R² Twin mothers as supermums: analysis of the fitness of mothers of twins using demographic data from rural Gambia. It has been suggested that twinning is a non-adaptive consequence of polyovulation, which is advantageous because it enables fetal selection and high abortion rates with fewer missed cycles, and possibly more potential fetal sex-selection. A prediction of this hypothesis is that mothers of twins have higher fertility. We test this prediction using demographic data from rural Gambia. We find twin mothers have shorter interbirth intervals and later age at last reproduction. Although twin mortality is high, mothers of twins have more children surviving to age 5 over their lifetime. Twin mothers have slightly higher BMIs and are more likely to have boys among the siblings of twins. We did not find significantly higher mortality in male twins, or higher mortality among siblings of twins in this society. These findings are generally consistent with the polyovulation hypothesis, and also suggest that mothers of twins are generally phenotypically fit.

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Friday Evening Keynote Address: Richard Wrangham

Wrangham R. Ecology and phylogeny in the human ape: Towards an integrated evolutionary psychology. Chimpanzees and bonobos share striking behavioral similarities with humans, including group hunting by males, tool-using, non-conceptive sexuality, and an unusually high potential for peaceful intergroup interactions. Yet we and these other apes are separated by 2 genera, 5 million years, a trebling of brain size, and major differences in ecological and social pressures. So why, if behavior is adapted to context, should our behaviors ever be similar? And why should the similarities be in some cases with chimpanzees, but in other cases with bonobos? I suggest two principal kinds of answer. First, direct ecological pressures created by scramble competition are somewhat similar in the three species, and lead to parallel constraints on features such as alliance formation, group defensibility, and individual vulnerability to aggression. The nature of scramble competition varies among sexes, creating stronger similarities among females between humans and bonobos, and among males between humans and chimpanzees. For example, scramble competition appears responsible for the ape distribution of both concealed ovulation and killing raids. Second, and more speculative, are the correlated consequences of selection for reduced male violence. Bonobos and humans share several behavioral tendencies that appear to be linked only indirectly to ecology, including reduced female-female aggression, extensive non-conceptive sexuality (heterosexual and homosexual), and social dependence. By analogy with domestication, I propose that these bonobo-human similarities originated from parallel processes of selection against intense male aggressiveness, which incidentally favored various neotenous traits.

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Saturday AM, Plenary Address: Richard Potts

*Potts R*¹ **The adaptive crunch: Habitat instability as the context of early human behavioral evolution.** Most environmental hypotheses of human evolution point to progressive climatic cooling and drying as the driving force of adaptive change. These hypotheses today rely on ocean and ice-core records without paying much attention to the actual environmental contexts inhabited by early humans. Efforts to correct this problem show that large-scale habitat instability, rather than progressive change, was the predominant environmental challenge encountered by hominine populations. According to East African Plio-Pleistocene records, major remodeling of landscapes and resources occurred approximately once every 6,000 to 65,000 years. Long-term instability was linked to smaller-scale (interannual to millennial-scale) fluctuation, creating a spectrum of increasing environmental variability over time that shaped the adaptive properties of organisms. In humans, major evolutionary change comprised a complex sequence of increasing versatility, including (from oldest to youngest) greater locomotor mobility, expanded environmental manipulation, enhanced mental mapping, and diversification of meme systems – each of which was manifested in times of dramatic environmental novelty. I suggest four guidelines relevant to understanding the evolutionary basis of human adaptive systems: (1) uniquely human qualities emerged under diverse and highly variable environmental settings; (2) social strategies evolved in relation to resource distributions that were altered significantly and repeatedly by climatic and other external factors; thus the traditional distinction of social *versus* environmental explanations of cognitive evolution may be invalid; (3) scenarios of human behavioral evolution often use adaptive reasoning that lacks any time/place context and is temporally irrelevant; and (4) early humans manifested systems of behavior for which there is no known analogue.

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Saturday AM Paper Sessions

1.0 Symposium:Hominid Transitions (Organized by: The HBES

Program Committee)

1.1 *Laden, G.* **With this handaxe, I thee wed? The origin and evolution of human pair bonding and food sharing may be visible in the archaeological record.** A striking feature of humans is the ability to "have" without "holding" life-history critical resources, often following sometimes considerable investment in those resources. The fitness-enhancing products of tool making and foraging are not co-opted by dominant individuals, but are incorporated in systems of sharing and reciprocity that are highly elaborated in humans, and that rely on the capacity to *invest*, and subsequently *to protect investment via socially mediated contractual or cooperative behavior*, in contrast to protection by direct defense. I argue that the same capacity facilitates the formation and maintenance of primary sexual access (pair bonds). This capacity extends to the control of resources distant in space, including absent mates and "owned" resources. I propose that the identification of any aspect of this behavioral system--pair bonding, complex food sharing, protection of investment, symbolic behavior (art?)-- would be strong evidence for the existence or at least nascent emergence of all of the other aspects of this nexus of behaviors. I propose that investment and investment protection is visible in the archaeological record. I argue that handaxe industries are the earliest manifestation of this capacity, and subsequent changes in the archaeological record indicate further evolution of this nexus of behaviors. Finally, I assert that this capacity allowed exploitation of an increasingly diverse range of habitats, accounting for the impressive biogeographical exploits of the genus *Homo*.

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1.2 *Stanford CB* **Significant others: Chimpanzees, bonobos and the five cherished myths of**

human behavioral origins. In this paper I will bring recent research on great apes to bear on five cherished myths of human behavioral evolution. These include the myths of 1) the clumsy biped, 2) the savanna model, 3) the hunting/scavenging dichotomy, 4) heat-seeking males versus coy females, and 5) the Monolithic Paleolithic. I argue that evolutionary psychologists tend to rely on outdated and models of human evolution when they seek support for hypotheses about human cognitive

and behavioral adaptiveness. The EEA (Environment of Evolutionary Adaptedness) is often conceived of simplistically as the CMD (Cave Man Days) for the purpose of formulating hypotheses. I will argue that the use of meat was a central feature of the evolution of humanity and discuss its role in the explosion in brain size that has occurred in the hominid lineage.

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1.3 *Robson S'* **Meat eating and human encephalization**

Animal products make up a larger portion of human than non-human primate diet. Humans also have larger brains, both absolutely and relative to body size. It has often been proposed that increased carnivory during human evolution provided the nutritional support needed to underwrite greater encephalization. Comparative analyses show that at birth, human brains are smaller than expected for a primate of our body weight, relative to their size at adulthood. This means that postnatal, not fetal, growth accounts for our departure from the general primate pattern. During the period of most rapid post-natal brain growth, infants are provisioned primarily (if not exclusively) by lactation. If increased carnivory is responsible for our larger brains, human breastmilk should differ from that of other primate by displaying a higher proportion of specific lipids which are critical to brain growth. Breastmilk in humans whose diets vary in meat content should also differ in predictable ways. Multiple lines of evidence suggest that maternal nutrition has little impact on breastmilk quantity or quality. In addition, human breastmilk does not appear to differ in composition from that of other anthropoid primates. If the proportion of meat in maternal diets does not affect breastmilk composition among humans, then increased carnivory cannot account for the human pattern of encephalization.

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2.0 Religion, religious experience and moral systems.

2.1 *Moore T'* **Placebos, faith, and morals: Or why religion?**

Religion is so powerful and so ubiquitous that humans probably have a genetic need for a faith. Faith is also involved in the very powerful effect of placebos, which benefit between 35 to 75 percent of the patients taking dummy pills. Religious people live longer than those without a faith, indicating that religious belief may act much like a placebo. An explanation for the origins of religion lies in selective pressure for larger social groups. Warfare between proto-human tribes appears to have generated evolutionary pressure for larger groups; other things being the same, the larger tribes conquered the smaller. Larger groups of humans, however, experience difficulties in maintaining solidarity and preventing free riders. Religion and its rites strengthened group cohesion, making free riding more expensive and harder to conceal. In other words, a religious urge evolved to enhance warfare.

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2.2 *Goldberg R*¹ **Selection advantages of religious fasts**

This paper evaluates the evolutionary significance of public fasting, a widespread phenomenon among human populations. There is hardly an aspect of social relations in which food (or its lack) is not implicated in some way. Just as all social codes regulate within-group food sharing, the deliberate abstention from eating carries a powerful social message of willingness to sacrifice one's welfare to those of the group. Illustrations of religious fasting will be taken from Christianity, Hinduism, Islam and Judaism in an attempt to describe some common features of all religious fasts. Group selection theory should show how specific behaviors of individuals, acting alone or in concert with other group members, may simultaneously provide selection advantages for oneself and the group. The concept here is that, by public and ritual denial of otherwise desirable food, an individual can elevate social ranking and leave more and better provisioned descendants. In addition, when individuals fast in unison with others, the shared experience of communion through deprivation may enhance group cohesiveness, lending a competitive advantage as against both prey and other human groups.

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2.3 *Schloss JP*¹ **Historical oscillations of religious zeal as cheater**

detection mechanisms: Religious revivalism as costly or hard to fake signaling. Both scholarly externalist and participatory internalist descriptions of western religious history describe millennia old, cyclic patterns of renewal in religious fervor followed by periods of stasis and cultural accommodation, referred to by Max Weber as "routinization of charisma." To the extent that both moral and religious systems facilitate direct and indirect reciprocity by identifying reliable reciprocators within social groups too large to keep track of individual exchanges, they are vulnerable to and must solve the problem of cheater detection. The history of religious revivalism reveals regular features that may accomplish this by providing signals of group membership in two ways. Many manifestations entail genuinely costly signals (e.g., snake handling, self-flagellation, food deprivation, obligatory servitude, voluntary impoverishment and/or celibacy). Others entail autonomic responses that are highly difficult to intentionally fake (e.g., ecstatic speech, convulsive weeping, hysteric laughter, piloerection, thermogenesis, hallucinatory perceptions). Four expectations from Darwinian principles will be examined in light of religious history: 1) magnitude of religious manifestations should scale directly to communitarian nature of the group and inversely to status of the individual, 2) degree of routinization or signaling attenuation over time (incursion of cheating) should be proportional to resource accumulation for both groups and individuals, 3) prophetic revivalism should be aimed more at detecting cheating through self-deception than conscious hypocrisy, 4) neither the biological demands of costly signals nor the challenges of hard to fake signals should entail net fitness reductions.

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2.4 *McClenonJ¹* **Content analysis of an anomalous experience collection: Evaluating evolutionary perspectives.** Hypotheses derived from two evolutionary perspectives are evaluated through content analysis of 1215 anomalous experience narratives. The "direct benefit" theory suggests that experiences such as apparitions, ESP, psychokinesis, and out-of-body experiences provide particular humans with survival advantages and, as a result, genotypes associated with these episodes have increased in frequency over time. The "ritual healing" theory suggests that hominid rituals provided greater therapeutic benefits to

those more open to hypnotic suggestion. As a result, these rituals selected for genotypes associated with hypnotizability, a trait linked to the propensity for anomalous and religious experience. These two theories are not mutually exclusive. Both portray anomalous experiences as a foundation of shamanism, the basis for all later religions. In general, the data support the ritual healing theory.

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2.5 *Navarrete CD*¹ **The evolution and function of moral reasoning: A synthetic view.**

Much of the discussion within moral psychology has been dominated by the cognitive-developmental model, which emphasizes justice reasoning as the basis for moral action. Others have emphasized empathy and affect as the backbone of moral sentiments. Recently, evolutionists have posited that moral systems evolved to serve the interests of kin-selection and reciprocal altruism. This paper briefly reviews the evidence and logic for these models. A synthetic view is then posited to reconcile the various approaches where components of each are non-exclusive. This synthetic model borrows heavily from dissonance theory, but seeks to integrate this approach with the meta-theory of evolutionary biology. The model makes the following claims: 1) moral attitudes and reasoning are post-hoc verbal statements of affect and intuitive judgments, 2) these moral cognitions are generated from evolved mechanisms, calibrated from social input from the local culture, 3) in the proximate sense, they emerge as a way to deal with the dissonance created from (im)moral action versus moral reasoning, 4) they ultimately function as rationalizations to the narrative self and to others the intention to conform to group norms and mores. The paper close with a discussion of the implications of the new approach and how future research may be employed to provide further evidence for the theory.

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2.6 *Wiebe RP*¹ **Criminal behavior, reproductive fitness, and moral responsibility**

What if the brains of many or most humans contain adaptations--cognitive modules or adaptive strategies--that directly cause criminal behavior?

Should this absolve them of responsibility for their crimes, if their crimes increase their reproductive fitness? If what many evolutionary thinkers believe is true, men are designed by nature to (among other things) rape and murder, and psychopaths are designed to exploit everybody. The question becomes whether these facts should occasion any significant revision of standards for criminal and moral responsibility. This talk will examine potential defenses for criminal behavior that advances the actor's reproductive fitness, and will discard them all. Rather than justifying behavior that preserves the status quo and promotes the "patriarchy," as some have asserted, the Darwinist idea of adaptive strategies or cognitive modules simply augments the "rational choice" assumption of classical criminology. Current standards should therefore suffice to establish criminal responsibility, even in the face of the fuller picture provided by evolutionary psychology of the motivations and reasons, both ultimate and proximate, for human behavior.

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3.0 Evolutionary psychology: models, variation, social influence, fear and parental investment.

3.1 *Ketelaar T'* **Is Affect simply an algorithm for representing Utility? Evidence for an emotional basis to the “Losses loom larger than Gains” effect.** Emotions are often conceptualized in terms of two components: 1) a cognitive appraisal component and 2) an affective (good vs. bad) feeling state component. Guilt, for example, consists of both: (a) a negative affect state (guilt feels bad) and (b) cognitions about the self as an agent whose actions have violated a social norm. To date, much of the literature on the affective component of emotion has focused on the biasing effects that affective feeling states have on subsequent judgment and decision-making tasks (Ketelaar & Clore, 1997). This paper presents an alternative, adaptationist view of affect in which affective feeling states are viewed as strategic mental states that represent the affordance structure of the current environment. A brief task analysis of the adaptive problem of affordance representation is presented in which “Affordances” are defined as the positive and negative utilities associated with certain properties of

ecological environments. In a series of four experiments, it is then shown that positive and negative affective reactions to gains and losses correspond to several well-established descriptive properties of Utility functions, including the well-known “Losses loom larger than gains” effect. These findings are discussed in terms of their implications for understanding the proximate and ultimate functions of mood states and their role in affordance perception.

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3.2 *Colarelli S M¹, Yang C²* **How Much Practical Utility Do Individual Differences Really Have?**

A large, irreconcilable gulf exists between evolutionary psychology and areas of applied psychology associated with individual differences. Many applied psychologists argue that one of psychology’s great achievements has been the ability to measure individual differences and to predict behavior from tests that measure individual differences. Evolutionary psychologists, on the other hand, argue that most individual differences are the results of random genetic noise and are not adaptive. Moreover, ordinary lay people can assess important individual differences almost as accurately and reliably as psychologists, and it is generally not possible to predict long-term behavior in complex bio-social ecologies on the basis of most individual differences. We tested this view by examining the relationship between intelligence, personality, and vocational interests and a variety of work-related criteria (training grades, performance evaluations, accidents) for 673 industrial workers over periods of 30, 10, and 3 years. Initially significant relationships between individual difference measures and those criteria diminished over time, and the criteria related inconsistently to one another and to individual differences. The results suggest that, from an evolutionary psychological perspective, applied psychologists’ faith in the practical utility of individual differences is not justified.

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3.3 *Brase G¹* **Directly testing the assumption of frequency superiority, with some implications for social influence.**

Evolutionary and ecological validity considerations indicate that: a) frequentist representations of information should be superior to single-event representations (e.g., Cosmides & Tooby, 1996; Gigerenzer &

Hoffrage, 1995), and b) the size of the reference class in a judgment task can influence people's judgments (Wang, 1995, 1996). Previous work with judgment under uncertainty tasks has borne out these predictions. These results, however, involve only indirect support for these ideas; improved judgments are inferred to have been due to frequentist formats and small reference classes. A possible confound within this paradigm is that frequency formats also reduce the computational complexity of the judgment problems. The present research sought to simply and directly evaluate if –by themselves— frequency formats and small reference class sizes are clearer than other formats. The present research found that frequencies based on small reference classes (simple frequencies, e.g., 1/3) and percentages (relative frequencies, e.g., 33%) were perceived as clearer than frequencies based on very large reference classes (total frequencies, e.g., 90 million Americans) and single event probabilities (e.g., .33). It was also found that the persuasiveness (monetary elicitation and impressiveness) of statistical information can be systematically influenced by presentation format. Specifically, actual magnitude and persuasiveness were positively related, but total frequency information was more persuasive for smaller magnitudes and less persuasive for larger magnitudes.

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3.4 *Fetchenhauer D'* Why are women more afraid of crime than men?

A vast number of studies show that women are more afraid of becoming a victim of crime than men despite the fact that their victimization risks tend to be lower than that of men. This fact has often been called the “fear victimization paradox”. In my talk these findings are explained from an evolutionary point of view. This explanation rests on the assumption that for men and women different levels of fear and risk-orientation have been adaptive. For both sexes high levels of fear and low levels of risk seeking were adaptive insofar as they resulted in the careful avoidance of possible dangers. However, for men it was necessary to compete with other men for the access to potential mates. To be successful in this intrasexual competition being too fearful and risk avoidant was a great hindrance. Furthermore, women prefer dominant men with a high social

status. However, men can only achieve such a high status if they succeed in the intrasexual competition with other men. From this line of reasoning a number of different hypotheses are derived and empirically tested with a sample of 270 university students. It can be shown that men engage more often than women in risky behaviors in a number of different areas (i.e. delinquency, traffic behavior and contraceptive behavior) and are more often victimized than women both by crimes and accidents. Furthermore women are more fearful of negative events, regard the outcomes of these events to be more severe than men and perceive a higher probability of being victimized.

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3.5 *Boster J*¹ **Family values: What American parents want for their children.**

When American parents are asked what personal and social traits they want for their children and themselves, they report they want the same things for their daughters as they want for their sons and for themselves: Characteristics of a good and independent person (e.g., self-confidence, self-reliance, loyalty, maturity, dependability) are most important; traits that tie the child to the parent (e.g., knowledge and pride of ethnicity, sharing parent's religious beliefs, political beliefs, and interests) are least important. However, if presented with a forced choice, parents judge traits having to do with mastery of the public sphere (e.g., ambition, assertiveness, self-reliance, financial success) to be more important for sons and to have been learned or acquired by both sexes from fathers while they judge traits having to do with mastery of the private or domestic sphere (refinement, patience, sociability, good cook, chastity) to be more important for daughters and to have been learned or acquired by both sexes from mothers.

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3.6 *Chen YC*¹, *Wang XT*² **Sexual selection and the perception of health and environmental risks.** Using hypothetical dilemmas, Wilson, Daly, and Gordon (1998) demonstrated that men, as a result of sexual selection, are more likely than women to discount health risks and

environmental hazards in pursuit of present material and social benefits. We examined how this presumably universal sex difference in the willingness to tolerate health hazards and environmental degradation was manifested in a collectivist culture. In a first experiment, four hypothetical dilemmas incorporating two levels of financial incentive and two levels of health risk, were presented to the participants recruited in Taiwan. The overall pattern of choices revealed that men were clearly monetary incentive-oriented, whereas women were more concerned about health risks. Unlike Wilson, Daly, and Gordon's Canadian participants, more Taiwanese men than women chose to avoid the personal health risks at the cost of monetary profit in the higher-risk and lower-incentive situation. This effect disappeared in a second Taiwanese experiment where the risk manipulated was environmental degradation rather than personal health. Men were more profit seeking than women in both incentive situations. These results were analyzed in a framework of sexual selection based on life-history differences between men and women in their life-span expectancy and in reproduction. We hypothesized that a shorter life span and higher variance in reproductive fitness in men may lead to a greater amount of discount of future benefits in the face of present gain. However, this discounting function may be weakened in a collectivist culture where reproductive variance among men may be minimized by extended kinship, intermarriages, and a more stable social network.

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Saturday PM plenary address: Laura Betzig

***Betzig, L* Why the Pope's Catholic: A Darwinian history of the Church.**

In 31 BC, at Actium, Augustus beat Mark Antony and became the first emperor of Rome. Around 30 years later, Jesus of Nazareth was born. Augustus, like most emperors, distanced himself from the rich. They were killed, exiled, deposed, taxed-and subject to the "moral" laws. By the lex Papia Poppaea of AD 9, penalties were imposed on celibacy: against their intent, the rich had to let all their sons marry, and their heirs split up their estates. Jesus, at around the same time, was saying something

completely different. "Those who are accounted worthy to attain to that age and to the resurrection from the dead neither marry nor are given in marriage" (Luke 20:34-35). Paul, a little later, told the Corinthians in a letter that "he who marries his betrothed does well; and he who refrains from marriage will do better" (1 Corinthians 7:38). And St Augustine—after the last emperor moved east, and Alaric's Goths sacked Rome—affirmed that "the first to be born was a citizen of this world, and later appeared one who was a pilgrim and stranger in the world, belonging as he did to the City of God." For the next thousand years, those words would comfort the rich, who kept their estates intact by putting their younger sons in the Church. Strong kings—from Charlemagne to Holy Roman Emperors—would bring their peers down; weak kings would bow to the rich, and to their little brothers in Church.

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Saturday PM Paper Sessions

1.0 Symposium: Darwinian history (organized L. Betzig)

1.1 *Pinker S'* The Blank Slate, the Noble Savage, and the Ghost in the Machine

Why does talk of human nature inspire such fear and loathing in so many people? I suggest that it challenges three deeply held beliefs: the blank slate (the mind has no innate structure), the noble savage (people are naturally good), and the ghost in the machine (behavior is not caused by physical events). The beliefs are thought to undergird indispensable moral values, and challenges to the beliefs are therefore thought to challenge the values. If the mind has innate structure, then different people (or races, classes, or sexes) could have different innate structures, justifying discrimination and oppression. If evils such as rape, greed, or prejudice are innate, that would make them natural and hence good, or at best unchangeable, making attempts at social change futile. If behavior is caused by physical events in the brain, people could not be held responsible for their actions, unleashing endless Twinkie defenses. And if our values and choices are mere reflexes of an evolutionarily shaped, genetically programmed brain, they would be shams and life would be stripped of meaning and purpose. I show that the fears are based on non-sequiturs. Egalitarianism is the moral decision to ignore group statistics in

judging individuals, not an empirical claim about sameness. The naturalistic fallacy (natural = good) is a fallacy. Responsibility is a moral policy about consequences of behavior, and is no more undermined by genetic or evolutionary explanations of behavior than it is by environmental ones. And the meaning and purpose that people ascribe to life are not compromised by explanations of the ascribing process.

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1.2 *Wright R*¹ **Human nature and the direction of history**

Does human cultural evolution have a direction? Was the rise of social organization from the level of the hunter-gatherer village to the current, global level virtually inevitable? In recent decades it has been unfashionable to posit such directionality. One reason is political—a reaction against the horrors of Nazism and Stalinism, both associated with directional, even teleological, theories of history. But another source of resistance to directional cultural evolutionism lies in a misconception about human nature: a view of human psychology that minimizes the role of status competition within societies and is implicitly group-selectionist. This view lives on in anthropology textbooks today, decades after evolutionary biologists first argued persuasively that individual-level selection far surpasses group-level selection as a factor in the genetic evolution of human nature.

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1.3 *Sulloway F*¹ **Darwinian psychohistory: Principles and prospects**

Versions of psychohistory based on psychoanalytic theory have largely been discredited, based on the accumulated criticisms directed at that theory as well as the critical reassessments of previous attempts at psychoanalytically "reconstructed history." Given the demise of psychoanalytic theory, can Darwinian theory provide a more solid foundation for psychohistory? This talk outlines some of the basic principles that ought to characterize a Darwinian form of psychohistory, including those pertaining to family dynamics, between-family influences, nonfamily influences, and contingent experiences.

