Chapter 1

Notes

Please note that the location of the lecture theatres means that it will take about 5 minutes to walk between the Bloomsbury Theatre, the Gustav Tuck theatre, and the Cruciform building. This means that you are advised to choose which session you wish to attend and change sessions only at breaks, if you do not want to miss any talks. Switching mid-session is possible between Cruciform Lecture theatres 1 and 2 as these two theatres are directly adjacent. However, please use the back entrances if entering either of these theatres in the middle of a session.

NI means entrant to New Investigator competition
PD means entrant to Post-Doctoral competition
A means talk added to organised symposium by the organising committee.

Timetable

Thursday morning plenary **Bloomsbury**

Note	Time	Presentation
	9.00	Perrett, D.I, Little A.C., Tiddeman B.P, Penton-Voak I.S, Burt D.M, Schmidt N, Jones B.C., Oxley R, Kinloch N, Barrett L. **Facial attractiveness judgements reflect learning of parental characteristics.**

1 Thursday morning sessions

1.1 Sexual signals and mate value Chair: D. Singh **Bloomsbury**

Note	Time	Presentation
	10.30	Singh, D. **Cross cultural data validates waist-hip ratio and female attractiveness hypothesis**
	10.50	Tovee M.J, Cornelissen P.L, Hancock P.J.B, Warren T.T.L. **Human female attractiveness: waveform analysis of body shape**
	11.10	Jones B.C, Little A.C, Penton-Voak I.S, Burt D.M, Perrett D.I. **Fluctuating asymmetry and perceived health when viewing faces**
	11.30	Rhodes, G., Halberstadt J. **Why are average faces attractive?**
	11.50	Domb L, Pagel M. **Sexual swellings advertise female quality in wild baboons**

1.2 Reproductive scheduling and fitness Chair: J. Kent **Gustav Tuck**

Note	Time	Presentation
	10.30	Kent J.P. **Ecological constraints and marriage patterns in rural Ireland: changes over time**
	10.50	Jasienski M, Jasienska G. **Disappearing density-dependence of birth rates in post-war Poland: a new secular trend?**
NI	11.10	M.Gibson. **The impact of a labour-saving technology on first birth interval in rural Ethiopia**
	11.30	Grainger S. **Differences in age at first reproduction between social classes**
	11.50	Allal N, Sear R, McGregor I.A, Mace, R. **An evolutionary analysis of age at first birth for rural Gambian women**

1.3 Evolution of co-operation Chair: J. Patton **Cruciform 1**

Note	Time	Presentation
PD	10.30	Patton J. **Political influence as a motivation for meat transfers in a small-scale Amazonian society**
NI	10.50	Price M.E. **Punitive sentiment as an anti-free rider psychological device**
NI	11.10	Holland J.T. **The influence of varying levels of co-operation history, chance of reciprocation and certainty about this information on co-operative behaviour**
	11.30	Hess N, Hagen E. **The effects of female coalitions on resource allocation: two more experiments**
	11.50	Panchanathan K, Boyd R. **Reputation, indirect reciprocity, and the evolution of co-operation**

1.4 Child psychology and attachment Chair: J. Davis **Cruciform 2**

Note	Time	Presentation
PD	10.30	Davis J.N. **Explaining inter-individual differences in food preferences, or, how to get children to like their vegetables**
PD	10.50	Barrett H.C. **Sleep, death, and danger: Has natural selection shaped young children's judgment and decision-making abilities?**
PD	11.10	Browne D. I **"Cuckoo in the Nest" - Exploring the relationship between foster parents' children and their foster child**
	11.30	Brown S. **Selective investment theory: an alternative ethological account of attachment**
	11.50	Gall J.A, Weisfeld G.E. **Olfaction-mediated recognition of and affinity for kin of different degrees of consanguinity**

Thursday afternoon plenary **Bloomsbury**

Note	Time	Presentation
	1.30	Steels L. **Evolutionary language games with humanoid robots**

2 Thursday early afternoon sessions

2.1 Evolution of language I Chair: D. Dennett **Bloomsbury**
(Symposium organized by Robert Aunger)

Note	Time	Presentation
	2.50	Dennett D. **Why don't bacteria have language?**
	3.10	Harnad S. **Evolution of language: the innate, the learned, and the social**
	3.30	Mareschal D. **Rethinking the emergence of complex representations**
	3.50	Noble J, Quinn M. **Using evolutionary simulations to model the origins of communication and language - a cautionary tale**

2.2 Evolutionary economics Chair: T.Burnham **Gustav Tuck**

Note	Time	Presentation
	2.50	Burnham T.C. **How Charles Darwin will help Adam Smith**
	3.10	Monnot M, Monnot C.L.III **Machiavellian intelligence – performance across an organization**
	3.30	Wang X.T. **Risk distribution, risk perception, and risky choice**
NI	3.50	Marsh K. **Sustainability and the evolution of environmental preferences: the blurring of subjective values and objective reality over evolutionary timeframes**

2.3 Aggression and homicide Chair: M. Wilson **Cruciform I**

Note	Time	Presentation
	2.50	Daly M, Wilson M. **Income inequality and homicide rates in Canada and the United States**
	3.10	Beckerman S, Boster J, Erickson P, Jaramillo L, Regalado J, Yost J. **The reproductive consequences of endemic warfare.**
	3.30	Hilton N.Z, Harris G.T, Rice M.E. **The functions of aggression by male teenagers**
	3.50	Hiraiwa-Hasegawa M, Hasegawa T, Irie, S. **Motives of male-male and male-female homicide: what changes and what does not change through time**

2.4 Sexual behaviour Chair: M.Davis **Cruciform 2**

Note	Time	Presentation
	2.50	Singh, D, Davis M, Randall P. **Flaunting ovulation: lower WHR, enhanced self-perceived attractiveness, and increased sexual desire**
	3.10	Baptista A, Brites J, Santos R. **Sex and sex-role differences in sexual fantasies: evolutionary and cultural explanations**
	3.30	Brase G.L. **Jealousy in relationships: integrating sex and personality differences**
PD	3.50	Cvorovic J. **Polygyny and tolerated male homosexuality**

3 Thursday late afternoon sessions

3.1 The role of synergy in the evolution of complexity Chair: J Maynard Smith **Bloomsbury**
(Symposium organized by Peter Corning)

Note	Time	Presentation
	4.40	Maynard Smith J. **Introductory remarks**
	5.00	Corning P.A. **The emergence of "Emergence": Now what? The answer (in a word) is Synergy**
	5.20	Szathmáry E. **Synergy and the major evolutionary transitions**
	5.40	Richerson P. Boyd R. **Evolutionary constraints on the exploitation of synergy and social complexity**

3.2 Cognitive adaptation Chair: P Todd **Gustav Tuck**

Note	Time	Presentation
	4.40	Lieberman D.L, Tooby J, Cosmides L. **Does it pay to interfere? An investigation of whether individuals are sensitive to the different costs associated with inbreeding within the family**
NI	5.00	Rigby K. **Sexual selection and concepts: sex differences in understanding novel phrases**
	5.20	Elworthy C. **The interaction between cognitive adaptations and institutions**
	5.40	Todd P.M. **The effects of recognition on a clumpy world**

3.3 Aggression and rape Chair: J.Archer **Cruciform 1**

Note	Time	Presentation
	4.40	Gottschall T, Gottschall J.2 **The reproductive success of rapists**
	5.00	Vaughan A.E. **Fertility value and the prevalence of rape**
	5.20	Blokland A.A.J, Van Wijk A.P. **The etiology of sexual delinquency within an evolutionary framework**
	5.40	Archer J, Graham-Kevan N. **Partner aggression: is mate-guarding too narrow a perspective?**

3.4 Darwinian literary criticism Chair: J. Carroll **Cruciform 2**
(Symposium organized by Joseph Carroll)

Note	Time	Presentation
	4.40	Boyd B. **Fiction as adaptation: Dr Seuss's Horton Hears a Who**
	5.00	Carroll J. **Ecocriticism and evolutionary psychology**
	5.20	Easterlin N. **Wordsworth's Lucy poems and the Dual-Process Model of Grief**
	5.40	Gottschall J, **The Rape of Troy: A Darwinian perspective on violence in Homer's epics**

Thursday evening

7.30-9.30	**Poster session (with wine) South Cloisters, Eisai Lounge, Marquee**

Friday morning plenary **Bloomsbury**

Note	Time	Presentation
	9.00	Barker D.J.P. **The fetal origins of adult disease**

4 Friday morning sessions

4.1 Cultural evolution Chair: P. Richerson **Bloomsbury**

Note	Time	Presentation
PD	10.30	Coultas J.C. **Culture and conformity through an evolutionary lens**
	10.50	Kameda T, Nakanishi D. **Cost/benefit analysis of "conformity bias" in cultural transmission (2): an experimental test using interactive groups**
	11.10	McElreath, R. **How social learning maintains human variation and when natural selection wants us to learn socially: a population study from East Africa.**
	11.30	Gil-White F. **Finding the boundaries of 'memes': The case of folk-narratives**
	11.50	Boyd R, Richerson P. **What was the Pleistocene EEA really like and how did we adapt to it?**

4.2 Prenatal influences on behaviour and fertility Chair: J. Manning **Gustav Tuck**
(Symposium organised by John Manning)

Note	Time	Presentation
	10.30	Phillips D.I.W.1 **Prenatal growth and subsequent marital status : longitudinal study**
	10.50	Ronalds G.1, Godfrey K, Phillips D.I.W. **Fetal growth and the ratio of second to fourth digit length**
	11.10	Manning J.T, Taylor R.P, Bundred P.E. **2nd to 4th digit ratio, attractiveness, and athleticism: evidence for prenatal influences on sexual selection**
	11.30	Martin S, Manning J.T., Trivers R.L, Singh D, Venkatramana, P, Henzi, P Walton, J. **2nd to 4th digit ratio and Family size in England, Jamaica, India and South Africa**
NI, A	11.50	Tortorice J. **Gender identity, sexual orientation, and second-to-fourth digit ratio in females**

4.3 Altruism Chair: R. Dunbar **Cruciform 1**

Note	Time	Presentation
NI	10.30	Silke A. **Kin-directed altruism and bystander intervention in violent assaults: findings from Northern Ireland**
	10.50	Fieldman G, Plotkin H, Dunbar R.I.M, Richards J-M, McFarland D.J. **Blood is thicker than water: humans follow Hamilton's rule**
	11.10	Bossong M. **Sex differences in inheritance patterns: how mortality cues trigger strategic responses.**
NI	11.30	Kruger D. **An integration of proximate and ultimate influences for altruistic helping intentions**
	11.50	Boone J. L, Allen-Arave W. **Is honor worth dying for? Altruism, social class and survivorship in the Titanic disaster of April 15, 1912**

4.4 Costly signalling theory and the evolution of culture Chair: C. Power **Cruciform 2**
(Symposium organized by Camilla Power)

Note	Time	Presentation
	10.30	Knight C. **Speech: an exception to the Handicap Principle?**
	10.50	Kohn M. **Hand-axes and hominid mate choice**
	11.10	Power C. **African initiation rites as mechanisms for alliance formation: reciprocity or handicap principle?**
	11.30	Watts I. **Costly display in the Middle Stone Age of Southern Africa: red ochre use and the evolution of symbolic representation**
A	11.50	Giles A. **Sexual selection, ornamentation and the archaeological record**

Friday afternoon plenary **Bloomsbury**

Note	Time	Presentation
	1.30	Connor R. C. **Male dolphin alliances in Shark Bay, Western Australia**

5 Friday early afternoon sessions

5.1 Evolution of Individual Differences Chair: S.Gosling **Bloomsbury**
(Symposium organized by Samuel Gosling and Alexander Weiss)
Individual differences I.

Note	Time	Presentation
	2.50	MacDonald K. **Three levels of an evolutionary perspective on personality**
	3.10	Figueredo A.J, King J.E. **The evolution of individual differences in behaviour**
	3.30	O'Gorman R.1, Wilson D. **Individual differences, social norms, and the performance of task-oriented groups**
	3.50	Buss D.M. **Navigating the psychological topography of individual differences**

5.2 Nutrition and reproduction Chair: U. Mueller **Gustav Tuck**

Note	Time	Presentation
	2.50	Mueller U, Mazur A. **Evidence of unconstrained directional selection for male tallness**
	3.10	Sear R, Mace R, McGregor I.A. **The effects of maternal phenotypic condition on fertility and child mortality in rural Gambia**
	3.30	Hagen E.H, Barrett H.C, Price M.E. **Social correlates of health and nutrition in a Shuar village**
	3.50	Aiello L.C, Key C. **The energetic consequences of being a *Homo erectus* female**

5.3 Mental health Chair: R. Nesse **Cruciform I**

Note	Time	Presentation
	2.50	Nesse R.M, Keller M.C. **A central Darwinian algorithm: the role of mood in regulating allocation of effort among goals**
	3.10	Pillmann F. **Gender differences in the incidence of unipolar depression from an evolutionary perspective**
	3.30	Navarrete C.D., Kurzban R, Fessler D.M.T. **Anxiety and world-view defense: terror-management or coalition psychology?**
PD	3.50	Fessler D.M.T. **Pseudoparadoxical impulsivity in restrictive anorexia: an evolutionary perspective**

5.4 Evolution of language II Chair: J. Hurford **Cruciform 2**

Note	Time	Presentation
	2.50	Hurford J.R. **The neural basis of predicate-argument structure**
	3.10	Brighton H, Kirby S. **The survival of the smallest: prerequisites for the cultural evolution of compositional syntax**
	3.30	Martell C, Schoenemann P.T. **Modeling evolution of language without "mind reading"**
	3.50	Schoenemann P.T.1, Martell C.2 **A neural net model of word learning in children that does not require language-specific innate constraints**

6 Friday late afternoon sessions

6.1 Individual differences II Chair: A. Weiss **Bloomsbury**

Note	Time	Presentation
	4.40	Sulloway F. **Darwinian strategies in ontogeny: toward a family dynamics model of individual differences**
	5.00	Grant V. **Characteristics of achieving women**
	5.20	Mealey L. **Behavior genetic tools for studying human universals**
	5.40	Weiss A, King J.E, Enns, R.M. **Subjective well-being in chimpanzees is heritable and genetically correlated with dominance**

6.2 Parental investment and sex ratio Chair: R. Hames **Gustav Tuck**

Note	Time	Presentation
	4.40	Hames R, Draper P. **Women's work, child care and helpers at the nest in a hunter-gatherer society**
PD	5.00	Lummaa V. **Trade-off between current and future reproductive investment in pre-industrial Finnish mothers: consequences of offspring number, gender and survival**
	5.20	Leonetti D.L, Nath D.C, Hemam N, Rende Taylor L. **Is female-biased parental investment evident in two culturally different low caste Indian ethnic groups?**
	5.40	Norberg K. **Cads and kids: paternal investment and the sex ratio at birth in the United States, 1970-1998**

6.3 Evolution of technology Chair: R. Aunger **Cruciform 1**
(Symposium organised by Robert Aunger)

Note	Time	Presentation
	4.40	Aunger R. **Artifacts: evolving evolvability**
	5.00	Webb R.H. **Managing the evolution of technology**
NI	5.20	Lewens T. **Technological evolution: good news and bad news**
A	5.40	Wolpert L. **Toolmaking and the origin of causal beliefs**

6.4 Evolution of language III Chair: J. Hurford **Cruciform 2**

Note	Time	Presentation
	4.40	Smith K. **Key learning biases for the cultural evolution of communication**
	5.00	Reed P, Dickins T.E, Dickins D.W. **First stimulus equivalence class formation, second symbolic behaviour?**
	5.20	Smith A.D.M. **The role of shared meaning structure in communication**
	5.40	Yamauchi H. **Baldwin boosterism and Baldwin skepticism in evolution of LAD**

Friday evening: Keynote address (after Banquet in William Beveridge Hall, Senate House)

Note	Time	Presentation
	8.30	John Maynard Smith **The evolution of animal signals**

Saturday morning plenary **Bloomsbury**

Note	Time	Presentation
	9.00	Jobling M.A. **History and prehistory through the analysis of the Y chromosome**

7 Saturday morning sessions

7.1 Population history: genes, language and culture — Chair: R. Mace — Bloomsbury

(Symposium organized by Ruth Mace, Clare Holden and Stephen Shennan)

Population history I: genes

Note	Time	Presentation
	10.30	Pagel M. **Prospects for the study of population history: genealogical and phylogenetic perspectives**
	10.50	Thomas, M. **Genetic evidence for an Anglo-Saxon replacement of male Britons in England but not Wales**
	11.10	Zerjal T, Wells R.S, Yuldasheva N, Ruzibakiev R, Xue Y, Qamar R, Mohyuddin A, Ayub Q, Mehdi S.Q, Tyler-Smith, C. **History from genetics: a Y-chromosomal legacy from the Mongols**
PD,A	11.30	Chikhi L. **Admixture between farmers and hunter-gatherers during the Neolithic transition in Europe: evidence from Y chromosome and mtDNA data**
	11.50	Goldstein D.B. **Contrasting male and female demographic histories with Y chromosome and mtDNA variation**

7.2 The duration of partnerships — Chair: M. Borgerhoff Mulder — Gustav Tuck

Note	Time	Presentation
	10.30	Bongard T, Røskaft E. **Factors affecting the length of relationships in Norwegian women**
	10.50	Simão J, Todd P.M. **Structural factors predict relationship stability: evidence for the Attachment Theory, against the Sexual Strategies Theory and the Strategic Pluralism Theory**
	11.10	Klusmann D. **Sexual motivation and the duration of partnership**
	11.30	Weisfeld G.E, Weisfeld C.C, Imamoglu E.O, Wendorf, C.A. **Cultural differences in the impact of number of children on marital satisfaction**
	11.50	Borgerhoff Mulder M. **Coming out of the kitchen? Serial monogamy and sexual conflict in Tanzania**

7.3 Evolutionary games Chair: M . Surbey **Cruciform 1**

Note	Time	Presentation
	10.30	Surbey M.K, Rankin A.C. **Inter-relationships between Machiavellianism, narcissism, and self-deception in predicting levels of cooperation in the Prisoner's Dilemma Game**
	10.50	Mookherjee J. **Love is a hot choice: co-operative strategies of heterosexual human pair bonds using 'real life' game theoretical scenarios**
	11.10	Ringer P, Hancock P.J.B. **What's a pretty face worth: factors affecting offer levels in the ultimatum game**
	11.30	Fetchenhauer D. **Adaptive biases in the prediction of others' cooperative and defective behavior**
PD	11.50	Rilling J. **Imaging the neural correlates of social cooperation and non-cooperation in the Prisoner's Dilemma**

7.4 Philosophy and Darwinism Chair: J. Radcliffe Richards **Cruciform 2**

Note	Time	Presentation
	10.30	Radcliffe Richards, J. **Evolved morality and the naturalistic fallacy**
	10.50	Teehan J. **Ethics after Darwin**
	11.10	Atkinson A.P, Wheeler M. **Evolutionary psychology's grain problem and the cognitive neuroscience of reasoning**
NI	11.30	Nanay B. **Evolutionary psychology and the selectionist model of neural development: a combined approach**
PD	11.50	Dickins T.E. **Evolutionary Psychology is a lot harder than we thought**

	1.30	**Posters taken down - South Cloisters**

Saturday afternoon plenary **Bloomsbury**

Note	Time	Presentation
	1.30	Hawkes, K. **Foraging, life histories and paleoanthropology: the evolution of human families**

8 Saturday early afternoon sessions

8.1 Population history II: language

Chair: C. Holden

Bloomsbury

Note	Time	Presentation
	2.50	Renfrew C. **Genetic and linguistic models of population history: the farming dispersal model and the spread of Proto Indo European**
PD	3.10	Holden C. **Bantu language trees and the transmission of cultural traits between populations**
	3.30	Gray R.D, Jordan F.M. **Austronesian language phylogenies: evaluating hypotheses of Pacific settlement**
	3.50	Jordan F.M, Gray, R.D. **Austronesian language phylogenies: how tree-like is linguistic evolution?**

8.2 Cheating: Beyond the Wason selection task
(Symposium organised by Laurence Fiddick)

Chair: L. Fiddick

Gustav Tuck

Note	Time	Presentation
	2.50	Brown W.M, Moore C. **Coevolutionary arms races and psychopath detection: testing a partner preference model**
	3.10	Cummins D, Fiddick L. **Noblesse oblige: greater tolerance for cheating among subordinates in reciprocal social contracts**
	3.30	Nunez M. **'Cheating' as a facilitating intentional context for the False Belief Task**
	3.50	Over D. E, Manktelow K.I, Kilpatrick S.G. **Mitigation, aggravation, cheating, and violators**

8.3 Reproductive ecology
(Symposium organized by Gillian Bentley)
Reproductive ecology I : fertility

Chair: G. Bentley

Cruciform I

Note	Time	Presentation
	2.50	Smith E.A. **Why do good hunters have higher reproductive success?**
	3.10	Marlowe F. **Male provisioning and female reproductive success among foragers**
	3.30	Leslie P, Winterhalder B, Weiss J. **Adaptive fertility behaviour in a stochastic world**
	3.50	Lee P.C. **The evolutionary significance of weaning: comparative patterns from primates and implications for humans**

8.4 Female mate choice Chair: D. Feinberg **Cruciform 2**

Note	Time	Presentation
NI	2.50	Pashos A. **Handsome men, not high-status men, succeed in courtship**
PD	3.10	Penton-Voak I.S. **Cross-cultural differences in attractiveness judgements of male faces: a rural Jamaican sample**
	3.30	Scott C.F, Hancock P.J.B. **Constraining choices in mate and sperm donor selection**
	3.50	Feinberg D, Jacobson A. **Human mate choice and female preferences for male voices: correlation with symmetry and sexual behaviour**

9 Saturday late afternoon sessions

9.1 Population history III: material culture Chair: S. Shennan **Bloomsbury**

Note	Time	Presentation
	4.40	O'Brien M.J. **Cladistics is useful for reconstructing archaeological phylogenies: Paleoindian points from the Southeastern United States**
	5.00	Kirch P.V. **Cultural phylogeny and the "Triangulation Method" in historical anthropology: the view from Polynesia**
	5.20	Tehrani J. **Processes of cultural diversification in the evolution of Turkmen carpet designs**
	5.40	Collard M, Shennan S.J. **Cultural practices, language affiliation and geographical distance: a cladistic re-analysis of cultural patterns on the north coast of New Guinea**

9.2 Personality Chair: L. Cosmides **Gustav Tuck**

Note	Time	Presentation
	4.40	Cosmides L, Klein S, Tooby J, Chance S. **Decisions and the evolution of multiple memory systems: using personality judgments to test the scope hypothesis**
	5.00	Camperio C.A, Ceccarini F. **The evolution and adaptive value of islanders' personality**
	5.20	Tooby J, Cosmides L, Sell, A. **Why attribute personalities to persons? The regulation of social reasoning by information about behaviour in evolutionary games**
	5.40	Ando J, Hiraish K, Senju A, Ono Y, Hasegawa T. **Adaptive importance leads to small heritability? A trial to bridge Evolutionary Psychology and Behavior Genetics**

9.3 Reproductive ecology II: hormones Chair: G. Bentley **Cruciform 1**

Note	Time	Presentation
	4.40	Bentley G.R. **Puke by fluke? Non-adaptive explanations for nausea and vomiting in pregnancy**
PD	5.00	Bribiescas R. **Reproductive neuroendocrine function among Ache men of eastern Paraguay: Implications for the evolution of male reproductive strategies**
	5.20	Jasienska G, Ellison P.T, Jasienski M. **Differences among women and variation within women (among menstrual cycles) in progesterone production: empirical evidence and implications for population and behavioral studies**
A	5.40	Christiansen K. **Physical and behavioural masculinity as correlates of male reproductive success**

9.4 Evolution of human societies Chair: S. Perloe **Cruciform 2**

Note	Time	Presentation
	4.40	Schlegel A. **The elementary structure of human society and its implications for human evolution**
	5.00	Wilson A.P, Parker S.T. **"Cultural evolution" and the eusociality continuum in human societies**
	5.20	Roes F. **The size of societies and belief in moralising Gods**
	5.40	Sidanius, J, Kurzban R. **Political psychology and evolutionary psychology**

Sunday morning plenary **Bloomsbury**

Note	Time	Presentation
	9.00	Tomasello M. **Gaze following in chimpanzees**

10 Sunday morning sessions

10.1 Evolutionary public health — Chair: J. Chisholm — Bloomsbury
(Symposium organized by James Chisholm and Daniel Sellen)

Note	Time	Presentation
	10.30	Curtis V. **Dirt, danger and desire: motivating healthy behaviour.**
	10.50	Coall D, Chisholm J. **Low birthweight: a life history theory perspective**
	11.10	Pawlowski B, Ulijaszek, S.J. **Pre-pregnancy waist-to-hip ratio, breast feeding duration and maternal social status**
	11.30	Sellen D.W. **Evolutionary anthropological approaches to improved child nutrition**
A	11.50	Hanson R. **Showing that you care: the evolution of health altruism**
A	12.10	Barkow J.H. **What does local/indigenous knowledge tell us about human evolution and psychology.**

10.2 Life history evolution — Chair: R. Mace — Gustav Tuck

Note	Time	Presentation
	10.30	Shanley D.P, Sear R., McGregor I.A., Mace R, Kirkwood T.B.L. **Evolution of the menopause: an empirical evaluation**
	10.50	Nath D.C, Leonetti D.L. **Work activities of grandmothers and reproductive success: evidence from traditional Indian women**
	11.10	Voland E, Beise J. **The impact of historical Krummhörn grandmothers on familial reproduction**
	11.30	Helle S, Käär P, Jokela J. **Evolution of human longevity: reproduce early, die young?**
	11.50	Lycett J, Voland E. **Longevity and the Costs of Reproduction in a Historical Human Population**
	12.10	Josephson S.C. **Do humans trade quantity for quality in fertility?**

10.3 Evolutionary developmental psychology Chair: D. Bjorklund **Cruciform 1**
(Symposium organised by David Bjorklund)

Note	Time	Presentation
	10.30	Bjorklund D.F, Bering J.M, Hernandez Blasi C, Yunger J. L. **Principles of evolutionary developmental psychology**
	10.50	Parker S.T. **Comparative developmental evolutionary psychology (CDEP) versus developmental, comparative, and evolutionary psychology**
	11.10	Gómez J.C. **Can apes engage in referential communication? A case study in development as exaptation**
	11.30	Smith P.K. **Phylogenetic and ontogenetic origins of theory of mind**
A	11.50	Whiting B.A. **Great apes: the mystery of the big size of the "little brain"**
A	12.10	Crow T, Williams N.A. **A theory of speciation of modern Homo sapiens**

10.4 Perceptions and preferences in mate choice Chair: N. Pound **Cruciform 2**

Note	Time	Presentation
	10.30	Burt D.M, Little A.C, Tiddeman B.P, Perrett D.I. **Effects of other's ratings on perceptions of facial attractiveness in long and short term relationships**
	10.50	Todosijevic B, Ljubinkovic S, Arancic, A. **Mate selection criteria: a trait desirability assessment study of sex differences in Yugoslavia**
	11.10	Haselton, M.G. **The sexual overperception bias: naturalistic evidence of a systematic bias in men**
	11.30	Saad G, Eba A. **Sex differences when rejecting potential mates**
	11.50	Schubert J, Curran M.A. **Appearance effects in political careers: do politicians with good genes get more votes?**
	12.10	Pound N, Wilson M. **Facial electromyography (EMG): a promising technique for assaying preferences and social cognitions**

	12.30	**Conference ends**

Chapter 2
Talk Abstracts

Thursday Morning Plenary Address

Perrett D.I.[1], Little A.C.[1], Tiddeman B.P.[1], Penton-Voak I.S.[1], Burt D.M.[1], Schmidt N.[1], Jones B.C.[1], Oxley R.[2], Kinloch N.[1], Barrett L.[2] **Facial attractiveness judgements reflect learning of parental characteristics**

We review work on attractiveness using both natural face images and images manipulated by computer graphics. These techniques allow cues to masculinity, age, health and personality to be captured in composite facial images. We find preferences for facial cues to age, personality, masculinity and symmetry differ between individuals. These differences in attractiveness judgments appear to reflect familial characteristics, hormonal status and social competition. Experience of parental characteristics shapes mate preferences in various species, yet evidence of physical similarity between parents and spouses in humans is equivocal. We investigated visual preferences for faces, which are less constrained by factors affecting actual >partnerships (e.g. competition). We found that women born to old parents (over 30) were less impressed by youth and more positive to age cues in male faces than women with young parents (under 30). For men, mother's but not father's age similarly affected female facial preferences for long-term relationships. Thus human facial attractiveness reflects learning of parental characteristics.