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2.0 Symposium: The nature of psychopathy (organized by M. Lalumiere)

*Martin Lalumière*¹, *Chair: Linda Mealey*² **The nature of psychopathy.**

Psychopathy refers to individuals with a long history of antisocial behavior and an interpersonal style characterized by glibness, manipulateness, and callousness. Traditionally, psychopathy has been seen as a mental disorder and a disease, but more recent theoretical approaches, informed by game theory, have offered an alternative view: Psychopathy might represent a life-history strategy that was adaptive in the EEA. This symposium will address two questions derived from a selectionist perspective on psychopathy. The first is whether psychopathy is best described as a continuous trait or as a discrete type. This question will be addressed with taxometric analyses involving a large sample of dangerous offenders and a large sample of school-aged boys. The second question is whether psychopathy shows features of an evolved design. This question will be addressed by examining indicators of developmental instability among psychopathic and nonpsychopathic offenders and by examining the victim choice of psychopathic and nonpsychopathic sex offenders.

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2.1 *Quinsey VL*¹ Measurement and conceptualization of psychopathy

The principal measures of psychopathy among criminal offenders will be described, with emphasis on the Revised Psychopathy Checklist. The correlates and predictive validity of psychopathy suggest how the construct should be conceptualized. Two central theoretical issues concerning psychopathy remain to be resolved: (a) whether it is dimensional or categorical and (b) whether it is best conceptualized as an adaptation or a pathology.

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2.2 Skilling TA' Serious antisocial behavior in children: Evidence of an underlying taxon

A life-long pattern of antisocial behavior is seen in a small group of individuals. In longitudinal studies, about 5% of subjects are responsible for over half the offenses recorded for the whole cohort. It has recently been argued that this group of offenders is not just different in degree from other offenders but is different in kind--that it constitutes a taxon. If this is true, it is likely that the class can be identified in childhood. Taxometric analyses were applied to several measures of antisocial behavior in children: DSM-IV Conduct Disorder, the Psychopathy Checklist--Youth Version, and the Childhood and Adolescent Taxon Scale. Participants were 1111 school-aged boys from a community sample of students who were participating in a study on bullying. Taxometric analyses gave evidence of an underlying taxon for all three measures of antisocial behavior. Data gathered from the same sample on a measure of somatic complaints, hypothesized to be a continuous dimension, yielded no evidence of a taxon, strengthening the conclusion that a taxon underlying serious antisocial behavior can be demonstrated in children. Implications for understanding antisocial behavior in adults are discussed.

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2.3 Lalumière ML' Developmental instability and psychopathy

Recent theoretical models suggest that psychopathy may not be the outcome of defective developmental processes but may instead be a life strategy of social defection and aggression that was reproductively viable in the EEA. An adaptationist view of psychopathy suggests that it should show evidence of evolved design. The concept of developmental instability was used to test this suggestion. Developmental instability refers to an individual's degree of resistance to environmental and genetic stressors during development and its indicators provide an index of developmental health. In Study One, we obtained data on prenatal, perinatal, and neonatal sources and signs of developmental perturbations from the clinical files of 800 male offenders. In Study Two, we measured a sign of past developmental perturbations, fluctuating asymmetry, in 40 male offenders and 31 male nonoffenders. Psychopathy was assessed

with the Revised Psychopathy Checklist. Psychopathic offenders scored lower than nonpsychopathic offenders on obstetrical problems and fluctuating asymmetry and were similar to nonoffenders with regard to fluctuating asymmetry. These results support the view of psychopathy as an evolved life strategy.

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2.4 *Harris GT*¹ Psychopathy as a viable strategy: Empirical tests with sex offenders

The idea that psychopaths execute what has been a viable life history strategy has implications for the psychological make up of sex offenders. Not all sex offenders are psychopaths and this hypothesis predicts that psychopathic sex offenders' sexual preferences and victims systematically differ from those of sex offenders who are not psychopaths. Specifically, psychopaths are expected to prefer victims and activities associated with higher reproductive likelihood. I will present results from a large-scale followup study of incarcerated sex offenders. Data on the age and sex of victims and laboratory data on sexual interests will be used to evaluate the hypothesis that psychopathy has been a viable life strategy, while many paraphilic sexual disorders have not. A tentative two-pathway model of sexual aggression will be discussed.

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3.0 Aggression, homicide and dominance striving

3.1 *Dyson-Hudson R*¹ A Darwinian study of homicide

My statistical analysis of a sample of c 200,000 people-years indicates that Turkana pastoralists of NW Kenya—people who rely on violent self-help to resolve within-group conflicts, and have a long tradition of ethnic warfare—do not have a high homicide rate. Although the small number of homicides did not allow further statistical analysis, ethnographic accounts of the 18 homicides in the sample, considered in the context of Turkana ecology and social organization, provide insights into the often-

complex causes of individual homicides. Although this analysis of Turkana homicide does not draw directly on natural selection theory, it is based the paradigm that allowed Darwin to arrive at the theory of natural selection: The most interesting parameter ... of natural populations is the actual variation, its amount and its nature. (Mayr 1982:47). Statistical studies of diversity are valuable tools for testing the significance of hypothesized causal linkages—for testing hypotheses. However broad, multi-level ethnographic studies of within-group diversity, drawing on an understanding achieved during long-term interactions between the researcher and individuals of another group, provide insights that are invaluable for developing causal models—for hypothesis building.

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3.2 *Hiraiwa Hasegawa M¹, Hasegawa T²* **Homicide in Japan during the 1990's**

It is well known that age-specific homicide rate for males has its sharp peak in their early twenties and this pattern was supposed to be highly universal. However, in Japan, age-specific homicide rates have changed gradually during the last 40 years and there is no sharp peak in the graph any more; i.e. young Japanese men are no more homicidal than middle-age men. What is the major cause of this change? In addition to national statistics, we analyzed the records of nearly 1000 homicide court cases of the 1990s. This is not a simple phenomenon to be explained by one or two factors. However, we suggest that rapid changes in employment structure accompanying the rapid increase in higher education enrollment have brought more secure future perspective to more and more of the young people in recent years, thus made them more risk-averse. Some generations of people who were left behind in this change could not enjoy secure future prospect as they got older, and remained to be risk-prone even in their 40s and 50s.

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3.3 *Shackelford TK¹* **Reproductive age women are over-represented among perpetrators of husband-killing.** When a

woman kills her husband, it is almost always an unplanned action of self-defense against a battering husband or a last-ditch attempt to survive a batterer's tyranny. Younger, reproductive age women are battered and killed by husbands at higher rates than are older, post-reproductive age women. Because husband killing occurs in the context of self-defense or as a last-ditch effort to survive, reproductive age women should kill their husbands at higher rates than do post-reproductive age women. I used a sample of 8,077 husband-killings to test this hypothesis. Results support the hypothesis, and document that (a) the highest rates of husband-killing are for the youngest women; (b) the youngest husbands are at greatest risk of being killed by their wife; (c) women married to older men kill their husband at higher rates than do women married to same-age men and women married to younger men; and (d) reproductive age women kill their husband at higher rates than do post-reproductive age women across two groups: women married to younger men and women married to older men. Discussion suggests directions for future work that can improve the identification of women at greatest risk for husband killing.

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3.4 *Weekes-Shackelford VA*¹, *Shackelford TK*², *Buss DM*³ **Wife-killings committed in the context of a "lovers triangle"**. The killing of women by their husband poses an enigma for social scientists. Why do relationships presumably characterized by love sometimes result in death? A variety of explanations have been offered to explain this puzzling pattern. Among the most prominent are (1) sheer proximity and opportunity, (2) epiphenomenal byproducts of a male psychology designed for coercive control of women, and (3) evolved mate-killing modules. One way to test these explanations is to examine the contexts in which wife-killings occur. We secured access to a homicide database that included 345 spouse killings perpetrated by husbands in the context of a "lovers triangle," a context that signifies sexual infidelity. Results indicated that a woman's age, and hence reproductive status, predicts vulnerability to being killed in the context of a lovers triangle. Discussion focuses on alternative explanations for this finding, as well as findings not explained by existing theories of homicide.

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3.5 *Rommel W*¹ **Analytical sociology and the need for evolutionary psychology**

This paper tries to show how sociology can incorporate evolutionary psychological knowledge in its research designs. Evolutionary psychologists often criticize sociology for its holism and its neglect of evolutionary theory. However, this critique ignores recent developments within sociological theory, such as analytical sociology. Analytical sociology tries to integrate the psychic level in its explanations. Its practitioners (e.g. A. L. Stinchcombe, R. Boudon) look for the social mechanisms, which explain the observed associations between social events. They discern two main types of mechanisms: situational mechanisms and transformational mechanisms. Situational mechanisms explore how a specific social situation affects the behavior of an individual actor. Transformational mechanisms show how individual actions are transformed into some kind of collective outcome. If analytical sociology wants to explain the reaction of an individual actor to a specific social situation, it will need knowledge about the way in which the human mind processes information extracted from the social environment. A lot of evolved information processing mechanisms discovered until now are solutions to social adaptive problems. Therefore, evolutionary psychology is an important source of information for analytical sociology. In addition, the focus of analytical sociology on short-term social change can illuminate the importance of evolved psychic mechanisms for the study of modern society.

An example inspired by the work of standard social scientists (N. Elias, P. Bourdieu) and evolutionary psychologists (S. Pinker, J. H. Barkow) alike illustrates these theoretical ideas. The example explores, firstly, the interaction between a specific type of social stratification and our innate tendency to seek high social rank (situational mechanism), and secondly, the influence of this status-seeking behavior on the moral codes of a society (transformational mechanism).

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4.0 Evolution and function of emotions III: Health, depression, self esteem, patriotism.

4.1 *Curtis*¹ Dirt, danger and desire: motivating healthy behavior.

Health promotion aims to improve the health of whole populations by encouraging healthier ways of living. Essentially a pragmatic field, practitioners operate with a mixed bag of tools, borrowing insights from psychology, education, epidemiology and sociology. Some claim this eclectic mix to be the strength of the field, others protest that the often-poor results can be put down to theoretical confusion. Overall it is a field which could do with a dose of consilience: an integration between disciplines to solve a complex problem founded on an understanding of evolutionary psychology. Unconvinced about the capacity of any of the available theoretical models (health belief model, theory of reasoned action, theory of planned behavior, transtheoretical model, stages of change, etc) to effect changes in health related behavior, we began again. We gathered insights from anthropology, classical psychology, history, marketing and our practical experience and built a new model founded on the adaptive purposes of human behavior. The model suggests that energy has to be invested to change existing motivation (behavioral drives), current environments or learnt habits. We postulate that hygienic behavior is driven by the need to nurture, to avoid disgust objects, to classify, to order, to create aesthetically pleasing environments, to conform to local norms and to gain social status. Field research in Africa, India, the Netherlands and the UK produced results consistent with the model. Health promotion following this model would need to make healthy behavior less costly by improving the environment, to intervene at critical times when habits are being formed (childhood, new mother-hood) and to act to heighten motivation, for example, by reminding people of the dirty, contaminating nature of feces. Germ theory, which relies on the assumption that people will change their behavior in rational response to learning about germs is probably of limited value in promoting individual behavior change.

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4.2 *Hanson R*¹ **Showing that you care: The evolution of health altruism**

I propose a simple evolutionary-psychology model intended to account for many current health policy puzzles. I assume our ancestors: 1. Sincerely cared about outcomes for lasting social allies, 2. Prevented health-harming crises of allies, 3. Knew things others did not about who would remain an ally, 4. Allies were typically correlated into groups, and 5. Higher social status was having more and better allies. These imply that our ancestors wanted to visibly help their allies, in order to signal confidence in remaining allies. Small frequent efforts like gossiping could only signal short-term allegiance, so attention should turn to infrequent large efforts, such as weddings, funerals, revenge killings, wars, and aid for injuries. We have since lost some of these signals, so we may still rely on health care expenditures to “show that we care.” This model offers a simple unified explanation of these health policy phenomena: 1. A low marginal health-value of medicine, especially for the high status, 2. wide support for communally-provided health care, 3. feelings that the rich shouldn’t get more medicine than “the rest of us,” 4. health paternalism, especially toward the low status, 5. low interest in private signals about the quality of medicine, and 6. placebo effects, and a strong health/status correlation. If we further assume that our ancestors invested relatively more in cementing alliances during good times than in bad times, we might also explain the demographic transition, and why leisure and health care seem to be luxury goods.

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4.3 *Henriques GH*¹ **Depression as a behavioral shutdown mechanism: Disease or evolved defensive strategy?**

The prevailing model in psychiatry is that Major Depressive Disorder is a disease of the brain. Recent developments grounded in evolutionary theory regarding the nature of depression and the nature of disease cast doubt on the validity of this conceptualization. The concept of disease carries with it the notion of a biological defect or the malfunction of an evolved mechanism. Yet negative emotions and depression are likely evolved strategies that facilitated behavioral solutions to problems in the ancestral

environment. In particular, depression may have evolved as a behavioral shutdown strategy activated in times of chronic difficulty or stress. This formulation challenges the disease model because it suggests that Major Depression is not necessarily the result of biological dysfunctions but instead may be the consequence of evolved design.

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4.4 Pillmann F¹ The social competition hypothesis of depression - a review of current evidence. In 1967 John Price advanced the social competition hypothesis of depression linking depressive disorders to behavioral dispositions concerning dominance and subordination and regulating the negotiation of social rank. Although the hypothesis was elaborated by Price and others in subsequent publications it has not been generally accepted. In recent years new findings have emerged in the fields of animal behavior, behavioral pharmacology, and psychology regarding rank-related (agonistic) behavior and its connection to affective disorder. The present paper explores the possible relevance of this new evidence for the social competition hypothesis of depression. The focus is on animal models that show pharmacological effects of antidepressants on agonistic behavior, the role of affiliative behavior in the establishment of social systems, and psychometric methods to measure submissiveness and dominance in humans. Areas of uncertainty and speculation are critically discussed. It can be concluded that, despite some interesting empirical data, large gaps in the chain of evidence remain.

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4.5 Kirkpatrick L¹, Valencia A², Waugh C³, Webster G⁴ Domain-specificity of self-esteem and aggression. Previous research has produced mixed results concerning the relationship between self-esteem—conceptualized and measured as a global construct—and aggression. Based on an evolutionary-psychological theory of self-esteem (Kirkpatrick & Ellis, in press), we hypothesized that diverse measures of self-esteem, reflecting numerous functionally distinct, domain-specific

psychological mechanisms for self-evaluation, would be related differentially to aggression. In a laboratory experiment, 116 college-student participants received either positive or negative bogus feedback on an essay they had just written, and subsequently prepared a sample of hot sauce for consumption by their evaluator as part of a bogus taste-preferences study. Aggression, as measured by amount of hot sauce allocated, was significantly greater (1) among men versus women, and (2) in response to negative versus positive feedback. Most important, multiple regression analyses revealed that above and beyond these effects, (3) a measure of self-esteem reflecting perceived superiority to others was a significant positive predictor of aggression; and (4) a measure of self-esteem reflecting perceived social inclusion/acceptance by others was a significant inverse predictor of aggression. Consistent with prior research, (5) a measure of global self-esteem was unrelated to aggression.

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4.6 *Price M*¹ **Evolutionary psychology of patriotism**

I present an analysis of coalitional attachment (i.e., feelings of affection and devotion towards one's coalition), the centerpiece of which is a regression model that predicts 33% of the variance in US citizens' levels of attachment to the USA ("patriotism"). I suggest that coalitional attachment is a facultative adaptation which motivates people to perform altruistic acts for coalition co-members when they perceive a coalitional affiliation to be beneficial; through their altruism, they make themselves more valuable to coalition co-members and thus improve their chances of retaining the beneficial affiliation. I predicted that the more beneficial a person considers a coalitional affiliation to be, the more they will experience coalitional attachment, and I tested this hypothesis in a survey taken by 211 subjects. I also replicated 3 rival models for predicting patriotism (social dominance orientation, collective identity orientation, and birth order), and found my model to be nearly 3 times more predictive of patriotism than the next-best model. The items in my survey that best predicted patriotism were those which portrayed the USA as a benefit- or

harm-causing actor, which suggests that the way people process their relationship with their coalition is similar to the way in which they process reciprocal relationships with individuals. I conclude that the sociobiological "kin-selection" theory of coalitional attachment should be reconsidered, and that a theory of coalitional attachment based on reciprocal altruism might generate more accurate hypotheses.

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In Memorium : William D. Hamilton, 1963-2000.

William Donald Hamilton died in London on Tuesday, March 7 1h , 2000, -at the age of 63, from the effects of malaria contracted during a research expedition to the Congo. His loss constitutes an enormous setback to the field of inquiry that *Evolution & Human Behavior* covers, and a painful, personal blow to many members of the Human Behavior and Evolution Society.

Bill Hamilton is widely considered the most important theoretical biologist since Darwin. His genius, like Darwin's, resided largely in an ability to consider afresh his rich storehouse of highly specific and sometimes arcane biological knowledge in the context of fundamental issues of the greatest generality. He was, of course, the principal architect of inclusive fitness theory and hence of the "selfish gene" or "sociobiological" revolution that has shaped all subsequent thought and research on the evolution of social phenomena. He was also a primary contributor to contemporary understandings of the evolution of senescence, nonnepotistic cooperation, parasite-host coevolution, sex allocation, dispersal and population structure, signaling, and sexual reproduction. In an obituary in the *Guardian* (March 9th) , Alan Grafen wrote,

"The career of a typical Hamilton paper can be caricatured as follows. In review, it is panned by referees who demand shortenings and revisions. Immediately after publication, it attracts criticism for obscurity. Its significance slowly emerges through secondary works, further work is inspired, and one or more literatures develop around its themes. Later more mathematical work may even be rather partronising about the paper, and emphasise

discrepancies, while the primary finding is that the original idea is abundantly confirmed."

Evolutionary biology might have arrived at its present state if Hamilton had never walked among us, but one must wonder how much longer it would have taken and whether any of us would now be applying evolutionary theory to the study of human social behavior.

Although he never conducted or sponsored an empirical study of human behavior, W.D. Hamilton was a great supporter of this journal's goals. He was at a 1988 meeting at the University of Michigan at which the Human Behavior & Evolution Society was born, and his presence was critical. Randolph Nesse, the principal advocate of forming such a society, asked Hamilton if he would be willing to serve as the society's first president. After some persuasion, he agreed, whereupon those in attendance elected him unanimously and enthusiasm for the project soared. "Once he was President," recalls Nesse, "I found I could ask anyone else to do anything, and upon learning that Bill was the President, they agreed."

As HBES's founding President, Hamilton never took a directive role. In years when he had to choose between a tropical field trip and attending the society's annual conference, HBES seldom won. But he was always supportive and often participatory. At the first annual meeting at Northwestern University in 1989, he and a panel of luminaries wrapped up the conference with a discussion of the field and its future, and in 1992, he delivered a memorable keynote address, with lovely visual representations of his current models of the dynamics of parasite-host coevolution, at the society's banquet at the University of New Mexico. On occasion, he must have been ambivalent about the society's enthusiasm for evolution-minded analyses of human behavior and for his theories, for in a 1996 preface to a reprinting of his first published paper (Hamilton 1963), which presented the quick version of his inclusive fitness theory, Bill wrote,

". . . one thing has not changed-this is my dislike for the idea that my own behaviour or behaviour of my friends illustrates my own theory of sociality or any other. I like always to imagine that I and we are above all that, subject to far more mysterious laws. In this prejudice, however, I seem, rather sadly, to have been losing more ground than

I gain. The theory that I outline in the paper has turned out very successful. It certainly illuminates not only animal behavior, but to some extent as yet unknown but now being actively researched, human behaviour as well." (Hamilton 1996, p. 2)

Elsewhere in the same wonderful collection of reprinted classic papers and autobiographical musings, however, Hamilton (1996) reveals that he was keenly interested in the applicability of genetical theories to the evolution of human social behavior from the outset. As an undergraduate at Cambridge, he tried to persuade faculty from the Departments of Genetics and Social Anthropology to let him combine study of the two fields, and it was the refusal of either department to countenance such a plan of study that inspired him to leave Cambridge and pursue his Ph.D. at the University of London. 'Mere he met a more welcoming (if only marginally more comprehending) reception from faculty in the Galton Laboratories and the London School of Economics, and we are all the beneficiaries.

W.D. Hamilton never attained the level of public recognition that has been bestowed on many lesser lights. In 1994, we were delighted to be in the audience when he was awarded an honorary D.Sc. by the University of Guelph, but we were surprised, and on further reflection appalled, to learn that it was his first such honorary degree. But of course, Bill wasn't terribly interested in the pursuit of public recognition. (At one Human Behavior & Evolution Society meeting, he suggested, only half in jest, that HBES might be well advised to remain a small secret society.) What he was interested in was the natural world and the world of ideas.

Still, fame caught up with him as the influence of his ideas spread. Hamilton's (1964) papers on the genetical evolution of social behaviour are among the most cited (if not necessarily read; Seger & Harvey 1980) in the behavioral sciences; and in 1993, his status as the leading evolutionary theorist of his generation was affirmed by his being awarded both the Crafoord Prize and the Kyoto Prize.

All of Bill's papers up to 1981 were reprinted, with substantial, witty introductory commentaries, in a collection (Hamilton 1996) that reveals the marvelous originality of his mind. A second, similar volume of his subsequent papers is scheduled to appear this year. Reread Hamilton-

-or read him for the first time, if you are one of those who cited him at second hand for fear of the math-and mourn our loss.

Martin Daly and

Margo Wilson.

Damp equatorial Africa contains more different human disease organisms than any other part of the world. William D. Hamilton, who pondered the evolutionary impact of diseases for much of his professional life, recently returned from this region dying of falciparum malaria. He had gone there unfortified with malaria-fighting drugs. Some of his friends call this "risk-taking behavior." I call it a lack of common sense. Bill's forte was not common sense but uncommon sense. He had so much of the latter that one can wonder legitimately if he lacked room for the other. Perhaps, with too much common sense, he might not have provided the rest of us with the insights that have caused him to be described as the greatest evolutionary biologist of his generation.

Bill's extensive field meanderings, and his astonishing breadth of curiosity about natural history, resulted in a flood of wonderful anecdotes, and evidently were for him, as for Darwin, a source of ideas richer than most of us can imagine. He ranged across the literature of biology as if it were much the same. Except for his own internal logic, and his "maths," he relied on others to test his theories, and he was invariably delighted when any such effort succeeded. His overall contribution was to use his originality to turn the rudimentary or sometimes barely mentioned theories of distinguished predecessors – ideas overlooked or neglected by all the rest of us -- into magnificent theoretical edifices affecting our view of all life. Thus, he elaborated Darwin's theory to explain the existence of sterile castes in insects, and Fisher's hint about how to quantify altruism in caterpillars toward siblings, into a comprehensive theory accounting for underlying patterns of sociality everywhere, in both plants and animals. Similarly, he converted a maddeningly cryptic question on sex ratios (proportions of males and females in populations), posed by Ronald A. Fisher in 1930 about the significance of "territory," into a broadly enlightening explanation of the dramatically female-biased sex ratios that prevail in the broods of individual females in some species. These are species in which the female mates with her brother (who provides no parental care), and then determines the sex of each egg as it is laid -- this last possible because

males derive from unfertilized eggs. To make more males, or hardier males, than sufficient to fertilize the eggs is an unnecessary cost. The argument affected such broad issues as our views of the levels at which selection is effective in the hierarchy of organization of life, from genes to individuals, nations, and species.