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1 Thursday Morning Paper Sessions

1.1 Sexual signals and mate value

Singh, D.[1] **Cross cultural data validates waist-hip ratio and female attractiveness hypothesis**

Waist-Hip Ratio (WHR) is linked to variables which affect a woman's mate value. When body weight and the size of WHR are systematically varied, men of various ages and ethnicities judge female line drawings depicting normal weight and low WHR as most attractive. Recently, some investigators have suggested that the link between WHR and female attractiveness is evident only in Western societies. To examine this issue, I collected attractiveness judgements of herder-gatherer tribes from a rural area in Southern India. I measured WHR in men and women to assess the sexually dimorphic distribution in three tribal populations. Then, men of these three tribes were asked to rate the attractiveness of photographs of nude women with known body weight, height, and waist and hip circumferences. Men from all three tribes judged the photographs as attractive if the woman had a BMI – body weight corrected for height – in the normal range, and a low WHR. These findings are strikingly similar to attractiveness judgements of these photographs by US and Austrian men. These cross-cultural findings allow examination and explanation of why some investigators have been unable to confirm the WHR and female attractiveness hypothesis.

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Tovee M.J.[1], Cornelissen P.L.[2], Hancock P.J.B.[3], Warren T.T.L.[4] **Human female attractiveness: waveform analysis of body shape**

Two important cues to female physical attractiveness are Body Mass Index (BMI) and shape (particularly the Waist-Hip ratio or WHR). To determine the relative importance of these cues we asked 25 male and 25 female undergraduates to rate a set of 60 pictures of real women's bodies in front-view for attractiveness. In our set of images, the relative ranges of BMI and WHR favoured WHR. We based these ranges on a sample of 457 women. We did not limit the WHR range, although we kept the BMI range to 0.5 s.d. either side of the sample means. As a result, WHR averaged 1.65 s.d. either side of its sample mean. However, even with these advantages, WHR was less important than BMI as a predictor of attractiveness ratings for bodies. BMI is far more strongly correlated with ratings of attractiveness than WHR. BMI is correlated at around 0.5, whereas WHR is correlated only at around 0.15-0.2 It is possible that body shape is an important cue to attractiveness, but that simple ratios (such as WHR) are not adequately capturing it. So we treated the outline of the torso as a waveform and carried out a Fourier Analysis (FA), a Principal Component Analysis (PCA) and an Independent Component Analysis (ICA) on it to allow us to quantify body shape and correlate it against attractiveness. None of the components produced by these analyses that were good descriptors solely of body shape (as opposed to body size) were more strongly correlated with attractiveness ratings than BMI. Our results suggest that BMI is a stronger predictor of attractiveness than body shape.

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Jones B.C.[1], Little A.C.[2], Penton-Voak I.S.[3], Burt D.M.[4], Perrett D.I.[5] **Fluctuating asymmetry and perceived health when viewing faces**

"Good genes" theory suggests that mate preferences reflect health. Theory also suggests that symmetry may act as a visual marker for health. Consistent with these observations are reports that facial symmetry is both *associated with*, and a *cue to*, attractiveness and perceived health. Here, two experiments are discussed that explore the nature of the association between facial symmetry and perceived health. Experiment one observed a significant correlation between symmetry (measured using a facial-metric technique) and health ratings when controlling for attractiveness. In contrast, the association between symmetry and attractiveness ratings was not significant when controlling for health. These results suggest that the association between symmetry and attractiveness is mediated by a link between symmetry and health. Experiment 2 compares health ratings of full-face photographs presented as both normal versions and digitally "warped" versions in which symmetry alone was increased. Within-subjects ANOVA (Factor 1: *level of*

symmetry: normal, symmetrical. Factor 2: *gender of face*: opposite-gender, own-gender) showed a significant main effect for level of symmetry, suggesting that symmetry is a cue to perceived health. The significant 2x2 interaction indicated an opposite-gender bias in sensitivity to symmetry when judging health, suggesting that the perceptual analysis of symmetry may be an adaptation to the problem of discriminating between potential mates on the basis of health. Results from both experiments will be discussed with reference to both the "good genes" account of the link between symmetry and attractiveness and alternative explanations.

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Rhodes G.[1], *Halberstadt J.*[2] **Why are average faces attractive?**

Average faces are attractive. Natural variations in averageness correlate with attractiveness, individual faces can be made more (or less) attractive by increasing (or decreasing) their similarity to a computer-averaged composite of multiple faces and the computer-averaged composites themselves are usually more attractive than the individual faces that compose them. We investigated two possible accounts of why average faces are attractive. The first proposes that our preference for average faces is an adaptation for finding high quality mates. We tested this account by examining whether facial averageness signalled health and developmental stability in a large sample for which objective health data were available throughout development. We found that facial distinctiveness (a converse measure of averageness) at 17 was associated with poor childhood health in males, and poor current and adolescent health in females. These results are consistent with the claim that average faces are attractive because they signal high quality mates. We also examined a second account of the preference for average faces, namely that it is a perceptual by-product of general human information processing systems. To test this account, we examined whether average exemplars are attractive for stimuli that are not potential mates. We found that average exemplars were attractive for all five stimulus classes examined: dogs, birds, wristwatches, fish and automobiles. These results suggest that humans may have a generic preference for average exemplars, consistent with the idea that the preference is a by-product of general information processing mechanisms. Taken together, the results of the two studies suggest that two distinct evolutionary mechanisms may have contributed to our preference for average faces.

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Domb L.[1], *Pagel M.*[2] **Sexual swellings advertise female quality in wild baboons**

The females of many Old World primate species produce prominant and conspicuous sexual swellings of the perineal skin around the time of ovulation. These sexual swellings have been proposed to increase competition among males for females or to increase the likelihood of a female getting fertilized, by signaling either the female's reproductive status, or the timing of her ovulation. Here we show that female sexual swellings in wild baboons reliably advertise a female's reproductive value over her lifetime, in accordance with a theoretical model of honest signalling. Females with larger swellings attained sexual maturity earlier, produced both more offspring and more surviving offspring per year than females with smaller swellings, and had a higher overall proportion of their offspring survive. Male baboons use the size of the sexual swelling to determine their mating effort, fighting more aggressively to consort females with larger swellings, and spending more time grooming these females. Our results document an unusual case of a sexually selected ornament in females, and show how males, by mating selectively on the basis of size of the sexual swelling, increase their probability of mating with females more likely to produce surviving offspring. As humans may also be one of the few species with female sexual signalling, the contexts that select for female sexual signals will be discussed.

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1.2 Reproductive scheduling and fitness

Kent J.P.[1] **Ecological constraints and marriage patterns in rural Ireland: changes over time**

The Ecological Constraints Hypotheses (E.C.H.) has been used to organising a wide range of data on marriage patterns in rural Ireland. However, a number of anomalies run contrary to the E.C.H. For example, census data show that wealthy heads of households were no less likely to be celibate than occupiers of smallholdings and the development of low nuptiality after the famine was accompanied by a substantial rise in living standards. Further, the nuptiality levels of Irish emigrants and their descendants in the USA and Great Britain were higher than the Irish in Ireland yet lower than that of the host population.

It is proposed that these anomalies can be accounted for within an ecological framework. As the 19th century progressed, after the famine, the rural Irish became more philopatric, which is associated with changes in the structure of land ownership, which tied the rural population to fixed parcels of land. The developing philopatry based social structure lead to changes in reproductive strategies, resulting in a higher rate of delayed marriage and an increase in celibacy. Evidence supporting this analysis are found in other cultures, (eg Himalayan Buddhist villages; Israeli Kibbutz populations) and is further supported by comparing the nuptiality rates of urban with rural Ireland and nuptiality rates in Irish emigrant populations. Recent evidence with animal populations support the adoption of a broader ecological based approach to account for delayed dispersal in a variety of cooperative breeding species with differing ecologies and phylogenies.

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Jasienski M.[1], *Jasienska G.*[2] **Disappearing density-dependence of birth rates in post-war Poland: a new secular trend***?*

We document here a secular trend in the degree to which an index of population growth is negatively affected by higher population densities. We have used demographic data for 49 voivodships in Poland for the years 1948 through 1988. Population density in a voivodship was calculated as the number of people per 1 squared kilometer. Voivodships of four largest cities (Warszawa, Krakow, Katowice, and Lodz) and were excluded from the analyses as

outliers. The mean voivodship density rose from 67.6 in 1948 to 102.6 people per 1 km2 in 1988. The number of children born per 1000 people in each voivodship in a given year was the focus biological variable: it declined from 32.2 (mean of 45 voivodships) in 1948 to 16.6 in 1988.
The degree of density-dependence was quantified by the regression slope of the number of children born per 1000 people with respect to density (n=45). The density-dependence slopes were calculated for each year and plotted as a time-series for the years 1948-1988. There was a pronounced and statistically significant secular trend in the values of the slopes rising from –0.121 ($r2=0.17$, $p = 0.005$) in 1948 to –0.014 ($r2=0.18$, $p = 0.004$) in 1988. Number of children born per 1000 people was thus in 1948 more strongly affected by density (i.e. declined with increasing density more quickly) than it was 40 years later, even though overall population densities were lower. Human reproduction is, therefore, affected negatively by density only when the rate of children production is high.

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Gibson M.[1] **The impact of a labour-saving technology on first birth interval in rural Ethiopia.**

Across the developing world labour-saving technologies introduce considerable savings in time and energy that women allocate to work. Hormonal studies on natural fertility populations indicate that such a reduction in energetic expenditure (rather than improved nutritional status alone) can lead to increased ovarian function. Other qualitative studies have highlighted a link between labour-saving technology and behavioural changes effecting subsequent age at marriage, which may effect fertility. This bio-demographic study has been designed to investigate whether these physiological and behavioural changes do affect fertility at a population level by focusing on a recent water development scheme in Southern Ethiopia. The demographic consequences of a reduction in women's workload following the installation of water points, specifically the within population variation in length of first birth interval, are investigated. First birth interval length is closely associated with lifetime fertility in non-contracepting populations, longer intervals being associated with lower fertility.
Using life tables and multivariate hazard modelling techniques a number of significant predictors of first birth interval length are identified. Co-variates such as age at marriage, season of marriage, village ecology, and access to improved water supply have significant effects on variation in first birth interval. When entered into models as a time-varying co-variate, access to water tap stand is associated with an immediate reduction in length of first birth interval.

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Grainger S.[1] **Differences in age at first reproduction between social classes**

Five hypotheses that explain why there are differences in age at first reproduction between social classes are presented: 1) Lower social classes end their reproductive lives earlier than higher social classes, moving the whole process forward rather than extending it, in response to the shorter life expectancy of lower social classes. 2) Lower social classes desire a larger family size. In order for this to be achieved, it is necessary to extend the reproductive life. 3) The health of lower social classes deteriorates at a faster rate than higher social classes and thus in order to reproduce at the optimal level of health, it is necessary to reproduce earlier. 4) Lower social classes need a longer period of time to recover from one birth and prepare for the next, slowing down the process of reproduction, and thus require a longer reproductive life in order to achieve the same parity as higher social class women. 5) Lower social classes suffer a higher rate of unsuccessful pregnancies slowing down the process of reproduction, and thus require a longer reproductive life in order to achieve the same parity as higher social class women. Predictions arising from these hypotheses are tested using data from the 1970 British Cohort Study and The Health Survey for England 1997. The data reveal differences in the costs and benefits, in terms of both parity at the end of reproductive life and the efficiency with which that parity is achieved, to early or late reproduction between social classes.

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Allal N.[1]*, Sear R.2, McGregor I.A.*[3]*, Mace R.*[4] **An evolutionary analysis of age at first birth for rural Gambian women**

Life history evolution theory predicts trade-offs between growth, reproduction and survival. It is expected that age at first birth should be a key transition in each woman's life, in particular when living in food-limited, high-fertility and high-mortality environments: resources which can be exclusively devoted to growth and development throughout childhood are thereafter largely channeled into reproduction until menopause occurs. Using extensive demographic and anthropometric data from four villages (Keneba, Manduar, Kantong Kunda and Jali), which were collected from 1949 to date by the MRC Gambia, we have conducted an event history analyis to identify the predictors of age at first birth in rural Gambian women. Height and BMI at age 13 significantly predicted age at first birth, while other parameters, such as parental survival, age of husband or village, had no clear effect. Further, we observed interactions between age at first birth, sex of the first born child, adult height and total completed fertility. Finally, we shall discuss the effects on age at first birth of changes which have been occuring in the villages since 1975 (better health care, education, and economic opportunities).

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1.3 Evolution of co-operation

Patton J.[1] **Political influence as a motivation for meat transfers in a small-scale Amazonian society**

In this paper, I examine patterns of meat transfers in Conambo, a small-scale tribal community in the Ecuadorian Amazon. I argue that the usual set of Darwinian motivations for cooperation such as nepotism, status gain (showing-off), costly signaling, tolerated theft, and risk management (reciprocation in kind), do not adequately explain patterns of meat sharing in Conambo. The political history of Conambo indicates that coalitions are volatile and the political landscape is hazardous to those who navigate it poorly. Historically

homicide rates are among the highest ever recorded with fifty percent of men ending their lives at the hands of another. I propose that in Conambo one of the motivations for men to transfer meat to other households is to gain political influence. Such meat "gifts" are an aspect of a political strategy to forge and shore up alliances, and are embedded within a larger coalitional psychology. In making this argument, data on alliance patterns and coalitional hierarchies are examined and used to define coalitional structures. These data are compared to patterns in household by household meat transfers, and a significant correlation between political alliance and meat sharing is reported. Coalitional differences in patterns of meat transfers also correspond to differences in coalitional structures. I will argue that returns from pursuing strategies to increase one's political influence are influenced by coalitional stability. Conambo is politically divided into two main coalitions and the coalition that is more stable exhibit patterns in meat sharing that appears to be more politically motivated.

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Price M.E.[1] **Punitive sentiment as an anti-free rider psychological device**

Research on punishment in collective action contexts suggests that collective action participants willingly accept the costs of punishing free riders. Little is known, however, about the nature of the psychological mechanism that causes the individual participant to experience punitive sentiment towards free riders. I argue that this mechanism is specially designed to reduce the fitness threat posed by free riders: the more willing one is to sacrifice for collective success (i.e., the more one is at risk of being free ridden), the more one experiences punitive sentiment towards perceived free riders. I support this argument with data from two original studies: (1) among California undergraduates, one's willingness to comply in a military draft is highly positively correlated with how much one advocates punishment of non-compliers; (2) among the Shuar of the Ecuadorian Amazon, one's willingness to participate in collective work sessions (*mingas*) is highly positively correlated with how large a fine one thinks non-participants should have to pay. I also examine a rival hypothesis for the function of punitive sentiment: that it promotes collective success by coercing others to participate in the collective action. I present data from both California and Amazonia that dispute this view.

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Holland J.T.[1]. **The influence of varying levels of co-operation history, chance of reciprocation and certainty about this information on co-operative behaviour**

Evolutionary explanations of Human Behaviour must answer the problem of Altruism i.e. Why do individuals engage in behaviour in which the reproductive costs outweigh the benefits? or how do selfish genes benefit from unselfish vehicles? Kin selection (Hamilton 1964) and reciprocal altruism (Axelrod & Hamilton 1981) can explain some examples in certain specific conditions but many apparently altruistic actions fall outside these conditions. e.g. Blood donation is anonymous and the donor has no control over who will benefit and so cannot be explained by RA or Kin selection. Indirect Reciprocal Altruism (Nowak & Sigmund 1998) suggests that people will co-operate with others based on their past co-operation history even if there is no chance of reciprocation. They donate blood so that others will see them as co-operative and co-operate with them. This was shown in humans by Wedekind & Milinski (2000) who demonstrated that history was important in decisions about co-operation even when reciprocation was impossible, supporting Indirect RA. The current study aims to more fully investigate the relationship between potential for reciprocation and history at varying levels of certainty about the validity of this information. this was done by using a game in which the Participants had to give points away, to other players based on just these 3 pieces of information. All 3 factors had a significant influence on co-operation (i.e. higher chance of reciprocation, history and certainty correlated with higher donations by Ps) and there was a significant 3 way interaction. This shows that in this limited environment of only 3 factors, humans take into account the chance of reciprocation, people's past behaviour and the validity of their social information in deciding whether or not to co-operate and that these pieces of information are asessed in a complex manner. I conclude with some suggestions for future research and suggestions for other factors that might be important in influencing co-operation.

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Hess N.[1]*, Hagen E.H.*[2] **The effects of female coalitions on resource allocation: two more experiments**

A woman's inclusive fitness is limited by her ability to acquire scarce resources such as food, status, high quality mates, allies, or information. Many of these resources are distributed by other members of one's social group, and often multiple women seek to acquire the same resources. We propose that female coalitions are more successful than lone females in gaining control over resource distribution in social groups. Gossip may be one strategy for influencing resource allocation. Accurate, negative information about a woman can reduce her value to the group, and thus her access to group resources. The strategic use of gossip would involve the organized collection and dissemination of information that causes resource providers to direct resources towards oneself and away from one's competitors. Because such collection and dissemination are facilitated when multiple actors coordinate their efforts, female coalitions should have an advantage over lone females in the competitive use of gossip. Female coalitions might also be useful in other competitive strategies, such as ostracism, physical harm, withholding information important to survival or status attainment, threats of injury to one's dependents, prevention of access to valued resources (e.g., food patches or potential mates), enforcement of costly group norms, and punishment (because the costs of punishment are diluted for multiple punishers). Two experiments explore the effects of these competitive strategies on undergraduate subjects' allocation of scarce resources to hypothetical women.

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Panchanathan K.[1]*, Boyd R.*[2] **Reputation, indirect reciprocity, and the evolution of cooperation**

Humans cooperate in large groups of unrelated individuals, a fact

that is puzzling from an evolutionary perspective. Inclusive fitness (Hamilton, 1964) and direct reciprocity (Trivers, 1971; Axelrod and Hamilton, 1981) are insufficient explanations. Inclusive fitness works in groups of closely related individuals, but the low fecundity of humans means that such groups are small. Direct reciprocity can establish cooperation under certain conditions, the most important of which is repeated interactions between pairs of individuals. Large groups of cooperating humans, however, are often not engaged in repeated interactions with specific partners. Recently, Nowak and Sigmund (1998) have presented a theoretical model of indirect reciprocity. The authors consider the 'discriminator' strategy, which selectively channels cooperation to other cooperators. Although incomplete, this model lays the foundation for further theoretical research. This paper presents a more complete model of indirect reciprocity. First, we demonstrate that, when errors are considered, the 'discriminator' strategy cannot lead to cooperation. Next, we introduce a more complex strategy, called 'reputation discriminator'. This strategy, which attends to others' actions as well as their reputations, can be evolutionarily stable. Mechanisms which increase information exchange, such as gossip, become crucial for this strategy to flourish. Cooperation can persist even when information on others' actions and reputations is incomplete. Finally, we demonstrate that the 'reputation discriminator' strategy can invade a population of defectors when rare. Although the invasion criteria are severely restrictive when compared to models of direct reciprocity, they are still plausible.

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1.4 Child psychology and attachment

Davis J.N.[1] **Explaining inter-individual differences in food preferences, or, how to get children to like their vegetables**

Why is it that many of us will reject perfectly edible, nutritious food as distasteful? The existence of this phenomenon is puzzling, and, from an evolutionary perspective seems maladaptive. While the there exist explanations for our rejection of food that has made us ill, or food associated with things we have learned to find disgusting, or for why we are initially suspicious of novel food items, there is little understanding of why, outside of these situations, most of us still don't like certain foods, why inter-individual variation exists in which foods are disliked, or why inter-individual differences exist in food preference (liking) at all. I propose an evolved human food preference mechanism based on the mere exposure effect. Despite mere exposure having been dismissed by others as an implausible mechanism governing human food preferences, the mechanism I propose is consistent with previous research on food preferences, and can account for hitherto unexplained inter-individual differences in food preferences, and I present novel empirical evidence in support of it showing how it can lead to preference shifts not only for foods that are eaten, but for uneaten foods as well.

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Barrett H.C.[1] **Sleep, death, and danger: Has natural selection shaped young children's judgment and decision-making abilities?**

In the cognitive development literature it has been suggested that young children, lacking a specific understanding of death, assimilate it to sleep. Indeed, the two states share a variety of superficial cues, such as motionlessness, proneness, etc. However, it is precisely the *differences* between sleep and death that are most important for adaptive decision-making: for example, a sleeping lion is dangerous, whereas a dead one is not. A child unaware of these differences could be prone to potentially fatal errors.

The present study, therefore, tested the hypotheses that young children should understand that sleep is reversible, whereas death is not, and more importantly, that a sleeping animal can act in response to stimulus, whereas a dead one cannot. Development of these reasoning abilities should be relatively robust to differences in culture and environment. Children ages 3 to 5 years were tested in two populations: city-dwellers in Berlin, Germany, and Shuar hunter-horticulturalists in Ecuadorian Amazonia.

Despite the numerous dimensions along which these populations differ, children in both populations demonstrated significant understanding of the adaptively relevant differences between sleep and death by age 4. These results stand in contrast to earlier claims in the developmental literature. They demonstrate adaptive judgment and decision-making skills in a domain in which 3 to 5 year olds are commonly held to have little if any knowledge, and are consistent with the theory that natural selection has shaped developmental mechanisms for knowledge acquisition and decision-making in this domain.

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Browne D.[1] **"Cuckoo in the Nest" - Exploring the relationship between foster parents' children and their foster child**

In this paper I am examining the relationships between foster children and the birth children of foster parents. When a non-related sibling is introduced to a family competition becomes more intense and the foster sibling often behaves in a very disruptive and attention-seeking manner. Additionally it is not uncommon for birth children to feel rejected. It has never been investigated whether this perceived rejection is by accident or design (conscious or otherwise). It is quite possible that some of the behaviour witnessed in foster children arriving at a new placement is an attempt to seek attention from parents who do not have a vested genetic interest in their welfare. In this paper, an effect analogous to a baby cuckoo pushing away its foster siblings to increase chances of its own survival is described.

Using detailed questionnaires and interviews information on 127 foster placements from foster parents and social workers was obtained. Statistically significant results suggest that conflict between the foster siblings and the distress of the natural children are associated with poor placement outcome. This appears to be most common in families where the natural children are younger, or of the same age as the foster child. Case studies are used to highlight the types of problems that arose.

These results offer insight into how some foster children demand attention from their foster parents that not merely equals that given to the birth children but supersedes it. Implications for the durability of foster placements and developmental literature in general are discussed.

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Brown S.[1] **Selective investment theory: an alternative ethological account of attachment**

The present investigation was designed to test Selective Investment Theory (SIT), an altruistic theory of close relationships. SIT proposes that social bonds (durable feelings of affection) emerge from fitness interdependence (mutual dependence for survival and/or reproduction) in order to promote investment (i.e., the willingness to "give" at high cost, even in the absence of reciprocity). SIT's emphasis on giving, as opposed to receiving, sets it apart from most psychological accounts of close relationships (e.g., Hazan & Shaver, 1994), and from Bowlby's (1958) theory of attachment. The hypothesis that social bonds mediate a relationship between fitness interdependence and investment was tested in a population of undergraduates who were asked, in a between-subject design, to think about either a romantic interest, a family member, or a platonic friend and then respond to questions about their relationship. We assessed the degree of fitness interdependence between participants and the target, perceptions of interdependence, bonds, and investment. Results of structural equation modeling supported the hypothesis that fitness interdependence (measured by genetic interdependence, sexual interdependence, phenotypic similarity, and common fate) predicted feelings of unconditional love and attachment, which in turn predicted the willingness to invest in the well-being of the target. Evidence for mediation was obtained for each type of relationship tested, suggesting that a similar factor-structure underlies different types of relationships. These results are discussed in terms of their implications for understanding relationship phenomena that are difficult to explain using an egoistic framework.

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Gall J.A.[1]*, Weisfeld G.E.*[2] **Olfaction-mediated recognition of and affinity for kin of different degrees of consanguinity**

Kin recognition functions in kin altruism, parent-offspring bonding, and optimizing outbreeding, inter alia. Olfactory cues are important means of kin recognition in mammals, including humans. Mothers and newborns have been found to recognize each other by odor. Fathers can recognize their newborns, but this is not reciprocal. Mothers and fathers can identify their own juvenile children. Children and adults can recognize their siblings by smell. Consanguinity seems to aid recognition, since adults can match the odors of a mother and her infant, but not of spouses. Diet also plays a role, since MZ twins on different diets were easier to distinguish than those on similar ones. In the present study, ability to identify stepchildren and half-siblings was tested. Mothers were able to distinguish their biological children from controls ($p < .001$) but not their stepchildren. Prepubertal children could identify their full siblings ($p < .05$) but not their half-siblings or stepsiblings. Considering only those subjects who had successfully identified their kin: mothers found their child's odor pleasant rather than unpleasant ($p < .001$); children tended to like the odors of full siblings ($p < .10$) but not those of half-siblings. Thus, familiarity does not always suffice for olfactory recognition. Consanguinity seems to enhance recognition. However, the fact that grandmothers and aunts have been able to recognize a newborn suggests that exposure immediately after birth may enhance identification even when consanguinity is rather low. Sex differences in target and perceiver may also be important.

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Thursday Afternoon Plenary Address

Steels L.[1] **Evolutionary language games with humanoid robots**

In many domains of human cognition we find universal tendencies: in the sounds in the world's languages, color categories and their names, grammatical structures, the organisation of space and time, pick and place movements, etc. Some researchers have explained these tendencies by calling upon innate and hence genetically evolved structures. Others have sought alternative explanations based on generic learning processes that acquire categories through interaction with the world. The talk discusses some experiments with fully autonomous embodied robots (some of them having humanoid characteristics) that follow the second line of explanation but add an additional ingredient, namely social dynamics and cultural evolution. Using the framework of evolutionary language games, it will shown how shared categorial repertoires can emerge in a population of embodied agents and how these repertoires may exhibit the same tendencies as human repertoires if enough 'natural' constraints are incorporated in the agents and their environments. Examples in this talk focus particularly on the emergence of language sounds (vowels, consonants, and syllable structures), color terms and grammar.

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2 Thursday Early Afternoon Paper Sessions

2.1 Symposium: Evolution of language 1 Organiser Robert Aunger

Dennett D.[1] **Why don't bacteria have language?**

Artificial life models can be wonderful ways of exploring dependencies in nature, especially when they show how little it sometimes takes to get a recognizable analogue of some interesting biological phenomenon up and running. There is, however, a nagging source of concern: some phenomena exist only in extraordinarily complex systems–language is a fine example–and audaciously oversimplified models of them, if they are actually "successful," pose a challenge: if language were this simple, why wouldn't bacteria have language? After all, the artificial life agents are always much simpler than actual bacteria, and the mocked up costs and benefits that pose the opportunities for the artificial agents are typically hugely oversimplifed as well–not so different from the minimalist worlds in which bacteria presumably take their chances. If simplified language evolves in this simple, artificial world for these simple artificial agents, why wouldn't it long ago have evolved for bacteria in their world? The answer to the challenge is obvious, of course. There are some (unidentified) complexities that are *tacitly presupposed by the model but outside the model*, and that the world of bacteria lacks. But this answer, while no doubt true, is expensive: it comes close to conceding that whatever the model captures has nothing

much to do with language. The task of fending off this concession will be explored in the discussion.

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Harnad S.[1] **Evolution of language: the innate, the learned, and the social**

It is hard to say what is innate in language and meaning until we have a human-scale working model of language and meaning, and we do not (we have only toy models). But we can make some educated guesses: Chomskian Universal Grammar (UG) will be innate, not learned. The capacity to categorize and name all the things that humans can categorize and name will be innate, but the categories themselves (contra Fodor) will not: with perhaps a few rudimentary exceptions, they will be learned. Most will be learned through language itself (description), but the ground-level categories will be grounded in sensorimotor learning (direct experience), guided by feedback from the consequences of miscategorization. Some of the feedback will be social feedback, but in principle there is nothing social about category learning; and naming and describing categories is only social inasmuch as both the motivation for naming and describing, and the feedback on the shared conventions for naming and describing are social. But neither language evolution nor language learning seem to be "language games" of the sort that Steelsmodels.

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Mareschal D.[1] **Rethinking the emergence of complex representations**

Research in the last 15 years has suggested that very young infants posses highly sophisticated reasoning and representational systems. Because many of these abilities are present in 4- or 5-month-olds, it has been argued that they must be innate. In neural terms, this means that the representations are hardwired prior to any environmental experience. Unfortunately, the number of neural parameters that would need to be set is vastly superior to the maximum amount of information that can be encoded in the genes. In this talk I will describe a number of neural system in which complex behaviours, similar to those of young infants, can emerge very rapidly through interactions with a representative environment. In one example, evolutionary pressures are found to improve radically the learning efficiency of the system. The implications of this work are that only the default parameter values need to be specified for the system to develop representations that are matched to the characteristic of its environment. Evolution may in fact operate only on the setting of these default values.The discussion will be illustrated with examples of phonological perception, categorisation, and object directed-behaviours.