Hamilton contributed extensively to many other theories, such as George Williams's now widely accepted pleiotropic theory of senescence (the idea that, because selection is less powerful later in life, deleterious effects late in life can persist if they are accidental -- pleiotropic -- consequences of reproductively beneficial effects of the same genes early in life); the so-called "Red Queen" theory, including the idea that the costly genetic recombination of the sexual process pays for itself by enabling organisms to outrace the rapidly multiplying microorganisms of diseases and parasitism; and Robert Trivers's theory of reciprocating altruism among even unrelated individuals. One of my favorite essays was "Geometry for the selfish herd," in which he explained how even the seemingly random stollings and mergings of individuals, as in a foraging bird flock or mammal herd, are almost certainly strategies that continually involve trade-offs between obtaining the best food and placing some other individual(s) between the strategist and possible predators. His writings were often eloquent -- the most appealingly so, to me, his review of Michael Ghiselin's and George Williams's books on sex and evolution.

I once heard Bill assert before a group of colleagues that he avoided applying his theories to humans because he thought it too difficult and too subject to misinterpretation -- a reticence he later overcame. Yet his theory of nepotism alone accounts for the universal human awareness of

degrees of relatedness among virtually all close relatives. It provides the essential underlying vehicle for explaining the varied patterning of human kinship systems -- evidently derived from multi-tiered opportunities of social learning historically correlated with degrees of genetic overlap --in the hundreds of societies that have come to exhibit diverse ways of operating in their varied environments across the earth. Extensive differential nepotism (assistance to a wide variety of relatives according to their degrees of relatedness to self), which is the crowning glory of Hamilton's theory, is still known only in humans.

Despite his mild-mannered Clark Kent demeanor, there was a wannabe Superman inside Bill Hamilton, which made him extremely

competitive and surely accounts in part for what has been called his risk-taking behavior. Included were disastrous competitions with automobiles on his bicycle, at high rates of speed, on the narrow crowded road between his village and Oxford (described to me by his wife, Christine), and a reported similarly disastrous effort to disarm a knife-wielding thief in tropical America.

Although he was marvelous with individual students, and with colleagues in other fields,

I was warned (accurately) by two independent sources before he arrived at Michigan that he was not so likely to discuss novel ideas extensively with colleagues whom he regarded as working in his own field. In *Narrow Roads of Gene Land* -- and in discussions and a letter to me -- he

has described an early frustration at evident neglect of his ideas by colleagues in Britain. He believed for a while -- and possibly not without justification -- that senior biologists had striven to secure credit for some of them, or to transfer the credit to others; years later, in a letter on another topic, he abruptly volunteered to me that he no longer believed this was happening. Bill could fly into a tizzy, wonderful and astonishing for one of his gentleness, at what he deemed serious or pointed questioning of his theories. On one such occasion experienced by me (and three graduate students in the back seat of the car, startled into a lengthy dead silence), he seemed to be assuming that for kin-helping behavior to have developed in individuals via learning tendencies -- even if these tendencies were presumed to have evolved as a concomitant of stable differences in social relationships among relatives -- would somehow be a diminution of his theory.

The high respect of colleagues who understood Bill's work is shown not only by a world-wide affection, but by the unprecedented array of international awards and honors he received. It is a curious fact that he was never made a foreign associate of the U. S. National Academy of Sciences, and that one still occasionally hears even eminent biologists decry his work as -- in an extreme case known to me -- "fraudulent"(!). I see this startling attitude -- which all evolutionary biologists are now and then required to endure -- as a reflection of the difficulty even thoughtful and educated people often have in accepting a responsibility to evaluate fairly any findings that

purport to explain our own day-to-day behavior. Bill Hamilton, perhaps more than any other 20th century biologist, provided the basic tools for overcoming such reticence. I see it as up to the rest of us to use and develop them to generate the self-understanding, through knowledge of evolution, that is apparently prerequisite to significant -- and in my opinion potentially massive -- reductions of misery and strife across the globe.

Richard

Alexander

W D Hamilton is a good candidate for the title of most distinguished Darwinian since Darwin. Other candidates would have to include R A Fisher, whom Hamilton revered as a young student at Cambridge. Hamilton resembled Fisher in his penetrating biological intuition and his ability to render it in mathematics. But, like Darwin and unlike Fisher, he was also a superb field naturalist and explorer. I suspect that, of all his twentieth century successors, Darwin would most have enjoyed talking to Hamilton. Partly because they could have swapped jungle tales and beetle lore, partly because both were gentle and deep, but mostly because Hamilton the theorist was responsible for clearing up so many of the very problems that had intrigued and tantalised Darwin.

William Donald Hamilton FRS was Royal Society Research Professor in the Department of Zoology at Oxford, and a Professorial Fellow of New College. He was born in 1936, spent a happy childhood botanising and collecting butterflies in Kent, was educated at Tonbridge, then Cambridge where he read Genetics. For his Ph.D. he moved to London where he was jointly enrolled at University College and LSE. He became a Lecturer at Imperial College in 1964, where his teaching skills were not highly rated. After a brief Visiting Professorship at Harvard, he accepted a Museum Professorship at the University of Michigan in 1977. Finally, in 1984 he moved to Oxford at the invitation of Richard Southwood, who had been his Professor at Imperial.

Hamilton was showered with medals and honours by the academies and learned societies of the world. He won the Kyoto Prize, the Fyssen Prize, the

Wander Prize, and the Crafoord Prize--instituted by the Swedish Academy because Alfred Nobel unaccountably failed to include non-medical Biology in his list of eligible subjects. But honours and recognition did not come early. The autobiographical chapters of Hamilton's collection of papers, *Narrow Roads of Gene Land*, reveal a lonely young man driven to self-doubt by lack of comprehension among his peers and superiors. To epitomise the Cambridge of his undergraduate days, where "many biologists hardly seemed to believe in evolution" he quotes one senior professor: "Insects do not live for themselves alone. Their lives are devoted to the survival of the species . . ." This is "Group Selection", a solecism which would cause today's biology undergraduates to wince, but they have the advantage of a post-Hamilton education. The young Hamilton felt that in Cambridge he was wincing alone. Only the cantankerous Fisher made sense to him, and he had been advised that Fisher "was good with statistics but knew nothing about biology."

For his doctoral work he proposed a difficult mathematical model with a simple conclusion now known as "Hamilton's Rule." It states that a gene for altruistic self sacrifice will spread through a population if the cost to the altruist is outweighed by the benefit to the recipient devalued by a fraction representing the genetic relatedness between the two. Hamilton's original paper was so difficult and innovative that it almost failed to be published, and was largely ignored for a decade. When finally noticed, its influence spread exponentially until it became one of the most cited papers in all of biology. It is the key to understanding half the altruistic cooperation in nature. The key to the other half -- reciprocation among unrelated individuals--is a theory to which Hamilton was later to make a major contribution, in collaboration with the social scientist Robert Axelrod.

The great obsession of his later career was parasites--their evolutionary rather than their medical impact. Over twenty years, Hamilton convinced more and more biologists that parasites are the key to many outstanding problems left by Darwin, including the baffling riddle of the evolution of sex. The sexual shuffling of the genetic pack is an elaborate trick for outrunning parasites in the endless race through evolutionary time. This work led Hamilton into the arcane world of computer simulation, where his models were as richly textured, in their way, as his beloved Brazilian jungle. His spin-off theory of sexual

selection (how Darwin would have relished it!) was that bird of paradise tails and similar male extravaganzas are driven by the evolution of female diagnostic skills: females are like sceptical doctors, actively seeking parasite-free males to supply genes for their shared posterity. Male advertisement is an honest boast of health.

Hamilton's mathematical models never became arid; they were laced with, and often inspired by, bizarre natural history. Would that every mathematical lump were leavened, as Hamilton's were, by eye-witness accounts of, say, the male mite who copulates with all his sisters and then dies before any of them are born. Or of aphid females who give live birth to their daughters and granddaughters simultaneously.

For most scientists, good ideas are a scarce commodity, to be milked for everything they are worth. Hamilton, by contrast, would bury, in little throwaway asides, ideas for which others would kill. Sometimes he buried them so deeply that he overlooked them himself. Extreme social life in termites poses a particular evolutionary problem not shared by the equally social ants, bees and wasps. An ingenious theory exists, widely attributed to an author whom I shall call X. Hamilton and I were once talking termites, and he spoke favourably of X's theory. "But Bill", I protested, "That isn't X's theory. It's your theory. You thought of it first." He gloomily denied it, so I asked him to wait while I ran to the library. I returned with a bound journal volume and shoved under his nose his own discreetly buried paragraph on termites. Eeyerishly, he conceded that, yes, it did appear to be his own theory after all, but X had explained it much better. In a world where scientists vie for priority, Hamilton was endearingly unique.

Those who loved him saw a Felix with nine lives. Charmingly accident-prone, Bill would always bounce back. A childhood experiment with explosives cost him several finger joints of his right hand. He was frequently knocked off his bicycle, probably because of misjudgements by Oxford motorists who couldn't believe a man of his age with a great shock of white hair could possibly cycle so fast. And he travelled dangerously in wilder and more remote places than Oxford. He hiked through Rwanda at the height of the civil war, and was treated as a spy, so implausible was his (true) story that he was looking for ants. Held up at knife-point in Brazil, he made the mistake of fighting back, and was viciously wounded. He jumped into an Amazon tributary when his boat was sinking, in order to plug the hole, like

the little Dutch boy, with his thumb (the ferocity of Piranha fish, he explained, is over-rated). Finally, to gather indirect evidence for the theory (of which he was a strong supporter) that the AIDS virus was originally introduced into the human population in an oral polio vaccine tested in Africa in the 1950s, Hamilton went, with two brave companions, to the depths of the Congo jungle in January this year. He was rushed back to London, apparently with severe malaria, seemed to recover, then collapsed into complications and coma. This time, he didn't bounce back.

He is survived by his wife, Christine, from whom he had been amicably separated for some time, by their three daughters Helen, Ruth and Rowena, and by his devoted companion of recent years, Luisa Bozzi.

Richard

Dawkins

W.D. Hamilton was the greatest evolutionary theorist of the 20th century. Certainly, where social theory based on natural selection is concerned, he was easily our deepest and most original thinker. His first work was his most important--his theory of inclusive fitness--because this work is the only true advance since Darwin in our understanding of natural selection. Hamilton's advance is a natural and inevitable extension of Darwinian logic. In Darwin's system natural selection refers to individual differences in reproductive success (RS) in nature where RS is the number of surviving offspring produced. Hamilton enlarged the concept so as to include RS effects on other relatives, i.e. not just fitness or reproductive success but inclusive fitness, defined (roughly) as an individual's RS plus effects on the RS of relatives, each devalued by the appropriate degree of relatedness (r).

This idea had been briefly advanced by RA Fisher and JBS Haldane, but neither took it seriously and neither provided any kind of mathematical foundation for the theory. The latter was not as obvious as it sounds. For a rare altruistic gene, it is clear that $B r > C$ will give positive

selection, where B is the benefit conferred and C the cost suffered: but the matter is not so obvious at intermediate gene frequencies. As the altruistic gene spreads, should not the criterion for positive selection be relaxed? Hamilton showed that the answer to this was "no" and that his simple rule worked for all gene frequencies. He once told the story of

sitting down as a doctoral student to write to Haldane, but in order to formulate each question precisely he had to do additional work and after a couple of years of such work he never sent the letter because by then he had worked out all the answers himself. A noteworthy implication of Hamilton's 1964 work was that in almost all species the individual was no longer expected to have a unitary self-interest, since genetic elements are inherited according to different rules (contrast Y chromosome and mtDNA).

He soon followed this work with major advances in understanding selection acting on the sex ratio, the moulding of senescence by natural selection, aggregation and dispersal, the evolution of the social insects, the evolution of dimorphic males, and the origin of higher taxonomic units in insects. For the latter he argued that the more-or-less closed spaces created by rotting wood imposed a system of small, inbred demes in insects inhabiting it ("beetles under bark"), leading to a great diversity of homozygous forms, often with arbitrary, novel characters (such as a second complete metamorphosis in many male scale insects). In 1981 with Robert Axelrod he laid the mathematical foundation for the study of reciprocal altruism, when they showed that the simple rule of tit-for-tat in playing iterated games of Prisoner's Dilemma was itself evolutionarily stable.

Twenty years ago Hamilton began to devote most of his time to the theory that parasites play a key role in generating sexual reproduction in their hosts, recombination being a defense against very rapidly (and antagonistically) co-evolving parasites. In his memorable phrase, sexual species are "guilds of genotypes committed to free, fair exchange of biochemical technology for parasite exclusion". He was not the first to advance this theory but he took it more seriously than others and he worked most successfully to define the form of the argument as well as its implications. Notable here was his work with Marlene Zuk on parasites as a key to mate choice. In 1982 they showed that species of birds with higher loads of blood parasites showed more color (and song), an unexpected finding unless parasite-rich environments favored mate choice for brightly colored individuals, driving up the average level of brightness.

It is hard to capture on paper the beauty of the man and the reason that so many evolutionists felt such a deep personal connection to Bill

Hamilton. He had the most subtle, multi-layered mind I have ever encountered. What he said often had double and even triple meanings so that while the rest of us speak and think in single notes, he thought in chords. He was very modest in style, quiet and unassuming, with a warm sense of humor. He had no illusions about the clarity of his lecturing style, for example, and he once told a class we taught at Harvard that after hearing him lecture they would doubt that he understood even his own ideas! His letters were laced with jokes and humorous asides: he once sent me a newsclipping of a human father-to-son testicle transplant, along with the comment, "New vistas for parent-offspring conflict?". The last time I saw Bill at Oxford in December, 1999, he pointed with pride to the two, and possibly three, species of moss growing on his aging Volvo--indeed on its windows!--and told me that this was a clear advantage of Oxford over Cambridge, the latter climate being too dry.

He was a naturalist of legendary knowledge, especially of insects, but he was also an acute observer of human behavior, right down to the minutiae of your own actions in his presence. Had I noticed, he asked, that lopsided facial expressions in humans are almost exclusively male? (No, but I have seen it 100 times since then!) He was an evolutionist to the core, to the point of being heartened by news of fellow evolutionists enjoying some reproductive success! In a similar spirit I take joy in the lives of his three daughters, Helen, Ruth and Rowena, not to mention his many siblings. But the loss of this "gentle giant" is very great. Bill died at the age of 63 on March 7, 2000, after contracting malaria during fieldwork in January in the Congo. He had been strong in mind, body and spirit, with many new projects and thoughts underway. He will be sorely missed for many years to come.

Robert Trivers

One thing I can honestly brag about is my early recognition of Hamilton's immense importance. It led to some correspondence between us in the early 1960s on his classic works on kin selection and senescence, and my 1966 book manuscript. During my sabbatical in Iceland in 1966 and 1967, I took time to visit him at the University of London Field Station at Silwood Park and to enjoy his hospitality there. This was just two days after visiting David Lack at Oxford. Thus, on this one brief trip I met two most pleasant and immensely important scientists

of widely different ages. That the youthful Hamilton could be so far ahead of almost all living biologists on such important issues was mighty encouraging.

Over the next 14 years, we occasionally met at meetings and exchanged some more correspondence. Then, in the fall of 1980, I had a one-semester appointment at the University of Michigan while Bill was faculty there. He and I gave a graduate seminar on sexual selection and related topics. Two especially worthy students were Marlene Zuk, now Professor at the University of California (Riverside, USA), and David Quellar, now Professor at Rice University (Houston, TX, USA). To me they have been a heroine and a hero ever since, and Bill found Marlene a choice collaborator in explaining the importance of sexual reproduction and sexual selection.

Bill and I had many interactions in the 1980s and 1990s, including a 1999 meeting on my campus at Stony Brook (New York, USA) on the evolutionary significance of sexuality. What I remember most about that meeting was his talk on the role of genetic recombination in protecting offspring against pathogens that can quickly adapt to individuals of their parents' genotypes. In it, he compared, using impressive slides, a strictly sexual tree species in its native habitat, beset by serious pathogens, and in a habitat on another continent where its pathogens had not been introduced. The pathogen-free specimens must have had about ten times the biomass and fecundity of those in their natural habitat, where pathogens exacted extreme fitness costs.

Many of Bill Hamilton's important biological advances of the past half century are known to TREE readers, but I will exploit my present role to extol one of my favorites, which is not often recognized as a major contribution. His *Geometry for the Selfish Herd* proposed that the main reason for gregarious behavior in animals is to maximize competition for the bad things in life. If there are several sheep in a meadow all staying close together except for one that wanders off by itself, which is most likely to be attacked by a wolf? If the wolf sees the loner first, it will probably be the victim. If the wolf sees one of the others first, each will have companions to compete for the wolf's attention and, therefore, each will be a less likely victim, even without such benefits as alarm calls or collective alertness.

There are other bad things in life that gregariousness can mitigate. If I were in a room with a mosquito bearing the West Nile

virus, I would feel safer as one of a large crowd than I would alone. People in modern wealthy nations tend to think that pathogens usually come from close contact with other human victims; however, in a world full of pathogen vectors, such as mosquitoes, tse-tse flies and ticks, the largest crowd could provide the safest environment.

A long list of Bill's works might be recognized as crowning achievements, but my guess is that his 1964 kin-selection modeling could be the most widely admired and the most historically important. It was the most important for me, not only conceptually but also personally, because my wife and I had published a clumsy treatment of a related topic, natural selection among nuclear families. It was a relief to have our ideas replaced by Bill's simple proposal of selection among individuals for the adaptive use of cues indicative of kinship with any conspecific.

No real scientists ever agree on everything, and Bill and I had a brief conflict last year at the Stony Brook conference. I am not convinced that adaptation by local pathogens to parental genotypes need be the major problem solved by sexuality. I think that the general unpredictability of offspring environments is what provides the main advantage. This issue is most appropriately settled not by modeling or data gathering but by consulting authorities. For a reliable insight on the significance of sexuality there are many appropriate authorities, but one that is especially clear is the strawberry plant (*Fragaria*). Offspring that develop immediately in the parents' environment, with pathogens adapted to those parents' genotypes, will not be sexually produced; whereas those that develop at variable times in the future, over a large range of habitats will be. The allocation of resources to sexual and asexual reproduction must be that which balances the two-fold cost of meiosis by the advantage of genetic diversity among widely dispersed seeds.

Is sexual reproduction adaptive for a species such as ours, which reproduces asexually only by a rare and maladaptive polyembryony? Consider the fitness of a seemingly normal parthenogenetic woman who produces diploid ova ready to develop, but also consider her fitness with just a step in that direction, ova with 24 instead of 23 chromosomes? If a life cycle normally includes no asexual reproduction, as in nearly all vertebrates and insects and many plants, the sexual process might be maladaptive historical legacy from an early ancestor in which it was adaptive.

I dislike one aspect of Bill Hamilton's career—its brevity. That he

will no longer be solving basic biological problems is sad news for biology.

George Williams

Sunday AM Plenary Address: Robert Trivers

Trivers RL **Intragenomic conflict and mental evolution**

Selection for selfish genetic elements may interact with mental evolution in several ways. Internal genetic conflict due to differing degrees of relatedness to others (eg mtDNA vs nuclear, sex chromosomes vs autosomes, maternal chromosomes vs paternal) may lead to biased information flow within the individual, internal mental conflict and some mental fragmentation. This may interact with self-deception selected to deceive others. These possibilities are especially evident for imprinted genes in mammals, including humans. At the same time, selection for biased gene transmission, ranging from meiotic drive elements to transposable ones, is expected to inflate genome size, with correlated positive effects on cell size. This may limit mental evolution by limiting the number of neurons per unit brain size. There is evidence for precisely such an effect in salamanders which, along with lungfish, have the largest vertebrate genomes. In this context, it is noteworthy that both mammals and birds have among the smallest genome sizes in vertebrates. In humans, about 2/3rds of all genes are active in the brain, which, in turn, is especially sensitive to genetic difficulties (e.g. trisomy 21 and close inbreeding). Evidence available supports the speculation that a long history of positive selection for mental prowess in the primate and human lineage may have selected against those selfish genetic elements that distort transmission in their own favor, thereby both generating genetic problems and, separately, inflating genome size.

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Sunday AM Paper Sessions

1.0 Symposium: Infectious causation of mental illness (organized by P. Ewald)

Infectious causation is one of the three primary hypotheses of

disease causation, yet hypotheses of infectious causation of mental illnesses are often dismissed without evidence simply because there is some evidence to support genetic and noninfectious environmental causes of mental illness. Such supportive evidence does not, however, justify rejection of infectious causation, because these three categories of hypotheses are not mutually exclusive: all infectious diseases that have been adequately assessed for host genetic and noninfectious environmental influences have documented such influences. The dismissal of infectious causation has occurred in spite of conclusive evidence that mental illnesses can be caused by infection such (e.g., syphilitic insanity) and strong supportive evidence for infectious causation of illnesses such as obsessive compulsive disorder, schizophrenia, and bipolar disorder. This symposium will address these issues by focusing on the current state of evidence for genetic, infectious, and noninfectious environmental causes of particular mental illnesses.

1.1 *Torrey FE*¹ **Infections, cats, and schizophrenia**

There is strong evidence that non-genetic factors are involved in the etiology of schizophrenia. The evidence includes the fact that the pairwise concordance rate among monozygotic twins is only approximately 30 percent, and that both winter birth and urban birth are risk factors for developing the disease. Infectious agents have been considered as possible etiological agents for schizophrenia since the end of the 19th century. Studies of viral antibodies, antigens and genomes in schizophrenic sera and CSF have yielded mixed findings. Recent research has suggested that an infectious agent transmitted by domestic cats may be involved. This would be consistent with the epidemiology of schizophrenia and the domestication of cats. In addition, two studies have reported that individuals with schizophrenia had more exposure to cats in childhood than matched controls had. Current research is focusing on toxoplasmosis as a possible agent. Three studies have found increased levels of toxoplasma antibody in the serum and CSF of individuals with schizophrenia. Toxoplasmosis is also known to cause schizophrenia-like symptoms in some individuals and to alter dopamine and other neurotransmitters. Finally, some antipsychotic medications effective in schizophrenia are also known to suppress the toxoplasma parasite.

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1.2 *Cochran GM*¹ **Evolution and infectious causation of mental illness**

An evolutionary analysis suggests that the most common and serious mental illnesses are likely to be caused by pathogens, essentially because natural selection purges harmful human genes much more effectively than harmful parasite genes. This argument extends to many common maladaptive behavioral syndromes that are not generally considered mental illnesses.

Infectious causation of some mental illnesses, such as neurosyphilis and AIDS dementia, are firmly established. Other mental illnesses have been linked statistically to infection, though infectious causation is still being debated. Bipolar disorder has been linked to borna disease virus. Schizophrenia has been linked to borna disease virus, toxoplasmosis, and herpes viruses. Pediatric obsessive-compulsive disorder has been linked to streptococcal infection. Chronic fatigue syndrome has been linked to borna disease virus. Alzheimer's disease has been linked to *Chlamydia pneumoniae*. Hypotheses proposing infectious causes of mental illnesses are often dismissed without evidence against them, and in spite of substantial evidence supporting them. Evolutionary considerations add credibility to hypotheses of infectious causation, and therefore support greater investments in research efforts to evaluate them.

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1.3 *Leckman JF*¹ **Obsessive-compulsive disorder: Evolutionary and developmental perspectives.** Evolutionary biology provides a potentially powerful framework for understanding disease pathogenesis in psychiatry and should permit the integration of new knowledge from a broad range of scientific disciplines. Obsessive-compulsive disorder (OCD) usefully illustrates the value and limitations of evolutionary perspectives. OCD is an etiologically heterogeneous condition that affects 1 to 3% of the population. The clinical features of OCD can include obsessions about harm befalling self or close family members. Similar worries occur normally and likely to have had adaptive value by ensuring the well-being and reproductive success of family members. For example, some obsessional worries closely resemble normal parental preoccupations that surround the birth of a new family member. In a

recently completed empirical study semi-structured interviews were used to determine the presence of anxious intrusive thoughts associated with harm avoidant behaviors at three time points with 41 expectant parents. Consistent with our hypothesis the content and character of these worries were found to resemble the symptoms of OCD. These preoccupations peaked for both mothers and fathers close to birth and were readily distinguished from symptoms of depression and generalized anxiety. While these findings are consistent with an evolutionary point of view, they are not a direct test.