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Noble J.[1]*, Quinn M.*[2] **Using evolutionary simulations to model the origins of communication and language - a cautionary tale**

Individual-based evolutionary simulations (e.g., those used in artificial life models) have great potential to explain the progression from non-communicative behaviour, through simple animal signalling systems, and finally to complex human language. However, to date most of these models have failed to look at the origin of communication. To explain: evolutionary biologists agree that signalling systems don't spring into being fully formed. Either an informative behaviour is exploited by nascent receivers (e.g., an intention movement), or a pre-existing response bias is exploited by would-be signallers. But simulation models have typically implemented an arbitrary signalling channel, and then looked at the conditions under which evolution (or learning) would lead to its effective use. This usually means finding the right mappings from meanings to signals and back again (e.g., work by MacLennan, Steels, and others). The question of why the signal behaviour should have been performed or responded to in the first place is ignored.
We argue that artificial life models can be used to examine the evolution of communication from genuinely non-communicative origins. We briefly describe simulations, of both competitive and cooperative contexts, in which movement is the only way that one individual can affect the sensory world of the other. If signals are to evolve, they must develop from movements that do not originally have a signalling function. We are yet to produce a system as rich as human language in such a simulation, but we believe that considering origins is necessary in order to produce satisfying and complete evolutionary explanations.

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2.2 Evolutionary economics

Burnham T.C.[1] **How Charles Darwin will help Adam Smith.**

This work examines the current state of economics and suggests that the application of Darwinian theory will play a central role in improving economics. The current debate in economics pits tradition economists against the increasingly powerful behavioral economists. Homo economicus, the traditional economic construct, is a consistent and competent maximizer of utility. Homo behavioralis, the version drawn from observation of human behavior, is a contradictory, non-optimizing creature filled with foibles and moral sentiments.
In this paper, the two antagonistic positions are summarized: Homo economicus vs. Homo Behavioralis. This discussion includes the most important and well-documented examples of "irrational" economic behavior. Both sides of this debate remain aloof from any notion of a genetic human nature. Seen in the light of evolution, the two positions - seemingly contradictory - are both compatible with an evolved human nature. As with evolutionary perspectives in other social sciences, a Darwinian perspective holds the key to a richer and more accurate economic science.

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Monnot M.[1]*, Monnot C.L.III.*[2] **Machiavellian intelligence – performance across an organization**

Machiavellianism is a strategy of social conduct that involves manipulating others for personal gain, often against the other's self-interest. All humans are capable of manipulative behavior to some degree, but some are more willing and more able than others. Also,

evolutionary game theory suggests social manipulation is adaptive in some situations but maladaptive in others. Machiavellianism can be measured as a quantitative trait if the Mach V questionnaire developed by R. Christie and F. Geis, is employed to assess a sample. We hypothesized that there are differences in the degree of "Machiavellianism," across an organization. If the ability and willingness to manipulate others was a major selective force in the evolution of human intelligence, will this process be reflected within modern organizational structure? How will it vary across different levels of power, status, and resource accumulation in the organization? Is this trait associated with reproductive output? Data from an academic and from a business setting will be presented.

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Wang X.T.[1] **Risk distribution, risk perception, and risky choice**

Recent developments in the evolutionary psychology, economics, management science, and behavioral ecology reveal that normative utility theories of decision making contract five problems: (1) a focus on only logical consistency but not social consistency, (2) a focus on only individual utility but not collective utility, (3) a lack of consideration of how people search and integrate cues of risks under cognitive, social and ecological constraints, (4) a lack of consideration of the effects of task requirements and goals, and (5) the use of a single number (expected value) to measure subjective utility at the cost of losing information about risk distribution. This paper examines how people make use of risk distributions (e.g., the variance in expected payoff or in reproductive fitness) to maximize the probability of reaching a goal or a minimum requirement. The research on risk sensitive foraging shows that animals either seek or avoid variance according to their energy budget. Our research on human decision making found that while the goal setting remains the same, the minimum requirement for the survival of group members increases from a large group to a small group, and to a kin group. The setting of the minimum requirement differentiates the subjective utilities of the choice options of the same expected value. As the minimum requirement exceeds the expected value, an option with a higher variance would be preferred; and vice versa. The author proposes and tests a Bounded Risk Distribution model that takes into account the mean-variance and goal-minimum requirement relationships in making both hypothetical life-death decisions and real reproductive and parental decisions.

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Marsh K.[1] **Sustainability and the evolution of environmental preferences: the blurring of subjective values and objective reality over evolutionary timeframes**

Recognition of the evolutionary nature of environmental preferences within evolutionary and environmental psychology starts to blur the boundary between subjective value and objective physical reality that hinders progress in the conceptualisation and, therefore, attainment of sustainability. Different evolutionary approaches to environmental aesthetics are reviewed and found to agree on the influence of similar landscape features in the determination of environmental preferences, though disagree on the way in which we combine them. Certain of the features agreed upon correspond with the features outlined in non-linear ecological models as contributing to ecosystem resilience, while the disagreement concerning the combination of these features provides scope for the hypothesis that the evolutionary aspects of environmental preferences primarily reflect resource availability. While evolutionary principles require us to reject the idea that adaptations reflect concern for the sustainable use of environmental resources, adaptation to the survival problem of the identification of resource availability may well have this as a side effect. The "resource availability" hypothesis is shown to compare well against better established environmental preference models, though there is still the problem of reconciling it with the current observed level of environmental degradation. Something which will require further research.

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2.3 Aggression and homicide

Daly M.[1], *Wilson M.*[2] **Income inequality and homicide rates in Canada and the United States**

Homicides in which victim and killer are unrelated men typically arise from competitive conflicts over social and material resources, and such cases constitute both a majority of all homicides and the most variable component of homicide rates. Homicides therefore "assay" the local level of intrasexual competition, suggesting that inequitable access to resources may be a major determinant of variation in homicide rates. Comparisons at scales ranging from nations to neighbourhoods support this hypothesis, but the relevance of inequality per se has been questioned on the grounds that high inequality is usually associated with low average income. The Canadian provinces provide a test case in which this correlation is reversed, and the positive relationship between income inequality and the homicide rate is undiminished; moreover, temporal change in inequality is a significant, albeit weak, predictor of temporal change in provincial homicide rates. When Canadian provinces and U.S. states are considered together, local levels of income inequality appear to be sufficient to account for the two countries' radically different national homicide rates.

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Beckerman S.[1], *Boster J.*[2], *Erickson P.*[2], *Jaramillo L.*[3], *Regalado J.*[3], *Yost J.*[4] **The reproductive consequences of endemic warfare.**

The Waorani have been called the most warlike people on earth. In pre-contact times as many as 60% of all their deaths were the results of homicide. They currently comprise about 2000 individuals living in the tropical forests of eastern Ecuador, up from a total population of about 500 when the first of their four territorial groups was contacted in 1958. The Waorani Life History Project is an attempt to examine the behavioral ecology of Waorani homicide through interviews with older Waorani, some of whom were not peacefully contacted until 1972-3. The project will test the predictions of three families of hypotheses with recall data on survivorship, marriage, and reproduction. The first family entertains the proposition that particularly fierce warriors enjoyed a fitness advantage, either individual or inclusive; the second considers the possibility that Waorani homicide was pathological from a fitness

point of view; while the third contemplates the position that Waorani warfare was simply the outcome of larger groups trying to exterminate smaller groups. We report a preliminary analysis testing predictions from the first family of hypotheses. This report is limited to a consideration of individual reproductive success of men reaching adulthood in pre-pacification times. These men are compared on their numbers of raids participated in and organized and on their numbers of wives and children.

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Hilton N.Z.[1], Harris G.T.[2], Rice M.E.[3] **The functions of aggression by male teenagers**

We hypothesized differences in self reports of victimization and perpetration among adolescents according to the sex of reporter. In Study 1, reports of male-to-male aggression revealed that perpetrator reports agreed with or exceeded victim reports, and victims were more likely to be strangers than close friends. In contrast, for male-to-female aggression, perpetrator reports were consistently lower than victim reports, and victims were less likely to be strangers than girlfriends. Study 2 revealed similar findings among students asked about frequency of acts and number of victims/perpetrators for physical and sexual aggression. Study 3 revealed that aggression by females contrasted with aggression by males with respect to intra- versus inter- sex aggression and perpetrator/victim agreement. Our conclusion that teenaged male perpetrators do under-report their aggression towards females is consistent with a selectionist account whereby males who exerted physical control over their mates would have a reproductive advantage. As females would not prefer mates who are violent towards them, males might also have inherited a tendency to conceal this behavior. A reputation for successful male-to-male aggression, in contrast, would be adaptive because of the status gained among males.

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Hiraiwa-Hasegawa M.[1], Hasegawa T.[2], Irie, S.[3] **Motives of male-male and male-female homicide: what changes and what not changes through time**

Homicide rate in Japan constantly decreased during the 40 years since the?end of the Second World War and now reduced to the one 4th of the 1950s. Along with this change, age- and sex-specific homicide rates also changed. In the 1950s we had the so-called "invariable shape" with the sharp peak among men in their early 20s. However, in the 1990s, there is virtually no age peak in men's homicide rates. Despite this dramatic structural changes in homicide rate, the motive categories and the relative proportions of each motive category have remained quite the same: when men kill men the most predominant motive is altercation and escalated showing-off, and when men kill women the most predominant motive is sexual jealousy and mate-guarding. When men kill women, both in the 1950s and in 1990s, there was an unusual age gap between the male killer and the female victim, either the male was much older than the female or the female is older than the male. This may be reflecting the differences between them in their perception of future prospect.

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2.4 Sexual behaviour

Singh, D.[1], Davis M.[2], Randall P.[3]* **Flaunting ovulation: lower WHR, enhanced self-perceived attractiveness, and increased sexual desire**

There is accumulating evidence that human females actively advertise their ovulatory status both behaviorally and physiologically. Non-contracepting females wear tighter fitting clothes and expose more skin in public places during ovulation, and these behaviors are accompanied by hormone-driven physiological enhancements including more symmetrical breasts and more attractive pheromone scents. We will present data from 27 female volunteers in which the ovulatory cycle was defined by self-report and validated by measuring the magnitude of cervical fluid discharge. Volunteers kept a month-long diary recording daily measurements of body weight, waist and hip circumferences, and the amount of cervical discharge. A daily log recording self-perceived attractiveness, mood swings, perceived stress, and sexual desire was also kept. Results show a convergence of physiological and behavioral enhancements highlighted by reduction in WHR and increased self-perceived attractiveness during the ovulatory phase. Furthermore, during the ovulatory phase, subjects reported more positive mood, less stress, and greater sexual desire. This increase in self-perceived attractiveness, coupled with more positive mood and sexual desire, allows the female to publicly display her ovulation in order to draw more attention from potential mates.

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Baptista A.[1], Brites J.[2], Santos R.[3] **Sex and sex-role differences in sexual Fantasies: evolutionary and cultural eplanations**

Evolutionary explanations are sometimes criticised as "just so stories" and even when the results support evolutionary hypothesis they could also be interpreted by alternative theories. The objective of this research was to conduct an empirical test of two competing theories about sex fantasies. 310 male and 374 female university students were studied with a 26 item questionnaire developed by Ellis and Symons (1990). These subjects were classified according to the social-role theory in four sex-role categories: feminine (high feminine-low masculine), masculine (high masculine-low feminine), androgynous (high masculine-high feminine) and undifferentiated (low feminine-low masculine). A multivariate analysis of variance, with sex and sex-roles as factors, for twelve items of the questionnaire was conducted. Evolution theory was supported in nine comparisons between sexes and social-role theory in four comparisons between sex-role categories. The fourteen categorical variables of the questionnaire were cross-tabulated by sex and sex-roles and the results provided support for evolutionary hypotheses in eight variables and for social-role theory in one case. The results in the Portuguese population were remarkably similar to those reported with American students. In general, they indicate that sex

fantasies are different for young man and women and similar across different cultures, as expected from an evolutionary point of view, but, at least, a small part of this variance could also be shared with cultural sex-role education.

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Brase G.L.[1] **Jealousy in relationships: integrating sex and personality differences**

Although men and women clearly differ in term of jealous reactions in relationships (with men relatively more upset by sexual infidelity), there is also much within-sex variation as well. Initial research (n=50) using a continuous scale measure found some intrasexual individual differences, particularly within the male sample. Further exploration of this result focussed on the personality trait of sociosexuality, using the sociosexual orientation inventory (SOI); a measure of sociososexual attitudes and behaviors. Two studies, one with university undergraduates (n=249) and one with an open internet sample (n=645), used the SOI and a six-item measure of sexual vs. emotional jealousy in relationships. In addition, the internet study also included the continuous scale measure used in the initial research. These studies replicated the initial difference between men and women, as well as the results of the initial study, but provided less clear results regarding the effects of sociosexual orientation. The results of this research are discussed in terms of their general implications as well as their relationship with recent cross-cultural research on intersexual jealousy.

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Cvorovic J.[1] **Polygyny and tolerated male homosexuality**

This paper presents an explanation for a behavior that appears to represents a puzzle to evolutionary explanations of behavior: tolerated male homosexuality. It will argue that tolerated male homosexuality within traditional societies occurs as a response to high degrees of polygyny. Due to the intense competition among males for females, polygynous societies are characterized by a high degree of violence among males. One means of reducing this conflict is to allow male homosexual activity as a substitute for heterosexual intercourse. When this occurs the homosexual behavior is usually closely regulated regarding the age, modus and behavior for the participants. This explanation is supported by cross-cultural research on 43 societies (Standard Cross Cultural Sample and Human Relation Area Files) that shows there is a positive association between polygyny and homosexuality.

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3 Thursday Late Afternoon Paper Sessions

3.1 Symposium: The role of synergy in the evolution of complexity
Organiser Peter Corning

Symposium abstract: "Synergy" — the unique combined effects produced by two or more parts, elements or organisms — has played a major role in the evolution of complexity, from eukaryotic cells to symbiotic partnerships and human societies. This symposium will explore the dynamics of "synergistic selection" in nature (in John Maynard Smith's term), as well as the constraints, obstacles and facilitators that affect the potential for realizing and benefitting from synergy, plus the relationship between synergy and what is commonly referred to as "emergent" effects, an elusive term that is used in various ways among complexity theorists.

Corning P.A.[1] **The emergence of "Emergence": Now what? The answer (in a word) is Synergy**

Despite its current popularity, "emergence" is a word with a "shady past" and an elusive, ambiguous standing in contemporary evolutionary theory. In this paper, I will begin by briefly recounting the venerable history of the term and will detail some of its current usages. Not only are there radically varying interpretations about what emergence means but "reductionist" and "holistic" theorists have very different views about the issue of causation. However, I will argue that these two seemingly polar positions are not irreconcilable. Reductionism, or detailed analysis of the parts and their interactions, is essential for answering the "how" question - how does a complex living system work? But holism is equally necessary for answering the "why" question - why did a particular arrangement of parts evolve? In order to answer the "why" question, a broader, multi-leveled selection paradigm is required that can perhaps be characterized as "Holistic Darwinism." The reductionist approach to explaining emergent complexity has entailed a search for "laws of emergence." By contrast, the "Synergism Hypothesis" focuses on the "economics". In a nutshell, the synergistic (co-operative) effects produced by various combinations of parts have played a major causal role in the evolution of complexity. Indeed, synergy has played an especially important part in shaping human evolution. I will also argue that the phenomena often identified with emergence represent, in effect, a subset of a much larger universe of combined effects in the natural world; there are many different kinds of synergy, but not all synergies entail emergent phenomena.

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Szathmáry E.[1] **Synergy and the major evolutionary transitions**

It is a recurrent phenomenon in evolution that individuals come together and this benefits them in terms of fitness. Ultimately, this process can lead to an evolutionary transition to a higher-level evolutionary unit. This can happen between related and unrelated individuals. Queller coined the phases "fraternal" and "egalitarian", to refer to these two modes of transition. In the first case the initial advantage comes from economy of scale (quantitative synergy) and in the second from complementation of function (qualitative synergy). Initial and evolved forms of complementation can be different: bacterial ancestors to mitochondria, for example, could not have been producing ATP for the host.

Coming together, based on synergy, has increased complexity in evolution, including genetic complexity. For example, the genome of a plant cell has its roots in at least three, originally unrelated genetic systems. The nucleus, mitochondria and plastids are separate genetic compartments even today.

In several cases, if complexity had increased, there was no way back.

This phenomenon is called 'contingent irreversibility'. There is no mitochondrial cancer, for example, because of the respective bacterial genes have either been lost, or transferred to the nucleus. A particularly interesting phenomenon is that of 'synthetic lethal' mutations, which show how components, originally either related or not, can become irreversibly dependent upon each other's presence. Such an effect is likely to have played a major role in the evolution of *Homo sapiens.*

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Richerson P.[1]*, Boyd R.*[2] **Evolutionary constraints on the exploitation of synergy and social complexity**

Evolutionary biology and social science tend to focus on the adaptive side of the evolutionary equation, but Darwinian theory is also a theory of maladaptation. Consider Hamilton's inclusive fitness rule for altruistic acts, $B/C > 1/r$. If evolutionary mechanisms could favor it, the more adaptive rule would be $B/C > 1$. In other words, Hamilton's rule predicts that real organisms will maladaptively pass up all altruistic deals $1 > B/C > 1/r$. The mechanism of reciprocal altruism is similarly hedged with tight constraints. Most authorities agree that Hamilton's rule and the constraints on reciprocal altruism are real and that they describe the patterns of altruism observed in almost all species. Humans are an exception, cooperating with unrelated people and violating the rules of reciprocity. For many tens of thousands of years humans lived in tribal scale societies that were larger and more cooperative than any other ape society. For the last ten millennia, food production and other technological advances have made possible massive societies that routinely provide public goods and other forms of cooperation on a very large scale. Nevertheless, humans are very far from taking up every altruistic act for which B/C > 1. Our hypothesis is that group selection on cultural variation led to the coevolution of innate tribal social instincts in the middle to late Pleistocene. These instincts, together with evolved cultural institutions, support ingroup altruism. However, since the human breeding system has no analog of queen superfecundity and worker sterility, genes also remain under selection to conform to the standard evolutionary constraints on altruism. The result, even in tribal scale societies are more or less crude, highly conflicted adaptations to exploit altruistic deals $1 > B/C > 1/r$ and to gain payoffs from one-shot and short-term reciprocal interactions. Complex societies are built by work-arounds that evolve to take advantage of prosocial human instincts by creating a variety of institutions to evade the narrow limits of ingroups directly supported by the tribal instincts. All of the work-arounds have weaknesses that can be exploited for narrow advantages by individuals and small groups, leading to manifest crudities in even the most adaptive complex societies so far created. Since human societies face even more limited competitors except other human societies, our ability to construct large scale cooperate social systems in defiance of the usual limits imposed by selection has made us a big success in spite of the crudity of our solutions to the problem of cooperation. As is generally the case, maladaptations tell us as much or more about evolutionary processes as adaptations.

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3.2 Cognitive adaptations

Lieberman D.L.[1]*, Tooby J.*[2]*, Cosmides L.*[3] **Does it pay to interfere? An investigation of whether individuals are sensitive to the different costs associated with inbreeding within the family**

The actions and decisions of close genetic relatives can greatly impact one's inclusive fitness. Since close relatives are capable of engaging in behaviors that have negative consequences on an individual's inclusive fitness, cognitive systems that were capable of evaluating the potential costs of relatives' behaviors and decreasing the probability that fitness-compromising behaviors occurred would have been selected for over evolutionary history. For example, inbreeding is a potentially very costly act, not only to the individuals involved, but also to other close kin. For each individual within the family, there is a cost/benefit fitness matrix that takes into account the outcome of an incestuous union and the outcome had both family members mated outside the family. It is expected that individuals are sensitive to these costs and benefits and are capable of determining which incestuous dyads within the family are most costly. To test this hypothesis, subjects were asked to rank order sexual acts involving two family members on a scale of disgust and a scale of interference. In addition, subjects were asked to allocate money from 4 budgets among 5 incestuous familial dyads according to which dyad they would spend most time interfering and preventing sexual intercourse from occurring. Results will be discussed along with future empirical work.

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Rigby K.[1] **Sexual selection and concepts: sex differences in understanding novel phrases**

A sex-difference in understanding novel phrases due to sexual selection was hypothesised. Evolutionary theory predicts differences in the cognitive capacities of the sexes, resulting from differential selection pressures. Male intra-sex competition (Kodric-Brown & Brown, 1984) and inter-sex, male display for female mates, led to the hypothesis that males have been sexually selected to be more creative (Miller, 2000) than females in mate choice situations. This was tested empirically using Ss' interpretations of novel concept combinations. Gagné (2000) has been argued that of the two ways of interpreting noun concept combinations one form ('property interpretations') is rarer (more creative) than the other ('relation interpretations'). So for the novel phrase **Dalmatian Coat** a property interpretation might be:

"a white coat with black dots"

whereas a relation interpretation might be:

"a coat for Dalmatians"

Hence, it was hypothesised that males would produce more property interpretations than females.

Method: using a repeated measures design Ss were asked to generate interpretations of five novel concept combinations. The tests were carried out by a male stooge 'experimenter' to prompt intra-sex male competition.

Analysis: Content-analysis and repeated measures GLM were used.

Results: Males produced significantly more property interpretations than females and females produced significantly more relation interpretations than males.

Conclusion: This suggests that at a fundamental level there are sex-

based differences in terms of understanding of novel phrases that are potentially caused by sexual selection. Greater repercussions are feasible on sex-differences in cognition resulting from sexual selection. Further studies are required to test this.

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Elworthy C.[1] **The interaction between cognitive adaptations and institutions**

Humans possess cognitive adaptations which support exchange and other forms of social interaction. Examples are the the groups of co-adapted traits which give rise to language, and the specialised "look for cheaters" algorithm identified by Cosmides and Tooby which supports social exchange.
Tools like hammers, and instruments like telescopes, can be regarded as complementing morphological adaptations. They extend the strength of the arm and the sight of the eye, and enable objectives to be achieved that would otherwise be impossible. Political institutions such as democratic voting systems or written constitutions, and economic institutions such as limited liability companies and stock markets, act in a similar manner. This paper examines the interaction between these institutions and the cognitive adaptations that underlie them, from theoretical and historical perspectives.

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Todd P.M.[1] **The effects of recognition on a clumpy world**

In many domains, the most well-known items are much more widely recognized than lesser-known items, reflected in a (sideways) "J-shaped" distribution of things like citations per paper or sales per music album. While this environmental structure can arise at least partly from the underlying quality of the items, the action of intelligent agents making choices and communicating information about their world can also determine the distribution of knowledge and choices in the world. This is a specific instance of the fact that cognitive mechanisms not only are shaped by their environments through evolution and learning, but also exert a shaping force on their surroundings through their repeated use. Here we explore such evolutionarily important cognition-environment interaction by looking at how choices made with a very simple cognitive mechanism, the recognition heuristic (which selects recognized options over unrecognized ones), can affect the structure of the choice environment. An agent-based simulation is used to show what behavioral factors impact the emergence of environmental structure. In particular, we are interested in whether and in what circumstances the recognition heuristic can itself create a clumpy environment, in which some options are recognized, "talked about", and chosen, much more often than others (e.g., following a J-shaped distribution). Such environment structure can in turn make the recognition heuristic ecologically rational, that is, able to make beneficial choices.

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3.3 Agression and rape

Gottschall T.[1]*, Gottschall J.*[2] **The reproductive success of rapists**

In the turbulent wake of Thornhill and Palmer's *A Natural History of Rape*, numerous commentators have noted the urgent need for better data on the reproductive success of rapists. Scholars on all sides of the issue agree that a crucial, unanswered question concerning the adaptive significance of rape is, "How frequently are raped women impregnated by their assailants?" (1) This paper undertakes a thorough review and critique of the literature on rape-pregnancy and the way this literature has been interpreted both by proponents and opponents of the evolutionary view of rape. (2) Next, it presents our own estimation, from US government data, of pregnancy rates for a single episode of forced sex; our preliminary numbers are consistent with other studies suggesting that pregnancies resulting from a single rape may be more common than pregnancies resulting from a single instance of consensual intercourse. (3) Using US government data on birth control usage, we form an estimate of ancestral rape-pregnancy rates by adjusting for the large number of women in our sample who would have been using hormonal contraception, an IUD, and/or were administered emergency pregnancy prophylaxis. (5) We conclude that ancestral pregnancy rates for a single act of forced sex likely outstripped ancestral pregnancy rates for a single act of consensual sex by a significant margin. (6) We close by examining this finding in the context of various adaptation and by-product theories of rape, proposing a new by-product hypothesis to account for the phenomenon.

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Vaughan A.E.[1] **Fertility value and the prevalence of rape**

The aim of this study was to investigate the prevalence of rape and its positive association with Fertility Value (FV; current capability of reproducing) and to examine the differences between the rape of reproductive and non-reproductive age females. It was predicted that within a certain age group the prevalence of rape would be positively associated with FV. This was predicted on the basis that rape is a short-term mating strategy (Buss & Schmitt, 1993), which was adaptive (Thornhill & Palmer, 2000). Alternatively, a positive relationship with Reproductive Value (future capability of reproducing) would be expected if rape were a long-term strategy. It was also predicted that in the case of offences where the victim had a low FV, the offender would either injure the victim, possess a non-reproductive sexual orientation or commit another offence. Data were collected from the Prison Service, Law Reports and the Probation Service. Three British Home Office studies were also examined. A significant positive relationship was found between FV and rape prevalence, but also between Reproductive Value and rape prevalence, suggesting that rape may be a long-term strategy in some cases. Logistic regression indicated that offenders with a non-reproductive sexual orientation were more likely to rape someone with a low FV, whereas offenders who committed a secondary offence were more likely to rape a victim with a high FV. Victims who were injured were just as likely to have a high or low FV. These findings provide only inconclusive support for the predictions derived from the adaptive hypothesis of rape, and only sexual orientation explained the rape of victims with a low FV.

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Blokland A.A.J.[1]*, Van Wijk A.P.*[2] **The etiology of sexual delinquency within an evolutionary framework**

Using insights from both Sexual Strategies Theory and Life History Theory we have developed an evolutionary model regarding the etiology of sexual coercive behavior. The model integrates both evolutionary and psychological theories on sexual aggressive behavior. By regarding sexual coercion as an outcome of a short-term reproductive strategy our multi-causal model brings together insights from developmental, attachment, cognitive and family systems theory within an overarching evolutionary framework. Hypothesis on the over all sexual development, familial-context, attachment, emphatic capacities, impulsiveness and individual defects of (juvenile) sexual offenders are discussed. To test the validity of the proposed model a review of literature on the risk factors of sexual delinquency from both sociobiological as well as 'mainstream' psychological sources is presented. We conclude that on the one hand mainstream psychology has thus far mostly ignored valuable biological insights in the nature and possible causes of sexual aggression. On the other hand, by failing to integrate the differentiated knowledge on the correlates of sexual delinquency and on the psychological processes leading to a sexual offense congregated by non-evolutionary psychologists, sociobiologists and evolutionary psychologists have presented oversimplified models of sexual coercion; a fact which, in our opinion, has contributed to the resistance encountered from both the scientific community as well as the public opinion.

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Archer J.[1]*, Graham-Kevan N.*[2] **Partner aggression: Is mate-guarding too narrow a perspective?**

The current evolutionary perspective of physical aggression between partners emphasises men's violence to women and their proprietary motives, which are a consequence of mate-guarding, derived from paternity uncertainty. This view predicts that: (1) most partner aggression will be by men to women (since mate-guarding is derived from paternity uncertainty); and (2) that partner physical aggression by men will be associated with a general tendency to control the partner; any physical aggression to partners by women will not share this association. Findings from meta-analyses of physical aggression and their consequences did not support the first prediction. Findings from three samples (refuge women, students, and men prisoners) showed that there were significant positive correlations between use of physical aggression and non-aggressive controlling behaviours for both men and women, and that the magnitude of correlations did not differ between the sexes. This does not support the second prediction. It is argued that both men and women have evolutionary reasons for seeking to control partners, and that an analysis based only on mate-guarding by men is too restricted.

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3.4 Symposium: Darwinian literary criticism
Organiser Joseph Carroll

Symposium abstract: Each of these four papers formulates specifically Darwinian principles of literary theory, applies the principles to a specific literary problem, and sets the principles in opposition to alternative current forms of literary understanding. Boyd contrasts evolutionary cognitive psychology with historical ideological critique. Carroll contrasts Darwinian concepts of organism and environment with concepts available in the burgeoning field of Aecocriticism.@ Easterlin contrasts a recent Darwinian model of grief with earlier models associated with other psychological paradigms. Gottschall contrasts a sociobiological understanding of proximal and ultimate motives with traditional literary stipulations of motive. The four specific literary applications and the four sets of theoretical topics are diverse. The applications include modern children=s literature, Victorian fiction, Romantic elegies, and Greek epic narrative. The theoretical topics include evolutionary cognitive psychology, ecology, Darwinian psychiatry, and sociobiology. This apparent diversity serves to emphasize the underlying unity of an emerging synthesis in Darwinian literary studies. Each participant will explain the way in which his or her theoretical and interperetive propositions situate themselves within the larger adaptationist program associated with sociobiology and evolutionary pscyhology. Each participant will argue that literary representations derive from an evolved human nature, have adaptive value, and fulfill elemental human needs. The separate fields of inquiry within the panel are complementary and overlapping components of a larger Darwinian understanding of literary representation.