In a related series of studies we have examined the emergence of obsessional traits in early childhood. Specifically, a parent-report questionnaire, the Childhood Routines Inventory, was developed to assess compulsive-like behavior in young children, and was administered to 1,492 parents with children between the ages of 8 and 72 months. The frequency of compulsive-like behaviors changes with age: Two-, 3-, and 4-year-olds engaged in more compulsive behavior than children younger than 1 year of age and older than 4 years of age. This developmental view-point complements an evolutionary perspective with regard to OCD. Finally, evolutionary explanations, while difficult to test, have a strong heuristic appeal and may provide useful clinical insights by deepening the clinician's understanding of the origins of certain forms of developmental psychopathology.

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2.0 Cognitive architecture and specializations

2.1 *Tooby J¹, Cosmides L²* Resolving the debate on innate ideas

While we believe that Chomsky's arguments and Pinker's learnability theory analyses logically demonstrate the need for "innate ideas" in the acquisition of grammar, sociologically, this argument has failed persuade the majority of cognitive and behavioral scientists. One reason for this is that grammatical patterns in human language are objectively present in the world, tempting researchers to speculate that they might eventually find some kind of cognitive architecture that could detect such patterns

without any assistance from computational machinery specialized for the task. However, if it can be shown that organisms need to acquire – and do develop – competences based on patterns that are not objectively present in the external world, then no possible learning architecture could acquire those competences unassisted by “innate ideas”. The impossibility of learning things that are not present in the world to be learned would demonstrate conclusively the reality of innate ideas, resolving the issue sociologically as well as analytically. Hume’s argument that one cannot derive an *ought* from an *is* shows one major class of such competences fitting this precondition: motivation. The value of a behavioral outcome is not objectively present in the external world, and so cannot be learned without the assistance of innate ideas. Therefore, any concept or category necessary for specifying a goal state required for the successful functioning of an organism’s adaptations must be, in some way, innately (that is, evolutionarily) specified. Such categories are numerous, and so innate ideas necessarily exist. Discovering their boundaries and properties requires empirical study.

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2.2 Barrett HC¹ Evidence for two modes of biological reasoning

How do people predict the properties of living things, based on what they know about other living things? This paper presents a model of an evolved reasoning system with two distinct modes, each specialized to solve a particular kind of inference problem. The first mode is a *taxonomic* mode, which relies on the principle that organisms can share traits by virtue of descent from a common ancestor. In this mode, organisms are categorized taxonomically (i.e., based on relatedness), in order to predict the presence of traits without regard to function. The second mode is a *biological role* mode, which relies on the principle that organisms can share traits by virtue of convergent evolution. In this mode, organisms are categorized by biological role (e.g., predator), in order to predict the presence of functional traits. Unlike the taxonomic mode, inferences in the biological role mode are strengthened by prior hypotheses about a trait’s function. Thus, the dual-mode model predicts the use of different categorization schemes for different kinds of inferences. Experimental evidence for the existence and functional

specificity of these two modes of reasoning is presented, and the results of other developmental and cross-cultural studies are interpreted in light of the theory.

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2.3 Pound N¹ Sex differences in mental rotation: the importance and evolutionary significance of intrasexual variation. On average, males outperform females on tests of spatial ability involving mental rotation. However, meta-analyses have indicated that they are also generally more variable than females in their performance on these, and other tests of spatial ability. In the present study, 155 male and 213 female undergraduate students completed a computerized version of the Shepard-Metzler Mental Rotations Test and the typical sex difference in average performance was replicated. However, in contrast with previous studies it was females who were the more variable sex as measured by response accuracy, time taken to complete the test and the speed with which they mentally rotated stimuli. Moreover, while the frequency distribution of male response accuracy was unimodal, the distribution of female scores was bimodal. These results will be discussed in relation to evolutionary theories of sex differences in spatial ability since substantial intrasexual variation might be a consequence of relaxed selection or the existence of stable cognitive polymorphisms. Proximate causes of bimodality in the female performance distribution may involve the activational and/or organizational effects of estrogens, which are known to influence spatial cognition.

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2.4 Duchaine BC¹ Face-specific impairments in a case of developmental prosopagnosia: Neuropsychological evidence for an evolutionarily specialized face recognition system.

Advocates of evolutionary approaches to the mind have commonly pointed to language and face recognition as paradigm examples of evolutionarily specialized domain-specific systems. However, despite the perception that there is overwhelming evidence in support of the existence of a face-specific recognition system, it is an open question whether face recognition is performed by a domain-specific system or a

domain-general system, and without a grasp on this issue, claims for evolutionary specialization are necessarily premature. Prosopagnosia has provided the strongest evidence in favor of domain-specific accounts of face recognition, but these reports are fraught with methodological weaknesses and there are no unequivocal reports of pure prosopagnosia. In order to address these questions, I have been working with a 52 year old developmental prosopagnosic referred to as Bill C. Experiments I have run with Bill C. have falsified the three domain-general explanations for prosopagnosia, and by doing so, have supported a domain-specific account of it. In addition, because Bill C.'s prosopagnosia appears to result from genetic deficits, it appears that face recognition develops independently of other object recognition systems. Thus, face recognition does, in fact, appear to be performed by an evolutionarily specialized domain-specific system.

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2.5 McBride D¹ Accounting for paradoxical brain size and IQ differences among races and sexes. Reported differences among races and sexes in head and brain sizes, and in IQ scores, present an interesting paradox. Specifically, it is not clear why males fail to demonstrate significantly greater IQ scores than do females, given that mean male head sizes significantly exceed those of females. Four hypotheses are proposed to account for the paradox. The explanations arise from considerations of (1) psychometric practices, (2) physiological efficiency of brain functioning, and (3) the possibility of sexual selection of large head sizes. Evidence supports a combination of the foregoing, though psychometric peculiarities are the most salient. The ancestral environment in which brain sizes were selected probably did not work arbitrarily. That is, spatial and verbal challenges to survival were probably not equally weighted. This is in contrast to current psychometric practice, which adds and eliminates items from IQ tests for reasons other than to support the pursuit of evolutionary theory. The corrective prospects of an ecologically valid intelligence test are discussed.

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2.6 Kurzban R¹, Leary M² Evolutionary origins of stigmatization: The functions of social exclusion. We present a re-conceptualization

of stigma that changes the emphasis from the devaluation of an individual's identity to the process by which individuals who satisfy certain criteria come to be excluded from various kinds of social interactions. We propose that phenomena currently placed under the general rubric of stigma involve a set of distinct psychological systems designed by natural selection to solve specific problems associated with sociality. In particular, we suggest that human beings possess cognitive adaptations designed to cause them to avoid poor social exchange partners, join cooperative groups (for purposes of between-group competition and exploitation), and avoid prolonged contact with those individuals who are differentially likely to carry communicable pathogens. The evolutionary view contributes to the existing conceptualization of stigma by providing an account of the ultimate function of stigmatization and helps to explain its consensual nature.

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3.0 Coalitions, conflict and cooperation

3.1 *Hess, N'* Female coalitions and gossip: Two experiments

Two experiments tested predictions derived from the hypothesis that the coalitional use of gossip is a form of female intrasexual competition. Experiment 1 examined the psychology underlying the dissemination of gossip, specifically the psychology of competition. If gossip is a form of competition, its content should promote negative perceptions of competitors. The level of competitiveness of a hypothetical female classmate was varied, then subjects were asked to identify what kinds of information would be transmitted about that classmate to a friend. Options included negative and positive information about the classmate's mate value, academic abilities, social competence, and other traits. I predicted that the more competitive the classmate was, the more negative traits would be reported of her. Experiment 2 addressed the believability of gossip. Women may be able to more effectively disseminate harmful information about their competitors when they do so in coordination with other women rather than alone. This may be because the probability of an assertion's being true increases with the number of independent sources

that report it. Prior research has shown that people are more likely to believe trivia statements when the statements are repeated and when the source of those statements is perceived as credible. Studies have not tested these effects with gossip statements, nor have they tested variables relating to multiplicity of sources. This experiment examined the effects of source multiplicity and source independence on perceived truth of repeated gossip statements. Results are discussed in light of the hypotheses.

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3.2 *Kunstmann AL¹, Rohde PA², Euler HA³* **Reconciliation: primatological concepts tested in humans.** We conducted a psychological study to test some primatological hypotheses on the functions of reconciliation. Based on the assumption that reconciliation's serve to repair the relationship damaged by a conflict episode, the Valuable Relationship Hypothesis (de Waal, 1986) predicts that the probability of reconciliation depends on the value of the relationship the two confronting individuals are maintaining. The higher the loss they risk by a relationship threatened in its existence and well functioning, the greater their intention to reconcile should be. The Uncertainty Reduction Hypothesis (Aureli & van Schaik, 1991) focuses on the short-term effects of reconciliation, assuming that reconciliation leads to a fast decrease in stress and fear originally caused by the conflict episode. Furthermore sex differences in the probability of reconciliation were hypothesized. Men should be more conciliatory in their conflicts with other men than women quarreling with other women due to the great importance that alliances and cooperation have in male intrasexual competition. In our study we focused on non-romantic same-sex relationships and used different methods like hypothetical scenarios, the act frequency approach and direct questionnaires. Some of our results, as of March 2000 from 39 males and 58 females, support the presumed sex differences and the existence of general features of reconciliation in humans that have already been found in non-human primates.

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3.3 Ziker, J¹ Food sharing among indigenous hunters of the Russian arctic: Behavioral models and preliminary evidence. With the break-up of the Soviet command economy, the Dolgan and Nganasan, two of Russia's indigenous Siberian peoples, have returned to subsistence hunting, fishing, and trapping. Informal distribution of the prey follows a number of behavioral ecological models. This paper provides preliminary evidence for three models based on focal follow observations and self-report explanations. The models are: kinship resource transfer, buffering exchange, and immediate-return cooperation. Buffering exchange and immediate-return cooperation appear to be connected diachronically and may depend, in part, on patterns of prey distribution and migration. In the Dolgan and Nganasan communities where this research was conducted, the people are relatively isolated from potential sources of trade. The development of non-market distribution strategies among indigenous north Siberians is evidence of a basic human social and economic adaptation. This phenomenon, while representing an extremely difficult time for these northern hunter-gatherers, provides an opportunity to test hypotheses of food sharing and to describe the relative importance of different food-distribution mechanisms for various classes of social relationships and ecological conditions.

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3.4 Campbell L¹, Stewart M², Manning J³, Simpson JA⁴ Men behaving dominantly: Intrasexual competition, emergent leadership, and the male waist-to-hip ratio (WHR). This study examined how men with different waist-to-hip ratios (WHRs) behaved in one of two group contexts: when an attractive woman observed the group interaction (in an intrasexually competitive situation) or when no female observer was present (in a non-intrasexually-competitive situation). The WHR is a potential marker of male viability (Singh, 1995), with WHRs in the .90-.95 range related to superior health. The WHR is partly heritable, and women rate WHRs in the ideal range as more attractive. The WHR may, therefore, be an honest indicator of health status. Men were

randomly placed in 4 person groups and asked to solve a given problem (a leaderless group discussion paradigm). In 22 of these groups an attractive female "observer" was present. These group interactions were unobtrusively videotaped, and lasted approximately 30 minutes. It was hypothesized that men with WHRs in the ideal range would behave in a more socially dominant fashion than men with WHRs outside of this range, but only in the intrasexually competitive situation. Two sets of trained raters observed each group interaction and coded each participant's behavior on a number of theoretically relevant dimensions. Results revealed that men with WHRs in the ideal range behaved both more leaderlike and more socially dominant than other men, but only in groups where the female observer was present. Men with attributes that signify greater health, then, are more likely to behave in a more dominant fashion toward other men in an intrasexually competitive situation.

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POSTER ABSTRACTS (In alphabetical order, first author)

Alonso H, Demarest J **The effects of attractiveness, age, and sexual experience on the desirability of a female for short term and long term relationships.** Research and theory on mate selection indicate that males value characteristics differently depending on the expected type of relationship. While traits signaling reproductive ability in prospective mates are important in both short term and long term mating situations, sexual fidelity is valued differently. In this study, men read a brief biography of a female model and were asked to evaluate her effectiveness in selling various products. Embedded in the questionnaire were items about her desirability for a short term and a long-term

relationship. The biographies differed in two features; the age of the model (18 or 35), and information about her life style that suggested the amount and type of sexual experience she had (none, monogamous, promiscuous). In addition, some subjects saw a photo of the model which had been previously rated as high or low in attractiveness relative to other models. Other subjects did not view a photo. It was expected that attractive, young virgins would be rated as more desirable for a long-term relationship than women who had some sexual experience. In contrast, sexual experience was expected to enhance the desirability of women, especially older attractive females, for short-term relationships. Finally, young females and more attractive females were expected to be more desirable than older and less attractive females for both short and long term relationships. The results supported all three hypotheses.

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Aktipis, CA **A social interface theory of consciousness**

Why is there a phenomenological experience associated with the information processing that goes on in our brains? I suggest that certain evolutionary pressures may have led to the emergence of a 'social interface' that has within it representations of the motives of oneself and others, access to certain memories, perceptual information about the physical world, emotional experience, and the feeling that one is making decisions about one's actions. In suggesting that consciousness evolved as a representation of the mental states that others would ascribe to oneself, I draw on the fact that perceptual and emotional elements that can be processed by the ToMs of others are the same elements that make up a large part of our phenomenological experience. The evolutionary framework set out in this model is one that requires several phylogenetic steps.

The first focuses on physiological arousal and its relation to emotional states. This is followed by a discussion of Intentionality Detection and Theory of Mind and their relations to emotional, volitional and epistemic states. Lastly, it is suggested that the adaptedness of self-deception combined with a self-reflective Theory of Mind Mechanism could have resulted in a discrepancy between the emotional phenomenological experience and ultimate intentions in the realms of perception, emotion and decision-making. It is suggested that an understanding of certain

psychological deficits might be an important component of developing a model of the mechanisms underlying phenomenology and that this framework might be useful for the study of various psychological phenomena and their relation to each other.
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Babula J, Demarest J **Sex differences in mate preferences using multiple methodologies: Does the mate value of the evaluator matter?** Regan (1998) reported that the mate value and sex of the evaluator influenced mate selection. Women were more selective than men about the mate value of an ideal mate (i.e., there were more domains in which it mattered) but the higher the mate value of the man, the less he was willing to compromise. The current study was a partial replication of the classic study of mating preferences by Buss and Barnes (1986) with the added dimension of mate value of the evaluator. Three different methodologies were used to assess Ss' relative preferences for various traits in an ideal mate (i.e., rating scale, ranked differences, and paired comparisons). The mate value of participants was evaluated by a panel of judges based on the Ss' appearance and a brief biography created by each participant. Significant sex differences were found for the characteristics of ATTRACTIVENESS (M > F) and HONESTY (F > M) using all three methodologies. Although there was no sex difference for the WEALTH/FINANCIAL STATUS trait, the trend was in the predicted direction (F > M). In no case did the mate value of the participant make a difference in the outcome. Although puzzling, the lack of any effect of mate value on the relative importance of various traits in an ideal mate raises questions about the effects that have been reported (e.g., Regan, 1998) and about methodological issues for assessing mate value. Some of these issues (e.g., first impressions) will be discussed.

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Barber N **Parental investment as an integrative concept in developmental psychology**

Parental investment is a concept derived from biology, which implies that parental care is a finite resource that has predictable consequences for the success of offspring. With an important modification in respect to the affective tone of parent-child relationships, parental investment is a useful

integrative concept in developmental psychology. This paper draws on published literature to discuss its relevance for (a) adaptive variation in parental behavior, (b) attachment theory, (c) cognitive development, including language development and (d) development of social problems such as delinquency and teen pregnancy. The paper concludes with description of a research agenda based on the parental investment concept.

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Breitenstein J' **The extent to which evolution is taught in high school psychology courses**

This learning venue offers an important opportunity to present psychology as a scientific endeavor with evolutionary underpinnings. All teachers assigned to teach psychology in Iowa (N = 246) were surveyed regarding course content and continuing education needs. Seven of the 110 respondents (6.6%) listed evolution as a topic included in their courses. This topic was the least frequently endorsed among 17 listed.

Preferences identified by respondents for continuing education (e.g., participation in on-line research projects for classroom presentations) are presented as promising opportunities to increase interest in evolutionary psychology.

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Brown S, Demarest J' **Sex differences in jealousy: The role of emotional involvement in sexual infidelity.** The purpose of this study was to examine the impact of emotional involvement in a situation involving sexual infidelity on various feelings of jealousy. Subjects were given one of three scenarios describing sexual infidelity by a hypothetical mate. In one, the partner argues that it meant nothing (no commitment), in a second, the partner reveals strong emotional feelings for the third person (commitment), and a third scenario does not say (unstated). Men were expected to exhibit the same amount of jealousy in all three conditions since men should always regard sexual infidelity as very upsetting due to paternity uncertainty. Women were expected to have the most jealousy in the commitment scenario since this situation would suggest the greatest likelihood of loss of resources and future parental investment. Jealousy was assessed on a 10 point rating scale for five different emotions (Jealous, Distressed, Upset, Angry, Betrayed). Of the

two hypotheses, the first was supported while the second was not. All three scenarios produced the same amount of jealousy, although the commitment scenario yielded more intense Anger reactions than the no commitment scenario. In general, women had more intense emotional reactions than men, but this differed significantly only for the Upset ratings. Also, there were significant differences in the ratings of the five emotions, with the lowest ratings given for “Jealousy” and the highest ratings given for “Betrayed.” This study raises conceptual and methodological questions about research on jealousy, especially the predictions drawn from an evolutionary framework.

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Burch R¹, Gallup G² **Paternal resemblance predicts family violence**

Convicted spouse abusers participating in a court mandated domestic violence treatment program were asked to complete a questionnaire and rate the degree to which their children looked like them. Degree of paternal resemblance was positively correlated with the quality of the men’s relationship with their children. On the other hand, degree of paternal resemblance was inversely proportional to the severity of injuries suffered by the spouses at the hands of these abusive males. Similar results were also found in the abusive males’ parents. These results are the first to show that males may use paternal resemblance to assess paternity.

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Caporaso K¹, Goodrich D², Fouts R¹ **ASL modulations in chimpanzees: Variability across context and recipient.**

Erting (1981) has said, “Effective communication depends upon an ability to adjust appropriately to different audiences, situations, and topics.” Modifying speech to enhance meaning is one important method of adjusting communication. Modifications in vocal speech include raising the voice, slowing or speeding up speech, or sharply enunciating specific words. American Sign Language (ASL) can be modified by several different methods that alter the place, movement, or sign configuration. This study examined modifications used by five chimpanzees at the Chimpanzee and

Human Communication Institute (CHCI) at Central Washington University. The chimpanzees use the signs of ASL in daily activities both with human caregivers and with each other. Interns at CHCI record instances of sign use by the chimpanzees in sign logs. This study analyzed sign logs from 1983 to 1999 in order to examine whether the context and the recipient alter the type of modification used by the chimpanzees. First, types of modifications were compared across contexts. It was found that the most common type of modification for all contexts was directed signing. Some modulations, such as emphatic signing, were frequently found in certain contexts but rarely or never found in other contexts. Second, the recipients within each context were examined. It was found that the types of modulations used varied by recipient. The chimpanzees also showed individual differences in modulation use that may be a reflection of either personal speaking style or their relationship to the conversation partner.

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Cornwell RE¹, Palmer CT², Davis HP¹ **Sociobiology and evolutionary psychology: A 25 year retrospective on change and treatment in psychology.** In an effort to understand how sociobiology and its progeny (evolutionary psychology) have been treated within the social sciences, we have reviewed approximately 150 general introductory psychology textbooks spanning the 25 years since the publication of E.O. Wilson's "Sociobiology: A New Synthesis." The treatment of sociobiology and evolutionary psychology was reviewed using three distinct criteria: (1) the amount of text devoted to aspects of the disciplines, (2) whether or not the treatment was positive/neutral or negative, and (3) whether or not the treatment was accurate. Additionally, we looked at specific topics (e.g. altruism, kin selection, mating strategies, etc.), the citations of both advocates and detractors of sociobiology and evolutionary psychology, and the relationships between sociobiology and evolutionary psychology. The treatment of both disciplines has greatly improved over the past twenty-five years. For example, there has been a significant increase in the amount of coverage, an increase in the number of positive citations of sociobiologists and evolutionary psychologists, and a decrease in the

number of critical citations. However, we found a trend toward a narrowing and fractionalization within the discipline of evolutionary psychology. For example, there has been a marked increase in the treatment of mating strategies without a concomitant increase in the treatment of other topics such as kinship, altruism, parent-offspring conflict, and other social behaviors. In addition, we have found that while some exceptional textbooks do an outstanding job of explaining the concepts of sociobiology and evolutionary psychology, many textbooks continue to misrepresent both disciplines' theoretical constructs.

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*Davis MD*¹ **Social status and language: Linguistic cues to the origins of social status**

Ancestral humans faced the adaptive problems of assessing their relative social status and acting accordingly. Failure to solve this problem would have resulted in constant interpersonal conflict. I hypothesize that cognitive mechanisms exist which utilize language to send and receive cues to an individual's relative social status. Specifically, I predict that higher status humans use social, third person, and family word types with greater frequency than lower status humans, reflecting their greater social integration. Because lower status humans have less direct access to resources, lower status humans would benefit from bargaining with and possibly even manipulating higher status humans. It is predicted that this will be reflected by more frequent use of self reference, causal, and cognitive mechanism word types. Additionally, since conflict is potentially more costly for lower status humans, they are predicted to use tentative word types with greater frequency. Pilot data support these predictions and a more sophisticated study is underway.

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*Entine J*¹ **Why black athletes dominate sports and why we are afraid to talk about it**

Athletes of West African ancestry make up 70% of the NFL and 85% of the NBA, and hold 95% of the top times in sprinting. North and East

Africans dominate distance running. Remarkably, as equality of opportunity has increased over the years, equality of results on the playing field has declined. This paper addresses whether such staggering statistics are accidents of culture or reflect something more deterministic. It further explores the socially explosive issue of whether it is appropriate to examine the possibility of functional differences between populations considering how race science has frequently been distorted to justify segregation and genocide. Patterns of athletic success reflect the burgeoning knowledge of phenotypic and genotype differences between populations grounded in thousands of years of evolution. Athletes of West African ancestry dominate North American sports that demand fast-burst running and jumping; East Africans are the world's supreme distance runners; Eurasian whites dominate field events (hammer throw, shot-put, javelin), wrestling, weightlifting, and the offensive line in football which demands natural upper body strength; East Asians are over-represented in sports requiring extreme flexibility, such as diving, gymnastics and skating events. The politically acceptable explanation for such trends – that black athletes succeed to escape the ghetto and that blacks, whites, and Asians are culturally channeled into certain sports – is grossly simplistic and even racist. It should be replaced by a more sophisticated paradigm that reflects a bio-cultural perspective that acknowledges the complex interaction of biology and the environment.

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Fiddick L¹ **Are rights and duties complementary and interdefined? Further evidence for separate adaptive domains of reasoning.** One of the most interesting findings in support of Social Contract Theory (SCT) is the demonstration that performance on social contract versions of the Wason selection task is sensitive to one's social perspective (Gigerenzer & Hug, 1992). SCT interprets this finding as evidence for a special-purpose "look for cheaters" algorithm that instantiates an egocentric definition of cheating. Critics of SCT (Holyoak & Cheng, 1995) have argued that the perspective effect can be more parsimoniously explained by assuming that the duties imposed on one party by obligations, such as social contracts, entail countervailing rights for a second party. On this view, a mechanism for reasoning about obligations in general, and not specifically for social contracts, provides a better account of people's reasoning. I tested these rival views of

reasoning by extending the perspective switching paradigm to another class of obligations: precautionary obligations. If rights and duties are complementary and interdefined, as the critics of SCT claim, then the perspective effect should also be found with precaution versions of the selection task. The results of two experiments demonstrate that the perspective effect does not generalize to precautionary obligations. These results suggest that, while social exchanges may be characterized by complementary and interdefined rights and duties, precautionary obligations are based on unilateral duties with no countervailing rights. Hence, as predicted by SCT, reasoning about obligations is not a unitary phenomenon, but is a collection of more domain-specific inferences.

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***Fukui H*¹ The effects of music and visual stress on testosterone and cortisol in men and women**

Psychological and physiological stimuli induce various changes in testosterone (T) and cortisol (C). However, the relation between T and C and musical stimuli are not well known. In this experiment, the influence of musical stimuli and stressful stimuli to T and C secretion was investigated. Saliva testosterone (ST) and saliva cortisol (SC) concentration were measured among 88 healthy college students, 44 men and 44 women. Subjects were placed under four different conditions: (1) listening to music, (2) listening to music with visual stress (silent film with violent scenes), (3) visual stress without music, and (4) silence. All subjects submitted two saliva samples before and after in each conditions. ST and SC levels were assessed by RIA. The presence of music significantly decreased ST in males, but increased ST in females. For both sexes SC decreased in the presence of music and increased in its absence. Neither any significant effect resulted in preference of music in both sex and menstrual cycle in female. Data suggests those effects of music and stress on ST and SC differs according to sex. T is deeply connected with dominance and status. I propose a new hypothesis of evolutionary function of music that it exist to control the condition of the human body physiologically and psychologically, suppressing sexual and aggressive behaviors, and avoiding confrontations in group-living, so as to be adaptive for man.

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***Gardner, R*¹ Improved neuroimaging research would investigate social rank signals**

Sophisticated neuroimaging techniques are rendered trivial by kindergarten questions on the experiential end of the research. Improved variables would involve social rank perceptions as people pay great attention to such factors in themselves and others. Such attentions likely play large roles in the brain's usual activity as elaborated over evolutionary time, not just the era of human language. More relevant neuroimaging results would therefore stem from study that includes adequate conceptualization and measures of social rank changes with social context factored in. R-theory provides a tool for this. This theory formulated with John Price defines R as estimates of value, worth, status, power, strength, and/or esteem in the self and others. R elaborates in humans resource holding potential (RHP) investigated in combative animals. R-sources in humans include substantive worth, territorial position, fighting strength, mate value, attractiveness, allies, group-conferred status, thymic state, individual story line, health, moral high ground, and interpersonal RS. Anathetic and catathetic signals illustrate interpersonal R-sources. Anathetic signals include boosting comments or bonding laughter that causes the receiver and sender each to feel added R. Catathetic signals of put-downs or mocking laughter diminishes receiver's R while increasing sender's R. These impact differently depending on the roles, ranks and in-out-group status of signal-senders and receivers, social context estimated by the listed R-sources. Study design should include functional MRI and PET data as dependent variables with independent variables stemming from experimental manipulation of interpersonal R. But all R-sources for each communicating party involved need to be controlled for, including not only the subject's but that of experimenters interacting with the subject, to assess accurately neuronal impact of interpersonal R exchange.

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*Gottsch JD*¹ **Self-awareness, death anxiety and the memetic evolution of religious canon**

Purpose: To propose a model of how human behaviors dictated by religious canons provided adaptive strategies that have been selected over time to enhance fitness. **Methods:** The peculiar human behavior of religious practice is traced in its evolutionary development from the emergence of self-recognition in a presumed ancestral ape to increasingly sophisticated self-awareness that led to the understanding of death. Human beliefs and behaviors are analyzed as to their ability to counterbalance the emergence of this new state of mind struggling with death anxiety. **Results:** A study of ancient and modern Near Eastern religious canons reveals the mutation, selection, and vertical transmission of fitness-enhancing textual units, defined as theistic memes. The earliest recorded theistic memes dealt with human fear of death and defined man's earliest relationship to god. Theistic memes that could theoretically affect fitness through selection and incorporation into religious canons included those dictating beliefs about (a) self-awareness in an unknown world, (b) strategies and behaviors toward others and within the nuclear family, and (c) appropriate sexual behaviors within marriage. Prohibition of sexual practices such as incest, adultery, homosexuality, bestiality, castration, and religious prostitution would have further maximized fitness. **Conclusions:** Vertically transmitted theistic memes in the Hebrew canon were largely incorporated into Christian and Muslim religious canons (New Testament and Qur'an). Mutations of theistic memes during vertical transmission into these other canons allowed the same fitness-enhancing stability for the gentile and Arabic populations.

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*Guisinger S*¹ *The evolutionary psychology of sports*

An anthropologist from Mars might be more intrigued by our enthusiasm for sports than our mating rituals. A billion people watched the most recent Olympics; successful players are heroes. Testosterone levels rise as much as 20% in fans watching a winning team. No other legacy of our Pleistocene past has such a hold over our time and passions with so little connection to ordinary people's reproductive fitness in the present. This paper reviews evidence that people's love of watching and playing sports represents an *archelust* or "ancient passion," a cognitive-emotional

schema or story that is part of our genetic heritage. The selection pressures that led to inbred love of sports were most likely the need to practice hunting and fighting skills. Evolved psychological mechanisms probably include pleasure in practicing skills, pride in competence and in withstanding rigors, idealization of the strong and skillful, willingness to submit to hierarchical structure based on knowledge and competence, fantasizing and story-telling about heroic triumph, and euphoria in being part of a winning team. This *archelust* has facilitated powerful group bonding, but has also probably contributed to overhunting of hundreds of species of vertebrates in the New World and Australasia. The relationship between these evolved psychological mechanisms and culture is evident in the religious fervor that accompanies the Super Bowl and even Little League contests. Evolutionary psychology has tended to emphasize computational problem solving over affect and narrative. Sports provide a model for the integration of emotion and cognition into complex schemas.

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***Hagen, EH* Social constraints on reproductive decision-making and postpartum depression**

Cooperation is a potent strategy for extracting benefits from others by providing benefits in return. Unfortunately, it exposes individuals to numerous social hazards such as exclusion, manipulation, exploitation, and cheating. If such pitfalls could not be mitigated or avoided, then cooperation could not have evolved. In particular, if there were no means to renegotiate unprofitable cooperative contracts, the risks of entering into such contracts might easily outweigh the potential benefits. Because the benefits provided by cooperating individuals can be extremely valuable, recipients of these benefits may be reluctant to renegotiate one-sided contracts, and may even impose social costs to prevent the defection of their partners. One counter-strategy for individuals involves withholding benefits until better terms are offered, i.e., 'going on strike.' Depression may be an example of such a strategy--it decreases the benefits that afflicted individuals can provide to others. Child rearing is a quintessential cooperative endeavor with high costs and benefits that are evolutionarily well defined. Recently collected data show that levels of postpartum depression (PPD) experienced by mothers with unplanned and unwanted

pregnancies is highly correlated ($r = .63$, $p = .003$) with the degree to which their husbands oppose abortion. Further, maternal PPD is correlated with a decrease in the mother's investment in childcare, and an increase in the husbands' investment in childcare. These data and numerous data from previous studies strongly suggest that PPD may be an adaptation to reduce the hazards associated with cooperative child rearing. This model may also apply to cooperation and depression in general.

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Healy Y¹, McGrath K², Burch R³, Platek S⁴, Gallup G⁵ **Mediation of mood by sexual activity**

Prostaglandins that are absorbed through the vaginal walls have been hypothesized to decrease the amount of depression a woman experiences. Although it is clear that absorption through the vagina of androgens, as well as other endogenous chemicals does occur, no evidence clearly shows an association between this absorption and mediation of mood. Using validated measures of mood, we investigated the difference between persons who have and have not engaged in recent sexual activity. Amount of sexual activity has been suggested as being mediating factor in sexual jealousy. Evidence that sexual activity can mediate mood is discussed in terms of evolutionary strategies to reduce female extra pair copulating and male abandonment.

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Heath KM¹, Intigrinova TP² **Revisiting pastoralists as conservationists: why do pastoralists seasonally move?**

Ruttan and Borgehoff Mulder (1999) advanced the utility of game theory to demonstrate that selfish economic interests among the Barabaig can lead to the conservation of dry pastoral grazing reserves by wealthy herders coercing poor herders to seasonally move to wet pastures. We re-examine the above study and argue that the authors' model is not applicable to the majority of traditional pastoralists. We then present an alternative model based on the nutritional value of grazing lands and traditional pastoralists settlement patterns. We concur with Ruttan and Borgehoff Mulder that the conservation of pastures is the byproduct of selfish

individual economic interests. However, we conclude that 1) environmental options and constraints rather than coercion structure pasture choice, and 2) most traditional pastoralists would prefer to graze on nutritionally rich wet season pastures but are forced to leave because of ecological factors.

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Holcomb H¹ **Teaching Buss's text: catalyst for the revolution?**

Buss's *Evolutionary Psychology* is the field's first textbook. Its aim is to promote acceptance of the field. This is both a scientific and a philosophical task. Buss's text showcases the science but ignores the philosophical task—trying to get people to think about the world and their own basic beliefs in a new way. How do you shift people's paradigms? A string of evidence-driven studies is insufficient; one can accept Buss's evidence without drawing Buss's conclusions because interpretation of the evidence is guided by one's pre-existing paradigm. When a new science conflicts with prior beliefs, how should belief systems be rationally revised—when should we reject the science and retain our prior beliefs versus reject our prior beliefs and accept the science? I tested the presumption that scientific texts beat popularizations in revolutionizing people's thought. I asked my students, "Having read Buss's text after Wright's *The Moral Animal*, how has Buss's text changed your assessment of the field?" They report fewer benefits than expected. Students thought that: (1) Buss's text did not change their minds very much; (2) Both authors interpreted the facts in ways that fit the author's preconceived ideas; (3) Buss's conclusions about which hypotheses were confirmed by empirical tests were rejected, often because they thought of rival hypotheses that could explain that data; (4) The science's foundations are shaky; (5) Buss's text hides key issues on which acceptance/rejection turns.

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Kelly K, Demarest J' **Costs and benefits of close and casual**

opposite sex friendships?

Stimulated by the recent pioneer study on sex differences in costs and benefits in same and opposite sex friendships (Bleske & Buss, 1999), we conducted a similar study of casual and close opposite sex friendships. We looked at how sex, age (<24; >30), and commitment in a current relationship affected the relative cost/benefit ratings of 20 characteristics taken from Table 5 and Table 7 of Bleske and Buss. A six point rating scale with 0 = very costly and 6 = very beneficial was used to rate each characteristic. We found that close friends provided significantly more benefits (or fewer costs) than casual friends for 8 of the 20 items. Unexpectedly, there were few sex differences and when they were found they were manifested in interactions with the other variables of age, commitment in a current relationship, and type of friend. In addition, participants in self-described committed relationships reported that friends provided more costs when the items reflected potential threats to their circumstances (e.g., the friend is jealous, or is seen as a potential mating partner). Finally, there were no significant differences in the cost/benefit ratings for 6 of the 20 traits despite the fact that all the traits in this study had been selected because they were either very costly or very beneficial in the Bleske and Buss (1999) research. Differences in the methodologies of the two studies may account for some of these differences.

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***Kruger D*¹ Evidence for cognitive processes promoting inclusive fitness**

Two questionnaire studies shed light on the psychological component of tendencies predicted by Hamilton's (1964) inclusive fitness theory of discriminatory altruistic behavior based on genetic similarity. In study 1, participants favored the closer relation in assistance impacting material wealth, social status, and health. In study 2, participants rated assistance aiding survival and material wealth as more rational and ethical when these actions were performed for closer relatives. Participants also felt a greater obligation to perform these acts for a close relation. A comparison condition where assistance was unlikely to affect survival or reproductive success did not exhibit these tendencies.

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McDowell R¹, Mulcahy J², Fuentes A³, Fouts R⁴ **Preliminary assessment of the relationship between social density and aggression in a group of five socially-housed chimpanzees (*Pan troglodytes*)**

De Waal (1989) has proposed a coping model in which chimpanzees limit aggression under periods of high density. This model predicts that increased absolute density (individuals per unit volume) will not cause a significant increase in conflict due to strategies such as limitation of movement and/or increased affiliative behavior. Aureli & de Waal (1997) demonstrated this by examining 45 chimpanzees under two conditions of absolute density. Chimpanzees in high-density conditions showed reduced levels of social activity and a slight decrease in conflict rate in accord with the de Waal coping model. The purpose of this study was to examine the effects of social density, or inter-individual distance, on conflict rate. Data on conflict and post-conflict behaviors, as well as conflict and non-conflict inter-individual distances, have been recorded as part of the Post-conflict Negotiation study at the Chimpanzee and Human Communication Institute at Central Washington University. Preliminary results show that average inter-individual distances are significantly less during pre-conflict periods. This suggests that social density may be more correlated with aggressive behavior than absolute density. Furthermore, inter-individual distances between conflict participants are significantly less than non-participants during pre-conflict periods. Thus, dyadic proximity, in addition to group density, may play a role in aggressive behavior. Overall, these findings suggest that both increased social density and increased proximity between opponents prior to conflict may be reliable predictors of conflict.

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Mealey L¹ **Human testes size, sexual dimorphism, and mating**

system

In non-human primates, sexual dimorphism of body size is closely correlated with mating system. Body size dimorphism in humans, however, falls in a range that is not particularly helpful for inferring the likely mating system of our ancestors, and most authors conclude that we have a history of a multi-male breeding system with "mild polygyny". Relative testes size (testes weight/body weight) is also a correlate of mating system. Again, most authors who have relied on that index report little confidence in the ability to drawing conclusions in the range where humans lie. I report a recalculation of relative testes size in humans, and suggest that according to this index it would seem that humans do not have a history of a multi-male mating system, but rather, a history of monogamy or of harem polygyny.

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Miller GF¹ **Why mental abilities inter-correlate positively in a massively modular mind: Mutations, the *g* factor, and the *G* matrix.** Evolutionary psychologists expect mental adaptations to be highly modular, with low heritability. Yet psychometrics and behavior genetics reveal a highly heritable ‘*g* factor’ representing the all-positive inter-correlations between the efficiencies of different mental abilities. This discrepancy can be reconciled by considering the effects of mutations with multiple harmful effects on functionally independent brain systems. I will present genetic models showing that a highly heritable *g* factor arises inevitably even in a massively modular cognitive architecture, given (1) individual variation in mutation load, arising through mutation-selection balance and assortative mating for fitness, (2) most mutations having pleiotropic effects on more than one cognitive system, and (3) those effects reducing functional efficiency on average. These mutational effects suffice to produce all-positive entries not only in the matrix of correlations between human mental abilities (as captured by the *g* factor), but more generally in the genetic variance-covariance matrix (*G* matrix) between all fitness-related traits. The *g* factor does not imply that humans evolved a “general-purpose intelligence”. Rather, *g* will arise in any species where deleterious mutations generate positive genetic covariances between mental traits. (Critics of intelligence research often stress the complexity of brain development; ironically for them, this model

shows that stronger developmental pleiotropy leads to a stronger *g* factor.) This model is consistent with recent research suggesting a heritable general ‘fitness factor’ superordinate to the *g* factor, and supports the hypothesis that sexual selection shaped some human mental traits specifically as fitness-indicators.

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Miller R.¹, Brase G² Sex differences in the perception of and reasoning about quid-pro-quo sexual harassment. The thesis of this study is that evolution has had a significant influence on the development of human reasoning within the realm of sexual harassment. Quid pro quo (QPQ) sexual harassment, in which something is offered in exchange for sexual contact, is typically regarded as a relatively well defined type of harassment. Within the general phenomenon of QPQ harassment, however, it was predicted that differences would emerge in the perception of a harassing statement based on the context. Specifically, a QPQ conditional statement may be interpreted as either a social exchange or as a threat, depending on: a) the framing of the statement (involving gains or avoiding losses), b) the specific situation of the person receiving the statement (i.e., if the event tied to the sexual contact is likely or unlikely to occur anyway), and c) the sex of the respondent. Furthermore, evolutionary theories of human reasoning predict differences in inferential processes based on whether a situation is perceived as a social exchange or as a threat. A modified Wason selection task was used to assess these differences. Studies with male and female undergraduates support the predictions of differing perceptions of QPQ harassment, with an interaction effect between the sex of the respondent and the context of the harassment. Results indicate that females are more sensitive to contextual factors when evaluating QPQ harassment, as compared to males.

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*Mills ME*¹ **How theoretical feedback loops differ in the Standard Social Science Model vs. the Integrated Model** Both the Standard Social Science Model (SSSM) and the Integrated Model (IM) have feedback loops at the center of their theoretical formulations. This paper reviews the history and fundamental assumptions of the SSSM and IM, and presents diagrams to illustrate their respective proposed feedback mechanisms. The differences in the conceptualization and operation of these causal loops with respect to the selection of behavior is discussed. It is suggested that the additional phylogenetic feedback loop offered by the Integrated Model provides a heuristic that is necessary to fully understand behavior.

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*Mysterud I, Steen M*² **Birth order, creationism, and attitudes toward evolution**

Frank Sulloway's book *Born to rebel* (1996) has stimulated to a renewed interest in birth-order effects on personality development. One of Sulloway's examples from the 19th century concerns attitudes toward evolution, where firstborns were found to be less likely than later borns to support the idea of an organic evolution of life on earth. We wanted to explore if birth order would influence the attitudes toward evolution in a contemporary environment in which this idea of an organic evolution, especially among humans, is still controversial. For four years (1996-99), we have sampled students studying nursing at the Diakonhjemmet College, School of Nursing, in Oslo, Norway. To be admitted to this college, students have to confess that they are Christian. In such a college setting one would expect creationism to be prevalent. The sex ratio among the students is highly female biased, and our sample size of 192 students consists of 171 women and 21 men (63 first-, 55 middle-, and 60 lastborns; for 14 students birth-order data was lacking). The paper presents our preliminary findings as to the influence of birth order on the acceptance of evolution and of humans as an evolutionary product.

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Nakanishi D¹, Kameda T² **Cost/benefit analysis of “conformity bias” in cultural transmission: an experimental test.** Kameda & Nakanishi’s (this conference) evolutionary game analysis on cultural transmission indicated that there can be a polymorphism of individual learners and social learners in a human group. When cost associated with individual learning (e.g., information search) is higher than cost for social learning via conformity, there should be an equilibrium where individual learners and social learners coexist in a group. The analysis suggested that (a) the degree of conformity bias in a group is determined by the cost of individual learning and that (b) the adaptive strategy for individual learners is to reduce (not to increase) conformity bias with an increase in information search cost. We report a psychological experiment to test some of these notions. Participants made a series of judgments about a fluctuating environment. They were instructed that their reward would be contingent on the number of correct judgments. In making judgments, participants were provided social information (i.e., how others judged in the preceding trial) for free, as well as an opportunity to explore the focal environment individually for a cost. Thus, when making judgments, participants had two choices: whether to use social information only, or to also purchase the information-search opportunity. We created 2 conditions about the individual information search: low vs. high cost. The results supported our predictions above. Participants who purchased information-search opportunity reduced their conformity level in the high cost condition, compared to the low cost condition. We argue that humans adjust conformity bias according to information search cost in a heuristic manner.

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O’Connor LE¹, King J², Berry JW³ **A new measure of chimpanzee psychopathology**

In a previous study of psychopathology, social adjustment, and subjective well being in 41 chimpanzees, we found that chimpanzees were reliably rated on each scale by observers familiar with the chimpanzees. We also found that psychopathology, as measured by the Chimpanzee

Psychological Adjustment (CPA; King & O'Connor, 1999) had a significant negative correlation with subjective well being and social adjustment. This study was the basis for a new measure of psychopathology, The Chimpanzee Psychopathology Scale (CPS; O'Connor, Berry & King) based on personality attributes in the original Chimpanzee Personality Measure (CPM; King and Figueredo, 1997). We selected items that corresponded in content to categories of psychopathology on the Brief Psychiatric Rating Scale (BPRS; Overall & Gorham, 1962). Internal consistencies were established for each psychopathology subscale. This measure of psychopathology derived from the CPM correlated significantly with the first psychopathology measure (CPA). We then examined a data set of 152 chimpanzees included in the original chimpanzee personality study (King and Figueredo, 1997). Psychopathology had a significant negative correlation with subjective well being. Female chimpanzees were significantly higher than males in social adjustment, and in the Anxiety subscale. Higher female scores in Depression approached significance. This is consistent with sex differences usually found in anxiety and depression in humans. Higher male scores in hostility and emotional reactivity also approached significance. There were no differences between males and females in subjective well being. A cluster analysis found four categories which in their extreme form displayed similarities to several personality disorders in humans: schizoid, histrionic, avoidant, and antisocial.

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Platak S¹, BurchR², Healy Y³, Gallup G⁴ **Patterns of male sexual jealousy**

Male sexual jealousy (MSJ) is an evolutionary strategy to reduce the probability of female extra pair copulations that might result in that male being cuckolded, and thus investing in offspring that do not represent him genetically. The patterns of male sexual jealousy have been reported in the clinical population as being neurotic, aberrant, and maladaptive to both partners in a relationship. However, these patterns that have been continually referred to as destructive have only recently begun to be discussed as functional behaviors. The current research begins to investigate questions regarding the development of male sexual jealousy

(MSJ), such as how the quantity of resources invested prior to attainment of reproductive fitness may increase MSJ, how sexual satisfaction and amount of sex may act to mediate one's sexual jealousy.

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Rende, LM¹ **Parental strategizing and child labor migration in Thailand**

Child welfare issues have become acute in Thailand over the past few decades and are interpreted as a result of the impact rapid modernization has had on the opportunities available for sons and daughters to fulfill their culturally ascribed familial obligations. The parental logic and goals behind one of these child welfare outcomes, migratory wage labor, were investigated from an evolutionary perspective via qualitative interviews and focus groups, exploring in particular evolutionary hypotheses of parental investment and reproductive success. Respondents who were parents, in all generations, clearly emphasized the helper-at-the-nest obligations of their daughters while supporting cheater strategies for their sons. Daughter migrants were expected to remit substantial funds to support their families, while son migrants were not expected to do the same. Parenting decisions for daughters were particularly sensitive to the number of younger siblings in the household, while decisions for sons did not appear to be as sensitive. The results of this early research confirm that Thai parents attempt to lower the costs of parenting by not financially supporting migrant children. Parents further enhance their reproductive and social resources with remittances sent from migrant daughters, and additionally augment their reproductive fitness through the cheating strategies of their migrant sons. The biocultural environment of northern Thailand in general, with matrilineal tendencies and common extramarital mating, perpetuates this gendered parenting. I conclude that policy addressing child trafficking, labor, and prostitution would better protect children if it recognized parenting strategies as being biologically driven as well as financially and socially driven.

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Rogers A¹, Harpending H², Wooding S³ **Genetic evidence still points to a Pleistocene population explosion**

Five years ago, mitochondrial genetic data seemed to provide clear evidence for a dramatic expansion in human population size during the late Pleistocene. Since then, new kinds of genetic data have become available and the story has become more complex. Evidence for an expansion is clear in some of the new loci but not in others. The case for the expansion hypothesis is strengthened by two observations: (1) Those genetic systems least likely to be influenced by natural selection are most likely to show evidence of expansion. The only genetic systems that fail to show evidence of expansion are those that are translated into protein. (2) Not only do the untranslated genetic systems agree that an expansion occurred, they also agree about the time of the expansion: All support a date between 30,000 and 150,000 years ago. This agreement between presumably neutral genetic systems throughout the genome provides strong evidence in favor of the expansion hypothesis. If an expansion of population size did occur, then natural selection must have obscured its signature in all of the protein-coding loci that have been examined. This implies pervasive balancing selection throughout the nuclear genome.