Boyd B.[1] **Fiction as adaptation: Dr Seuss's *Horton Hears a Who***

I propose that fiction is a human behavioral adaptation. Just as the human visual and aural systems evolved for other reasons but led to the visual and musical arts, fiction employs the human event comprehension system, which evolved for reasons that predate art—itself a human behavioral adaptation.

Our event comprehension system forms reliably in all normally-developing human individuals, as a set of theories that combines intuitive physics (objects and forces), intuitive ontology (animals, plants and artifacts), and especially intuitive psychology or Theory of Mind (beliefs, desires and intentions), and an intuitive sociology (affiliation, hierarchy and exchange). Storytelling evokes default responses in our event comprehension system, often through supernormal stimuli, in order to maximize attention for the story and hence the teller.

Although neither minds nor stories from the early human past survive in fossil form, studies of another kind of early modern humans—children—can reveal innate, evolved ways in which human minds comprehend their world. In the same way, a great children's story can reveal how a great storyteller appeals to a child's event comprehension system before it has been significantly reconfigured by local culture. I examine Dr Seuss's children's classic *Horton Hears a Who*, contrasting the current literary-critical model of historicist ideological critique with an evolutionary model that, I suggest, can better explain fiction in general and offer both a more wide-ranging and a more fine-grained explanation of particular works.

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Carroll J.[1] **Ecocriticism and evolutionary psychology**

In the past ten years, ecological literary criticism–that is, criticism devoted to the study of literary representations of the natural environment—has become the fastest growing movement in literary studies. Ecocritics now have their own professional association, their own academic journal, and an impressive bibliography of scholarly work. Ecocritics have a subject matter, and they share in a certain broad set of attitudes, values, and public policy concerns, but they do not yet have one major component of a distinctive school or movement; they have no theory, no common set of basic conceptions about their subject. In the absence of any overarching theory, ecocritics have sought to incorporate their ecological subject matter within other, already established theories. There are thus ecocritics who identify themselves as ecofeminists, Marxists, Bakhtinians, phenomenologists, and poststructuralists, and a substantial proportion of ecocritics affilate themselves with the idealist views of nature associated with the English Romantics and the American transcendentalists. I shall argue that the Darwinian view of human nature takes precedence over all these theoretical schools. The relation of the organism and the environment is central to Darwinian thinking, and that relation can be adequately understood only in its evolutionary character as the product of adaptation through natural selection. In literary representation, organism and environment constitute two of the three fundamental elements: "character" and "setting." The third fundamental element is "plot," and plot depends on motives that are rooted in an evolved human nature.

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Easterlin N.[1] **Wordsworth's Lucy poems and the Dual-Process model of grief**

Evolutionary and cognitive psychology invite a variety of new possibilities for the investigation of literary works. Not least among these is interpretation that explores the psychological processes depicted in literature. Since the poetry of William Wordsworth has long been admired for its psychological perceptiveness, an interdisciplinary method that applies current models of evolutionary psychology to Wordsworth's poetry helps to illuminate and clarify what the poet intuited about human beings, including such issues as mother-infant interaction, self-construction, and recovery from grief and loss. In an interpretation of the Lucy poems, this paper will demonstrate that Wordsworth's depiction of recovery from grief is consistent with the dual process model recently developed by Stroebe and Schut (described in John Archer's *The Nature of Grief*). Whereas a number of earlier recovery models conceptualized a stage- or phase-like progression from loss to recovery, Stroebe and Schut, working within the framework of Darwinian psychiatry, theorize that most people oscillate between loss-oriented and restoration-oriented coping strategies. Stroebe and Schut's dual-process model is consistent with the irrational efforts of Wordsworth's speaker, who wishes to establish a new relationship with Lucy and to reinforce his own separation from her simultaneously--a mixed coping strategy observable primarily in his ambivalent attitude toward the natural world with which Lucy is intensely identified.

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Gottschall J.[1] ***The* Rape of Troy: A Darwinian perspective on violence in Homer's epics**

Homeric scholars have debated the causes of violence in the Iliad and Odyssey for more than 2,500 years. These scholars have acknowledged that disputes in the Homeric epics, between individual men and between groups of men, often *superficially* touch upon rights to desirable women. The Trojan War begins in the seduction of Helen, continues with pitched disputes over the young war brides Chryseis and Briseis, and concludes with the triumphant Greeks divvying up thousands of Trojan women to become concubines and slaves. Likewise, the primary conflict of the Odyssey results from the attempts of young men to sleep with women claimed by Odysseus: his wife and female slaves. Yet, over the centuries, Homeric scholars have traditionally contended that winning (and often amassing) women was merely a proximate goal masking more important motives: Greeks and Trojans fight not over Helen but over besmirched honor, Achilles and Agamemnon rage not over who will possess an alluring young woman but over social dominance, Odysseus and the suitors tangle not over his gorgeous wife but over political power. *The Rape of Troy* disputes this dominant view, showcasing the power of Darwinian literary studies with new insights into two of the most exhaustively analyzed stories in the world. The Homeric scholars have had things entirely backwards: for Homer's heroes, as for ordinary men, women do not represent a proximate route to the ultimate goal of honor, political power or social dominance; honor, political power and social dominance are the proximate routes to the ultimate goal of women.

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Friday Morning Plenary Address

Barker, D.J.P.[1] **The fetal origins of adult disease**

Epidemiological studies provide a substantial body of evidence that people who had low birthweight, or who were thin or short at birth, or who failed to grow in infancy, have increased rates of coronary heart disease, stroke, non-insulin dependent diabetes and hypertension. This has led to the fetal origins hypothesis, which proposes that these diseases originate through adaptations which the fetus and infant make when they are undernourished. These adaptations include diversion of oxygenated blood away from the trunk to favour the brain, alterations in the hormonal systems which regulate growth and maturation, importantly insulin and cortisol, and alterations in body composition. The adaptations permanently change the structure and function of the body.

The path of growth through childhood modifies the risk of disease associated with small body size at birth. The highest death rates from coronary heart disease among men occur in those who were thin at birth and at one year but whose weight gain accelerated in childhood so that they had an above average body mass index. Death from coronary heart disease may therefore be a consequence of poor prenatal or infant nutrition followed by improved postnatal nutrition. Other patterns of fetal and childhood growth are associated with the later development of stroke, non-insulin dependent diabetes and hypertension and the patterns differ between the two sexes. Common to them all is a period of reduced early growth followed by a period of accelerated growth. The persisting changes in the body's structure and function that are

associated with reduced early growth alter the body's responses to adverse biological and social influences in later life. For example, people who were small at birth are more prone to developing Type 2 diabetes or coronary heart disease if they become overweight in adult life.
A number of maternal influences which programme the fetus have now been identified. They include the mother's body composition before and during pregnancy and her diet.

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4 Friday Morning Paper Sessions

4.1 Cultural evolution

Coultas J.C.[1] **Culture and conformity through an evolutionary lens**

Conformity or majority influence has been the focus of many studies within psychology and the contribution of a conformist bias to social cohesion and group formation has been widely accepted. From an evolutionary perspective, conformity makes sense when it leads to facilitation of acceptance into a group through the adoption of behaviours that are beneficial for the group. If an evolutionary social psychology is going to encompass conformity it needs to look at selection at both the individual and group level. A model from gene-culture coevolutionary theory (conformist transmission) proposes a form of cultural group selection and redirects attention towards proportion as a variable in conformity research. Group size may be important in conformity research but the proportion of a group producing a specific behaviour has a strong influence on whether others adopt that behaviour. A synthesis of past research on majority influence and a theoretical model of conformist bias could be a fruitful way to view conformity.

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Kameda T.[1]*, Nakanishi D.*[2] **Cost/benefit analysis of "conformity bias" in cultural transmission (2): an experimental test using interactive groups**

Kameda & Nakanishi (2000) proposed an evolutionary game model on evolvability of "conformity bias" in cultural transmission under uncertainty (see Nakanishi & Kameda, this conference, for further extension of the model). The analysis showed that, if individual learning is more costly than social learning (as in many realistic situations), there should be a Hawk-Dove game like equilibrium where individual and social learners coexist in a group. That is, if many others engage in costly individual learning in the group, then you are better off just conforming to others without paying extra cost for individual learning. Whereas, if many others follow such a strategy, then you would be better off engaging in costly individual learning. The ratio of individual and social learners in the equilibrium is determined by the extra cost and benefit associated with individual learning. This paper provides an empirical verification of this thesis using interactive groups in a laboratory setting. In 6-person groups, participants made a series of judgments about a fluctuating environment individually. Monetary rewards were contingent on the number of correct judgments. In making judgments, participants were provided social information (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. Consistent with our prediction, the ratio of individual and social learners stabilized over time, yielding a Hawk-Dove game like equilibrium in groups.

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McElreath R.[1] **How social learning maintains human variation and when natural selection wants us to learn socially: a population study from East Africa**

Many cultural differences among human groups are known to be adaptive, but how these adaptations arise and remain stable is largely unknown. In southwest Tanzania, several ethnic groups live along a gradient of wet and drier environments and are differentiated economically as predominantly farmers and herders, respectively. The research presented here leverages individual data on 238 informants from three ethnic groups to replicate differences found before between East African farmers and herders and then to examine these domains in detail, in a single economically differentiated ethnic population. This research leverages individual data on residence, economy, and parents' economy to test several hypotheses about the causes of these differences. Some differences are better explained by community residence, while others are better explained by household economy, including measurable intergenerational effects. Additional variation in attitudes is explained by ethnicity, independent of residence or economy. These results constitute the first steps in understanding which learning mechanisms, times of life, and ecological variables are responsible for cultural differences - adaptive and otherwise - and their stability in the face of substantial migration between regions. I make sense of the different patterns of learning by invoking costs of information as an organizing feature of how natural selection designs the human brain to interact with its environment.

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Gil-White F.[1] **Finding the boundaries of 'memes': The case of folk-narratives**

Important work initiated by scholars such as Boyd & Richerson (1985), and Lumsden & Wilson 1981) has concerned itself not with any specific memes, but rather with the formal, emergent properties of cultural systems that are capable of inheritance, mutation, selection, and cumulative adaptation. In a different tradition, other scholars have conducted much work on why certain specific memes are widespread around the world, and how our evolved psychology helps every new generation of children to re-bootstrap them (Atran 1990; Boyer 1994; Hirschfeld 1996). The work done in the first tradition benefits from the second and vice-versa. Ultimately it is desirable that we understand (1) the dynamic processes in which *specific* memes are embedded (whether or not these are widespread memes around the world or locally varying), and (2) the proximate psychological mechanisms that intervene to assist humans in parsing the world of cultural variation to determine, in any particular domain, what is the 'meme'. These parsing mechanisms need not be the same for every domain and probably aren't. This paper will present data concerning the narrative domain. The data was collected in Mongolia, where a story

was born and began to spread before the ethnographer's eyes, thus affording an opportunity to study, in real-time, the stability of story elements over time. A second assay of the stability of the different story elements was made again 1½ years later. Here, then, is a naturalistic window into how the brain parses and stores a heard narrative, and an empirical effort at finding the narrative 'meme', cognitively defined.

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Boyd R.[1], Richerson P.[2] **What was the Pleistocene EEA really like and how did we adapt to it?**

The Pleistocene is well known for its high amplitude glacial fluctuations. The low frequency part of the glacial fluctuations has been fairly well understood for some time. Milankovich hypothesis, holding that the main glacial cycles are driven by insolation variation caused by variations in the earth's orbit at quasi-periodicities of ~20,000 years, 41,000 years and 100,000 years, fits most of this data fairly well. Fluctuation on these scales is too slow to drive much evolution except by vicariance mechanisms, as most organisms can shift ranges rapidly enough to cope with such low frequency variation. In the last decade high-resolution work on ice cores and ocean sediments documents high amplitude fluctuations in last-glacial climates on millennial and submillennial time scales, right down to the resolution limits of the records (1-10+ years). Data published in the last few years from anaerobic, rapidly accumulating, low latitude ocean cores show that most if not all human environments of the last glacial were subject to high frequency climate fluctuations greatly exceeding those of the Holocene. The last glacial, and by inference most Pleistocene climates, were characterized by noisy variation on time scales of evolutionary and ecological importance. We argue that the evolution of culture as the main mode of human adaptation is likely an adaptation to extreme environmental variation. The quite sudden reduction of high frequency variation at the beginning of the Holocene likely explains the quasi-unilinear evolutionary trajectory of human evolution during the last ten millennia. That human societies have been out of equilibrium with Holocene environments for this period of time is a measure of rates of cultural macroevolution.

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4.2 Symposium: Parental influences on behaviour and fertility
Organiser John Manning

Phillips D.I.W.[1] **Prenatal growth and subsequent marital status: longitudinal study**

Men who do not marry have higher rates of cardiovascular disease and a shorter lifespan than married men. The hypotheses which have been proposed to explain this are either that healthier men tend to marry or that the social support offered by marriage is protective. However it is also possible that factors which lead people to remain unmarried are linked with the susceptibility to cardiovascular disease. As small size at birth is associated with an increased risk of cardiovascular disease, we hypothesised that prenatal growth restriction might be associated with whether men marry or not. We tested this in two long-term prospective birth cohorts of men who belonged to generations in which marriage was a social norm. In 3577 men born at the Helsinki University Central Hospital, Finland, during 1924-33 and in 1659 men born in East, North and Northwest Hertfordshire, UK, during 1920-30 we found that lower birthweight was associated with a higher percentage of men who had never married. The odds ratio (OR) of marrying increased by 1.42 (95%CI 1.11 to 1.81) per kg increase in birthweight in Finland and 1.51 (1.08 to 2.12) per kg increase in birthweight in Hertfordshire. These trends were not altered after adjusting for the men's height, weight, social class, income and age. These data raise the possibility that early growth restriction influences the factors involved in partner selection which may include socialisation, sexuality, personality, or emotional responses. They also suggest that the well-established link between marital status and health may have its origins during intrauterine life.

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Ronalds G.[1], Godfrey K.[1], Phillips D.I.W.[1] **Fetal growth and the ratio of second to fourth digit length**

A high ratio of the length of the 2nd finger relative to the 4th finger (2D:4D ratio) is associated with higher luteinising hormone and oestrogen concentrations in adulthood and, in men, with lower testosterone levels and a younger age at first myocardial infarction. As the 2D:4D ratio remains constant throughout life, it is thought that this ratio is established during intrauterine life. Furthermore as the ratio is sexually dimorphic, it has been suggested that it reflects prenatal concentrations of sex hormones. Sex hormones concentrations during gestation are known to influence rates of fetal growth and skeletal maturation and therefore associations between fetal growth and the 2D:4D ratio would provide support for this hypothesis. We have tested this by measuring the 2D:4D ratios of 139 men and women aged 48-57 years whose size at birth was recorded in detail. There were no associations in women. However, men with a higher 2D:4D ratio were shorter at birth ($p=0.02$) and had a greater head circumference (0.02) relative to their body length. These finding provide support for the hypothesis that the 2D:4D ratio is determined during fetal life.

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Manning J.T.[1], Taylor R.P.[2], Bundred, P.E.[3] **2nd to 4th digit ratio, attractiveness, and athleticism: evidence for prenatal influences on sexual selection**

The 2nd to 4th Digit Ratio (2D:4D) is lower in males than females, and there is evidence that it is negatively associated with prenatal testosterone and positively with prenatal oestrogen. We report associations between 2D:4D and inter and intra-sexual selection. Thus (1) photocopies of hands were rated as attractive and/or sexy when 2D:4D was low. This effect was significant for male hands but not female and was independent of sex of rater and age, height and weight of the owner of the hand (2) low 2D:4D was correlated with male running speed and high 2D:4D with premature male heart attack. Low 2D:4D was associated with high self-rating and team-mate rating for attainment in a number of sports including

soccer, and with high scores in a test of visuo-spatial judgement. Professional soccer players had lower 2D:4D than males who did not play professional soccer. Within the professional sample the first-team players had lower 2D:4D than reserves and international players lower 2D:4D than non-internationals. We conclude low 2D:4D in male hands is associated with perceptions of attractiveness, an efficient and durable cardiovascular system, good visuo-spatial judgement and sports ability.

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Martin S.[1], Manning J.T.[2], Trivers R.L.[3], Singh D.[4], Venkatramana P.[5], Henzi P.[6] Walton J.[7] **2nd to 4th digit ratio and Family size in England, Jamaica, India and South Africa**

The ratio of the length of the 2nd and 4th digit (2D:4D) is sexually dimorphic, with males having on average lower ratio than females. 2D:4D is negatively related to correlates of fertility (sperm counts, testosterone) in males and positively with correlates of fertility (oestrogen and LH) in females. Data are presented from European, Caribbean, African, Asian and Oriental populations. We show that ethnic variation in the 2D:4D ratio of adults is greater than that of variation due to sex. Children from England, Jamaica and China (Han and Uygur) also show sex and ethnic differences indicating an early developmental origin of 2D:4D. Family size was negatively related to 2D:4D in men and positively associated with 2D:4D in women after the influence of age and ethnicity was removed.

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Tortorice J.[1] **Gender identity, sexual orientation, and second-to-fourth digit ratio in females**

Gender identity and sexual orientation may aid reproduction, provided that an individual's gender identity and sexual orientation directs one towards members of the opposite sex. Thus far, knowledge of how sexual orientation and especially gender identity develops and works is poorly understood. This paper hypothesizes that there are two distinct modules in the brain that contribute to the expression of gender identity and sexual orientation, respectively. Fetal testosterone may play an important role in the development of gender identity and sexual orientation, and may differentially affect the development of these modules due to varying levels during progressive stages of prenatal development. Evidence indicates that the ratio of the length of the 2nd to 4th digits (2D:4D) is negatively correlated with prenatal testosterone levels. This paper reports on two studies of 2D:4D and gender identity and sexual orientation in females. In one study, the 2D:4D of lesbians (n=25) was lower than that of a control group of heterosexual women (n=23), but not significantly different. However, dividing lesbians into the categories of butch and femme (based on self-ratings) showed that butch lesbians had a significantly lower 2D:4D ratio than both femme lesbians and heterosexual controls. In a second study, the 2D:4D ratio of 58 male-identified but female-born, or "transgendered," persons (based on self-identification, and without regard to sexual orientation) was computed. The ratio of transgendered individuals was not significantly different from female, heterosexual controls. The relationship between fetal testosterone and female sexual orientation and gender identity is discussed.

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4.3 Altruism

Silke A.[1] **Kin-directed altruism and bystander intervention in violent assaults: findings from Northern Ireland**

Bystander intervention to assist victims of violent assaults is notoriously uncommon. Evolutionary theory however predicts that there can be adaptive value in assisting biological relatives in physically dangerous situations. This study explores the effect relationship to the victim has on the likelihood of intervention by bystanders in violent interpersonal assaults. The study is based on an analysis of 500 violent attacks which occurred in Northern Ireland. The study tested the hypothesis that biological relatives of victims will be more likely to intervene in violent assaults than friends, acquaintances or strangers. The results supported this hypothesis. The study found that bystanders and observers to attacks were more likely to intervene in attacks when they had a biological relationship with the victim, and non-relatives were much less likely to provide overt assistance. The study also found that there were other significant differences between cases involving family members and those which did not, with for example offenders behaving differently when family members were present at the scene of the attacks. These findings are discussed within the context of kin-directed altruism.

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Fieldman G.[1], Plotkin H.[2,3], Dunbar R.I.M.[2,4], Richards J-M[3], McFarland D.J.[5]. **Blood is thicker than water: humans follow Hamilton's rule**

Hamilton's theory of kin selection provides an explanation for the evolution and stability of altruistic behaviour. There is considerable evidence for its applicability to animals but this has not hitherto been empirically demonstrated in humans. We report here an experimental study that attempts a direct test of Hamilton's rule by imposing a genuine cost - endurance when performing an isometric ski-ing exercise - for monetary payment. The experimental design required participants to donate the money earned by their efforts to a set of recipients of four degrees of relatedness to themselves. We used the cost to the participant (endurance) as a measure of the magnitude of the individual's altruistic behaviour. The results provide evidence in support of Hamilton's rule. Our experimental data suggest that humans behave more altruistically towards those to whom they are more closely related. That is, they behave as though their kinship categories are underpinned by a genuine biological reality. The strong correlation obtained between relatedness and the level of affection for the recipient reinforces the notion that humans use proximate measures as cues for genetic relatedness. Thus, directing one's altruism at those for whom one holds strong affections will typically have the effect of channeling it into genetic relatives.

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Bossong M.[1] **Sex differences in inheritance patterns: how mortality cues trigger strategic responses**

By analyzing legacies in California from 1890 to 1984 Judge & Hrdy (1992) detected a gender related difference: Men with children were statistically more likely to leave all of their property to a wife than were mothers to a husband. The authors argue that men were more likely than women to remarry and have additional children. Thus, in order to transfer their wealth to their mutual children, men can leave it to their wives but women can avoid risks by giving it to the children directly. This hypothesis was tested by two experiments in which subjects were asked to put themselves in the position of a person writing a will and allocate the wealth to the surviving spouse and the children. Age and sex of the heir/heiress were experimentally varied. The results support the inclusive fitness interpretation.
Thinking about one's own death is a 'natural state' when people are writing their wills. In a third experiment the assumption was tested that mortality salience is a necessary condition to trigger strategic responses that are suitable to reach fitness enhancing goals.

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Kruger D.[1] **An integration of proximate and ultimate influences for altruistic helping intentions**

This paper integrates psychological and evolutionary theory relevant to altruistic helping. Psychologists have studied subjective experiences and motivations, such as empathic concern and oneness, leading to helping intentions. Evolutionary theorists have examined tendencies to exhibit adaptive behaviors predicted by inclusive fitness theory, predominantly with non-human animals. Evolutionary theory recognizes two pathways for altruistic behaviors, kin selection and reciprocal altruism. Constructs derived from social psychological and evolutionary theory were integrated into a structural equation model to predict participants' (N = 643) helping intentions. Results indicated that constructs relevant to the evolutionary adaptations of reciprocal altruism and kin selection accounted for the largest portion of the variance in helping intentions. Oneness and empathic concern also made unique contributions to the variance, but did not mediate the effects of evolutionary adaptations.

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Boone J. L.[1]*, Allen-Arave W.*[2] **Is honor worth dying for? Altruism, social class and survivorship in the Titanic disaster of April 15, 1912**

Zahavi first introduced the idea that altruistic behavior might be explained as a form of costly signaling. Altruism in the form of costly signaling corresponds most closely to what is often termed by-product or no-cost mutualism in the sense that it does not depend on reciprocation by the recipient of the altruistic act. Hence, it may be important in explaining what appear to be "group benefit" kinds of behaviors. We show that enactment of the "women and children first" rule in the Titanic disaster functioned as an honest signal of commitment on the part of males to act consistently as protectors and providers, and that this code of honor was important in regulating social position among males as well. The survivorship evidence presented suggests that male passengers on the Titanic assessed costs, risks, and benefits of such behavior differentially, contingent upon their age and socioeconomic status. Specifically, men from 2nd class were more likely to go down with the ship in deference to women and children than were men on 1st or 3rd class, suggesting that 2nd class males took the "women and children first" rule more seriously because they were less willing to take the loss in honor and prestige that would have resulted in their surviving.

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4.4 Symposium: Costly signalling theory and the evolution of culture
Organiser Camilla Power

Symposium abstract: Costly Signalling Theory (CST) offers the prospect of an evolutionary approach to a range of 'wasteful' and 'extravagant' human cultural behaviours which have hitherto eluded Darwinian analysis. Expensive ritual, art, and body ornament are among various apparently maladaptive or non-functional behaviours for which the archaeological and ethnographic records offer empirical data. In particular, CST enables us to model problems of collective action, while maintaining the perspective of the individual bearing the cost of signalling.

Knight C.[1] **Speech: an exception to the Handicap Principle?**

According to the Handicap Principle, two conditions are necessary for communication to evolve: the parties must have a common interest, and signals must be intrinsically reliable. Only the discernible costliness of signals can guarantee their reliability. By ignoring this constraint in favour of a focus on cognitive and other mechanisms, theorists who have recently debated the evolutionary emergence of speech have allowed an excessive number of competing theories to proliferate. As a system of low-cost conventional signals, speech does appear to violate the Handicap Principle. However, Zahavi's theory can be defended if speech is modelled correctly as a special case, with costly ritual signaling of status incorporated into the picture. This substantially reduces the number of evolutionary models allowable on theoretical grounds. It also permits remaining models of the evolutionary emergence of speech to be tested in the light of archaeological and ethnographic data.

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Kohn M.[1] **Handaxes and hominid mate choice**

Handaxes, bifacial stone artefacts with a characteristic tear-drop shape, are a uniquely salient and pervasive element of the archaeological record. They first appeared 1.4MYA, and persisted for over a million years; they are found in Africa, Asia and Europe. No other persistent or systematic artefact patterns appeared until the end of this period; which prompts the question of why this industry was so enduring. Other aspects of the record are also remarkable: the degree of refinement in the manufacture of many specimens, the occurrence of examples apparently too large for practical use, and the absence of signs of wear on many examples. The distinctive features of the handaxe industry have not been satisfactorily explained by accounts based on the mechanics of handaxe production or use. They can, however, be accounted for by a model which treats them as both functional tools and as Zahavian handicaps, serving as honest indicators for mate choice.

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Power C.[1] **African initiation rites as mechanisms for alliance formation: reciprocity or handicap principle?**

In evolutionary environments, a criterion of mate choice for both sexes would be ability to negotiate social alliances. Initiation ritual could function to demonstrate the extent of an individual's alliances to prospective mates. But if initiation rites are understood as mechanisms for formation and display of alliances, what is the most appropriate model for the evolution of these costly signals? Do rituals serve to establish reciprocity (cf. Trivers 1971) or prestige (cf. Zahavi and Zahavi 1997)? These two models argue different underlying reasons for the high costs involved in ritual. In the case of reciprocity, the high cost of joining an alliance acts as deterrence to cheats or freeriders. In the Handicap or prestige model, high signal costs reliably indicate quality to alliance partners and prospective mates. Reciprocal altruism theory predicts that ritual mechanisms should be elaborated as risks of freeriding increase. Factors such as density, dispersal and mobility of populations (including which sex moves and stability of marriages) should affect signal costs. Handicap principle predicts that rituals become more expensive as sexual selection intensifies: male ritual signalling elaborates as competition for access to healthy, fertile females increases; female signalling elaborates as competition for access to male-controlled resources increases. Predictions of these two models are tested against a sample of initiation rites for both sexes in 22 sub-Saharan African cultures. A reciprocity model is supported in the case of female initiation, while a handicap model is supported for male initiation.

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Watts I.[1] **Costly display in the Middle Stone Age of Southern Africa: red ochre use and the evolution of symbolic representation**

Beginning ca.300-400kya, red ochre is the earliest archaeological evidence not directly concerning subsistence. By the early Late Pleistocene, between 100k and 130kya, its use became both regular and ubiquitous in southern Africa, subsequently spreading with the dispersal of modern humans. Since ochre was principally used as a pigment, costly signalling theory is applicable to its analysis. Use of red ochre increases tenfold in southern Africa during the early Late Pleistocene. Data from Blombos Cave (southern Cape, South Africa) demonstrates preferential collection and modification of materials with the most saturated and reddest streaks, despite temporal changes in raw material use. At most sites, ochre would have been locally procured, but we see examples of high quality, apparently exotic materials. At the few sites where ochre is locally scarce, MSA people seem to have gone to considerable lengths to procure it. Procurement distances of up to 130km are indicated, having no counterpart in contemporary, regional, lithic procurement patterns. Other indications of the costs associated with ochre use come from intensively utilised pieces. Repeated episodes of abrasion frequently resulted in honed points or 'crayons', these are among the most curated objects encountered. Preferential selection of saturated reds is particularly pronounced, and the form of abrasion suggests use for defined marking rather than colouring large surface areas, consistent with design. Direct evidence for design is provided by several pieces of ochre bearing geometric engravings at >70k BP. Zahavi's 'handicap principle' would suggest that we are dealing with costly ritualised displays.