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Rohde PA¹, Hoier S² **Interest in children and sociosexuality: Intrasexual patterns of covariation in men and women.**

It is known that there is both intra- and intersexual variation in in 1) interest in children (IIC) and 2) sociosexuality. Here we present first results of a questionnaire study in which we explore the possible functional significance of IIC in prereproductive men and women (age range 19 to 35). Both attitudinal and behavioral (self-report) data were collected. We predicted that 1) in men IIC plays a role in mate attraction whereas 2) in women a high degree of IIC is paralleled by a relatively restrained sociosexuality, reflecting a psychological trade-off between alternative reproductive strategies. Overall, the first hypothesis found more support than the second. Attitudinal measures of IIC and sociosexuality did not show the predicted positive and negative correlations in men and women,

respectively. Experience with childcare corresponded to attitudinal ratings in men, but not in women indicating that men's IIC is a reasonably reliable signal of male parental motivation and may thus function as an attractive trait in a mating context. Accordingly, promiscuous behavior (i.e. number of sex partners) tended to be positively related to childcare experience in men, but contrary to expectation this was also true for women. These and other findings are critically discussed and alternative hypotheses are considered.

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Rushton JP¹, and Rushton E² Changes in behavioral complexity and hominid musculo-skeletal traits over evolutionary time. In this paper, we use Aiello and Dean's *Human Evolutionary Anatomy* (1990), the standard reference for hominoid comparative anatomy, to tabulate the changes that occurred in 60 different musculo-skeletal traits over the 4 million years from australopithecines to the first *Homo* species to *Homo erectus* to *Homo sapiens*. We present tables, charts, and figures of both cranial traits (size of the face, temporal fossae, post-orbital constrictions, jaw bones, tooth root lengths, neck muscle attachments) and post-cranial traits (pelvic widths, femoral heads, femoral curvatures, and tibial plateaus), which we examine using discriminant function analysis and linear trend tests. Our results indicate that a cascade of changes in hominid skeletal anatomy occurred because of the expansion of behavioral complexity and brain size (420 to 1350 cm³) rather than because of the mosaic of different reasons given in the literature (e.g., changing diets, styles of locomotion, reproductive strategies). Increasing brain size must confer substantial evolutionary advantage to absorb the costs of such system-wide changes.

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Salmon CA¹ Sex, birth order and the nature of non-kin relationships

Previous studies have indicated that sex and birth order is strong predictors of familial sentiments. Middleborns tend to be less family-oriented than first or lastborns, while sex differences seem to focus on the utility of kin in certain domains. In this study, the impact of birth order on attitudes toward family and friends were examined, indicating more positive views toward friends on the part of middleborns and less positive opinions of family in general on the part of middleborns. The issue of the possible impact of birth order on mating strategies was also explored.

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Segal NL¹, Arad S² **Perceived social closeness and familiarity in twins reared apart: An update**

Perceptions of social closeness and familiarity between reared apart monozygotic (MZA) and dizygotic (DZA) twins were assessed via a comprehensive Twin Relationship Survey. This study is the first to systematically examine social relatedness in this unique twin sample. The present analysis extends a similar study reported by the same investigators in 1999, based on a smaller number of twins. Participants in the current sample included 89 MZ and 67 DZ individual twins and triplets who took part in the Minnesota Study of Twins Reared Apart. They ranged in age from 16 - 70 years, with a mean age of 45.30 years (SD = 13.58). Ratings of initial and current social closeness and familiarity were higher for MZA twins than for DZA twins at the highest choice levels (e.g., feeling "closer than best friends" and "more familiar than best friends"). Correlations between twins' perceptions of their current physical resemblance and current social closeness and familiarity were positive and statistically significant ($r = .25, p < .01, n = 152$; $r = .35, p < .01, n = 152$). Correlations between social relatedness ratings and total contact time, total time apart and percentage of lifetime apart were non-significant. Correlations between social relatedness ratings and some separation/contact measures (while modest) were significant, but in the direction opposite to that predicted (e.g., more time from separation to first contact was associated with increased current closeness). Participants' current social closeness and familiarity ratings for their newly found co-twins twins exceeded those for the nonbiological siblings with whom they were raised. The findings are consistent with evolutionary views of greater cooperation and affiliation directed toward

close genetic relatives, compared with distant relatives or non-relatives. The results also suggest that theories of social relatedness can be informed by considering the genetic relatedness of individuals.

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*Sellen DW*¹ **Can evolutionary approaches show us how to feed young children?**

Anthropologists and others have attempted to influence public health nutrition by using various models of what our ancestors ate in the more or less distant past to infer that certain diets are more healthy than others. These models usually focus on adult diets and fail to consider the differing dietary needs of individuals over the life history or what our ancestors ate as young children. However, since the idea of a return to a “natural”, “ancestral” or “evolved” diet has tremendous appeal to the general public and inappropriate use of data can generate food fads, extreme care must be taken in applying such “evolutionary” approaches to developing recommendations for young child nutrition. The wide range of adult diets proposed reflects the theoretical problems inherent in the evolutionary approach, which include choice of the appropriate point in time and space at which the diet our bodies were designed for was eaten and lag between current and past lifestyles and risk exposures. In this paper I review various types of data that might be used to reconstruct the diets of juvenile hominids or to infer the patterns of weaning among populations of anatomically modern humans engaged in different types of subsistence. Conclusions are that juvenile hominids were probably weaned onto a diet higher in fat, protein and micronutrients than that of adults; weaning foods were diverse and of high quality among anatomically modern humans; and recent pre industrial societies practised patterns of weaning concordant with current international recommendations derived from clinical observation.

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Senju A^{1, 6}, *Tojo Y*², *Konno M*³, *Hiraishi K*^{1, 4}, *Hasegawa T*¹, *Hasegawa M*⁵ **Impaired social intelligence predicts the level of dysfunction of autistic children.** Patients with autism are thought to suffer a deficit in ‘social intelligence’, in particular in the ability to infer

the mental states of others. Social intelligence is considered to be a domain-specific cognitive ability that processes social information. Here we investigate the relationship between autistic children's mind-reading ability, or theory of mind, and the level of their behavioral deficits. Twenty-four autistic children (with varying levels of dysfunction) were tested with a Japanese version of the 'Eyes Test' (Baron-Cohen et al., 1997), a relatively non-verbal theory of mind test. The task involved judging of the mental states of others from photographs of their eyes. Results indicated that score on the 'Eyes Test' predicted participant's level of autistic dysfunction. Since mind-reading ability was not explained by age, verbal ability or general intelligence, the correlation between mind-reading ability and behavioral deficit could not be attributed to general developmental delay. Moreover, positive correlation between 'Eyes Test' score and false belief test score was also found. These results suggest that a deficit in social intelligence account for autistic disorder. Domain-specificity of social intelligence, and the validity of the 'Eyes Test' as a social intelligence test, are also supported.

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Sheets V¹, Schnitzer S², Brosnan M³ **Reproductive exchange and the decision to divorce**

Evolutionary researchers have argued that marriage is a reproductive contract (Buckle, et al., 1996; Betzig, 1989; Kenrick & Trost, 1987). Consequently, men and women are believed to evaluate mates on different dimensions: While men seek partners who are young and beautiful (cues indicative of fertility), women seek partners of status and "means" (who are capable of supporting a family). Researchers have found support for these predictions in marriage preferences and actual marriage decisions. Extending from this, we hypothesize that men are

more willing to initiate a divorce following drops in “her” reproductive fitness (due to aging or declining attractiveness) and that women are more willing to initiate a divorce following drops in “his” ability to provide economic support. Although prior researchers (e.g., Buckle, et al., 1996; Betzig, 1989) have made similar proposals, their data have been indirect (e.g., based on examinations of divorce petitions and laws). We tested our hypotheses using demographic and self-reported reasons for divorce obtained from a small survey (N=50) of recently divorced people. Both hypotheses were supported. Women over 35 were significantly more likely than younger women to have been “dumped” by their ex-husbands while women in marriages plagued by financial strain were more likely to have “dumped” their husbands (than women in marriages with fewer financial worries).

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Shellberg T' **Shouldn't we tell the freshmen the basics of behavior?**

Dazzling growth of the biobehavioral sciences (Ethology, Sociobiology, Evolutionary Psychology, Behavior Genetics, Neurobiology, etc.) has revolutionized Pope's “proper study of man” There's been a flood of research, books, and articles since the 60's, and new upperclass and graduate curricula from California to Austria. But it seems nobody's telling the freshmen. Traditional introductory psychology and sociology classes are offered everywhere, but comparable no-prerequisite intro. behavioral biology courses are virtually nonexistent. The formal behavior education of nearly all students is thus, still today, shockingly limited to the mostly abiological, often antibiological, pre-Lorenzian and pre-Hamiltonian, even pre-Darwinian perspectives typical of most introductory social science classes. It's a rare college graduate who knows what natural selection has to do with human sexual behaviors or homicide statistics, or why understanding modern evolutionary theory is critical for understanding philosophy and medicine. It's a rare pre-law student or political science major who learns anything about primate behavior, or the biology of motivation and it's a rare biology teacher who's ever had a behavioral biology class, or who could even explain the

difference between a proximate and ultimate answer. We have not provided suitable educational opportunities for most students to learn the basics of behavioral biology. Since 1980 I have been teaching a big (150 students per semester) no prerequisite, broad based introductory course in behavioral biology. Student response has been consistently very enthusiastic. From psychology and philosophy, art, and criminal justice students, to pre law, pre-education, and pre-medical majors, most students on anonymous evaluations say the subject matter of this class should be required or strongly advised for most all students. My talk will describe this course and argue for development of similar courses elsewhere.

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Soltys J¹, Thompson K¹, Brown H¹, Thompson NS¹, Pietrzak R² **Do babies' cries simulate respiratory distress?** In a series of papers, Desureau, Olson, and Thompson have generated theory, models and data that suggest that infants' cries may be deceptive communication in a novel and ambiguous sense. Cries are truthful in the sense that they convey information about real needs in the infant, but deceptive, the argument goes, because they do so by simulating respiratory distress. The theory predicts that as cries vary in the intensity of their effect on listening adults they will vary in the intensity with which they simulate interference with breathing (by long gaps between breaths) and/or hyperventilation (by panting). The theory is tested on a sample of 9 cry sequences collected by a colleague during the course of a study using the Strange Situation. The Strange Situation involves brief separations between parent and infant that often provoke vigorous crying in young infants. Independent ratings of the intensity of the cries were correlated with variations in cry duration, cry pitch, phonation, inhalation and exhalation.

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Stockwell M¹, Platek S², BurchR³, Gallup G⁴ **Variation in male sexual jealousy as a function of race**

Recent evidence has suggested that there is variation in sexual morphology and sexual behavior among different racial/ethnic groups. If

one adopts the “out of Africa” hypothesis of post-anthropogenesis migration, we might expect a variation in male sexual jealousy (MSJ) to have acted as an evolutionary pressure for variation in these behaviors associated with morphological and behavioral changes. This research compares differences in the amount of male sexual jealousy (MSJ) between races and within races as a function of current and past sexual behavior, and imaginary patterns of female pre- and post- copulatory behavior.

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Sullivan RJ1 Substance-seeking behavior (self-medication) in schizophrenia: EEA mismatch or psychological adaptation?

Evolutionary theoretical interpretations of substance-using behaviors conventionally assume a maladaptive mismatch between hedonistic domain general mechanisms and the contemporary availability of pure psychoactive substances. This presentation considers an opposing perspective, that psychotropic substance seeking is functionally organized behavior mediated by psychological adaptations that evolved in the EEA - the selective use of plant alkaloids to autoregulate CNS neurotransmitter (NT) imbalances. Hypothesized selection pressures will be discussed and include NT imbalances resulting from maladaptive affect states, stress, seasonal stress, NT depletion resulting from malnutrition, brain damage, and mental illness. This hypothesized behavioral dynamic is analogous to well documented but less complex homeostatic mechanisms that trigger the seeking of substances from the environment by organisms (e.g. salt, water, nutrients). In contrast to the variability of substance seeking behavior in non-clinical populations, schizophrenia is an ideal subject of study in that well described neurotransmitter imbalances are closely linked to specific symptoms/behaviors and are regulated by specific drugs/substances. A growing body of research not only suggests that self-medication in schizophrenia can be therapeutically effective, but also links the choice of drugs by sufferers to specific symptoms with known neurotransmitter antecedents. These nonrandom associations between biochemistry, behavior, and drug choice, are consistent with functionally organized behaviors. Problems with this hypothesis will be discussed including the significant sex-differences in substance-seeking behavior,

the distinctions between substance seeking, drug tolerance and addiction, and the issue of conflicting psychological/behavioral and physiological adaptations.

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Swan T¹, Steers-Wentzel K², Benack S³ **The evolution of worry**

Worry and its accompanying affect of anxiety are often seen as endemic problems of the modern world. We suggest that an evolutionary perspective can inform our understanding of worry, both by elucidating the ways in which worry could be an evolved adaptation and also by considering ways in which discrepancies between the ancestral and modern environments can lead to chronic and dysfunctional worry. We conducted a content analysis of the reported conscious worries of 189 young adults. Participants listed up to five things that they worry about and indicated on a Likert scale the intensity of their worry about each issue. Major categories of worries are examined in terms of how they reflect 1) issues of concern in the ancestral environment, 2) discrepancies between the ancestral and modern environment that might promote chronic or non-useful worry, and 3) gender and age-relevant concerns.

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Todd PM¹, Barrett, HC² **Judgment of domain-specific intentionality based solely on motion cues**

People readily ascribe intentions to other interacting people or animals based on their motions (e.g., “that circling pigeon is courting”), and even extend intentional description to animated moving dots (as shown originally by Heider and Simmel—e.g., “those dots are fighting”). Using motion alone allows intention judgments to be made at a distance, which could be adaptively advantageous. But do people make accurate judgments of intentions based on motion, and what specific motion cues lead to these judgments? We explored these questions in a three-person game, where two participants were told to move a dot on a computer screen to make it interact in a convincingly intentional way with the other participant’s dot, and a third participant watched the moving dots and

judged the intention being displayed. All three participants were given a monetary incentive whenever the third participant made the correct judgment, indicating that the first two participants had produced an intention-specific trajectory. The motion-producing participants were told to display intentions from a set of evolutionarily important domains including pursuit/evasion, fighting, courting, leading/following, guarding/invading, and play. We found that people are accurate at judging the original intentions from the motion trajectories alone, but do make systematic confusions between categories. The judgments can also be explained in terms of decision mechanisms that use simple cues such as relative heading, relative distance, relative vorticity, and velocity. Preliminary results indicate that children can make similar judgments of intention in this task.

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***Tucker WT* Estimating changes in infertility and voluntary childlessness over time among American men and women.** This poster investigates the prevalence of sterility and voluntary childlessness among the American population over the twentieth century. Clinical research is divided between studies indicating a secular rise in the number of men and women experiencing sterility and those finding no such trend. Researchers interested in human life-history theory wish to study trends in voluntary childlessness as a means to explore the evolutionary ecology of fertility decisions. Both groups of researchers are hampered by a general inability to distinguish voluntary from sterile childlessness in available data. This poster presents and applies a demographic method that separates the childless population into sterile and voluntarily childless components. Little support is found for a change in the background level of sterility over the last century. Change in the prevalence of voluntary childlessness over time is discussed in a life history context.

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***Umanoff D* Substance, behavioral and belief addictions as a consequence of genetic diversity within the evolution-derived instinct decision-making apparatus** I hypothesize and synthesize from

current human and animal studies an evolution-derived neurological mechanism for instinct decision-making and discuss the addiction ramifications of genetic diversity within this system. In a subgroup of organisms (people and other animals) with genetically determined critically low activity of the evaluator (the Feel O.K. System) of this mechanism, addictions of all kinds are inexorable as a result of unconscious attempts to raise the activity of this system. These addictions are derived from the instincts that intrinsically raise the activity of this system via reinforcing neurotransmitters and extrinsic chemical analogues of these same neurotransmitters (drugs) that similarly raise the activity of this system. Thus, addictions are “unintended” consequences of genetic variation of the decision-making apparatus and are all either instinct (behavioral addictions) or neurotransmitter substitute (drug) derived. The adaptive advantages of genetic diversity within this system during the era of evolutionary adaptation are discussed. Also discussed is the utility of this hypothesis for addiction related research, recovery, and public policy changes.

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Valencia A¹, Waugh C², Webster G³, Kirkpatrick L⁴ **Domain-specific self-esteem and aggression against romantic partners.** The partner-violence literature is one of the few research areas to investigate the empirical relationship between aggression and self-esteem. Most findings in this area suggest that men with low (global) self-esteem are more likely to aggress against their romantic partners (Goldstein & Rosenbaum, 1985; Collins & Read, 1990; Murphy et al., 1994, Kesner et al., 1997). However, Kirkpatrick and Ellis (in press) have argued that self-esteem comprises a collection of numerous functionally distinct, domain-specific psychological mechanisms for self-evaluation and behavior regulation, which would be expected to relate to other psychological and behavioral variables (including aggression) in different ways. In a laboratory experiment designed to test this theory, Kirkpatrick et al. (2000Bthis conference) found that distinct functional domains of self-esteem were differentially predictive of aggression: Self-perceived superiority to others predicted greater aggression, whereas self-perceived social inclusion/acceptance was inversely related to aggression. The present studies were therefore designed to examine the degree to which specific domains of self-esteem may differentially predict aggression in the

context of romantic relationships. In Study 1, self-perceived mate value of college men was positively related to violence against romantic partners. In Study 2 [in progress], global self-esteem and a variety of distinct functional domains of self-esteem -- including self-perceived mate value, superiority to others, and social inclusion -- are measured to assess the degree to which they differentially predict the use of aggressive tactics against partners in romantic relationships.

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Vallone J¹, Phelan J² **Heterozygosity, symmetry, and attractiveness among biracial and uniracial individuals.** We explored evolutionary hypotheses concerning heterozygosity and attractiveness in humans. Based on recent notions about perceptions of physical attractiveness and their relationship to developmental stability and fitness; we predicted that (a) an individual's attractiveness rating would correlate negatively with their fluctuating asymmetry, and (b) attractiveness would be positively related to heterozygosity (operationally defined by racial/ethnic background). To assess whether any relation between perceived facial attractiveness and measured fluctuating asymmetries could be ascribed to other potential covariates, five additional pieces of information were gathered (1) Age; (2) height; (3) body weight and composition; (4) handedness; and (5) blood type.

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Voracek M¹, Stieger S² **Testing evolutionary hypotheses in virtual environments: Massive evidence for male-female differences in sexual jealousy from a large-scale on-line study.** Evolutionary theories (Symons, 1979; Daly et al., 1982) predict a pronounced and universal sex differential in sexual jealousy. As compared to women, men should give more weight to cues for their mate's possible sexual infidelity than to emotional infidelity. The findings of a seminal paper by Buss et al. (1992), the first to empirically confirm this sex differential, have been repeatedly and cross-culturally replicated (as yet, in more than 25

independent samples from 8 countries on 3 continents; cf. Voracek, 1999). For the first time, we successfully replicated this finding within the "virtual environment" of the Internet. Using the extended item set from Buss et al. (1999), we conducted an on-line questionnaire study restricted to the approx. 45,000 student e-mail account holders at the University of Vienna, Austria. A large random sample (some 25,000) of this population was contacted via e-mail for study participation. 3,560 students participated (by far the largest sample ever recruited within this research area). Extensive data validity checks indicated that this sample was sufficiently representative with regard to the demographics of the broad and multifaceted underlying population. 30% of male vs. 16% of female participants chose the sexual infidelity response within the main forced-choice jealousy item as more distressing. More detailed multivariate analyses, following Buss et al. (1999) and in accordance with the findings therein, lend clear support to the evolutionary hypothesis, not to a competing one (viz., the sexes different beliefs about conditional probabilities of sexual/emotional infidelity), to account for this sex differential.

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Waugh C¹, Webster G², Valencia A³, Kirkpatrick L⁴ **Aggression and the domain-specificity of self-**

esteem: Replication and extension. In a recent laboratory experiment, Bushman & Baumeister (1998) found narcissism, but not (global) self-esteem, to predict aggression in response to an "ego threat." Based on an evolutionary theory of self-esteem as a collection of functionally distinct, domain-specific psychological mechanisms for self-evaluation and behavior regulation (Kirkpatrick & Ellis, in press), Kirkpatrick et al. (2000--this conference) conceptually replicated this study, adding several self-esteem scales chosen to represent some of these hypothesized domains. A measure of perceived superiority to others was positively related to a behavioral measure of aggression, whereas measure of perceived social inclusion was inversely related to aggression. The present study is as an extension of Kirkpatrick et al. (2000) in which the domain of another hypothesized dimension of self-esteem, mate value,

is made salient. Pairs of same-sex participants wrote essays in competition to be chosen by an opposite-sex partner for participation in a subsequent joint task. They then exchanged essays with their competitors, and received (bogus) negative or positive feedback that ostensibly would also be seen by the opposite-sex partner. Aggression was measured as the amount of hot sauce allocated to the competitor in a subsequent (bogus) taste preference task (McGregor et al., 1998). We hypothesize that (1) the results from Kirkpatrick et al. (2000) regarding perceived superiority and social inclusion will be replicated; and (2) a measure of self-perceived mate value will also positively predict aggression in response to negative feedback.

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Webster G¹, Waugh C², Valencia A³, Kirkpatrick L⁴ **The stability of self-esteem: A function of domain-specificity?** Previous research by Kernis and colleagues (1991, 1993) has shown that people differ not only with respect to the average level of (global) self-esteem, but also with respect to the stability/instability of self-esteem across time; moreover, average level and stability are only moderately intercorrelated, and correlate differentially with other variables. Based on an evolutionary-psychological theory of self-esteem (Kirkpatrick & Ellis, in press), according to which self-esteem is conceptualized as a collection of numerous functionally distinct, domain-specific psychological mechanisms for self-evaluation, we hypothesized that (1) stability of global self-esteem will correlate differentially with average levels of self-esteem in distinct domains; (2) self-esteem in some specific domains will be more stable than in other domains; and (3) the stability of self-esteem, particularly in certain domains, will differ as a function of current mating status. In the present study, college student participants completed a set of questionnaire measures to assess current levels of self-esteem in multiple domains, and later completed (abbreviated) measures of these same constructs (via the internet) on 8 different occasions across a five-day period. Stability of self-esteem within each domain is assessed as the standard deviation of measures across time. These stability estimates are

then examined with respect to their variability across domains, their correlations with Time 1 measures, and the degree to which they differ on average between mated and unmated individuals. [Data collection is in progress at the time of this writing.]

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*Weiss E*¹ **Inferring Kennewick Man's behavior from CT- scans**

Kennewick Man is one of the very few early Holocene (post-Ice-Age, circa 9000 yr BP) skeletons found in North America. His antiquity, his Caucasoid facial features, and an arrowhead lodged in his hip immediately catapulted him to celebrity status. As a graduate student with expertise in computer tomography (CT-scans) working in the same department as Professor Jerome Rose, who is part of the government team examining Kennewick Man, I was asked to examine cross-sections of Kennewick Man's femur (thigh bone) and determine both his robusticity and what type of activities he engaged in. Throughout life, bones experience external and muscular forces to which they respond and so avoid breaking. Which muscles are used and how much can be determined by examining bones. Comparing cross-sectional ratios from three locations on Kennewick Man's femur with previously published data, I found his femur was most similar to Amerindian hunter-gatherers and that he was transitional in robusticity between Pleistocene (Ice-Age) and Holocene populations. Kennewick Man appears to have behaved like other Holocene hunter-gatherers -- hunting small animals and gathering wild vegetables. My analyses also indicated that Kennewick Man engaged in some big game hunting like his Pleistocene ancestors.