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Giles A.[1] **Sexual selection, ornamentation and the archaeological record**

Within a Darwinian framework, human ornamentation can be seen to relate to sexual selection. Different male/female reproductive strategies and different socio-cultural environments should therefore result in different patterns of ornamentation. If this is the case, patterns of ornamentation seen in the archaeological record can be used to explore the reproductive strategies of men and women in past societies. Building on Bobbi Low's study (1979), and using studies utilising the Standard Cross-cultural Sample (Murdock & White 1969) and the HRAF, I show that, ethnographically, different socio-cultural contexts relate both to different male/female dynamics and to significantly different patterns of ornamentation. These findings are used to interpret ornamentation patterns recorded for the European Bronze Age. The results show that the Darwinian framework has considerable potential for the interpretation of male/female reproductive strategies in the archaeological record. Certain existing hypotheses are strengthened, others are challenged, and new interpretations for elements of Bronze Age ornamentation that have so far been unexplained are
suggested.

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Friday Afternoon Plenary Address

Connor R.C.[1] **Male dolphin alliances in Shark Bay, Western Australia**

Male bottlenose dolphins in Shark Bay, Western Australia, exhibit two levels and two patterns of alliance formation. Trios and pairs of males cooperate to form consortships with individual females that are often maintained with aggression. Teams of such alliances cooperate in conflicts with other alliances over females. Some pairs and trios are quite stable, lasting up to 15 years, whereas in one 14

member 'super-alliance,' pairs and trios were relatively labile. Such lability invites the hypothesis that super-alliance males viewed each other as 'equivalent' for the purposes of forming consortships. However, there were marked partner preferences in the super-alliance and alliance stability correlated with consortship rate, suggesting a more complex social structure. Male-male bonds were maintained by synchrony as well as by physical contact. Individuals surfaced synchronously with their pair and trio alliance partners more often than with other males in the group. Synchrony between individuals from different but affiliating alliances occurred more often during socializing and especially during more intense bouts of social activity that often involved a female consort. These results suggest a role for synchrony in tension-reduction as well as other forms of bond maintenance. The occurrence and complexity of bottlenose dolphin male alliances varies between study sites and may co-vary with a number of factors, including the rate that males encounter each other in competitive circumstances. This logic suggests an explanation for sex differences in alliance formation in fission-fusion species that is more general than has been offered for primates. The primate model compares the rates of territorial encounters between males and females but fails to explain the patterns in non-territorial odontocetes. The odontocete model focuses on differences in encounter rates in competitive circumstances: receptive females for males, and resources for females. Territoriality is then incorporated as a special case in which competitive encounters are extended to include defense of areas containing resources and females.

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5 Friday Early Afternoon Paper Sessions

5.1 Symposium: Evolution of Individual Differences I Organisers:- Samuel Gosling and Alexander Weiss

Symposium abstract: Evolutionary psychology has focused primarily on the mechanisms that underlie human universals, and has largely overlooked the origin and role of individual differences. Yet individual differences in personality, temperament, and intelligence have long been a central focus of personality psychology, developmental psychology, and behavior genetics and have recently been identified in a wide range of non-human species. The symposium's goal is to present emerging work by a collection of theorists and researchers who believe that individual differences can and should be reconciled with evolutionary processes. Specifically, the papers in this symposium will use a variety of evolutionary perspectives and multiple levels of analysis to integrate evolutionary processes with the development, maintenance, and detection of individual differences. Together these papers underscore the theoretical relevance of individual differences for evolutionary psychology and highlight the viability of studying them.

MacDonald K.B.[1] **Levels of an evolutionary perspective on personality**

This paper develops a synthetic perspective that incorporates three levels of analysis: Personality systems as universal psychological mechanisms; systematic group (i.e., gender, birth order, age, ethnic) differences that can be illuminated by evolutionary theory; and individual differences. At the level of universal mechanisms, personality systems are species-typical systems with adaptive functions in the human environment of evolutionary adaptedness. At the level of group differences, the evolutionary theory of sex, parent-offspring conflict theory, and life history are used to analyze sex, age and ethnic differences in personality systems. At the level of individual differences, variation in personality consists of a range of viable evolutionary strategies for humans. Humans evaluate and act on the genetic and phenotypic diversity represented by this range of viable strategies in order to solve adaptive problems.

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Figueredo A.J.[1], *King J.E.*[2] **The evolution of individual differences in behavior**

There exists a long history of psychological research into human individual differences in such areas as temperament, personality, and intelligence. Recently appended to this corpus is an emerging literature documenting the existence of parallel differences in nonhuman animals. Thus, there is increasing reason to ponder the evolutionary basis of such individual differences. While some theorists have explored the potential adaptive value of particular traits, few have examined the possible adaptive significance of the interindividual variability itself. Although some species seem to possess a degree of interindividual variabilty comparable to that of humans, there nevertheless appear to be major differences in the extent of individuation across different taxa. These differences in variability do not seem to reflect those of a single phylogenetic progression, or adaptive radiation, but a process of graded convergence across sometimes taxonomically distant groups. The most likely ecological correlate of individuation appears to be degree of sociality. A new theory is proposed that derives the evolution of interindividual variability from a frequency-dependent mechanism of disruptive selection analogous to intraspecific character displacement. Theoretical and practical implications of this theory are discussed.
*Presenter

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O'Gorman R.[1], *Wilson D.*[2] **Individual differences, social norms, and the performance of task-oriented groups**

It can be expected from evolutionary theory that humans will vary in their willingness to cooperate in groups. In addition, this variation is likely to be affected by social norms which can alter the social environment regarding cooperative behavior. Thus, it can be predicted that there will be an interaction effect between the normative climate and individual differences. We examined individual differences for cooperative behavior in an experiment in which groups of individuals were assigned a task of studying a number of papers for an examination. Measurements were taken of participants using personality scales that relate to group behavior, including one which relates to working cooperatively with other individuals. Participants were randomly assigned to groups, some of which were instructed to design a set of ground-rules for their own group, to which the group-members had to sign their names. The ground-rules would prescribe how the group would accomplish it's task. Participants logged how much time they spent studying for the

exam, both alone and as a group. Finally, evaluations of the task, group, and individual reactions to the situation were measured after the exam. The data suggests a relationship between individuals' disposition towards working cooperatively with other individuals and their performance as individuals vis-à-vis as part of a group, and also suggests that a normative environment interacts with these relationships. Furthermore, individuals' perceptions of other group members' effort relates with the cooperative dispositions of those individuals.

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Buss D.M.[1] **Navigating the psychological topography of individual differences**

Each person's social landscape contains individuals who differ in their value as dyadic allies, coalitional collaborators, reproductive consorts, and genetic vehicles. The interpersonal topography also contains treacherous peaks and valleys—people who can impede, derogate, humiliate, betray, steal, cripple, or kill. Humans have evolved assessment devices designed specifically for negotiating the social and psychological labyrinth. Social selections, for example, are not based on universals such as whether a person possesses language or bipedal locomotion. Decisions instead hinge on attributes that differ across persons. Correctly assessing future developmental trajectories , spheres of social influence, and hostile intent are indispensable for solving particular suites of adaptive problems. Because individuals compete with others in navigating the social terrain, they often attempt to manipulate reputations, affecting others' perceptions of their own and competitors' standings on key dimensions of difference. Derogation of competitors, for example, becomes a means for exploiting the assessment mechanisms of others in the service of alliance formation, mate competition, and hierarchy negotiation. The conceptual framework of evolutionary psychology must expand to incorporate the evolution of psychological assessment mechanisms, the role of individual differences in creating adaptive problems, and the means by which individual differences are exploited in solving adaptive problems.

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5.2 Nutrition and reproduction

Mueller U.[1], *Mazur A.*[2] **Evidence of unconstrained directional selection for male tallness**

There are many reports on a positive relation between tallness and socio-economic success, and between tallness and health in the human male. Accordingly, tallness is an explanatory variable in many studies on health or behavior. Recently a positive relationship of tallness to fitness has been reported. However, it remains unclear whether this fitness advantage is the effect of the socio-economic success of tall men (making them good providers) or of body height itself (tallness being associated with some genes directly - without father present - favorable for offspring number or survival). Also, the shape of the selection function (directional at all ? against short men ? favoring men around some above-average height ? favoring only very tall men ?) remains unclear. Here, for a cohort of military officers, we show that tallness has a direct casual effect on male fitness, independent of socio-economic success, and that selection works strongly in favor of very tall men, not just against short men. Since there are no hints of any evolutionary check on this selection, these findings suggest unconstrainted directional selection for tallness in men.

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Sear R.[1], *Mace R.*[2], *McGregor I. A.*[3] **The effects of maternal phenotypic condition on fertility and child mortality in rural Gambia**

Life history theory predicts that trade-offs will be observed between reproductive effort and somatic effort, such as growth or somatic maintenance. In practice, phenotypic correlations often obscure these trade-offs. This analysis uses demographic and anthropometric data collected over 25 years from rural Gambia to demonstrate that reproductive effort and somatic maintenance are positively correlated in rural Gambia. Multilevel discrete-time event-history analysis on the predictors of birth rate revealed that women in good phenotypic condition, measured by height, weight and haemoglobin level (an indicator of both nutritional status and disease load) have significantly higher reproductive rates than women in poor condition. Similar analysis on the probability of child death shows that the children of tall women also have lower rates of mortality than those of shorter women. This suggests that phenotypic correlations between reproductive and somatic effort are prevalent during the reproductive lifespans of women in this population. It also suggests that women who invest resources in growth rather than reproduction in adolescence benefit in later life in terms of faster reproductive rate and higher child survival.

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Hagen E.H.[1], *Barrett H.C.*[2], *Price M.E.*[3] **Social correlates of health and nutrition in a Shuar village**

The Shuar are Native South American horticulturists. Anthropometric and other health data were collected from approximately 150 members of a Shuar village in Ecuador. Indices of recent access to food included body mass index (BMI) and an index of body fat computed from triceps and abdominal skinfold thicknesses. Indices of long term access to food and other nutrients were height-for-age, arm muscle area, and a 'development' index computed from mid-upper-arm circumference and calf circumference. Family variables that were predicted to correlate with these indices included the number of consumers, the number of producers, reproductive value, and father status. After controlling for age and sex, each of these variables was significantly correlated with the indices of recent access to food among dependents aged 3-20, and a multivariate regression model incorporating all four accounted for 38% of the variance in the body fat index, and 29% of the variance in BMI. The indices of longer-term access to food and nutrients correlated with number of consumers and producers, and (marginally) father status for this same group of dependents. A multivariate regression model incorporating these three variables accounted for 23% of the variance in the development index. The consumer/producer ratio was (marginally) correlated with arm muscle area.

These results accord well with parental investment theory, as well as with the work of Chayanov. They also replicate, in part, earlier results reported for a Yanomamö village by Hagen et al. (in press).

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Aiello L.C.[1], Key C.[1] **The energetic consequences of being a *Homo erectus* female**

Body size is one of the most important characteristics of any animal because it affects a whole range of behavioural, ecological and physiological traits including energy requirements, choice of food reproductive strategies, predation risk, range size and locomotor style. This paper focuses on the implications of being large bodied for *Homo erectus* females, estimated to have been 65.6% larger than average australopithecine females. The energy requirements of these hominins are modelled using data on activity patterns, body mass, and life history from living primates. Particular attention is given to the inferred energetic costs of reproduction for *Homo erectus* females based on chimpanzee and human reproductive scheduling. Daily energy requirements during gestation and lactation would have been significantly higher for *Homo erectus* females as would total energetic cost per offspring if the australopitheicnes and *Homo erectus* had similar reproductive schedules (gestation and lactation lengths and interbirth intervals). Shortening the interbirth interval could considerably reduce the costs per offspring to *Homo erectus* and have the added advantage of increasing reproductive output. The mother would, however, incur additional daily costs of caring for the dependent offspring. If *Homo erectus* females adopted this reproductive strategy, it would necessarily imply a revolution in the way in which females obtained and utilized energy to support their increased energetic requirements. This transformation is likely to have occurred on several levels involving co-operative economic division of labour, locomotor energetics, organ size, and other physiological mechanisms for reducing the energetic load on females.

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5.3 Mental health

Nesse R.M.[1], Keller M.C.[2] **A central Darwinian algorithm: the role of mood in regulating allocation of effort among goals**

The large-scale structure of human behavior is organized by goals. This gives advantages by allowing pursuit of large tasks that can only be accomplished over multiple episodes of effort at separate times, and by facilitating strategic flexibility in the face of obstacles. Fitness depends substantially on making commitments to goals that will give maximal reproductive payoff, allocating effort optimally among them, and shifting strategies, goals and patterns of effort, as a function of experience and anticipated payoffs. Substantial evidence shows that low mood is aroused when efforts to reach a goal appear increasingly futile. Low mood is said to escalate to depression when a person is unable to disengage from an unreachable goal, but specific evidence on this has been lacking. To test this hypothesis, we conducted an intensive study of a community sample of 120 adults from census blocks of middle or low income that were predominantly white or predominantly black. Six hours of interviews were conducted over three sessions to gather standard psychological and social measures in addition to new measures of goals and the success of efforts to pursue them. Physiological measures and salivary samples for cortisol and were gathered simultaneously. Preliminary analysis of this data shows an association between depression and the pursuit of unreachable goals. The data also reveal that patterns of effort allocation vary systematically among people as a function of their age, sex, partner status, reproductive status, and work/income status in ways that would tend to maximize reproductive success.

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Pillmann F.[1] **Gender differences in the incidence of unipolar depression from an evolutionary perspective**

OBJECTIVE: A female preponderance in unipolar depression has been consistently demonstrated. We explore the hypothesis that an evolved adaptive gender-specific trait underlies the observed differences in incidence. METHOD: Own data from 1036 in-patients and epidemiological data from the literature are used to test conclusions drawn from theoretical considerations. RESULTS: Evolutionary hypotheses converge in postulating unipolar depression to be the extreme manifestation of an adaptive trait serving as a „defense": the individual is protected from the harmful consequences of its own continued activities. Such a trait would be expected to show a gender difference favoring women. Clinical and epidemiological data consistent with this concept include: the dimensional nature of the gender difference, its size and age distribution, and a positive correlation between severity of depression and magnitude of the gender effect. CONCLUSIONS: Data are consistent with the hypothesis although more direct tests are necessary.

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Navarrete C.D.[1], Kurzban R.[2], Fessler D.M.T.[3] **Anxiety and world-view defense: terror-management or coalition psychology?**

According to terror-management theory (TMT), existential terror is managed by the individual's worldview, which gives subjective reality a sense of permanence, order and meaning. To the extent that one's worldview provides protection against death concerns, reminding individuals of their death should increase the need for this buffer (Greenberg, Pyszczynski, and Solomon, 1986). Advocates of TMT have shown that subjects who are asked to contemplate their own deaths exhibit positive evaluations of people whose attitudes and values are similar to their own while derogating those with dissimilar views (Harmon-Jones, et al., 1997).
In contrast to TMT, our evolutionary view holds that the relevant psychological issue is not existential terror, but rather the workings of those features of the mind that facilitate social networks and bonds. Positive evaluations of norm-conforming behavior and negative evaluations of norm-violating behavior serve to advertise an individual's allegiance to shared standards and hence one's reliability and predictability as a coalition member, a status the value of which increases in times of uncertainty. This leads to the prediction that some types of aversive stimuli will lead to increases

in ethnocentrism, pro-normative attitudes, etc. Hence, whereas TMT predicts that no stimuli or arousal short of that which elicits thoughts of death will lead to the aforementioned changes in social evaluation, we predict that other aversive stimuli will have this effect as well.
Here we present data from experiments consistent with our view. Subjects asked to meditate on aversive thoughts without being reminded of their mortality were more likely to derogate dissimilar others than subjects in a control group. These effects were not accompanied by an increase in accessibility of death related thoughts. Implications for this research are discussed.

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Fessler D.M.T.[1] **Pseudoparadoxical impulsivity in restrictive anorexia: an evolutionary perspective**

Sufferers of restrictive anorexia nervosa exhibit a combination of rigorous self-restraint and episodic impulsivity, including binge eating, anger attacks, kleptomania, self-mutilation, and suicidality. The apparent paradox of excessive self-control punctuated by impulsivity can be resolved using an evolutionary perspective that views impulsivity in general, and many of the above behaviors in particular, as fitness-enhancing responses to resource scarcity. Evidence from experimental, catastrophic, and 'therapeutic' human starvation, and data from animal models, support the ubiquity of increases in impulsivity under severe dietary constriction. The serotonergic system is the proximate mechanism mediating the relationship between dietary adequacy and impulsivity. Self-injurious behaviors are explicable as misfirings of a calibrated reduction in risk sensitivity. Similarly, excessive exercising by anorexics may reflect reward systems that normally encourage adaptive increases in ranging behavior under conditions of scarcity.

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5.4 Evolution of language II

Hurford J.R.[1] **The neural basis of predicate-argument structure**

Neural correlates exist for a basic component of logical formulae, PREDICATE(x).
Vision and audition research in primates and humans shows two independent neural pathways; one locates objects in body-centered space, the other attributes properties, such as colour, to objects. In vision these are the dorsal and ventral pathways. In audition, similarly separable `where' and `what' pathways exist. PREDICATE(x) is a schematic representation of the brain's integration of the two processes of delivery by the senses of the location of an arbitrary referent object, mapped in parietal cortex, and analysis of the properties of the referent by perceptual subsystems.
The brain computes actions using a few `deictic' variables pointing to objects. Parallels exist between such non-linguistic variables and linguistic deictic devices. Indexicality and reference have linguistic and non-linguistic (e.g. visual) versions, sharing the concept of attention. The individual variables of logical formulae are interpreted as corresponding to these mental variables. In computing action, the deictic variables are linked with `semantic' information about the objects, corresponding to logical predicates. Mental scene-descriptions are necessary for practical tasks of primates, and pre-exist language phylogenetically. The type of scene-descriptions used by non-human primates would be reused for more complex cognitive, ultimately linguistic, purposes. The provision by the brain's sensory/perceptual systems of about four variables for temporary assignment to objects, and the separate processes of perceptual categorization of the objects so identified, constitute a preadaptive platform on which an early system for the linguistic description of scenes developed.

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Brighton H.[1]*, Kirby S.*[2] **The survival of the smallest: Prerequisites for the cultural evolution of compositional syntax**

Much linguistic research suggests that the structure of human language is determined to a large degree by the structure of an innate language faculty. This has led many researchers to examine the role of natural selection in explaining the origins of language. In this paper, however, we extend recent work that suggests that some of the fundamental properties of language are not directly determined by the learning mechanism but instead emerge from the dynamics arising from cultural selection.
We employ a computational methodology termed the "iterated learning model" to explore the relation between learning biases and cultural stability of languages. In this model, information is transfered solely via cultural rather than genetic transmission. Cultural transmission is modelled using a mathematically sound approach to learning based on Kolmogorov complexity. We view language as a complex adaptive system, and note that only stable languages will survive. Stability results when a language is learnable from sparse exposure, but is nevertheless expressive.
We argue that the emergence of compositional syntax (the property of human language where the meaning of a signal is a function of the meaning of its parts) occurs under specific conditions of preadaptation. A compositionally structured language only has a cultural stability payoff when: 1. An agent must frequently express meanings for which no pertinent signal has been observed. This phenomenon is known as the poverty of stimulus. 2. The cognitive apparatus of the agent is such that meanings are represented with a high dimensionality. We argue that these conditions are specific to hominids — the number of communicatively relevant situations coupled with the degree of complexity used in categorising these situations results in a strong pressure for the emergence of compositional syntax.

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Martell C.[1]*, Schoenemann P.T.*[2] **Modeling evolution of language without "mind reading"**

Agent-based modeling has become increasingly popular as a method for testing the evolutionary plausibility of theories of language. Artificial neural nets, in particular, have been used since they seem to parallel fundamental features of how the brain works. However, most neural-net models are trained using the correct answer. In a model of agents communicating with one another this is equivalent to the agents reading each others "minds" — a trait

we do not want to ascribe to people when learning a language. In this paper, we look at one such model (Batali 1998) and show that if we try to incorporate noise in the training, such that the nets are not always trained on exactly the correct answer, the population of agents do not appear to converge on a common language. This noise is meant to model the fact that in real situations people are presented with a variety of stimuli accompanying each sentence, such that the intended meaning is not inherently clear. Since any model of language development must take this into account, we discuss possible solutions. One possibility is a system of neural-net based agents which trains an agent using the response of other agents, not by knowing what is in other agents' "minds".

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Schoenemann P.T.[1]*, Martell C.*[2] **A neural net model of word learning in children that does not require language-specific innate constraints**

Explanations of language evolution usually invoke some forms of innate constraints operating on the learning mechanism. These constraints are assumed to be specific to language (e.g., part of a hypothetical "language acquisition device"). However, since the evolutionary process is biased towards elaborating pre-existing abilities, it is important to investigate ways in which language might have evolved without requiring language-specific adaptations. One area in which a number of innate constraints have been proposed is in the acquisition of word meanings by children. How does a child learn what a particular word means, given that it could potentially refer to almost anything in the child's cognitive universe? We discuss a model of how children might learn word meanings that does not require language-specific constraints, but instead relies on successive loose mappings between strings of words the child hears and an array of possible semantic meanings. Over time, the mappings of individual meanings to individual words emerge as some associations are strengthened and all others are not. We demonstrate that simple neural nets have this very ability. Since real brains are many orders of magnitude more complex, it is likely that this model is applicable to human children, thereby obviating the need for innate constraints on word learning.

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6 Friday Late Afternoon Paper Sessions

6.1 Individual differences II

Sulloway F.J.[1] **Darwinian strategies in ontogeny: toward a family dynamics model of individual differences**

Research in behavioral genetics has shown that roughly half of the variance in personality is attributable to the environment and that most environmental influences are not shared with siblings. This means that the development of personality involves substantially "open genetic programs" that achieve ontogenetic adaptations through experiences that are largely unique to the individual.
These conclusions have given new impetus to studies of contingent differences within the family, including birth order, salient features of "family niches," and sibling relationships more generally. In this paper I present a Family Dynamics Model of sibling differences, which includes four mechanisms: (1) parent-driven processes associated with differences in parental investment; (2) predominantly sibling-driven processes involving niche partitioning within the family; (3) sibling-driven interactions associated with status differences within the sibling dominance hierarchy; and finally (4) sibling-driven efforts at divergence and "deidentification," especially among adjacent siblings. Recent research on more than two hundred thousand subjects who were recruited on the Internet provides supporting evidence for this model.
Finally, I also discuss to what extent such influences generalize to behavior outside the family of origin and present data showing that sibling strategies persist in adulthood among nonfamily members and are sometimes transformed to facilitate other adaptive goals.

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Grant V.[1] **Characteristics of achieving women**

Professionally written biographies of 169 women selected for inclusion in a Dictionary of Biography were analysed for data on family size and structure, longevity and personality characteristics. Results showed that women were more likely to be biographees if they had never married, or, if married, had no children. Of those who did have children, biographees were more likely to have given birth to boys only or more boys than girls rather than girls only or more girls than boys ($p<.05$). Married women without children lived longer on average than either those that had never married or those with children. Mothers of sons or more sons than daughters had the shortest life spans on average. The incidence of a cluster of personality characteristics related to dominance support the notion that mothers of sons differ from mothers of daughters on this dimension. An attempt is made to interpret results from an evolutionary perspective.

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Mealey L.[1] **Behavior genetic tools for studying human universals**

Evolutionary psychologists seek to elucidate the mechanisms underlying human universals; behavior geneticists seek to elucidate the mechanisms underlying individual differences. The wheat of one discipline tends to be the chaff of the other. But do both throw out the baby with the bath water?
Much of human variation is likely to be evolutionarily meaningful—for example, the result of universal facultative responsivity, niche specialization, age- and sex-related pleiotropy, and frequency-dependent selection. Behavior geneticists have studied these phenomena from other perspectives and using other terminology (e.g. phenotypic canalization, reaction range, gene-environment correlations and gene-environment interactions). This presentation will highlight several behavior genetic methodologies that can contribute to the study of evolutionary psychology— in particular: monozygotic cotwin comparisons, meta-analyses of broad versus narrow heritability, and analysis of covariance (comorbidity).

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Weiss A.[1], King J.E.[2], Enns, R.M.[3] **Subjective well-being in chimpanzees is heritable and genetically correlated with dominance**

We investigated whether happiness and personality were the result of common genes, by estimating genetic and environmental sources of variance and covariance on SWB and Dominance scores from 128 zoo chimpanzees. Seven models estimating different sources of variance and covariance were compared using a derivative free restricted maximum likelihood procedure. The two models with the best fit and parsimony were similar. Both included additive genetic and nonshared environmental effects for SWB and Dominance and strong genetic correlations. They differed in that one model had moderate heritable maternal effects and negligible nonshared environmental correlations whereas the other had maternal effects fixed to 0 and moderate environmental correlations. Of these, we chose the model that did not include maternal effects because it was the more parsimonious of the two. The genetic correlation between SWB and Dominance suggest that happiness may be a sexually selected signal for fitness.

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6.2 Parental investment and sex ratio

Hames R.[1], Draper P.[2] **Women's work, child care and helpers at the nest in a hunter-gatherer society**

Although a large literature on "helpers at the nest" exists, very little deals with humans. The research we do have on humans demonstrates the effect in agricultural populations where mother's workload is high, the location of her work is near the home and her child care and work can be mitigated by putting an elder child, usually female, in charge of younger children. In such cases the reported findings are that women with first and sometimes second born daughters achieve higher total fertility than women whose first and second born children are sons. In the present study we ask: "Does 'daughter first' improve mothers' reproductive success in a hunting and gathering context?" Among the Ju/'hoansi (!Kung) researchers have reported an absence of a peer caretaking custom and have explained it on the grounds of an interrelated set of factors that cause women not to delegate substantial caretaking to any allo-parent, including children. These factors are: the work of women takes them far from home base; the distance and conditions of travel to gatherable food render children inappropriate as helpers; women breast feed for several years; there is an absence of weaning foods.
We report the results of our analyses of reproductive histories of older Ju/'hoansi women and consider women's reproductive success in the context of the gender sequence of children, survivorship of sequential children and situational factors of the woman's own position in a kinship structure. We discuss important methodological considerations that ought to be employed by those attempting to deal with this problem.

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Lummaa V.[1] **Trade-off between current and future reproductive investment in pre-industrial Finnish mothers: consequences of offspring number, gender and survival**

The number and gender of offspring produced in a current reproductive event can affect a mother's future reproductive investment and success. I studied the subsequent reproductive outcome of pre-industrial (1752-1850) Finnish mothers producing twins versus singletons of differing gender. I predicted that giving birth to and raising twins instead of singletons, and males instead of females, would incur a greater reproductive effort and hence lead to a larger future reproductive cost for mothers. I compared mothers' likelihood of reproducing again in the future, their time to next reproduction, and the gender and survival of their next offspring. I found that mothers who produced twins were more likely to stop breeding or breed unsuccessfully in the future as compared to those of a similar age and reproductive history that produced a same-gender singleton child. As predicted, the survival and gender of the offspring produced modified the costs of reproduction for the mothers. Giving birth to and raising males generally appeared to be the most expensive strategy, but this effect was only detected in mothers producing twins and thus suffering from higher overall costs of reproduction.

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Leonetti D.L.[1], Nath D.C.[2], Hemam N.[3], Rende Taylor L.[4] **Is female-biased parental investment evident in two culturally different low caste Indian ethnic groups?**

The association of low status with female-biased parental investment in human societies as predicted by the Trivers-Willard hypothesis is examined in two of the lowest status groups (with equally low economic resources) in N. E. India: scheduled caste Bengalis in Assam and scheduled tribe Khasis in Meghalaya. These groups differ dramatically, however, in their cultural kinship systems. The Bengali are patrilineal with restriction of female mobility. Marriages are arranged and the woman joins her husband's household to be supervised by her mother-in-law, providing paternity certainty. Men control all property and dominate selling and buying in the markets. The Khasi are matrilineal and women own property and run the markets. When a daughter marries, the husband may or may not join her household. She continues to reside with her mother until one or two children are born then moves into her own household when a younger daughter marries. Among both Bengali and Khasi, demand for children is high. However, women's work is labor intensive and their nutritional status is poor. Therefore, a reproductive age woman's capacity to produce and raise children is clearly marginal and dependent on her culturally constrained access to resources. Survivorship of children and their growth is contrasted and effects of household composition (extended lineal, nuclear, female-headed), resources, and mother's nutritional status are considered in the assessment. No sex-bias of investment is evident among Khasis, while male-bias of investment appears among Bengalis. The latter finding may be due to lack of opportunities for hypergeny in this very low caste.

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Norberg K.[1] **Cads and kids: paternal investment and the sex ratio at birth in the United States, 1970-1998**

Over the last several decades, there has been a modest decline in

the human sex ratio at birth in the US, Canada, and a number of other industrialized countries. I propose an association between a decline in paternal investment and a decline in the sex ratio at birth. This is demonstrable in cross-sectional observations from US vital statistics, but a stronger causal argument is made, based on prospective data from two nationally representative surveys. In a combined sample of 26998 births, I find that mothers who are married or living with a male partner when interviewed before the child's birth had 51.73% male infants; mothers who were not living with a male partner had 49.53% male infants. (Chi square = 11.18, p = .001) The effect holds true after controlling for many other observable factors, among children born to the same mother or father, and when the comparison is made before the child's conception. Selection against male birth may occur at conception or later; for example, non-cohabiting couples may have less frequent intercourse, or lower paternal involvment during pregnancy may lead to selective miscarriage. This result is strongly consistent with a Trivers-Willard effect in humans; furthermore, I suggest that mating markets may provide the signals by which an individual "reads" his or her own status relative to the local reproductive community in the TW model.

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6.3 Symposium: Evolution of Technology Organiser Robert Aunger

Symposium abstract: The Evolution of Technology

A plethora of social scientists are currently attempting to address the growing impact of modern technology on contemporary life. However, their studies tend to focus on themes like "identity in the Age of the Internet," or "the social construction of virtual reality." Such studies do not provide an understanding of the forces at work changing modern societies. After all, we're still not sure about even the most basic features of technological change: Is necessity the mother of invention, as a popular adage suggests? Perhaps the reverse is true: our "needs" for new products are manufactured, the creation of advertisers. There is not even a widely accepted vocabulary for public or scientific discussion of this topic. What is technology anyway? Presumably, it includes -- at minimum -- artifacts and the know-how necessary to make them. But where is this know-how? In people? In factory assembly lines? In the "invisible hand" of the market? Or in all of the above? We don't currently have a framework for addressing these questions. This session seeks to provide a solid theoretical foundation for discussions of technological change by using evolutionary theory as a means for developing a better understanding of artifacts. A range of proposals toward this end are presented.

Aunger R.[1] **Artifacts: evolving evolvability**

Evolutionary theory has difficulty accounting for artifacts because they are not just phenotypes, or interactors, or replicators. Instead, artifacts are a heterogeneous group sharing only the quality of being produced from environmental materials through the activity of organisms (and even this relationship is becoming more indirect as factories become automated, and machines begin to make machines). An Acheulian handaxe, for example, can be seen as a mental object (the artifact's "genotype"), which is used to create, through an activity such as flint-knapping, a physical object (the phenotype, or artifact itself). Alternatively, Dan Dennett sees artifacts as true Dawkinsian vehicles: objects such as cars lumber around the landscape with "car" memes (or cultural replicators) inside. Some artifacts, however, are parasitic replicators, such as computer viruses. These viruses feed off a computer's metabolic ability by causing it to automatically update its memory. Yet other artifacts are (or will be) true replicators: nanites, or nano-scaled machines which can self-assemble and replicate (presently in virtual forms inside computers). They will (perhaps soon) be able to metabolize some form of energy and reproduce themselves independent of human activity.

The examples above exhibit a temporal order, from hand axe to nanite. New, more dynamic categories of artifact are continually being added to the existing roster. The types of artifact which arrive later have internalized the ability to change themselves in more and more fundamental and powerful ways with time. I therefore conclude that artifacts are evolving greater evolvability, which accounts for their ability to occupy multiple evolutionary categories.

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Webb R.H.[1] **Managing the evolution of technology**

Processes for managing research and development (R&D) within commercial organisations show many similarities to those that govern evolution by natural selection. Distinctively human activities such as conceptual analysis and intentional design distort the underlying evolutionary dynamic less than is commonly supposed. This is clear even in larger organisations with more formalised R&D management systems. A Darwinian analysis of such systems in real organisations allows us to locate and quantify the primary evolutionary drivers: mutation, recombination, selection and replication. By deliberately manipulating these parameters, it is possible to improve the performance of the R&D process very significantly. Many of the interventions suggested by an 'evolutionary audit' are consistent with current best practice. However, its theoretical basis is quite different from that of standard technology management theory, and this can lead to unusual recommendations. For example, managers are prompted to identify and eliminate 'parasitic' technologies freeloading in their R&D pipelines, and to introduce procedures to purge 'selfish' innovations that have proliferated internally but will never contribute to final products. An evolutionary approach also suggests novel ways of exploiting the distributed intelligence of internet users (without these people necessarily being aware that they are contributing to an R&D process).

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Lewens T.[1] **Technological evolution: good news and bad news**

There is good news and bad news for evolutionary models of technological change and technological innovation. The good news is that artefacts of all kinds do evolve by a process of Darwinian selection. The bad news is that models of technological evolution that are both general and informative are unlikely to be forthcoming. An analogue of Developmental Systems Theory seems likely to be applicable to technological evolution. This fact bolsters evolutionary models of technology change, since it frees them from

any obligation to find cultural analogues of replicators and interactors, or genotypes and phenotypes. Unfortunately, it also suggests that evolutionary models will not find any general principles of heredity that might give them novel predictive or explanatory resources. Hence evolutionary explanations for technology change will not add significantly to the kinds of explanations that are already available to the traditional human and social sciences.

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Wolpert L.[1] **Toolmaking and the origin of causal beliefs**

Primates can learn many complex tasks.and even use simple tools. Yet careful experiments (Povinelli: Folk Physics for Apes) make it clear that they have no concept of cause and effect. How did this causal understanding evolve? What advantages did it offer with respect to survival, when other primates thrived without it? I want to propose that it was necessary for the making and use of complex tools. It is not possible to make and use a complex tool such as a spear tipped with a stone arrow head without a concept of cause. This technology could be the adaptive activity that drove human evolution including language. Children develop core concepts of causality at a very early age and that basic causal thinking is activated with minimal effort .A case can be made that such causal thinking is genetically determined, a developmental primitive. Further evidence that brains are programmed with causal reasoning, the need to tell a consistent story, comes from mental illness, such as confabulation due to brain damage.

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6.4 Evolution of language III

Smith K.[1] **Key learning biases for the cultural evolution of communication**

It has been argued that human language is the only learned symbolic communication system in the natural world. Recent computational models (known as "iterated learning models") investigate what sorts of learning mechanism must be in place in order to ensure that such communication systems are culturally stable. There appear to be two key learning biases that are required. Existing models may be reinterpreted in terms of these two biases, their common elements emphasised and related to known properties of child language learning.

The two biases can be expressed in terms of a production function, p(m), mapping meanings to signals, and a reception function, r(s), mapping signals to meanings. Essentially, learning mechanisms that result in culturally stable systems are biased in favour of an injective p(m) which is a subset of r(s).

Problematically, these biases also make incorrect predictions of the structure of human languages. While they correctly predict a lack of synonymy, they also predict few homonyms, which are actually rife in linguistic systems. The reasons for this and modifications to the iterated learning model involving the introduction of syntactic contexts will be discussed.

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Reed P.[1]*, Dickins T.E.*[2]*, Dickins D.W.*[3] **First stimulus equivalence class formation, second symbolic behaviour?**

There has been recent debate within the field of behaviour analysis as to whether the ability to form 'mathematical' (ME) stimulus equivalence (SE) classes is essential for the acquisition of linguistic symbols, or vice versa (Horne & Lowe, 1996, and related peer commentary). This discussion has moved beyond ontogenetic concerns, and recent theorists have speculated on the role of stimulus equivalence in the evolutionary emergence of symbols and symbolic behaviour (Dickins & Dickins 2001; Place, 2000). In this paper we discuss the potential role for SE in both fixing the content of proto-linguistic symbols (Place, 1995/6), and providing the key symbol property of symmetrical reference (T .E. Dickins, 2000a, b; Hurford, 1989). This argument is augmented by data from fMRI studies (Dickins et al., 2001). Furthermore, we argue that there is some reason to be suspicious of claims for SE as a peculiarly human ability. First, it is unclear whether ME is identical to SE, there are other forms of equivalence that nonhumans display. Secondly, even if SE is identical to ME, then it is unclear if the optimal conditions for establishing SE have been employed in nonhumans. These reasons, together with the previous arguments, make for an evolutionary account of language that is thoroughly grounded in a revised view of SE and simple learning.

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Smith A.D.M.[1] **The role of shared meaning structure in communication**

Recent work in evolutionary linguistics has concentrated on the evolution of syntactic structure, explaining its emergence as a consequence of the recognition and coding of regularities between signals and meanings. The successful emergence of syntax in these simulations, however, is predicated on the pre-existence of a fixed, structured semantic representation, and on the explicit coupling of meanings and signals in the linguistic transfer. Language acquisition studies suggest, however, that feedback is not provided to language learners, meanings are not transferred, and conceptual structure is not innate, but is formed from an interaction between environmental experiences and the semantic structure of the particular language being learnt.

We investigate the interaction between the development of language and conceptual structure, using simulated populations of interacting agents, who build a conceptual model of the world around them through both direct experience of the world and, to a lesser extent, their communicative experiences. Agents develop individual, distinct representations of their environment, and a dynamic language develops in the population from the interactions between them. Although successful communication is possible when agents connect different meanings to the same word, overall communicative success appears to be related to the proportion of shared meaning structure in the population, suggesting an increased role for language in conceptual development.

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Yamauchi H.[1] **Baldwin boosterism and Baldwin skepticism in evolution of LAD**

It has been a popular idea that the Baldwin effect is a crucial factor of the evolution of language (e.g. Pinker & Bloom, 1990, Briscoe 1997). Based on Chomsky's Principles & Parameters theory (Chomsky, 1981), Turkel (to appear) studies a computational model in which agents try to establish communications. In the model, it is observed that over the course of evolution, large part of linguistic knowledge is significantly nativised. Initially six out of twelve genes represent parameters. At the end of the simulation, almost all genes represent principles. This result supports the idea that innate language knowledge is ascribed by the Baldwin effect.
Crucially, however, Turkel assumes that linguistic knowledge is directly encoded in genes. In other words, each gene can encode one principle/parameter. Given the fact that higher cognitive abilities are often the subject of polygenetic inheritance (Atmar, 1994), it is more sensible to assume that epistasis and/or pleiotropy play an important role in evolution of innate linguistic knowledge.
In the modified simulation of Turkel, two or more genes represent one principle/parameter (i.e., epistasis): and one principle/parameter is affected by two or more genes (i.e., pleiotropy). To model this polygenetic inheritance in Turkel, Stewart Kauffman's NK-landscape model (Kauffman, 1989) is incorporated. Striking results are observed; although convergence toward a single genotype is still observed, subsequent emergence of the Baldwin effect is severely suppressed under these circumstances –in the worst case, no parameters are replaced by principles.

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Friday Evening

Keynote Address

Maynard Smith J.[1] **The evolution of animal signals**

A major problem in explaining the evolution of animal signals is to explain why signals are reliable. Why don't animals lie? Various possible answers will be discussed – that signals are not in fact reliable; that signaller and receiver have a common interest; that the signal is a kind that cannot be faked; that the signal is too costly for lying to be profitable. A second question that arises for higher animals, particularly primates, is what signals can tell us about what is going on in the animal's head. Do signals merely reflect the internal state of the signaller, or can they provide accurate information about the external world? Does an animal that signals intend to alter the behaviour of the receiver?

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Saturday Morning Plenary Address

Jobling M.A.[1] **History and prehistory through the analysis of Y chromosomes**

Our DNA is a message from our ancestors. As it passes down to us, it mutates subtly at each generation; the pattern of these mutations contains the histories of population expansions, migrations, colonisations, conquests, and admixture. Most DNA undergoes recombination, which reshuffles information and makes this record difficult to decipher. However, one chromosome, the Y, bears a simpler signature of its past, since it escapes from recombination. This chromosome, responsible for the initiation of male development, is male-specific, so the record it carries is of a male-specific history. Together with mitochondrial DNA, a maternally inherited component of our genome, we can use the Y to investigate sex-specific processes in human evolution, from the origins of agricultural societies to the genetic impact of the colonising Europeans of the last 500 years. In cultures with patrilineal surnames, Y chromosome analysis gives access to sub-regional histories and can illuminate social phenomena such as the history of illegitimacy.

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7 Saturday Morning Paper Sessions

7.1 Symposium: Population history: genes, language and culture

Organisers Ruth Mace, Clare Holden and Stephen Shennan)

Population history I: genes

Pagel M.[1] **Accounting for phylogenetic and genealogical uncertainty in comparative studies**

Comparative studies are widely used to test hypotheses about evolution and adaptation: what were rates of migration?; what was the ancestral state of some trait?; or, are two or more traits correlated? To ensure that hypotheses are tested correctly, these investigations must account for the pattern of relationships among individuals within populations (the genealogy) or among species within higher taxonomic groupings (the phylogeny). However, phylogenies and genealogies themselves are seldom known with certainty, and different accounts of evolutionary history can return different answers to the comparative question. I outline a relatively new set of techniques that can be used to account for phylogenetic or genealogical uncertainty in comparative studies. Markov-chain Monte Carlo (MCMC) methods can be used to draw a random sample from the universe of possible histories, and to estimate the evolutionary hypothesis in each. In this way, uncertainty about the true tree is effectively removed from the comparative test, and conclusions are not conditional upon any given tree or genealogy. I illustrate the approach with an example from the primates.

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Thomas M.[1] **Genetic evidence for an Anglo-Saxon replacement of male Britons in England but not Wales**

British history contains several periods of major cultural change that may have coincided with substantial immigration from continental Europe, but the contribution of each of these postulated migrations to today's gene pool remains controversial. In this study, we examine evidence for recent male population

replacement in England. To do this, we used 12 biallelic polymorphisms and six microsatellite markers to define high-resolution Y-chromosome haplotypes in a sample of 313 males from seven towns located along an east-west transect from East Anglia to North Wales. The English towns were genetically very similar, but the two Welsh towns differed >significantly both from each other and from the English towns. We compared our data with an additional 177 samples collected in Friesland and Norway, and found no significant English/Frisian differences. Genetic dating suggests that the close English/Frisian affinity is consistent with a substantial Anglo-Saxon replacement of Y-chromosomes in England, but not in Wales.

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Zerjal T.[1], Wells R.S.[2], Yuldasheva N.[2,3], Ruzibakiev R.[3], Xue Y.[1,4], Qamar R.[1,5], Mohyuddin A.[1,5], Ayub Q.[1,5], Mehdi S.Q.[5], Tyler-Smith, C.[1] **History from genetics: a Y-chromosomal legacy from the Mongols**

The Y chromosome is a very sensitive tool for investigating 'genetic history' and events such as past migrations. The absence of recombination over most of its length and the father-to-son mechanism of inheritance provide the possibility of tracing male lineages through time. We have investigated 13 populations from Central Asia using two types of Y marker: 14 slowly-evolving binary markers were used to identify Y-chromosomal DNA haplogroups, while 16 highly polymorphic microsatellites were used to asses the amount of variation within each haplogroup. Large overall differences between eastern and western Central Asian populations were found, and a few populations showed low diversity, suggesting a small number of male founders. However, the most unexpected finding was that a single common lineage (haplotype) accounts for more than 12% of the chromosomes. The same haplotype has also been observed in populations from the far East of China and in the Hazara from the North of Pakistan. A single male lineage has thus spread recently through populations separated by enormous geographical distances. We have estimated the time of the most common recent ancestor for this haplotype, and it is roughly 800 years (95% CI 500-1600 years). It is possible that such a large-scale genetic event would be recognisable in the historical record and we are investigating the possibility that the lineage could be a genetic contribution from the Mongols during their expansion that started under the leadership of Chinggis Khan.

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Chikhi L.[1] **Admixture between farmers and hunter-gatherers during the Neolithic transition in Europe: evidence from Y chromosome and mtDNA data.**

The onset of agriculture in the Middle East triggered a population expansion which brought farming and associated technologies across Europe about 10,000 years ago (Ammerman and Cavalli-Sforza, 1984). The genetic impact of the arrival of the first farmers in Europe is however still much debated. While some authors have argued that this impact was "major" others have insisted that the transmission of agriculture was mostly a cultural process. The first view was prevailing among population geneticists due to the work of Cavalli-sforza, Sokal, Barbujani and their collaborators. It has been challenged recently by results coming from mitochondrial DNA (mtDNA, e.g. Richards et al., 2000). The interpretation of the mtDNA data lead to a controversy that is now fuelled by new results and interpretations of Y chromosome data (Semino et al., 2000).
In previous studies, the importance of the Neolithic contribution in Europe has been inferred using indirect approaches (correlations between genetic and archaeological or linguistic data, coalescence time of haplogroups, etc.). However, if one wishes to estimate admixture in Europe, a specific model is required. Chikhi et al., (in press) have developed such a method. The method takes into account drift since the admixture event.
The method is applied to the Y-chromosome and mtDNA data published by Semino et al., (2000) and Richards et al. (2000), respectively. In both studies the authors suggest that the contribution from Neolithic farmers is most likely to have been around or less than 10-20%. The admixture analysis does not confirm this view.

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Goldstein D.B.[1] **Contrasting male and female demographic histories with Y chromosome and mtDNA variation**

The uni-parentally inherited genetic systems, the mtDNA and Y chromosome, offer a range of unique advantages relative to other genetic regions for evolutionary inference. For this reason both systems have been used extensively in efforts to infer human evolutionary history, and have provided important insights into the maternal (mtDNA) and paternal (Y chromosome) histories of many different populations. Because most studies have tended to focus on only one of these complementary systems, however, we have relatively little information concerning differences in the demographic histories of males and females. Here I review three examples in which Y chromosome and mtDNA variation were used to compare the demographic histories of males and females in specific populations. In cases involving populations from North Europe, Euarasia, and Africa, we find that the sexes have very different demographic histories. More generally we find that there are no simple generalizations for these differences: for example, it seems that in some cases females have shown more geographic mobility, in other cases less.

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7.2 The duration of partnerships

Bongard T.[1], Røskaft E.[2] **Factors affecting the length of relationships in Norwegian women**

We present results from a questionnaire presented to 22 000 subscribers of a Norwegian female magazine ("KK"). "KK" paid for the printing, free reply postage and gifts to the respondents. The response rate was 15 %, or about 3400 persons. We presented 65 different questions for the respondent, asking her to answer the same questions for her partners as well. Here we present results

concerning the length of the relationships in years in relation to body size differences, economic status variables, number of lifetime relationships of a woman, and her number of children.
We found a negative correlation between the length of a relationship and the number of lifetime partners of a particular woman. Size and weight differences did not affect the length of the relationships. Women living in self-owned houses remained with their partners for longer periods than those that rented their accommodations. The expectations of high economic wealth prior to engagement affected the length of relationships in a negative way. The partner's economic stability, time investment and the respondent's perceived economic satisfaction was significantly lower in a broken relationship than in ongoing ones. Women in broken relationships had on average a higher education than their partners.
We will discuss the use of magazines for financing studies, and the problems and limitations concerning questionnaires of this kind. A way of dealing with the lack of a representative sample of a population is suggested.

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Simão J.[1], Todd P.M.[2] **Structural factors predict relationship stability: evidence for the Attachment Theory, against the Sexual Strategies Theory and the Strategic Pluralism Theory**

We present a new computational model of human mate choice based on an evolutionary functional analyses that shows how different socio-structural factors influence romantic/sexual relationships stability. This includes: sex-ratio, rate at which new potential partners are met, the possibilities of interacting with alternatives partners after a relationship is consumed (sex/marriage), emergence of reduced courtship periods, and differential likelihood of producing surviving offspring in conditions of both parents, single parent, and step-parent assisted, weaning. Using the model, we show that with reasonable assigned parameters that depict EEA conditions, divorce rates are lower than in modern societies. Divorce in the EEA is argued to be mainly associated with infertility, and the necessity for retaliation in face of detected EPC (cheating), while divorce in modern societies is argued to be more strongly associated with the possibility of meeting better partners once a relationship is consumed. We further argue that modern contraception is likely to activate an "infertility detection and cheating enabling" evolved psychological mechanism, which increase divorce rate in modern societies. Our results suggest that long-term bonding was likely to be the main structuring kind of relationship in the EEA, and that practices of serial monogamy are more characteristic of modern environments. This provides strong evidence for the Attachment Theory (by Miller, Fishkin, and others), against the more widely know Sexual Strategies Theory (by Buss and Schmitt), and the Strategic Pluralism Theory (by Gangestad, Simpson, and others). It further casts the "four-year itch" argument (by H. Fischer) to the status of fallacious.

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Klusmann D.[1] **Sexual motivation and the duration of partnership**

The variation of sexual motivation with duration of partnership is analysed in data from a survey of German students. The sample of N=1865 includes only students aged 19-32 who reported to be heterosexual and to live in a steady partnership. Main results are: (1) Sexual activity and sexual satisfaction decline in women and men as the duration of partnership increases. (2) Sexual desire only declines in women. (3) Desire for tenderness declines in men and rises in women. Post hoc explanations for these results are evaluated, considering habituation, routine, polarisation of roles, balance of reciprocity, and gender role prescriptions. In addition, an explanation from evolutionary psychology is offered, entailing the following ideas: The psychological mechanisms of attachment in an adult-pair bond have evolved from the parent-child bond. Due to this non-sexual origin, a stable pair bond does not require high levels of sexual desire, after an initial phase of infatuation has passed. Nevertheless, male sexual desire should stay at a high level to the extent it is selected for in evolutionary history as a precaution against the possibility of sperm competition. The initial high level of female sexual desire is assumed to reflect an adaptive function: to boost attachment in order to establish the bond. However these interpretations of cross-sectional data as reflecting longitudinal trends should be taken with caution since self-selection has an unknown influence. The probability of having a steady long-term partnership at the time of the survey or a short-term partnership or none at all depends on individual differences in mating strategy and such differences could also account for part of the results.

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Weisfeld G.E.[1], Weisfeld C.C.[2], Imamoglu E.O.[3], Wendorf, C.A.[1] **Cultural differences in the impact of number of children on marital satisfaction**

Marriage researchers have struggled with the vexing finding that, although the ultimate goal of male-female bonding is increasing reproductive fitness, increased number of children seems to lower marital satisfaction, as measured in various ways, for married couples in Western countries. This study utilized LISREL to examine duration of marriage and number of children as predictors of mutual love in married couples (the Love Scale of the Marriage Questionnaire, Russell & Wells, 1986). Subjects were 1,357 British couples, 456 Turkish couples, and 420 U.S. couples. The samples were all urban, and resembled each other further in average age, marital duration, and number of previous marriages. Analyses suggest that, while number of children may lower love for British and U.S. couples, that is not the case for Turkish couples. On the other hand, duration of marriage lowered love for Turkish wives and British husbands and wives. Results are discussed in terms of social support systems for families, which vary considerably across cultures, and in terms of the relation of marital satisfaction to reproductive fitness.

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Borgerhoff Mulder M.[1] **Coming out of the kitchen? Serial monogamy and sexual conflict in Tanzania**

Serial monogamy is often seen as a strategy whereby some men extract more than a single female reproductive lifespan through divorce and remarriage, leading to greater variance in the reproductive success of men than women. According to this view predictions can be made that (a) more men remain unmarried than women, (b) men marry wives who are younger than themselves, (c) men are more likely to remarry than women after a divorce or widowing, (d) men remarry more rapidly than women, and (e) in second marriages men marry brides younger than the woman deserted. The assumed generality of such a pattern, even in populations with no polygyny, is fundamental to predictions concerning evolved sex differences. In preliminary data on Pimbwe and Fipa villagers in the Rukwa valley, Tanzania, where monogamy is prevalent, divorce common and paternal investment apparently quite low, there is no evidence for any of these predictions. Furthermore initial analyses of fertility and offspring survival suggest that multiple marriages are more productive in terms of reproductive success for women than they are for men. The constraints that shape these distinct patterns are discussed, leading to a broader questioning of the derivation of hypotheses pertaining to evolved sex differences.

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7.3 Evolutionary games

Surbey M.K.[1]*, Rankin A.C.*[2] **Inter-relationships between Machiavellianism, narcissism, and self-deception in predicting levels of cooperation in the Prisoner's Dilemma Game**

The ability to engage in self-deception may underly certain aspects of human cooperation and reciprocity. By rendering the selfish motives of oneself and another unconscious, self-deception may facilitate the initiation and maintenance of cooperation in long-term relationships. This study represents an extension of a previous report that heightened levels of self-deception, as measured by the Self-Deception Questionnaire (SDQ) (Sackeim & Gur, 1978), predicts increased intentions to cooperate in Prisoner's Dilemma-like situations (Surbey & McNally, 1997). We tested the prediction that Machiavellianism and narcissism, personality traits associated with impaired social relationships and increased levels of defection, are characterized by atypical levels of self-deception. One hundred and thirteen undergraduate students completed standard measures of Machiavellianism and narcissism, and the SDQ. Intentions to cooperate were quantified by responses to a series of hypothetical situations conforming to the payoff matrix of the classic Prisoner's Dilemma Game. Over all conditions, participants with highly Machiavellian personalities reported lower intentions to cooperate than others and engaged in significantly lower levels of self-deception. Highly narcissistic individuals exhibited lower intentions to cooperate in private situations, where defection would not be detected, as opposed to public settings. Like Machiavellians, individuals with high levels of narcissism engaged in lower levels of self-deception. These results support the hypothesis that moderate levels of self-deception facilitate cooperation and explain why some personality traits are associated with impaired reciprocity and sociality.

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Mookherjee J.[1] **Love is a hot choice: co-operative strategies of heterosexual human pair bonds using 'real life' game theoretical scenarios**

Recent research indicates that maternal and paternal effort is important for raising of viable human children (Key & Aeillo 2000). Love within a pair-bond may be a candidate for increasing the overall levels of parental investment for human offspring (Frank 1988). I tested the hypothesis that increased love in pair bonds increases the levels of co-operation within the pair bond. I asked heterosexual couples a series of questions that were framed in 'real life' Prisoner's Dilemma scenarios and were typical areas of couple conflict (sex, freedom, money and household chores) (Lewin 1955). These were scored according to the Prisoner's Dilemma game. The study included a control group of couples who were not in a 'romantic' pair bond but were house/flat sharers. The results indicated differences between the *love* and *not love* conditions, although merely increasing the 'level' of love had little affect in a couple's co-operation scores. This indicates that love may be a mechanism enabling couples to have higher levels of co-operative decision making. This type of affective heuristic for co-operative strategies can be termed a 'hot' choice as opposed to 'cold' or rational choice (Miller 2000) and may be more adaptive due to its emotionally reinforcing nature. There were also sex differential results between males and females on the areas of conflict/co-operation (e.g. males co-operating more for issues relating to sex). The results are analysed within the framework of current evolutionary theory's debates on the mechanisms of male parental investment.

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Ringer P.[1]*, Hancock P.J.B.*[2] **What's a pretty face worth: factors affecting offer levels in the ultimatum game**

In the ultimatum game, one player is given a sum of money, such as £10, and has to offer some proportion to a second player. The second player may accept or decline the offer. If accepted, both players keep what they have agreed, if declined, the money is returned to the experimenter and neither gets anything. Usually, the first player does not have any contact with the second, everything is anonymous. We wondered what effects knowing something about the person might have, specifically, what they look like.

Participants were presented with photographs of five men and five women, of varying attractiveness. They were asked how much they would offer to each. They subsequently rated the faces for attractiveness. Results showed that faces rated as attractive were offered significantly more than the unattractive ones. Also, male donors offered significantly more than females, and male faces were offered significantly more than the females. There were no interactions: although there was a slight tendency for men to offer relatively more to attractive women and vice versa, this was not significant.

Participants were then told which faces had accepted their offer and which had refused, by allocating each face to a "nice" or "nasty"

group, who would accept not less than £3 or £5 respectively (counterbalanced across trials). Participants then played the game again, making each face a new offer. In this second round, all effects of attractiveness and sex disappeared, leaving only a significantly greater offer to the "nasty" faces.

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Fetchenhauer D.[1] **Adaptive biases in the prediction of others' cooperative and defective behavior**

Throughout evolutionary history it has been important for humans to validly predict the trustworthiness of others. However, when having to decide whether one should trust or distrust another person there are two possible mistakes that can be run into. 1) one may distrust another person that actually would have been trustworthy or 2) one may falsely trust someone who objectively should not be trusted. It can be argued that in many situations the negative consequences of the first kind of mistake have been less sincere than those of the second (which indeed would have been lethal under many circumstances). Given this argument it can be derived that humans' perception of others' level of cooperation has not evolved to be precisely and valid but mainly to avoid this second kind of mistake. Thus, it is predicted that people systematically tend to underestimate other's trustworthiness (recently Hazelton and Buss have suggested that a similar mechanism might account for the tendency of males to overestimate females' sexual intentions). This hypothesis was tested in a series of experiments where subjects first had to indicate their own behavior and then were asked to estimate how average others would behave in a number of game theoretical paradigms (dictator games, ultimatum games and trust games).