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*Zineddine AI*¹, *BurchR*² *Platek S*³, *Gallup G*⁴ **Differences in occupational schedules can predict sexual jealousy.** Men and women do not differ in the amount of sexual jealousy they experience, but they do differ in what motivates it. Male sexual jealousy (MSJ) is most often associated with the fear that one's female companion will engage in

extra pair copulations (EPC's). Using questionnaires, we assessed the reactions of men and women to imaginary but likely scenarios in which the degree of a partner's sexual and/or emotional dissociation from the relationship varied. Comparisons between the sexes are consistent with others' findings that men more often fear sexual infidelity and women more often fear emotional infidelity. These findings are discussed in the light of variations in selective pressures and evolutionary differences in sexual strategies.

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Symposium

Evolutionary Analysis in Law

**Organizer: Society for Evolutionary Analysis in Law
(SEAL), Owen Jones**

At its most fundamental level, law is a mechanism for regulating human behavior. To encourage human behavior to move in directions it might not otherwise go on its own, law uses a combination of incentives, including rewards (such as tax credits) and punishments (such as incarceration). The effectiveness of law often depends on the model of human behavior on which legal policy-makers rely in tailoring incentive programs to various desirable or undesirable behaviors. That model cannot be complete without an evolutionary perspective on how and why the human brain biases the probability of different behaviors as a function of variations in environmental conditions. This symposium will present several views on the benefits of thinking about legal issues from an evolutionary perspective.

Jones O[i], **Evolutionary analysis in law: Prospects for applied evolutionary psychology**

Because it is charged by society with changing aspects of behavior in human populations, law is a potential arena for applied evolutionary psychology. Without doubt, however, there are more ways to misapply an evolutionary perspective than there are to apply it wisely. We know, for example, that descriptions of how or why people may behave as they do can never serve, alone, as justifications for their behavior. But because the normative goals of law are often already well-formulated (for example, the law is charged with trying to reduce the incidence of child abuse and sexual aggression) evolutionary thinking may help the law to achieve pre-articulated goals more efficiently. This talk will explore some of the ways by which evolutionary thinking might legitimately do that.

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Judge D' **When gender-blind law isn't: Demography, sex differences, and legal outcomes for women and men.**

Legal transformations in America from the early colonial period to present included movement away from laws that were explicitly pegged to gender. In some cases, gender blind law preceded normative behavior - for example, intestate egalitarian inheritance between sons and daughters preceded normative equality by decades. Other such changes often occurred only after prolonged social agitation -- such as the case with married women's property acts. However, gender neutral law does not necessarily result in gender-neutral outcomes. When demographic

processes are sex specific and/or the sexes exhibit inherently different behavioral preferences, gender blind laws may not result in similar outcomes for women and for men. In this presentation I discuss the often unintended outcomes that result from inherent sex differences interacting with "gender-neutral" legal structures. "Sex-specific" and "gendered" legal outcomes are distinguished because outcomes differ depending on the roles of particular individuals, and those roles, while typically falling to one or the other sex, may not be universal. Examples of gendered outcomes include those resulting from property law, probate law and intestacy statutes, family law, and tort reform. A common basis of sex specific outcomes arises from the broad ramifications of male and female reproductive life histories. If the goal of legal reforms is equality of the sexes under law, true sex differences in demographic experience and in behavior must be explicitly recognized and incorporated into legal reform.

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***Thomson JA* Darwin goes to court: Principles of an evolutionary forensic psychiatry and psychology**

There is now a substantial body of work in evolutionary psychology and psychiatry about human nature and psychopathology that can be applied to forensic psychology and psychiatry. This new knowledge lends itself to basic principles which, if kept in mind by the forensic clinician, can act as a universal acid against illusions, bad theories, and wishful thinking about human nature. These principles protect the forensic clinician from either dehumanizing the defendant or minimizing violence. They broaden the formulation of a defendant's actions. Only if the expert witness can come to terms with some of the terrible aspects of human nature and their adaptive significance, can he or she offer objective assistance to a defendant, his legal counsel, and those empowered to render justice. The author will outline the basic tenets of an evolutionary forensic psychology and psychiatry and illustrate them with actual case material.

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***McGinnis J* Constitutive Law and the Human Constitution**

This paper offers a framework for applying evolutionary biology to constitutional law. Serious thinking about constitutionalism has always

revolved around the question of what is the nature of man. The Framers of the United States Constitution premised their work on their view of humans' innate self-interest, altruism, and inequality. Other social theorists from Rousseau to Marx defended their very different views of the proper constitutive mechanisms for society on the basis of different claims about these same human characteristics. Today evolutionary biology is providing us with the information to make a more independent and objective assessment of the elements of human nature relevant to politics. Five windows of analysis--general evolutionary theory, the natural history of man, the anthropology of universal man, primatology, and the evolutionary study of the animal kingdom as a whole--can through a process of triangulation illuminate the disputes over conflicting political claims about human nature. By way of example, I suggest that these methods show that the Framers were more accurate than Rousseau in their assessment. Humans, like many other animals living in groups, have two innate modes of acquiring resources from other members of their species that live in proximity--through exchange or through their position in the social hierarchy. A good constitution provides mechanisms that encourage individuals to use the axis of exchange rather than the axis of hierarchy to obtain resources, because this leads to a more productive and less conflict ridden society.

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Symposium

Is the Mind Made for Murder?

Organizer: Society for Evolutionary Analysis in Law (SEAL), Thomson,

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Murder is as old as man. There have long been theories of homicide attributing its occurrence to social learning, culture, and psychopathology. The most widely known evolutionary analysis views

homicide as the extreme, not necessarily intended, end of a continuum of normal violent responses to conflict, which shares common motives, causes, and risk factors with non-lethal violence. David Buss and Joshua Duntley, in contrast, see murder's ancient history, persistence, patterns, and prevalence as evidence suggesting mechanisms in the mind specially designed to yield the death of a human. Buss and Duntley propose mechanisms that are sensitive to a range of environmental inputs. Particular situations trigger the emotions that fuel the deadly behavior. Their proposed homicidal mechanisms are calibrated by experience, and they contain cost-benefit computations, self-assessment procedures, decision rules, and deception capacities. And, as part of their support for the idea that homicide is sufficiently pervasive to constitute both an adaptation and a selection pressure, they observe specific anti-homicide mechanisms of the mind. This symposium will focus on the theory and evidence for specific homicide mechanisms of the mind. The two researchers will present their theory and their latest empirical research. Two commentators and the audience will respond, evaluate, and discuss. Is the theory sound? Does the evidence support it?

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I. *Duntley JD¹, Buss D²* The killers among us: A co-evolutionary theory of homicide

Why do humans kill other humans? We argue that existing theories of homicide provide inadequate answers to this question. We propose a comprehensive co-evolutionary theory of homicide that details a number of specific psychological adaptations selected to solve unique adaptive problems. These include adaptations to kill rivals, opposing coalitions, infants, stepchildren, and mates. Homicidal fantasies provide not merely a window into killer psychology, but are central functional components of our psychological homicide adaptations. Cognitively costly premeditation's about killing are triggered by evolutionarily recurrent adaptive problems for which homicide was a possible solution, and serve to mobilize attention, produce cognitive simulations (scenario-building), evaluate costs and benefits, rehearse strategies of enacting a kill, and motivate actual homicides. Because of the dramatic fitness costs to victims (it's bad to be dead), selection

has forged co-evolved psychological anti-homicide adaptations. Some killer adaptations, such as those that motivate killing to prevent getting killed, are simultaneously anti-homicide adaptations. Killer psychology, in turn, co-evolved to be sensitive to social contexts in which the costs to the killer were minimized. After presenting new empirical studies that support specific predictions from the theory, we address objections to the theory, including (1) that the costs of killing would have been too high for a psychology of homicide to have evolved; (2) that homicide occurred too infrequently to be acted upon by selection; (3) that there were many alternative strategies other than killing for solving the same adaptive problems; and (4) that killings are more parsimoniously explained as epiphenomenal byproducts of evolved mechanisms designed for non-lethal coercive control.

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II. *Wrangham R*¹ **An Ape Perspective on Human Intra-Specific Killing**

Ape-human comparisons can help evaluate the evolutionary status of design for killing.

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III. *Napoleon Chagnon*¹ **Most Anthropological Evidence Doesn't Support Homicide Modules**

Ethnographic evidence on the conduct of violence/warfare in the remaining, well-studied, unacculturated tribesmen is scant, but what there is indicates that conflicts between individuals and small groups of individuals (local groups, bands) usually becomes intentionally lethal only within a range of reasonably well understood cost/risk/benefit situations. Growing amounts of archaeological evidence for prehistoric homicide does not necessarily support a homicide module hypothesis.

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IV. *Buss D, Duntley JD* **Reply and Discussion**

Symposium

The Organization of Literary Meaning

Organizer: Joseph Carroll

The four papers in this symposium concern themselves with connecting adaptive behavior and literary representations. Our common starting point is a set of basic problems: What functions do adaptive models serve? How do represented behaviors compare with actual or primary behavior? How are elemental or universal human behaviors inflected by specific environmental and cultural conditions, and how do these inflections enter into literary meaning? Since mental models differ from person to person, how do literary representations cope with differences among characters, author, and audience? Scalise Sugiyama offers a direct adaptive explanation for models--the idea that representations contain information relevant to fitness--and she takes food acquisition as her test case. Easterlin emphasizes the way elemental fitness behaviors are radically inflected by cultural traditions such as literary genre and period. Storey proposes an adaptive explanation for amusement laughter and argues that literary representations dissociate laughter functions into conventionalized generic forms distinct from ordinary experience. Carroll argues that authors create literary meaning by establishing relations among their own mental scenarios and those of their characters and audiences.

Scalise Sugiyama M[i] **Food for thought: The role of narrative in human subsistence**

In previous papers, I have proposed that narrative emerged in human prehistory as a kind of virtual reality: by simulating the human environment, it enables us to acquire information useful to survival and reproduction without undertaking the costs and risks of first-hand experience. Two classes of information integral to the pursuit of fitness are subsistence and social information. If narrative is indeed a means of

storing and transmitting such knowledge, we would expect the stories of our Pleistocene ancestors to be brimming with it. Unfortunately, they left no records for us to examine. A facsimile is at hand, however: the oral traditions of modern foragers, whose living conditions approximate those which produced the *Homo sapiens* mind. This paper presents the results of a survey of story collections from four geographically and culturally distinct foraging societies: the Apache, Crow, Selknam, and Yanomamo. Approximately 600 stories were analyzed for subsistence information content (social information content will be analyzed in a companion study). Results suggest that, indeed, hunter-gatherers use narrative as a conduit of subsistence-related information.

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***Easterlin N'* Archetypes, ambivalence, and literary meaning in Hans Christian Andersen's 'Little Mermaid'**

Much sociobiologically informed literary interpretation implicitly assumes that psychological norms shaped by the ancestral environment will provide direct keys to the meaning of cultural artifacts, including literary works. This view is problematic because it leaves out current environmental influences. Using the specific example of Andersen's "Little Mermaid," this paper demonstrates that environmental (i.e., cultural) influences are fundamental in shaping meaning in a literary text. Any story has numerous universal features, and in the case of this tale two such features are the maiden figure and basic narrative structure, yet these universal features are not correlated with fixed meanings. The maiden-mermaid (and, earlier in Andersen's tale, the child-mermaid) do indeed elicit interest because they are connected with universal adaptive and developmental issues such as fertility and sexual receptivity, helplessness, power, etc. However, drawing on mermaid lore, this essay demonstrates that symbols like the mermaid, though dependent on universal formal properties, only gain meaning in their specific cultural context. Attention to Andersen's cultural/historical period and to the story itself suggests that the mermaid's outsider status is her most meaningful quality, and that the story's preoccupation with the relation of outsider to dominant group as well as its ambivalence about self-other relationships is consistent with literary romanticism, itself the product of the massive industrial, social, and political shifts consequent on the Enlightenment.

Jobling I' **The hero story as a human universal: Using evolutionary psychology to understand literary universals**

The usefulness of evolutionary psychology and sociobiology for the study of literature is that, by enabling us to understand the universal architecture of the human mind, they enable us better to describe and account for literary universals, that is, those aspects of narrative that appear cross-culturally. One such literary universal is the story of the hero, in which a superhumanly strong man who represents a moral ideal defeats an incarnation of evil. As I show through an examination of three examples of hero/villain stories drawn from unrelated cultures: the Grimm folktale, *The Two Brothers*, the African epic *Sundiata*, and the Blackfoot Indian "Blood-Clot-Boy". This type of story is rooted in our evolved mental architecture in several ways.

Sociobiologists like Richard D. Alexander and Robert Trivers, along with social psychologists, have argued that people have a tendency to overestimate their altruism and ability to control the world, or, to use Trivers' word, their "benefectance". They have hypothesized that we engage in this type of self-deception because it is adaptive. Alexander says it is adaptive to deceive oneself about the extent of one's altruism because believing oneself to be altruistic helps one convince others that one is, and people are more likely to want to form mutually beneficial cooperative relationships with people who are altruistic than with those who are not. Furthermore, Shelley Taylor and Jonathon Brown suggest that people who believe that they can control the world make more of an effort to control it than those who do not. The reason for the universal popularity of the hero that he represents our fantasy of a supremely benefectant self, one that is able to conquer all adversaries and who behaves with perfect altruism.

Moreover, we attribute good and evil natures to the hero and villain, respectively. These attributions are caused by the mental tendency called "essentialism" by Gelman et al. which disposes us to believe that objects have an internal, innate, and unchangeable essence which causes them to be what they are. Beyond this, the attribution of an evil essence to the villain is motivated by our tendency to demonize those who are in competition with us. As Krebs and Denton have argued, this type of

demonization is adaptive because it gives moral justification to aggressive action against them.

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***Carroll J'* Scenarios of female mate choice in five novels of female development**

A relatively naive form of sociobiological literary criticism consists in examining fictional texts and pointing out that the characters follow certain basic patterns of behavior in areas such as survival, status seeking, mate selection, reproduction, parent-child interaction, and nepotism. Psychologically more sophisticated interpretive efforts have extended this list to include other topics in mainstream psychology such as the theory of emotions, development, and individual differences in personality. The most advanced form of sociobiological criticism integrates the analysis of represented behavior with the analysis of specifically literary structures such as verse forms, the organization of narrative, tonal organization, the use of symbolic motifs, and the manipulation of point of view. I shall argue that this latter category--point of view--has a special status. Literary representations are communicative acts, and meaning is always meaning for some specific person, from some specific point of view. Drawing on Antonio Damasio and E. O. Wilson, I shall designate literary representations as “scenarios” or interpretive models of reality, and I shall argue that literary meaning emerges out of the interaction from among three sets of scenarios: the author’s own (generally privileged) version of truth and reality; the versions formulated by the characters depicted, and the version implicitly attributed to the putative audience. The author negotiates with the divergent and often conflicting meaning systems of his characters, and he or she negotiates simultaneously with the expectations, values, sympathies, and antipathies of his or her putative readers. To illustrate these claims, I shall be comparing five novels that depict the personal development of young women: Austen’s Pride and Prejudice, Bronte’s Villette, Cather’s O Pioneers!, Bennet’s Anna of the Five Towns, and Hardy’s Tess of the d’Urbervilles. These novels have been chosen to illustrate specific differences in the authors’ relations to their subject.

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WORKSHOP

Participants: Kimber Haddix, UC Berkeley; Monique Borgerhoff Mulder, UC Davis; Hillard Kaplan, Univ. New Mexico; John Bock, Univ. New Mexico.

Topic: Evolutionary Demography

This workshop is to be a forum for a discussion about the contributions that human evolutionary ecology stands to make to the field of demography. We will begin by reviewing the many areas of overlap between the two fields, both topical and methodological. We will follow with a discussion of the main areas of research (both current and future) in human evolutionary ecology that stand to bear on demography, including on fertility transitions, embodied capital/economic evaluations of the costs and benefits of children within the family, and male-female conflict and its impact on fertility transitions. We will also discuss the obstacles to collaboration with demographers, and possibilities for overcoming them. Finally we will discuss specific predictions that evolutionary ecologists can make about key demographic patterns, and the general utility to demography of a predictive theoretical framework like human evolutionary ecology.

Symposium

The Battle for Human Nature: A Thirty Year War

Organizer: Ullica Segerstrale

In the "environmentalist" climate of the mid-20th century, attempts to explain human behavior based on evolutionary principles met with hostility from parts of academia, although they often fascinated non-academics. After the 1960's popular ethological books, it was sociobiology's turn to be put on the Index. Beyond race and intelligence - two issues sometimes desperately connected to sociobiology by the critics - an especially sensitive issue was that of sex roles and behavior. Any scientific suggestion of innate sex differences was typically treated as a moral crime, or as representing "politics by other means." In anthropology, evolutionary reasoning touched on yet another taboo: that of the Noble Savage, with consequent condemnation of those researchers whose field studies suggested otherwise. But behind the moral and political upheaval also lurked cool-headed academic strategizing: for Gould and Lewontin, at least, the sociobiology controversy represented "science by political means." In a changed climate, the conflict about evolution and human behavior has now - at least in principle - moved to address serious scientific matters, and projected future disputes may involve such issues as algorithms Vs epigenetic rules.

Irons W' **Tales from the front: How the thought police banned my human sexuality course.**

This presentation recounts events that occurred at Northwestern University in the fall of 1988. A young woman associated with the Women's Center who was enrolled in my course "The Evolution of Human Sexuality" filed a complaint with the Dean's Office charging me with sexual harassment. I was called into the Dean's Office and handed a dated list of statements I had allegedly made in the course. The young women claimed these statements created a hostile and intimidating educational environment. The list was very imaginative and bore limited relationship to anything I had actually said. I was told to provide the Dean's Office with a written explanation of why I had said these things. I was also told that I should not try to discuss the issue directly with my accuser, and that I should not retaliate in any way. Eventually the charges were dropped, but Following University policy, a record of the accusations was placed in my personnel file. I never taught the course again. In my evaluation, this was a clear-cut instance of censorship of ideas. I think it is especially strange that the ideas censored are ideas

that only a minority of members of the Northwestern Community find objectionable. Why does the University put such power in the hands of a few ideologues? Whatever became of academic freedom?

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Chagnon, N.1 The Noble Savage has no biology and evolutionists who think so should be repudiated.

My 35 years of field studies of the Yanomamö Indians ended in 1999 when I retired from UCSB. Intensifying chronic opposition to my research and especially my field research made it clear that the costs and risks of continuing far outweighed the benefits. Applying evolutionary theories to the behavior of ordinary people often draws sharp criticism and opposition from non-evolutionary academics, but applying it to the Noble Savage, as the Yanomamö have become, provokes often hysterical condemnation and active

interference in attempts to conduct field studies, including provoking natives to violence. Published work also becomes the target of extraordinary, non-academic attacks, even in professional academic journals. This presentation will briefly review the history and nature of the opposition to my research by some anthropological colleagues, Salesian (Catholic) Missionaries, the Academic Left, and most recently, local politicians and radicalized native Amazonian peoples in areas adjacent to or near the Yanomamö region in Venezuela and Brazil.

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Seegerstrale U¹ Politics by scientific means and science by political means: critical strategies in the sociobiology debate

It is now 25 years since the beginning of the sociobiology controversy. Critics like the Sociobiology Study Group (SSG) saw E. O. Wilson and other sociobiologists as doing "politics by scientific means," and the sociobiologists responded by turning this allegation back on the critics. But there is another interpretation of the activities of Wilson's two main scientific critics, Gould and Lewontin. Although they shared the political view of the SSG, for them the sociobiology debate was a way to pursue their own academic interests, in a move which might be called "science by political means." For Gould and Lewontin, academic controversy was

a Trojan horse for introducing anti-adaptationist thinking into scientific discourse at a time when it had little intellectual support and might have been easily dismissed. Later, the Trojan horse could be dismantled and anti-adaptationist argumentation stand on its own.

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Fetzer J **Future conflicts in evolution and psychology**

As political and ethical conflicts surrounding sociobiology recede, many conceptual and theoretical conflicts remain. Developments in this domain represented by Sociobiology(1975), Genes, Mind and Culture (1981), TheAdapted Mind (1992), and Consilience (1998), for example, exemplify ambivalence over problems of biological determinism, theoretical reductionism, ad free-will/determinism, even while displaying a general tendency toward increasingly broad conceptions of gene-culture co-evolution, which permit distinctions to be drawn between lower species, whose behavior is largely determined by their genes, and higher species, whose behavior is strongly affected by their cultures. Extensions of sociobiology may be expected to accent the role of cognitive versatility by building upon distinctions between mentality, intelligence and rationality as individual abilities that transcend even the role of culture. The tendency toward the invocation of Darwinian algorithms should shift back toward reliance on epigenetic rules as their theoretical strengths and weaknesses become adequately understood. The behavioral plasticity typifying the higher species will increasingly be regarded as a complex effect of individual cognitive abilities against a background of genetic and cultural factors predisposing specific organisms toward particular forms of behavior without thereby determining them.

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Symposium

Strong Reciprocity and Human Sociality: Game Theoretic Models and Empirical Tests

Organized and chaired by: Herbert Gintis

Experimental economists and other social scientists have documented an important form of human behavior that has been inadequately analyzed by behavioral scientists. In public goods, ultimatum, and other games where players gain from cooperative behavior, agents have a predisposition to cooperate and to undertake costly punishment of defectors, even when this behavior cannot be justified in terms of traditional equilibrium and learning concepts assuming selfish preferences. In everyday life, similar behaviors are commonly expressed in actions such as personal revenge and spontaneous collective action. We call this 'strong reciprocity.' Strong reciprocity is distinguished from Robert Triver's reciprocal altruism and tit-for-tat behavior in repeated games by the fact that strong reciprocity is not self-interested reciprocal behavior---it does not depend on the prospect that prosocial behaviors will be repaid by their beneficiaries.

Alvard M[i] **Cooperative big game hunting**

The Prisoner's Dilemma (PD) has dominated game theory research on cooperation because it presents challenging obstacles to cooperation while at the same time provides a good model for understanding reciprocity. The PD, however, is not the best paradigm for understanding all types of cooperation involved in large game hunting. Models of synergistic mutualism differ from the PD in the relative payoffs for cooperators and defectors. Mutualism is favored when *not* cooperating inflicts a cost on the cheater. Mutualism more closely matches the payoffs common to cooperative big game hunting. I present payoff data

from a study of the cooperative hunting practices of traditional Indonesian whale hunters of the village of Lamalera. Traditional whaling vessels are manned by crews of eight to 14 or more. Prey are dispatched with ~6m long bamboo harpoons tipped with iron points. The primary prey are sperm whales and ray. The alternative to whaling is hook-and-line or net fishing with small boats called *sapã*, accomplished alone or in teams of two. The data support the hypothesis that cooperative big game hunting at Lamalera is mutualistic. Analysis of 863 whale hunts indicates that returns from cooperative whaling are greater than *sapã* fishing.

Noncooperative *sapã* fishing returns are ~0.36kg/hr per person (N =800 fishing trips). Cooperative whaling returns are ~0.67kg/hr and 0.0kg/hr if attempted alone. Strong norms of share distribution ensure equity for hunt participants. The implications are discussed in terms of other hypotheses to explain hunting such as Costly Signaling Theory.

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***Ensminger, J'* Learning cooperation in the market--evidence from experimental economics in Kenya**

This paper is based upon recent data from experiments run in Kenya with the pastoral nomadic Orma. We know from innumerable experiments carried out in the US and other developed societies that individuals demonstrate more cooperation, trust, and fair-mindedness than would be predicted by game theoretical assumptions. Generally, however, experimental economists have not paid a great deal of attention to the demographic characteristics of the individuals who play some strategies over others. This paper presents data from the ultimatum bargaining game and the dictator game, which together give us a picture of the degree to which people are opting for fair play over narrow economic self-interest. The most striking finding is that those who have cash income from wage work or trade tend to play disproportionately more fair-mindedly. The theoretical argument presented here for such behavior turns on the greater advantages of reputational effects in the market, which reward trustworthiness and cooperation. In such a climate, those who develop a reputation from fair-mindedness may be signaling their trustworthiness and cooperative character. Further, it is argued that such characteristics are difficult to “shut off” even in the context of an anonymous one-shot game with no reputational

consequences.