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Rilling J.[1] **Imaging the neural correlates of social cooperation and non-cooperation in the Prisoner's Dilemma Game**

In modern-day humans, social success is dependent on the cultivation and skillfull management of cooperative interpersonal relationships founded on reciprocity. However, these relationships leave individuals vulnerable to exploitation by non-reciprocating, or only partially reciprocating social partners. Trivers (1971) proposed that the human psychological system seems well-adapted to managing reciprocal social relationships. If so, then highly negative emotional states might evolve to negatively reinforce social outcomes involving personal exploitation.

Relationships based on reciprocal altruism can be well-modeled with the iterated Prisoner's Dilemma Game. We decided to explore the neural basis of this psychological system using functional magnetic resonance imaging (fMRI). We scanned 19 women as they played the iterated Prisoner's Dilemma game with another woman who was outside the scanner. A non-cooperative gesture (i.e., defection) by one's partner was associated with activation in several limbic brain areas, including the hypothalamus, amygdala, and anterior cingulate cortex ($p<0.001$). Bilateral activation of the caudate nucleus was also observed. In the final rounds of the game, the frequency of mutual defection increased. In addition to the activations just mentioned for the main effect of the partner defecting, mutual defection was additionally associated with activation of brain areas involved with reward processing, namely the orbitofrontal cortex and the ventral striatum ($p<0.001$). We interpret these activations as neural activity that reinforces the successful avoidance of exploitation by a social partner. This study represents the first tentative steps toward mapping the evolved social psychology of the human brain.

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7.4 Philosophy and Darwinism

Radcliffe Richards J.[1] **Evolved morality and the naturalistic fallacy**

In the Darwin wars, as in many others, it is often more instructive to look at assumptions shared by the opposing sides than at what seems to divide them. Darwinians often mistake the implications of their own views because presuppositions drawn from a religious view of the world are mistakenly imported into Darwinian reasoning. This happens strikingly in the case of ethics. One view shared by many Darwinians and their religious opponents is that an evolutionary explanation of our deepest moral impulses precludes objective moral standards. But the question of whether moral impulses come from God or nature makes no difference to this issue. It is as mistaken to think that the existence of God would guarantee moral objectivity as that a purely Darwinian world would preclude it. The relevance for ethics comes at a another point, in the difference between a designed world with moral order at its foundations, and an evolved one in which the natural and the moral come apart. Darwinians do, of course, typically say that 'ought' cannot be inferred from directly from 'is'. Nevertheless, another common mistake is to do just that, and assume that when we have understood the origins of our moral impulses in natural selection, we have justified following them. A true understanding of the naturalistic fallacy does not lead to moral scepticism, but only to a much more radical understanding of the relevance of evolutionary theory for normative ethics.

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Teehan J.[1] **Ethics after Darwin**

Studies in both evolutionary science and neuroscience point to a much more dependent relationship between reason and emotion than is typically allowed for in many philosophical theories. For example, Kant grounds his ethical theory on a distinction between action based on emotion and action based on pure practical reason. However, an evolutionary approach to the relationship between reason and emotion seems to pose serious problems for any such philosophical view. Using Kant as the exemplar, this paper sets out the conflict between Kantian and evolutionary approaches to moral psychology and explores the ramifications of evolutionary theory for Kantian ethics. Most significant for this project is recent work on the evolution of cognition, and the integration of reason and emotion supported by evolutionary thinking and neuroscience. The paper concludes that an evolutionary understanding of reason and emotion provides support for a humanistic ethics, while powerfully challenging not only Kantian ethics, but any non-naturalistic ethical theory.

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Atkinson A.P.[1]*, Wheeler M.*[2]*:* **Evolutionary psychology's grain problem and the cognitive neuroscience of reasoning**

Prominent evolutionary psychologists have argued that the human cognitive architecture consists of a suite of domain-specific systems, rather than a small number of domain-general systems. This core claim of much evolutionary psychology is threatened by the "grain problem" (Sterelny & Griffiths, 1999). In the first part of this paper, we target Sterelny and Griffiths' portrayal of this problem as being on the right tracks, but nevertheless misleading in a way that underestimates the true extent of the difficulty. We argue that there is a second dimension to the grain problem, one which goes unnoticed by Sterelny and Griffiths.

The one-dimensional grain problem can be glossed as the difficulty of matching phenotypic features with selection pressures, given that selection pressures are hierarchical and nested. Sterelny and Griffiths suggest that, other things being equal, this problem can be resolved in those cases where it is possible antecedently to identify distinct phenotypic features (e.g. cognitive devices) subserving distinct types of behaviour. This escape route is blocked, however, once we expose the second dimension of the grain problem. This second dimension is the converse of the first, namely, the difficulty of matching selection pressures with phenotypic features, given that phenotypic features are hierarchical and nested. The consequence of the two-dimensional grain problem is that the prospect of establishing a principled and robust distinction between domain-specific and domain-general features simply evaporates.

Research on reasoning has played a key role in the evolutionary-psychological arguments for the 'Massive Modularity Hypothesis'. In the second part of the paper, we examine the interdisciplinary, multilevel nature of this research to show that, while the domain-specific/domain-general debate is often vacuous, evolutionary psychologists can and do live with the grain problem. The explanatory credentials of evolutionary psychology remain in good shape.

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Nanay B.[1] **Evolutionary psychology and the selectionist model of neural development: a combined approach**

Evolutionary psychology and the selectionist theories of neural development are usually regarded as two unrelated theories addressing two logically distinct questions. The focus of evolutionary psychology is the philogeny of the human mind, whereas the selectionist theories of neural development analyse the ontogeny of the mind. My endeavour is to combine these two approaches in the explanation of the evolution of human mind. This combination might help overcoming some of the criticisms of both theories.

According to the selectionist model of neural development environmental effects select among our neural connections after birth: the connections that are used will survive, whereas the rest will die out. I endeavour to examine this selective process in the light of recent evolutionary theories, and point out theoretical problems from the point of view of evolutionary biology.

The approach of evolutionary psychology has been widely criticised for various reasons. Instead of examining these standard critical points I raise another objection, namely the question of the connection between the levels of *explanandum* and the *explanans* of evolutionary psychology. The explained phenomena are mental entities: mating preferences, behaviour patterns, whereas the explanation is referring to the genome; thus, a biologically plausible explanation has to provide connection between these two levels of description.

I would like to argue that if the selectionist theories of neural development are used for explaining this missing step of evolutionary psychology explanations, this could lead to a biologically more plausible unified framework of the explanation of the evolution of human mind and behaviour.

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Dickins T.E.[1] **Evolutionary Psychology is a lot harder than we thought**

One application of evolutionary theory to psychology has led to the claim that specific adaptive problems were solved by the selection of domain specific modules which form part of both peripheral and central cognition (e.g. Pinker, 1997). This Massive Modularity Hypothesis (MMH) is at the heart of Evolutionary Psychology (EP), which explicitly attempts to uncover such proximate psychological mechanisms. Recently Samuels (2000) has supported a weak version of the MMH for EP after finding the neuro-constructivist challenge (e.g. Quartz & Sejnowski, 1997) wanting on a number of conceptual points. Samuels sees the MMH as a natural consequence of evolution and hence a necessary part of any form of EP. Fodor (2000) has approached the MMH from the direction of cognitive concerns, rather than explicitly evolutionary ones. He argues that the MMH is an essential step for computational cognitivism as it avoids the problem of abductive inference that otherwise arises from the inherently localist perspective of computational cognitivism. However, Fodor doubts the utility of every EP-style analysis of cognition and sides with a pseudo-Chomskyan view of some innate and modular abilities that is decidedly non-evolutionary. I shall outline both Samuels' and Fodor's positions and argue that Samuels has misconstrued the neuro-constructivist criticism of EP and that Fodor's position is only tenable if you take his variant of Chomsky's view of language origins seriously and there are good reasons not to within the neuro-constructivist literature. This counter argument damages the MMH and makes EP a lot harder.

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Saturday Afternoon Plenary Address

Hawkes K.[1] **Foraging, life histories, and paleoanthropology: the evolution of human families**

Modern humans are now the only hominids on the planet, but both population genetics and the fossil record suggest that we evolved quite recently. For most of the evolution of our lineage, hominids were much more like non-human apes than like modern humans, and the first widely successful members of our genus were probably unlike either. Paleoanthropology and the broader primate variation, including what we know of modern people, can combined to test hypotheses about what happened in human evolution through the Pleistocene. I review data from these different lines of evidence

challenging propositions that paternal provisioning and large brains drove the evolution of our life histories; focusing especially on why men hunt and the evolutionary importance of grandmothers.

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8 Saturday Early Afternoon Paper Sessions

8.1 Population history II: language

Renfrew C.[1] **Genetic and linguistic models of population history: the farming dispersal model and the spread of Proto Indo European**

The standard "wave of advance" model for the spread of farming has not so far been well-supported now that mitochondrial DNA and Y-chromosome studies are available to modify previous conclusions based on classical genetic markers. However, it would seem that many commentators have taken a simplified view of the "wave of advance". It will be argued that the data currently available did not conflict with such a model when relevant factors are taken into account. The observations may be relevant more widely than simply to the European case. In addition, some linguistic observations now appear to lend support to the notion of an Anatolian origin for proto-Indo European.

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Holden C.[1] **Bantu language trees and the transmission of cultural traits between populations**

Language trees provide information about past relationships among populations, because languages diverge when populations split, in a process similar to genetic divergence among isolated populations. Despite the similarities between processes of genetic and linguistic evolution, formal cladistic methods have rarely been applied to linguistic data. In this analysis, a maximum parsimony tree of Bantu language tree was constructed. Modern Bantu languages appear to reflect the spread of Neolithic and Early Iron Age farming across central and southern Africa between c. 3000 BC and AD 500. The Bantu language tree was used as a model of population history to investigate the nature of the transmission of cultural traits between populations, specifically to determine whether these traits are transmitted vertically, from 'mother' to 'daughter' populations, and/or by horizontal diffusion between neighbouring populations. Results indicate that cultural transmission is largely vertical, like genetic inheritance. This suggests that statistical methods (developed in evolutionary biology) that are based on the assumption that characters are mostly transmitted vertically may be used to estimate ancestral character states for cultural traits. The strong association between cultural traits and population history also suggests that controlling for population history is essential in cross-cultural comparative analysis.

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Gray R.D.[1]*, Jordan F.M.*[2] **Austronesian language phylogenies: evaluating hypotheses of Pacific settlement**

Darwin observed that evolutionary change in languages greatly resembled the processes of biological evolution: inheritance from a common ancestor and convergent evolution operate in both. However, despite many suggestions few attempts have been made to apply the computational methods used in biology to linguistic data. Here we report a parsimony analysis of a large Austronesian language data set. We used this analysis to test competing hypotheses of the colonisation of the Pacific - the "express train" and "entangled bank" models. The topology of the language tree was highly compatible with the colonisation sequence implied by the "express train" model. Some mismatches between the language tree and the 'express train" model are interpreted as evidence of borrowing.

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Jordan F.M.[1]*, Gra, R.D.*[2] **Austronesian language phylogenies: how tree-like is linguistic evolution?**

The shape of human history is currently a focus of debate. Are population histories phylogenetic – branching and tree-like – or reticulate and interconnected? Unfortunately, most arguments that characterise specific cultures as one or the other do so on the basis of *a priori* decisions. How are we to resolve this issue? Linguistic data, like genetic data, is highly amenable to the phylogenetic methods used by evolutionary biologists. One way to quantify and infer the extent of reticulation between languages, and thus cultures, is to use split decomposition methods. These computational methods allow us to graphically represent language borrowing as an interconnected network, as they do not assume a strictly branching tree structure. A "splits graph" reveals both the reticulate and phylogenetic signals in the data. Here we use the Austronesian languages of the Pacific to show that split decomposition methods can recover evidence of past cultural contact. Two case studies using Micronesian languages demonstrate that the reticulation seen in the splits graph is supported by independent lines of evidence. The successful use of these methods indicates their potentially fruitful application in studies of population history and cultural evolution.

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8.2 Symposium: Cheating: Beyond the Wason selection task

Organiser Laurence Fiddick

Symposium abstract: The ability to detect cheaters has featured prominently in evolutionary psychological research on social cooperation. Unfortunately experimental research on cheater detection has almost exclusively employed a single task, the Wason selection task. We believe that this narrow focus on a single methodology has distorted the intellectual debate about social cooperation. It has hindered our understanding of cheater

detection and the adaptive problem posed by social cooperation both by encouraging nonevolutionary alternative accounts of cheater detection based solely on methodological artifacts limited to the selection task and by obscuring other facets of social cooperation hidden by an over-reliance on the selection task. The purpose of the proposed symposium is to broaden the debate over cheater detection by highlighting various studies that investigate cheater detection employing methods other than the Wason selection task.

Although the research presented in this symposium draws upon a wide variety of methods and subject populations, and draws together researchers from a variety of different theoretical perspectives, there is a constant theme: Cheating. Collectively, these talks suggest that cheater detection is a more complex phenomenon than previous selection task research would suggest.

Brown W.M.[1], *Moore C.*[2] **Coevolutionary arms races and psychopath detection: testing a partner preference model**

Cheating in division of labour partnerships may have exerted pressures on ancestral cognitive architecture to assess the presence or absence of nonverbal expressions signaling prosocial emotions. Evolved mechanisms of altruist detection are expected when prosocial emotions are reliably linked to future altruistic behaviour (Trivers, 1971). When there are few opportunities for exchange (e.g. division of labour partnerships) altruist detection is beneficial relative to Tit-for-Tat. In a zero-acquaintance video presentation paradigm it appears that the presence of prosocial emotions can be detected (Brown et al., 2001). However, can the absence of prosocial emotions also be detected? One way to investigate this question is to look at the nonverbal expressions of individuals lacking a social conscience (e.g. psychopaths). Video-segments of incarcerated psychopaths and non-psychopaths (based on the Psychopathy Checklist Revised - PCL-R) playing cooperative games were presented to perceivers (blind with respect to psychopathy level and incarceration). Perceivers rated psychopaths' and non-psychopaths' nonverbal expressions of self- and other-interest. It was predicted that psychopaths' nonverbal behaviour would be rated as more self-interested and less other-interested than non-psychopaths. Results will be discussed in terms of evolutionary game theory, reliable signaling and partner preference models for the evolution of cooperation.

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Cummins D.[1], *Fiddick L.*[2] **Noblesse oblige: greater tolerance for cheating among subordinates in reciprocal social contracts**

In a series of studies on reasoning with reciprocal social contracts, subjects were found to exhibit marked tolerance for cheating when they believed the cheaters to be of lower status than themselves. Subjects were shown a reasoning scenario which described a carpooling arrangement between people of unequal (boss v employee) or equal status (colleagues). The arrangement constituted cooperative effort for mutual benefit and was expressed in terms of reciprocal obligations (i.e., "I'll drive if you pay for the gas.") Payment ledgers were included that showed four different levels of compliance on the part of the carpooling partner (ranging from 25% to 100%). Subjects were asked to inspect each ledger and rate how willing they were to continue the arrangement with the partner given the rate of compliance depicted on the ledger. In Experiment 1, subjects exhibited marked "noblesse oblige", showing far more tolerance for cheating when they adopted the perspective of an employer carpooling with an employee than when adopting the perspective of an employee carpooling with an employer. This effect was replicated in a series of subsequent experiments which were designed to rule out possible confounding factors.

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Nunez M.[1] **'Cheating' as a facilitating intentional context for the False Belief Task**

This paper presents evidence of how cheating affects children's inferences in the False Belief task. In Experiment 1, four-year-olds were presented with a standard False Belief Task under two conditions differing in the type intention attributed to the character who moves the target object (e.g., Anne moving Sally's marble from A to B). Ann's intention is either "to cheat" (condition 1) or "to be of help" (condition 2). Children were significantly more accurate in predicting Sally's misled behaviour under condition 1. In Experiment 2, the False Belief Task is transformed into a True Belief Task by including an episode in which Sally has perceptual access (peeks through a little window) to the target object displacement by Ann. This task was presented fewer than 4 different 'intentional' conditions. The intentions of the two characters for the two simultaneous actions (Sally looking through a window and Ann moving the object from A to B) were either 'well intended' or 'cheating (Ann)/cheating -detection (Sally) intended'. Four-year-olds predicted Sally's 'non-misled' behaviour significantly more accurately under the two 'cheating-detection- intended' conditions. Taken together findings of the two experiments suggest that an intentional context of cheating could work both as (1) an 'attentional' marker to register certain episodes above others and (2) as a 'trigger' for inferential short-cuts.

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Over D. E.[1], *Manktelow K.I.*[2], *Kilpatrick S.G.*[3] **Mitigation, aggravation, cheating, and violators**

Evolutionary psychologists have argued that people will have a significant tendency to identify violators of social rules when these violators are cheaters: those take a benefit without paying the required cost. We propose the hypothesis that not all cheaters, nor all violators in general, will be viewed equally. Some violators will be thought of as less guilty, or more guilty, than others. There are mitigating and aggravating conditions for cheaters and other violators. Among the mitigating conditions are ones in which the person who lays down the rule does have not full authority for doing so. We will present a series of experiments in support of our hypothesis, and show that mitigating and aggravating conditions, and the degree of authority of the rule maker, all have a significant effect on inferences from rules. We discuss why it was adaptive not to treat all violators as identical, and also suggest a link between assessing mitigating and aggravating conditions and a theory of mind module. Often assessing one of these conditions calls for an understanding of the violator's mind.

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8.3 Symposium: Reproductive ecology Organiser Gillian Bentley

Reproductive ecology I: fertility

Symposium abstract: These two sessions broadly cover reproductive ecology but are separated into two themes. The first session includes papers, primarily focusing on foraging societies, that model reproductive strategies. These contributions discuss how individuals attempt to optimize family size or maximize reproductive success through a variety of strategies. The second session focuses on endocrinological research in reproductive ecology. These papers discuss the implications of low reproductive hormone levels for a number of phenomena, both within and between different societies.

Smith E.A.[1] **Why do good hunters have higher reproductive success?**

Anecdotal evidence from many hunter-gatherer societies suggests that some males are a) more successful in hunting endeavors than others, and experience b) higher social status and c) mating success than other men. Quantitative data bearing on these patterns is scarce, but is now available for at least four widely dispersed cases: Ache (South America), Hadza and !Kung (Africa), and Meriam (Melanesia). All show that better hunters establish long-term reputations, and have higher reproductive success, than their counterparts. The leading hypotheses to account for this pattern are: 1) direct provisioning of hunters' wives and offspring; 2) increased number of mates from meat-for-sex exchanges; 3) social reciprocity (e.g. granting privileges to good hunters or their kids in order to encourage them to stay in the group); 4) costly signaling (better hunters signal underlying qualities that make them more preferred mates or allies); and 5) phenotypic correlation (hunting success and reproductive success are both effects of phenotypic quality, with no other causal links between them). I examine the qualitative and quantitative evidence bearing on these hypotheses from a broad range of foraging societies. Direct provisioning and meat-for-sex exchange are empirically problematic given the extensive sharing of large game, while social reciprocity is theoretically problematic given the unconditional nature of this distribution. I conclude that while none of the hypotheses can be definitively rejected, all but the costly-signaling hypothesis can be rejected in at least some cases. The exact nature of the benefits gained from mating or allying with better hunters needs further research.

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Marlowe F.[1] **Male provisioning and female reproductive success among foragers**

Although male provisioning has long been considered responsible for the evolution of human pair-bonds, this view has been increasingly challenged of late. In this paper, I show male provisioning has an important impact on reproduction across human foraging societies where data exist. Rather than lowering offspring mortality as often suggested however, the main benefit of male provisioning is increased fertility. Greater male provisioning may lead to higher fertility because it allows women to expend less energy foraging, which enables them to return to fertile cycling sooner. Alternatively, the extra food males provide may allow women to wean earlier since age at weaning is lower where male contribution to diet is higher. Even though male provisioning is not necessarily parenting effort, once it reached a substantial level it would have become a major influence on the ancestral mating system of humans.

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Leslie P.W.[1], *Winterhalder B.P.*[2], *Weiss J.*[3] **Adaptive fertility behavior in a stochastic world**

In many societies, ending the family cycle with too few or too many surviving offspring entails serious economic, social, or fitness consequences. However, since offspring survival is unpredictable, optimum completed family size is often not attained. Sibships may be depleted by greater than expected mortality, but bearing additional "insurance" children may result in overshooting the optimum if mortality is less than expected. The unpredictability of reproduction and family formation has been recognized by some demographers and behavioral ecologists, but the literature contains few examples of quantitative analysis or formal models of risk-sensitive reproductive behavior.
We present a model that predicts optimum fertility behavior in the context of unpredictable survivorship. Overall reproductive compensation can be partitioned into components attributable to the mean level of mortality (expected survivorship) and the unpredictable variance in family-building outcomes. The latter component we term "variance compensation." We explore in this paper the circumstances that are likely to produce relatively large variance compensation effects. Variance compensation most likely will result in systematic over-production of offspring. However, under identifiable conditions variance compensation may be negative, thereby helping to explain demographic phenomena as diverse as modern fertility transitions or the low fertility of specific socio-economic groups.

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Lee P.C.[1] **The evolutionary significance of weaning: comparative patterns from primates and implications for humans**

Weaning in primates and humans tends to be a *process* rather than an *event*. There is typically a terminal point reached where breastfeeding no longer occurs, but there is a gradual transition to independent feeding. Using the Short model of a threshold suckling frequency as the point at which fertility resumes, it is possible to separate the process of fertility resumption from weaning events in both humans and non-human primates. The resumption of fertility or the maintenance of lactationally sustained infant growth are trade-offs in parental investment strategies, which can be locally, ecologically and individually determined. Data from foragers, comparative data from natural fertility populations and from apes and monkeys all suggest that these trade-offs can be modelled, and that the concept of a "natural weaning age" is generally difficult to sustain. I argue that the major determinant of weaning is the mass gain of the infant to a threshold weight above which it can sustain

itself through independent foraging and where metabolic costs to the mother are difficult to sustain.

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8.4 Female mate choice

Pashos A.[1] **Handsome men, not high-status men, succeed in courtship**

Recent research on human mating depicts men as searching for physical attractiveness (PA) and women as searching for status. To identify the mechanisms which lead to universal, biologically interpretable, structures in social processes, I focused on the proximate causes for inter- and intrasexual differences in human mating preferences, attraction, and tactics.
I collected data on 180 young singles not currently in a relationship. A questionnaire and a video sequence (20-30 seconds) of each subject was taken. Next, each video sequence was rated by approximately 20 individuals of the opposite sex (also participants of the study).
Surprisingly, the answers given by male and female Ss regarding sociosexual behavior and mating preferences are predominantly congruent. Sex differences among preferences for good looking and high-status partners were small or even insignificant. Lower educated Ss had considerably higher status preferences than higher educated individuals. In both sexes, PA was much more preferred in a potential partner than status. For both sexes, physical appearance was decisive for the S's dating attractiveness. Male, but not female dating attractiveness also correlates with a kind and charismatic appearance. Furthermore, there was a positive linear relationship between men's PA and their number of sexual partners within the last year. Men with more than four sexual partners were all above-average in PA, while the most attractive women had a medium number of sexual partners. However, status had no influence here. The results show that sex differences in mating are more complex than often assumed.

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Penton-Voak I.S[1]. **Cross-cultural differences in attractiveness judgments of male faces: a rural Jamaican sample**

Recent research into mate choice and facial attractiveness has suggested the possibility of strategic pluralism in humans, with preferences changing in response to environmental and life history factors. In men's faces, putative cues to 'good genes' (e.g. facial masculinity) carry the cost of a perceived decrease in probable paternal investment (masculine faces receive negative personality attributions). Women's preferences for male faces are consistent with trade-offs between cues to good genes and cues to paternal investment that vary in response to hormonal status, relationship context, and 'mate value'. The research reported here shows that in a culture characterised by relatively low paternal investment (rural Jamaica) women appear to place more value on cues to good genes in male faces than in cultures characterised by higher paternal investment (urban United Kingdom and Japan). This result is consistent with a facultative response to a cultural contingency: in this case, an expectation of low paternal investment in rural Jamaica.

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Scott C.F.[1], *Hancock P.J.B.*[2] **Constraining choices in mate and sperm donor selection**

There has been extensive work asking women what they desire in a long term mate. There has also been work asking women for their preferences in a sperm donor (Scheib, 1994). For a sperm donor, women are relatively more interested in the health of the donor, and less in their character, than those seeking a partner. At HBES 2000, Li and Bailey reported the use of a constrained selection system for mate choice, where increasing one characteristic could only be done at the expense of others. Results indicated that women became relatively more interested in resource acquisition ability. We used such a constrained choice system to test women's choices for a sperm donor. Relative to an unconstrained choice, they became more interested in health and less in physique and social status. Relative to a constrained mate choice, those selecting sperm donors are much more interested in health while those choosing mates are more interested in character and personal abilities. The results are thus consistent with Scheib's findings, but with the differences between the two conditions emphasised. This suggests that the constrained approach to obtaining preferences is a valuable technique that can highlight what respondents are really interested in.

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Feinberg D.[1], *Jacobson A.*[2] **Human mate choice and female preferences for male voices: correlation with symmetry and sexual behavior**

Anatomical evidence and interspecies comparisons indicate that the human vocal tract has migrated during evolution to its current position, which is lower than that of neanderthals, australopithecines and extant chimpanzees. Within modern humans, male voices are significantly different than female voices with males exhibiting lower fundamental frequencies. Recent research indicates that females show a preference for males with lower voices, rating them more attractive in playback experiments. Other research has indicated that females are more attracted to males who are highly symmetrical. The research reported here predicts that fertile females are more attracted to males with lower voices because they have high degrees of symmetry as measured by levels of both facial and bodily fluctuating asymmetry (FA). It is predicted that females will assign personality ratings to males with lower voices which indicate dominance, increased desirability as short term mating partners, and low levels of parental investment, while assigning personality ratings to males possessing higher voices which indicate subordinant behavior, increased desirability as long term mating partners, and high levels of parental investment. These hypotheses will be tested by correlating sociosexual variables such as age of first sex and number of sex partners with vocal characteristics, including fundamental and formative frequencies, and levels of FA . The research reported here is intended to provide evidence that the anatomical morphology of the human vocal tract are a result of female sexual selection for lower voices in males.

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9 Saturday Late Afternoon Paper Sessions

9.1 Population history III: material culture

O'Brien M.J.[1] **Cladistics is useful for reconstructing archaeological phylogenies: Paleoindian points from the Southeastern United States**

Cladistics, a method used to create a nested series of taxa based on homologous characters shared only by two or more taxa and their immediate common ancestor, offers a means of reconstructing artifact lineages that reflect heritable continuity as opposed to simple historical continuity. Although cladistically derived trees are only hypotheses about phylogeny, they are superior both to trees created through phenetics, which employs characters without regard as to whether they are analogous or homologous, and to trees created by using undifferentiated homologous characters. To date, cladistics is an unused approach to constructing archaeological phylogenies but one that holds considerable potential for resolving some of archaeology's historical problems. For example, it has long been noted that the southeastern United States exhibits the greatest diversity in fluted-point forms in North America—an observation that prompted Mason (1962) to propose that fluted points originated in the Southeast and then spread to other areas. However, because of a paucity of such points from well-dated contexts in the Southeast, it is difficult to ascertain chronological, let alone phylogenetic, relations among the various forms. Evolutionary trees derived from cladistical analysis are testable hypotheses about those phylogenetic relations.

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Kirch P.V.[1] **Cultural phylogeny and the "Triangulation Method" in historical anthropology: the view from Polynesia**

In the current debate over the validity of a phylogenetic (cladistic) approach to historical reconstruction (as opposed to a "reticulate" or "ethnogenetic" approach), Polynesia offers an exemplary case study. The Polynesian region was settled late in world prehistory (within the past 3,000 years), and ethnologists have long argued that the Polynesian cultures share an essential core of systemic traits. Historical linguists have now defined the genetic relationships among 32 extant Polynesian languages, showing all to be derived from a Proto Polynesian ancestor. For their part, archaeologists have now refined the chronology and sequence of island settlement, and are delimiting the extent of post-colonization interactions. Recently, molecular anthropologists have argued that as biological populations the Polynesians all share a common genetic history which includes a significant "bottleneck" about 3,000 years ago.

Drawing upon a just-published monograph (Kirch and Green, 2001, *Hawaiki, Ancestral Polynesia*) in which the evidence is presented in great deal, this paper summarizes the value of applying a "triangulation method" in historical anthropology, explicitly situated within a phylogenetic approach. Although interarchipelago (i.e., inter-cultural) interactions occurred over the course of Polynesian history, the essential branching process of cultural differentiation can be clearly discerned. Using this phylogenetic model as a guide, and applying multiple lines of evidence from linguistics, archaeology, and comparative ethnography, a robust reconstruction of Ancestral Polynesian culture has been achieved. This approach should be applicable to many other cultural regions, particularly those which have undergone major linguistic radiations in recent prehistory.