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*Smith EA*¹ **Signaling generosity and willingness to punish**

Individually costly cooperation and enforcement of cooperative norms has been documented repeatedly in experimental and ethnographic contexts. These findings cannot be explained through standard forms of conditional reciprocity, but a variety of alternative explanations are currently under investigation. One such alternative involves costly signaling, wherein individuals honestly advertise their underlying qualities via acts whose costs (or benefits) are quality-dependent (e.g., lower-quality signalers pay higher marginal signal costs). I outline a game-theoretical model in which the costs incurred by acts of unconditional cooperation and punishment of non-cooperators serve as signals of the actor's ability or motivation to bear the costs of cooperation or punishment of non-cooperators. Observers benefit by using this information to make strategic decisions concerning interactions with signalers, as well as from the collective goods (including enforcement of prosocial norms) included in the signal. Signalers benefit via these changes in observer behavior. This model generates a number of predictions, including: (1) generosity signals underlying qualities or abilities that are valued in allies or mates, or that deter competitors; (2) partners (and third parties) use signals of generosity as an assay of commitment to an ongoing cooperative relationship; (3) punishment of non-cooperators signals qualities and intentions in a manner similar to the first two predictions; (4) punishment establishes a reputation that deters future free-riders; (5) increased group size enhances signaling benefits (by increasing the size of the audience, and hence broadcast efficiency).

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*Marlowe F*¹ **Sharing Among Hadza Hunter-Gatherers**

Compared to most animals, humans exhibit an unusually high degree of cooperation. One example is the extensive food sharing typical of hunter-gatherers. Explanations for this food sharing include 1) nepotism, 2) tolerated theft, and 3) reciprocity of three types: a) not-in-kind trade, b) showing off/costly signaling, and c)

delayed, in-kind exchange. If reciprocity was important over a long period of human evolution, we might expect norms of fairness to be fairly universal. To test this I conducted an experiment, using games that measure one's propensity to share, in an egalitarian hunter-gatherer society, the Hadza of Tanzania. In these games, the Hadza made less generous offers than people in state-level societies, and offers were lower the smaller the camp. Here I evaluate the explanations for food sharing in light of these results and data on Hadza foraging, which reveal something about motivation. I argue that several factors are involved and that tolerated theft is responsible for much of the outside household food sharing among foragers.

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Patton JQ¹ Social contracts, ultimatums, and reciprocal fairness in the Ecuadorian Amazon

Analysis of cross-cultural data for the ultimatum game indicate that proposers in the game are generous beyond what rational economic logic would predict, supporting the notion of an innate logic based on reciprocal fairness. In this paper, data collected in 1998 are reported from Conambo, a tribal community in the Ecuadorian Amazon. Conambo is comprised of two ethnic groups who share a common hunting, fishing, gathering, and horticultural lifeway, but each group apparently plays the ultimatum game using different standards of reciprocal fairness. I argue that differences in performance are not due to contrasting cultural values, or economic factors, but to differences in coalitional structures. First, I present data on the strengths of social contracts within Conambo and use these data to define coalitional boundaries. Second, I report a significant positive correlation between average social contract strengths and the amounts offered by proposers in the ultimatum game. And third, I present data to argue that the ultimatum game results correspond with observable patterns of cooperative behavior in Conambo. I conclude by arguing that coalitional differences in performance in the ultimatum game reflect different perceptions of trust, that is, members of the coalition with lower average social contract strengths have lower expectations that acts of cooperation will be reciprocated in the future which result in lower standards as to what offers in the game denote fair play.

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Panel

**The use of evolutionary biology in
understanding religion:
Promising beginnings and/or dangerous
directions?**

Organizer: Daniel Kriegman

Moderator: Irvén DeVore

Kriegman O' **Evolutionary analysis of intergroup conflict and
coalitional aggression:
Positing universal human psychological mechanisms for group
formation and conflict**
From our study of our closest primate relatives (Wrangham & Peterson,

1996) through all known human history (Keeley, 1996), coalitional aggression has been a central part of the story of our species. Virtually all authors who attempt to understand this tragic feature of our natural history posit a major role for religion and/or strongly held ideologies. Richard Alexander noted the ways in which religions helped define an ingroup and an outgroup. John Hartung has exposed the genocidal nature of the foundation of Judeo-Christian theology (the Bible) and its ingroup biased religious moral system. MacDonald has tried to develop an understanding of a specific religious grouping, Judaism, from an evolutionary perspective. Kriegman & Kriegman have presented a more general theory regarding the selective pressures created by coalitional aggression and the need for a mechanism--such as religion--to foster ingroup cooperation in the larger context of ongoing outgroup brutality. In this view, the innate tendency to form and adopt an ideology is a proximate mechanism by which humans form restricted identity groups. The specific characteristics, forms, and boundaries of these identity groups are determined, in large part, by environmental pressures, including the existence and behavior of other groups. Brief summaries of these views will be presented and contrasted to provide a framework for discussion.

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Kriegman D' Kevin MacDonald and the Jews: Hard medicine to swallow, or a delicious gift to Saint Stephen (J. Gould)?

In a recently published trilogy, Kevin MacDonald has attempted to apply an evolutionary analysis to understanding Judaism, anti-Semitism, and intergroup conflict. His controversial analysis concludes that Judaism is a "group evolutionary strategy," i.e., a set of ideological structures and behaviors that have resulted in (reworded slightly from MacDonald): (1) Jewish resistance to genetic and cultural assimilation with surrounding populations; (2) Jews engaging in resource and reproductive competition with gentile host societies; (3) high levels of within-group cooperation and altruism among Jews; and (4) eugenic efforts directed at producing high intelligence, high investment parenting, and commitment to group, rather than individual, goals.

Anti-Semitism, within his theory, derives from the fact that: (1)

Jewish cultural separatism results in both Jews and gentiles developing stereotypically negative attitudes toward outgroup members and the culture of the outgroup; (2) resource and reproductive competition between groups has been a common component of Jewish/gentile relationships; (3) because of Jewish within-group cooperation and altruism, as well as eugenic and cultural practices tending to result in high levels of intelligence and resource acquisition abilities among Jews, Jews are highly adept in resource competition with gentiles (MacDonald 1994). Can these conclusions be supported by the data and the theory? Is MacDonald's approach a reasonable application of evolutionary logic to intergroup conflict? Or is it an example, of precisely the kind of self-deception predicted by MacDonald's own theory when one group tries to "understand" the other? And, if so, is it just the kind of gift for which Stephen J. Gould lies in wait?

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Panel Discussants: Kevin MacDonald, John Hartung, Richard Wrangham
Symposium; Hominid Transitions

Organized by: The HBES Program Committee

***Laden, G.* 'With this handaxe, I thee wed? The origin and evolution of human pair bonding and food sharing may be visible in the archaeological record.**

A striking feature of humans is the ability to "have" without "holding" life-history critical resources, often following sometimes considerable investment in those resources. The fitness-enhancing products of tool making and foraging are not co-opted by dominant individuals, but are incorporated in systems of sharing and reciprocity that are highly elaborated in humans, and that rely on the capacity to *invest*, and subsequently *to protect investment via socially mediated contractual or cooperative behavior*, in contrast to protection by direct defense. I argue that the same capacity facilitates the formation and maintenance of primary sexual access (pair bonds). This capacity extends to the control of resources distant in space, including absent mates and "owned" resources. I propose that the identification of any aspect of this behavioral system--pair bonding, complex food sharing, protection of

investment, symbolic behavior (art?)-- would be strong evidence for the existence or at least nascent emergence of all of the other aspects of this nexus of behaviors. I propose that investment and investment protection is visible in the archaeological record. I argue that handaxe industries are the earliest manifestation of this capacity, and subsequent changes in the archaeological record indicate further evolution of this nexus of behaviors. Finally, I assert that this capacity allowed exploitation of an increasingly diverse range of habitats, accounting for the impressive biogeographical exploits of the genus *Homo*.

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***Stanford CB*¹ Significant Others: Chimpanzees, bonobos and the five cherished myths of human behavioral origins.**

In this paper I will bring recent research on great apes to bear on five cherished myths of human behavioral evolution. These include the myths of 1) the clumsy biped, 2) the savanna model, 3) the hunting/scavenging dichotomy, 4) heat-seeking males versus coy females, and 5) the Monolithic Paleolithic. I argue that evolutionary psychologists tend to rely on outdated and models of human evolution when they seek support for hypotheses about human cognitive and behavioral adaptiveness. The EEA (Environment of Evolutionary Adaptedness) is often conceived of simplistically as the CMD (Cave Man Days) for the purpose of formulating hypotheses. I will argue that the use of meat was a central feature of the evolution of humanity and discuss its role in the explosion in brain size that has occurred in the hominid lineage.

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Symposium

Darwinian History

Organizer and Chair: Laura Betzig

Pinker S' **The Blank Slate, the Noble Savage, and the Ghost in the Machine**

Why does talk of human nature inspire such fear and loathing in so many people? I suggest that it challenges three deeply held beliefs: the blank slate (the mind has no innate structure), the noble savage (people are naturally good), and the ghost in the machine (behavior is not caused by physical events). The beliefs are thought to undergird indispensable moral values, and challenges to the beliefs are therefore thought to challenge the values. If the mind has innate structure, then different people (or races, classes, or sexes) could have different innate structures, justifying discrimination and oppression. If evils such as rape, greed, or prejudice are innate, that would make them natural and hence good, or at best unchangeable, making attempts at social change futile. If behavior is caused by physical events in the brain, people could not be held responsible for their actions, unleashing endless Twinkie defenses. And if our values and choices are mere reflexes of an evolutionarily shaped, genetically programmed brain, they would be shams and life would be stripped of meaning and purpose. I show that the fears are based on non-sequiturs. Egalitarianism is the moral decision to ignore group statistics in judging individuals, not an empirical claim about sameness. The naturalistic fallacy (natural = good) is a fallacy. Responsibility is a moral policy about consequences of behavior, and is no more undermined by genetic or evolutionary explanations of behavior than it is by environmental ones. And the meaning and purpose that people ascribe to life are not compromised by explanations of the ascribing process.

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Wright R' **Human nature and the direction of history**

Does human cultural evolution have a direction? Was the rise of social organization from the level of the hunter-gatherer village to the current, global level virtually inevitable? In recent decades it has been unfashionable to posit such directionality. One reason is political-a reaction against the horrors of Nazism and Stalinism, both associated with directional, even teleological, theories of history. But another source of resistance to directional cultural evolutionism lies in a misconception about human nature: a view of human psychology that minimizes the role of status competition within societies and is implicitly group-selectionist. This

view lives on in anthropology textbooks today, decades after evolutionary biologists first argued persuasively that individual-level selection far surpasses group-level selection as a factor in the genetic evolution of human nature.

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Sulloway F' **Darwinian psychohistory: Principles and prospects**

Versions of psychohistory based on psychoanalytic theory have largely been discredited, based on the accumulated criticisms directed at that theory as well as the critical reassessments of previous attempts at psychoanalytically "reconstructed history." Given the demise of psychoanalytic theory, can Darwinian theory provide a more solid foundation for psychohistory? This talk outlines some of the basic principles that ought to characterize a Darwinian form of psychohistory, including those pertaining to family dynamics, between-family influences, nonfamily influences, and contingent experiences.

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Symposium

The Nature of Psychopathy

Organizer: Martin Lalumière¹, Chair: Linda Mealey²

Psychopathy refers to individuals with a long history of antisocial behavior and an interpersonal style characterized by glibness, manipulativeness, and callousness. Traditionally, psychopathy has been seen as a mental disorder and a disease, but more recent theoretical approaches, informed by game theory, have offered an alternative view: Psychopathy might represent a life-history strategy that was adaptive in the EEA. This symposium will address two questions derived from a selectionist perspective on psychopathy. The first is whether psychopathy is best described as a continuous trait or as a discrete type. This question will be addressed with taxometric analyses involving a large sample of

dangerous offenders and a large sample of school-aged boys. The second question is whether psychopathy shows features of an evolved design. This question will be addressed by examining indicators of developmental instability among psychopathic and nonpsychopathic offenders and by examining the victim choice of psychopathic and nonpsychopathic sex offenders.

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Quinsey VL1 **Measurement and conceptualization of psychopathy**

The principal measures of psychopathy among criminal offenders will be described, with emphasis on the Revised Psychopathy Checklist. The correlates and predictive validity of psychopathy suggest how the construct should be conceptualized. Two central theoretical issues concerning psychopathy remain to be resolved: (a) whether it is dimensional or categorical and (b) whether it is best conceptualized as an adaptation or a pathology.

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Skilling TA¹ **Serious antisocial behavior in children: Evidence of an underlying taxon**

A life-long pattern of antisocial behavior is seen in a small group of individuals. In longitudinal studies, about 5% of subjects are responsible for over half the offenses recorded for the whole cohort. It has recently been argued that this group of offenders is not just different in degree from other offenders but is different in kind--that it constitutes a taxon. If this is true, it is likely that the class can be identified in childhood.

Taxometric analyses were applied to several measures of antisocial behavior in children: DSM-IV Conduct Disorder, the Psychopathy Checklist--Youth Version, and the Childhood and Adolescent Taxon Scale. Participants were 1111 school-aged boys from a community sample of students who were participating in a study on bullying.

Taxometric analyses gave evidence of an underlying taxon for all three measures of antisocial behavior. Data gathered from the same sample on a measure of somatic complaints, hypothesized to be a continuous

dimension, yielded no evidence of a taxon, strengthening the conclusion that a taxon underlying serious antisocial behavior can be demonstrated in children. Implications for understanding antisocial behavior in adults are discussed.

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Lalumière ML **Developmental instability and psychopathy**

Recent theoretical models suggest that psychopathy may not be the outcome of defective developmental processes but may instead be a life strategy of social defection and aggression that was reproductively viable in the EEA. An adaptationist view of psychopathy suggests that it should show evidence of evolved design. The concept of developmental instability was used to test this suggestion. Developmental instability refers to an individual's degree of resistance to environmental and genetic stressors during development and its indicators provide an index of developmental health. In Study One, we obtained data on prenatal, perinatal, and neonatal sources and signs of developmental perturbations from the clinical files of 800 male offenders. In Study Two, we measured a sign of past developmental perturbations, fluctuating asymmetry, in 40 male offenders and 31 male nonoffenders. Psychopathy was assessed with the Revised Psychopathy Checklist. Psychopathic offenders scored lower than nonpsychopathic offenders on obstetrical problems and fluctuating asymmetry and were similar to nonoffenders with regard to fluctuating asymmetry. These results support the view of psychopathy as an evolved life strategy.

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Harris GT **Psychopathy as a viable strategy: Empirical tests with sex offenders**

The idea that psychopaths execute what has been a viable life history strategy has implications for the psychological make up of sex offenders. Not all sex offenders are psychopaths and this hypothesis predicts that psychopathic sex offenders' sexual preferences and victims systematically differ from those of sex offenders who are not psychopaths. Specifically, psychopaths are expected to prefer victims and activities associated with higher reproductive likelihood. I will present

results from a large-scale followup study of incarcerated sex offenders. Data on the age and sex of victims and laboratory data on sexual interests will be used to evaluate the hypothesis that psychopathy has been a viable life strategy, while many paraphilic sexual disorders have not. A tentative two-pathway model of sexual aggression will be discussed.

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Symposium

Infectious Causation of Mental Illness

Organizer: Paul Ewald

Torrey FE¹ *Infections, cats, and schizophrenia*

There is strong evidence that non-genetic factors are involved in the etiology of schizophrenia. The evidence includes the fact that the pairwise concordance rate among monozygotic twins is only approximately 30 percent, and that both winter birth and urban birth are risk factors for developing the disease.

Infectious agents have been considered as possible etiological agents for schizophrenia since the end of the 19th century. Studies of viral antibodies, antigens and genomes in schizophrenic sera and CSF have yielded mixed findings. Recent research has suggested that an infectious agent transmitted by domestic cats may be involved. This would be consistent with the epidemiology of schizophrenia and the domestication of cats. In addition, two studies have reported that individuals with schizophrenia had more exposure to cats in childhood than matched controls had. Current research is focusing on toxoplasmosis as a possible agent. Three studies have found increased levels of toxoplasma antibody in the serum and CSF of individuals with schizophrenia. Toxoplasmosis is also known to cause schizophrenia-like symptoms in some individuals and to alter dopamine and other neurotransmitters. Finally, some antipsychotic

medications effective in schizophrenia are also known to suppress the toxoplasma parasite.

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Leckman JF **Obsessive-compulsive Disorder: Evolutionary and Developmental Perspectives**

Evolutionary biology provides a potentially powerful framework for understanding disease pathogenesis in psychiatry and should permit the integration of new knowledge from a broad range of scientific disciplines. Obsessive-compulsive disorder (OCD) usefully illustrates the value and limitations of evolutionary perspectives. OCD is an etiologically heterogeneous condition that affects 1 to 3% of the population. The clinical features of OCD can include obsessions about harm befalling self or close family members. Similar worries occur normally and likely to have had adaptive value by ensuring the well-being and reproductive success of family members. For example, some obsessional worries closely resemble normal parental preoccupations that surround the birth of a new family member. In a recently completed empirical study semi-structured interviews were used to determine the presence of anxious intrusive thoughts associated with harm avoidant behaviors at three time points with 41 expectant parents. Consistent with our hypothesis the content and character of these worries were found to resemble the symptoms of OCD. These preoccupations peaked for both mothers and fathers close to birth and were readily distinguished from symptoms of depression and generalized anxiety. While these findings are consistent with an evolutionary point of view, they are not a direct test.

In a related series of studies we have examined the emergence of obsessional traits in early childhood. Specifically, a parent-report questionnaire, the Childhood Routines Inventory, was developed to assess compulsive-like behavior in young children, and was administered to 1,492 parents with children between the ages of 8 and 72 months. The frequency of compulsive-like behaviors changes with age: Two-, 3-, and 4-year-olds engaged in more compulsive behavior than children younger than 1 year of age and older than 4 years of age. This developmental view-point complements an evolutionary perspective with regard to OCD.

Finally, evolutionary explanations, while difficult to test, have a

strong heuristic appeal and may provide useful clinical insights by deepening the clinician's understanding of the origins of certain forms of developmental psychopathology.

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Cochran GM1 Evolution and Infectious Causation of Mental Illness

An evolutionary analysis suggests that the most common and serious mental illnesses are likely to be caused by pathogens, essentially because natural selection purges harmful human genes much more effectively than harmful parasite genes. This argument extends to many common maladaptive behavioral syndromes that are not generally considered mental illnesses.

Infectious causation of some mental illnesses, such as neurosyphilis and AIDS dementia, are firmly established. Other mental illnesses have been linked statistically to infection, though infectious causation is still being debated. Bipolar disorder has been linked to borna disease virus. Schizophrenia has been linked to borna disease virus, toxoplasmosis, and herpes viruses. Pediatric obsessive-compulsive disorder has been linked to streptococcal infection. Chronic fatigue syndrome has been linked to borna disease virus. Alzheimer's disease has been linked to *Chlamydia pneumoniae*.

Hypotheses proposing infectious causes of mental illnesses are often dismissed without evidence against them, and in spite of substantial evidence supporting them. Evolutionary considerations add credibility to hypotheses of infectious causation, and therefore support greater investments in research efforts to evaluate them.

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Symposium

Reproductive Effort: Trade-Offs in Mating and Parenting

Organizers: Mary Shenk and Geoff Kushnick

Presenters: **Geoff Kushnick, KG Anderson, Mary Shenk, and David Nolin (co-authored paper with Michael Alvard)**

Behavioral ecology contributes to the study of reproductive effort (the summed allocation of resources to mating and parenting) by examining the costs and benefits of allocatory decisions given prevailing physical and social environmental conditions. This approach assumes that human reproductive strategies have been shaped by natural selection to produce adaptive phenotypes in a wide range of contexts. The papers in this session represent theoretical and empirical applications of this perspective to a range of issues relevant to anthropology, demography, and evolutionary theory including parent-offspring conflict, stepfathering as mating effort, dowry inflation, and the relationship between parental investment and food sharing.

Kushnick GC1 Parent-offspring conflict models: prospects for use in human behavioral ecology field studies

Parent-offspring conflict (POC) models provide a promising framework for understanding human reproductive effort, yet the difficulties of confronting the models with data have impeded progress on this front. In this paper, I modify an existing model of optimal interbirth interval to incorporate the logic of POC and show how such a model might be used in a human behavioral ecology field study. My discussion is guided by a characterization of POC models that reveals that only a specific class of these models may be profitably applied to the human case. My characterization of POC models focuses on the following questions: (a) is it a battleground or resolution model?; (b) if a resolution model, who wins?; (c) how is parental investment operationalized?; (d) is the conflict inter- or intra-brood?; (e) what relevant parent and offspring attributes are included?; and, (f) what technique is used to find the optimal solution?

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Anderson KG 1 The life histories of American stepfathers in

evolutionary perspective²

This paper presents an analysis of the characteristics of men who become stepfathers, and their subsequent fertility patterns and lifetime reproductive success. Because women who already have children are ranked lower in the marriage market than women without children, men who marry women with children (e.g., stepfathers) are likely to have lower rankings in the marriage market as well. Using retrospective fertility and marital histories from the Panel Study of Income Dynamics (PSID), I show that men who become stepfathers have lower levels of education, less income, and are more likely to have been divorced before and to already have children, all characteristics that lower their rankings in the mating market. Men with one or two stepchildren are just as likely to have children within a marriage as non-stepfathers, although men with three stepchildren show decreased fertility. Among men age 45 and older, stepfathers have lower lifetime fertility than non-stepfathers, although the difference disappears when men's age at first marriage is controlled for. Additionally, stepfathers have significantly higher fertility than men who never marry. The results suggest that some men become stepfathers to procure mates and fertility benefits that they would otherwise have been unlikely to obtain; for these men, raising other men's children serves as a form of mating effort.

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2Postdoctoral competition.

Shenk, M1 Evolutionary and economic determinants of dowry inflation

In 1996, Hillard Kaplan published a general evolutionary model of fertility and parental investment which allows the generation of predictions regarding level of parental investment and fertility given information on the shape of the relationships of parental investment to child mortality and adult income. This paper begins by presenting a modified version of Kaplan's model which incorporates investment in two sexes of offspring. Some general implications of this model for differential investment in sons and daughters are explored. The model is then adapted to the specific case of parental investment in urban South India. Predictions are generated regarding the level and type of investment in sons versus daughters, and the phenomenon of South Asian dowry inflation is

discussed in relation to these predictions. Finally, some comparison is made with predictions generated from traditional economics models of dowry and investment in child quality.

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Nolin D¹ Alvard M² **Resource sharing and growth of offspring in Lamalera, Indonesia**

Studies of parental investment strategies often focus on resource allocation among existing or potential future offspring within the household. However, allocation of resources outside the household can have a positive effect on the fitness of offspring if there exists a system of reciprocal sharing between households that reduces household resource variance over time. If sharing is occurring then resource differences between sharing households should be reduced while those between different groups of sharers should be more pronounced, and these patterns should be reflected in the fitness of offspring. We test this hypothesis using anthropometric data collected in the whaling village of Lamalera, Indonesia during the active hunting season of May through August 1999 on children ranging in age from 0 to 18 years. Using genealogical and residence data to relate individual children to primary producers, we find that differences in children's rates of growth do not correlate with differences in their individual household harvests.

However, the average rate of growth of children within a higher level grouping of households does strongly and positively correlate with the per capita harvest in those groupings. These findings agree well with data on food sharing in the village. This research was supported by grants from NSF (SBR-9805095) and the Office of the Vice President for Research, SUNY-Buffalo.

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