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Tehrani J.[1] **Processes of cultural diversification in the evolution of Turkmen carpet designs**

The diversification of designs and motifs associated with the weavings of nomadic Turkmen tribes of Central Asia is addressed in relation to two hypotheses of culture change. These concern whether similarities observed in the cultural assemblages of separate populations can be best explained by descent with modification from a common ancestral assemblage (phylogenesis), or by the borrowing and blending of cultural entities that are rooted in several antecedent and/or contemporaneous assemblages (ethnogenesis). A cladistic analysis of Turkmen carpets and woven bags demonstrates that both phylogenesis and ethnogenesis were involved in the evolution of each tribe's design vocabulary over the last two hundred years. The results returned by the analysis strongly indicate that, prior to the Russian colonisation of Turkmen territorities in the late nineteenth century, relationships between the designs used by each tribe can be largely accounted for by phylogenetic processes of inheritance and diversification. However, the inclusion of weavings produced in later periods – which can be identified by the use of synthetic dyes – yields results more consistent with the predictions of the ethnogenesis hypothesis. These results are explored in relation to historical and ethnographic data on Turkmen social organisation, cooperation and conflict between groups, and carpet production during the periods concerned. In the light of these sources, it is suggested that cultural diversification - and the mechanisms that produce it - are shaped by forces that are more historically and socially contingent than is usually acknowledged in current debates.

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Collard M.[1]*, Shennan, S.J.*[2] **Cultural practices, language affiliation and geographical distance: a cladistic re-analysis of cultural patterns on the north coast of New Guinea**

In 1992 Welsch et al. published a set of data on the distribution of various material culture objects from locations on the north coast of New Guinea. They used regression analysis to assess the extent to which the patterns of similarity and difference related to the geographical distance between the locations concerned or to the distance between them in terms of language affiliation. They concluded that geographical distance was the main factor and that language affiliation made little difference.

Moore and Romney pointed out various shortcomings in Welsch et al's analysis and carried out a correspondence analysis on the object data for the locations. They then carried out a similar analysis on the matrix of distances between the languages concerned and on the matrix of inter-location distances. A correlation analysis indicated that both language and distance had a significant impact on the variation between sites in terms of their object assemblages. Unfortunately, Moore and Romney ignored the fact that the frequencies of the objects in the initial data set were relatively meaningless and analysed these rather than the presence/absence values. Furthermore, the way both analyses handled the

relationships between the languages by assigning relatively arbitrary similarity coefficient values to them was unsatisfactory. The result is that the roles of distance and language affiliation in accounting for variation between locations in terms of their cultural practices remain unclear. Our paper will use cladistic methods to re-assess the problem, including the mapping of the material culture information onto the relevant language trees.

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9.2 Personality

Cosmides L.[1], Klein S.[2], Tooby J.[3], Chance S.[4] **Decisions and the evolution of multiple memory systems: using personality judgments to test the scope hypothesis.**

We explore the functions of episodic and semantic memory in an unusual way: by considering the computational requirements of the decision rules that access them. Social interaction often requires split second decisions; some are best made by taking into account the personality traits of the parties involved. The human mind stores personality information in two different forms: (1) summary representations (e.g., **Mary**: ***Usually honest***), and (2) a database of episodes in which the individual manifested a personality trait (e.g., a memory of the time Mary returned a $50 bill she found). But why store summaries in semantic memory when a library of episodes is available (and vice versa)? The advantage of trait summaries: they provide fast access to relevant generalizations. The disadvantage: they are context-free. Personality does not exhibit unwavering cross-situational consistency: behavior is conditionally dependent on situations. Generalizations are most useful when their scope is delimited: when each is accompanied by information specifying those situations in which it does not apply (the *scope hypothesis*). Episodic memories that are inconsistent with a trait summary encode specific situations in which the generalization fails to predict the outcome. Therefore, speed plus accuracy can be engineered into a decision system via search engines that, upon retrieving a relevant trait summary, also search for episodic memories that are inconsistent with that summary – ones that place boundary conditions on the summary's scope. Using a priming paradigm and a decision task involving person memory, we tested (and confirmed) this counter-intuitive prediction of the scope hypothesis.

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Camperio C.A.[1], Ceccarini F.[2] **The evolution and adaptive value of islanders' personality**

Sampling 1,857 subjects, with an adjective FFM questionnaire we found that the personality of the population living in ten small Italian islands (divided in three archipelagos) is significantly different from that of mainlanders. After removing the known effects of sex, age and education, we still found significant differences between long resident islanders and mainlanders personality. In fact by comparing only the islanders (n=967) born in the islands, with mainlanders (n=598) born in the corresponding mainland coastal region, we found a marked similarity in the personality profile of all the islanders which distinguishes them from mainlanders. Islanders are significantly more introvert ($p<.001$), conscientious ($p<.001$), emotionally stable ($p=.036$) and less open-minded ($p<.001$). To investigate the effect of heredity, and shared environment on islander personality traits, we then compared the following three populations: 1) true islander descendants (n=624), 2) true mainland descendants (n=329), 3) islanders born from immigrants (n=193). We found again that the personality of the islanders descendants is significantly more introvert and less open-minded compared to both mainlanders and island immigrants, while conscientiousness and emotional stability are similar between islanders and immigrants and both traits are higher than mainlanders. These results suggest that lower extroversion and openness in islanders is due to heredity and selective emigration of non-random phenotypes; while higher conscientiousness and emotional stability profiles is influenced by shared environment on the islands. We will discuss both the genetic implications of migration patterns, and the adaptive value of islanders' personality in efficiently exploiting the harsh environment of small islands.

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Tooby J.[1], Cosmides L.[2], Sell, A.[3] **Why attribute personalities to persons?: The regulation of social reasoning by information about behavior in evolutionary games**

Our ancestors engaged in repeated interactions with each other ("evolved games"), and fitness payoffs in such interactions depended on how successfully an interactant predicted the moves of others. Predicting other's game behavior depended upon being able to integrate species-typical rules of play (human nature) with information about stable, individual-specific deviations from human nature (personality) as manifested in each game type. Accordingly, our neurocognitive architecture should be designed to (1) transform experiences of or narratives about others' behavior into representations about the stable individual differences specifically exhibited by each person; (2) rate others based on specific dimensions of categorization (e.g., honest, reckless, tough) that predicted individual performance by type of evolutionarily significant game; (3) store, retrieve, and (4) selectively feed such representations into those reasoning procedures to which they are specifically relevant, modifying their operation adaptively. Specialized procedures for cheater detection, for example, exploit certain species-typical rules of social exchange, as well as produce character information as output (i.e., identifying cheaters). Evidence presented shows that honest behavior by a specific individual relaxes cheater detection specifically for that individual, and this effect is selective to cheater detection. Honesty in social exchange does not make subjects less vigilant about detecting violations of other rules. Moreover, information about behavior in other evolutionary games such as threat does not relax cheater detection, nor do other less specific personality variables, like likeability. Results suggest that reasoning about a social game is selectively and precisely regulated by information about the individual's past behavior in that game type.

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Ando J.[1], Hiraish K.[2], Senju A.[2], Ono Y.[3], Hasegawa T.[2] **Adaptive importance leads to small heritability? A trial to bridge Evolutionary Psychology and Behavior Genetics**

This paper presents two empirical studies aimed to bridge two related, but isolated, fields; Evolutionary Psychology and Behavior Genetics. An evolutionary psychological point of view predicts that adaptively important mental traits have small heritability, for natural selection excludes disadvantageous traits, thus producing a genetically homogeneous population. We tested the hypothesis with the Wason Selection Task, on which Darwinian algorithms are supposed to work (Study 1), and with the Eyes Test which measures Theory of Mind ability (Study 2). If the cognitive ability working on these tasks are acquired through evolution, individual differences on them would be attributed mainly to environmental and error factors, rather than to genetic factors. We used a behavior genetics methodology, the twin design, to test the hypothesis. The studies were undertaken as part of Keio Twin Project in Japan. In Study 1, 219 pairs of twins (MZ, 133 pairs, DZ, 86 pairs, 15-27 years old) solved three Selection tasks. Concordance rates and similarity on the performance were not significantly different between MZ twins and DZ twins, indicating small genetic influence. Study 2 employed 85 pairs of twins (MZ, 52 pairs, DZ 23 pairs, 17-26 years old). Maximum-likelihood model-fitting analysis showed that CE model was the best in explaining variances on the Eyes Test, indicating that the variances can be attributed to both shared environmental factors and non-shared environmental factors. These results suggested that genetic influences on individual differences among normal adult sample on adaptively important traits are, at least, very small.

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9.3 Reproductive ecologyII: hormones

Bentley G.R.[1] **Puke by fluke? Non-adaptive explanations for nausea and vomiting in pregnancy**

A number of authors have suggested that nausea and vomiting in pregnancy (NVP) is an adaptive syndrome, protecting the mother from ingesting potentially teratogenic foods that might harm the developing embryo. Statistical studies show an inverse correlation between fetal loss and NVP lending support to adaptive explanations. NVP occurs in most populations but varying proportions of women are affected. Although less reliable data exist for women in developing countries, it appears that fewer women experience NVP where subsistence and health levels are lower.
Adaptive explanations for NVP have been attacked from a number of perspectives. More clinical explanations link NVP to rising levels of reproductive hormones during gestation, with NVP representing an unfortunate side-effect of pregnancy rather than an adaptation. No consensus has emerged, however, about which hormone is the primary culprit: progesterone, estrogen or human chorionic gonadotropin (hCG), or perhaps a combination of these. Women in developing countries have significantly lower levels of these reproductive hormones compared to women in developed countries. This paper discusses the implications of low hormonal levels for risks of NVP. It suggests that proportions of women experiencing NVP are reduced in developing countries because of lower hormone profiles typical there. Endocrinological studies therefore support a more clinical model for the occurrence of NVP. Lower levels of reproductive hormones during early gestation may also lead to higher levels of fetal loss, explaining the statistical correlation between rates of NVP and miscarriage.

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Bribiescas R.[1] **Reproductive neuroendocrine function among Ache men of eastern Paraguay: Implications for the evolution of male reproductive strategies**

Male reproductive neuroendocrine function, as reflected by testosterone, LH, and FSH levels, exhibits significant population variation. Nonwestern males, including Ache foragers of eastern Paraguay, exhibit significantly lower salivary testosterone (Tsal) levels compared to American males although the proximate mechanism for this variation has remained unclear. Potential sources of testosterone variation between populations include differences in Leydig cell production, LH function, GnRH production, or clearance rates. Serum gonadotropin (LH and FSH) and Tsal titers from healthy Ache males (n = 21) are reported to determine whether lower Tsal levels among the Ache are related to differences in gonadotropin function. Compared to American controls (n = 20), Ache Tsal levels were significantly lower although there were no significant differences in LH levels, suggesting some degree of Leydig cell insensitivity in Ache men. Follicle stimulating hormone (FSH) was higher in Ache men and exhibited a significant rise with age. No changes in LH or Tsal levels were noted with age. These data suggest that male reproductive neuroendocrine function may be canalized, perhaps during adolescence in response to chronic energetic stress. Although Ache neuroendocrine function does not seem to reflect compromised male fecundity, it does suggest that human male reproductive endocrine function may be related to somatic trade offs between survivorship and reproductive effort. Implications for the evolution of male reproductive strategies are discussed.

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Jasienska G.[1], Ellison P.T.[2], Jasienski M.[3] **Differences among women and variation within women (among menstrual cycles) in progesterone production: empirical evidence and implications for population and behavioral studies**

In premenopausal women, ovarian hormones are important determinants of reproduction, behavior and health. Levels of reproductive hormones produced during menstrual cycles are influenced by developmental and environmental factors. They vary e. g. in relation to women's age and their energetic status (including impacts of physical activity, diet and energy balance). Therefore, it can be expected that levels of reproductive hormones differ both among women as well as within a woman. Substantial differences from one menstrual cycle to the next may exist as responses to changes in lifestyle factors.
We present here the first quantitative analysis for non-industrial population in which we succeeded in partitioning the observed variation in ovarian progesterone production. Twenty two women aged 23-39 from an agricultural village in Southern Poland collected

daily saliva samples for four to six months. We estimate that as much as 44% of total variation in salivary progesterone is expressed as differences among individual women. Furthermore, 55% of total variation is due to variation among cycles (months). Life in this village is characterized by seasonal variation in workload which was shown to impact levels of produced hormones and may thus magnify among-cycle variation.
These results imply that population studies in which women are characterized by single cycles capture a significant amount of biologically relevant variation. However, measurements of several cycles per woman would enable more insight into the causes and significance of variation in reproductive function.

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Christiansen K.[1] **Physical and behavioural masculinity as correlates of male reproductive success**

The role of testosterone-dependent sex-typical behaviour and physique in male reproductive success was investigated in !Kung San hunter-gatherers of Namibia, a "natural fertility" population. Biologically active, free testosterone showed a significant positive relation to male reproductive success. The higher the number of children born, the higher was the father's testosterone level. Men whose children were still alive at the time of the investigation had significantly higher levels of testosterone than men who had lost children. While the influence of testosterone on fertility through seminal parameters and libido is well understood, the effect of a father's androgen level on his child's survival is less obvious. We looked for less direct pathways of testosterone action on reproductive success. In the !Kung San sample, free testosterone showed a positive correlation to a more robust body build and physical aggression. A more aggressive, probably socially dominant father could provide his children with better living conditions as a less assertive man. Living on a subsistence level in the harsh Kalahari semi-desert, these parameters could be crucial for the survival of a child.
However, a high level of behavioural masculinity is not generally associated with a higher reproductive success in the sense of generating offspring. In a sample of male infertility patients living in an urban environment (Hamburg) a higher level of male sex role identification (e. g. being dominant, competitive, assertive, independent) was associated with very low sperm counts, defects in sperm morphology and motility, resulting in extremely low fertility rates.

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9.4 Evolution of human societies

Schlegel A.[1] **The elementary structure of human society and its implications for human evolution**

In this paper I present a model of human society similar to the models that primatologists construct of primate societies. I propose that there are five fundamental kinds of groupings that underlie the structure of human communities. These elements are: the family and kinship grouping, with members of both sexes and all ages; adult females; adult males; adolescent females; and adolescent males. I discuss the differences between same-sex groups of both adults and adolescents and their implications for human evolution. I propose three hypotheses about early hominid behavior. (1) This structure implies a form of female-centered troops or communities with male transfer. (2) The three-generation family, consisting of at least one male attached to at least one female, and at least one offspring plus that offspring's mate(s), was in place before males could begin to specialize in hunting as a major food-getting technique. (3)The social complexity of relationships in the three-generation family promoted increased verbal communication and was a stimulus to the development of language.

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Wilson A.P.[1], *Parker S.T.*[2] **"Cultural evolution" and the eusociality continuum in human societies**

In this paper, we argue that human societies, like other animal societies, fall along a "eusociality continuum" characterized by increasing degrees of "reproductive skew" (within group variance in reproductive success) as defined by Sherman, Lacey, Reeve, & Keller (1995). At one end of the spectrum, foragers are characterized by food sharing, alloparenting ("helpers"), reciprocal altruism, and low to moderate reproductive skew, also characteristic of nonhuman cooperative breeders. Johnson and Earle's (1987) model suggests that these simple human economies rest on the twin pillars of the household/subsistence economy based in subsistence activities of female reproductives and their mates and helpers, and the group level/political economy based in male subsistence activities. As in other cooperative breeders, human foragers live in small groups with low population densities.
At the other end of the spectrum, highly stratified chiefdoms and archaic states are characterized by domestication, castes, slavery, extreme reproductive skew, asymmetrical reciprocal altruism, and elaborated kin manipulation, which are also characteristic of highly eusocial ant societies. Highly stratified chiefdoms and states, which first arose in the Neolithic, are based on specialized political/occupational castes. Johnson and Earle's (1987) model suggests that these castes arose as increased population pressure, increased benefits-of-philopatry, and increased social competition stimulated increasingly complex forms of kin manipulation in elites. As in ants, these highly eusocial societies live in large groups with high population densities.

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Roes F.[1] **The size of societies and belief in moralising Gods**

An analysis of data from the *Ethnographic Atlas* and the *Standard Cross Cultural Sample* shows a clear relation between the size of societies, and belief in certain kinds of Gods. Larger societies tend to be characterized by a belief in Gods that prescribe what one should and should not do. In contrast, Gods tend to be absent in smaller societies, or not active in human affairs, or active in human affairs but not supportive of human morality. These findings are interpreted as consistent with Richard Alexander's (1987) theory of morality. An alternative explanation, considering the influence of

stratification, is also discussed.

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Sidanius J.[1], Kurzban R.[2] **Political psychology and evolutionary psychology**

In this paper, we suggest that political science, like its brethren social science disciplines such as economics and anthropology, can both inform and be informed by evolutionary approaches to human behavior. Existing research in political science is directly relevant to questions that have been raised by evolutionary psychologists, and existing theory in evolutionary psychology is potentially valuable in interpreting findings in the literature in political science. To illustrate the potential for cross-fertilization between the disciplines, we discuss some data that speak to questions of the domain specificity of cognition with respect to different kinds of human groupings. Specifically, we present some findings that suggest that the psychology of sex-based hierarchy, or patriarchy, is a phenomenon distinct from group-based hierarchy, or coalitional/ethnic conflict. These findings suggest that the prevailing domain-general view of the social psychology of groups and discrimination is inadequate in important ways. We conclude that the marriage of political science and evolutionary psychology has the potential to provide fresh and novel insights into major domains of interest to researchers from both fields.

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Sunday Morning Plenary Address

Tomasello M.[1] **Gaze following in chimpanzees**

I report a series of studies investigating the gaze following behavior of chimpanzees. The studies demonstrate (1) that in their natural social interactions chimpanzees take account of where others are looking, (2) that in experimental settings they know what others can and can't see, and (3) that in other experimental settings they know what others have and have not seen in the immediate past. These studies are the first to demonstrate experimentally that chimpanzees actively monitor the psychological states of conspecifics.

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10 Sunday Morning Paper Sessions

10.1 Symposium: Evolutionary public health Organisers James Chisholm and Daniel Sellen

Symposium abstract: Evolutionary theory is our only grand scientific theory of life, but for some of us having such a theory is unsatisfying until we are able to use that theory to improve the human condition. One of the most exciting implications of the emerging consilient philosophy of knowledge (Wilson 1998) is the idea that like all adaptations, knowledge is *for* something. Evolutionary theory guides our attempts to understand human nature, and understanding of human nature leads to disease therapy (intervention) and policy (prevention). The concept of consilience also suggests that there is a fundamental unity in the organization of the world that we seek to describe and explain and that, as a consequence, traditional specializations in science are dissolving into a coherent synthesis. This approach has been most evident in the development of evolutionary medicine as a new field of inquiry (e.g. Trevathan et al 1999, Stearns, 1999, Nesse and Williams 1994). From evolutionary medicine it is only a small step to an *evolutionary public health* (e.g., Chisholm 1995) in which health and social policy more broadly are informed by evolutionary principles. The goals of this symposium are (1) to introduce the concept of evolutionary public health, (2) to examine new applications of evolutionary thinking to public health and social policy concerns, and (3) to identify some of its scientific, therapeutic, and philosophical implications.

Curtis V.[1] **Dirt, danger and desire: motivating healthy behaviour**

Health promotion aims to improve the health of whole populations by encouraging healthier ways of living. Essentially a pragmatic field, practitioners employ a mixed bag of tools, borrowing insights from psychology, education, epidemiology and sociology. This eclectic mix may either be the strength of the field, or the reason for its poor performance. Overall health promotion needs 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, transtheoretical model, stages of change, etc) to explain changes in health related behaviour, we built a new model founded on the adaptive purposes of human behaviour. For behaviour to change environment, habit or motivation (or a combination) has to change. Field work on hygiene behaviour in Africa, India and Europe suggested that motivational factors included the need to nurture, to avoid disgust objects, to classify, to create aesthetically pleasing environments and to gain social status. We propose that to be effective, hygiene promotion has to create facilitating social and physical environments, to intervene at critical times when habits are being formed or re-formed (childhood, new motherhood) and to act to heighten motivation, for example, by highlighting the dirty, contaminating nature of faeces. Educational approaches, which rely on rational responses to learning about germs, may be of limited value in promoting individual behaviour change.

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Coall D.[1], Chisholm J.[1] **Low birthweight: a life history theory perspective**

This paper will present a synthesis of life history theory, parental investment theory and parent offspring conflict theory in the understanding of low birthweight (LBW). Life history theory provides a rationale, via the trade-off between current and future reproduction, for why it may be advantageous for individuals under conditions of environmental risk and uncertainty (experienced as psychosocial stress) to reproduce at a young age. One factor which enables early reproduction is an earlier age at menarche. Assuming an individual is pursuing a current reproductive strategy and thereby increasing offspring quantity, under the parental investment

theory assumption of a trade-off between offspring quality and quantity, the newborn may be of a lower quality (LBW). It is predicted that mothers who experience early psychosocial stress and have earlier menarche are more likely to produce LBW babies. If the mother restricts the resource flow to the fetus, the extension of parent offspring conflict theory in utero predicts that the fetus will attempt to resist and increase its efforts to extract maternal resources by allocating more of its available resources to the placenta. Here it is proposed that LBW babies born to mothers who have early menarche are more likely to have a higher placental/ fetal weight ratio. Evidence in support of these hypotheses will be presented.

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Pawlowski B.[1]*, Ulijaszek S.J.*[2] **Pre-pregnancy waist-to-hip ratio, breast feeding duration and maternal social status**

Body fat distribution in females is related to health as well as endocrinological and reproductive status. Women with higher waist hip ratio (WHR) have lower probability of getting pregnant and have fewer children than those with higher WHR. Furthermore, women with lower WHR have first live births earlier than women with higher WHR. Thus, the potential for total fertility is greater among women with lower WHR. Duration of breast feeding is also related to the woman's reproductive value, and may be negatively related to pre-pregnancy WHR. However, in complex society, this effect may be mediated by social and economic factors. In this paper, we examine the relationships between prepregnancy WHR, duration of breast feeding, and social status. Complete data on birth weight, sex of child, maternal age, height, weight, waist circumference, hip circumference, economic status, and duration of breast feeding were collected by questionnaire on 562 mother-child pairs in 11 outpatients' surgery for healthy children and in 5 GP practices in Wroclaw, Poland. Analysis using the Ordinal Multinominal Linear Model with Logit Link revealed that the best and only significant predictor for the duration of lactation is WHR, there being no interdependence between parity and lactation. The relationship between WHR and breast feeding time is however influenced by mother's education. For mothers with university and high school education there is a significant difference in mean WHR according to duration of lactation ($F(2,419)=3.76$, $p<0.02$). There is no significant difference in mean WHR according to duration of lactation for women at the lowest level of education ($F(2,137)=0.6$, $p.<0.6$). The prediction of the duration of lactation on the basis of WHR is possible only for women attaining higher levels of education; that is, for those women whose breast feeding behaviour is not strongly influenced by adverse socio-economic factors. For women attaining the lowest levels of education, there may be high competition between breast feeding and work activity, economic or social factors being more important in determining the duration of lactation.

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Sellen D.W.[1] **Evolutionary anthropological approaches to improved child nutrition**

Evolutionary anthropologists have attempted to influence international public health nutrition by using various models of what our adult ancestors ate in the more or less distant past to infer that certain diets are more healthy than others. The idea of a return to a "natural", "ancestral" or "evolved" diet has tremendous appeal to the public, and extreme care must be taken in applying such "evolutionary" approaches to developing recommendations for young child nutrition. Usually these fail to consider the dietary needs of juveniles or resolve theoretical problems, such as lag between current and past lifestyles and risk exposures, and locating presumed diets of evolutionary adaptedness in time and space. I review various types of data that suggest (i) fitness advantages accrued to parents through improving weanling diets are large and a powerful force driving primate evolution; (ii) juvenile hominids were probably weaned onto a diet richer in fat, protein and micronutrients than that of adults; (ii) weaning foods were diverse and of high quality among Palaeolithic anatomically modern humans; (iv) recent pre industrial societies practised patterns of weaning concordant with current international recommendations derived from clinical observation. Conclusions are that time constraints on care-givers have always been a major factor limiting the quality and fitness consequences of child diets and that comparative analysis of the behavioural ecology of young child feeding in contemporary populations can facilitate the design of interventions to improve young child nutrition.

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Hanson R.[1] **Showing that you care: the evolution of health altruism**

Altruism is often suggested to explain otherwise puzzling health phenomena. But exactly which people and outcomes do altruists care about? A model of the health care behavior of our distant ancestors can account for several modern health policy puzzles. It assumes that altruism was directed toward social allies, that allies prevented harmful events, and that some people knew things others did not about who would remain allies. This model then explains: regulatory paternalism, especially toward the low status, value-driven support for national health insurance the social-status health-gradient, and the near-zero marginal health-value of medical care.

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Barkow J.H.[1] **What does local/indigenous knowledge tell us about human evolution and psychology?**

Local or indigenous knowledge tends to refer to the technical knowledge held at a community level by non-Western people (e.g., fishing, farming, and forestry techniques). Recent research by the author and his collaborators in two rural communities in South Sulawesi, Indonesia, found that local knowledge of child nutrition contributed to the high rate of malnourishment. An analysis of data from this project and from the literature suggests that human populations ordinarily develop "satisficing" but not optimal technical knowledge except when: (a) social competition is involved, or (b) survival is at stake so that groups lacking the requisite knowledge presusmably have perished. The findings strongly support the social intelligence model of human evolution and have implications for the processes involved in the differential dissemination of the informational particles of which "culture" is

arguably composed.

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10.2 Life history evolution

Shanley D.P.[1], Sear R.[2], Mace R[2], McGregor I.A.[3], Kirkwood T.B.L.[1] **Evolution of the menopause: an empirical evaluation**

We describe a theoretical analysis of the evolutionary factors that explain why menopause might be adaptive in women. Our model shows that a combination of physiological and social factors, not generally found in other species, are required to account for menopause. These factors suggest that in humans, for perhaps the first time in evolution, an adaptation has arisen reflecting the unique value of older individuals. It is significant that recent alterations in human life history, particularly as regards obstetric care and risks of maternal mortality, may have altered the factors which caused menopause to be adaptive. This has significant implications for potential applications of assisted-fertilisation procedures in older women. We describe tests of the evolutionary model using an empirical data set on human life history variables recorded in a West African population exhibiting natural fertility.

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Nath D.C.[1], Leonetti D.L.[2] **Work activities of grandmothers and reproductive success: evidence from traditional Indian women**

In a natural fertility society maximum fertility occurs around 20-30 years of age and then decreases gradually until the age of 50 years. Within this latter period and into post-menopausal life, a transition to caring for grandchildren tends to occur in traditional societies. This paper examines daily work-schedules of young grandmothers (aged 65 years and less) and their evolutionary significance for reproductive success in two very low socioeconomic groups in N.E. India. This analysis is based on two surveys --- one on scheduled castes of the Bengali patrilineal population in rural areas of southern Assam, India, and the other on scheduled tribes of the Khasi matrilineal population in the rural hilly areas of Meghalaya, India. Both qualitative and quantitative information was collected from mothers and grandmothers. Next to the mother, grandmothers are considered the most acceptable childcare providers. It is observed that grandmothers spend much energy in work in the fields and in the care of their households and grandchildren. Median age at last birth for both survey populations is 37 years. Average numbers of children ever born to ever-married women ages 40-49 years are high (6.1 and 6.9 respectively). Life table techniques and multivariate proportional hazards models are used to analyze birth interval data. Median first and second birth intervals are significantly shorter in the presence of a grandmother. Our findings support the Grandmother hypothesis that women increase their reproductive success by investing in their grandchildren.

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Voland E.[1], Beise J. [2] **The impact of historical Krummhörn grandmothers on familial reproduction**

On the basis of the church register entries from the Krummhörn (Ostfriesland, Germany, 1720-1874) we investigated whether the existence or non-existence of grandmothers had an impact on the reproductive success of a given family. We found that maternal grandmothers reduced infant and child mortality by approximately 2.5 percent points, while on the other hand, paternal grandmothers increased mortality by about one percent point. Fertility (measured by intervals between births) was not influenced by the grandmothers. However, in families with many children, the probability of another child depended to a significant degree on the joint existence of both grandmothers. Even in personal catastrophe situations, when the son/the daughter or the son-in-law/daughter-in-law dies early and leaves behind grandchildren without anyone to care for them, grandmotherly assistance did not reduce infant mortality to a significant degree. Overall, the results of this study are not able to unequivocally and substantially support core predictions of the „grandmother hypothesis". Even if the socio-ecological conditions of agrarian Krummhörn do not reflect the Pleistocene conditions for the evolution of menopause and this study, therefore, can not be a hard test of the „grandmother hypothesis", our results suggest, nevertheless, that the evolution of the post-generative lifespan could not have happened via kin-selection .

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Helle S.[1], Käär P.[2], Jokela J.[3] **Evolution of human longevity: reproduce early, die young?**

Theory of senescence predicts that longevity may be associated with the intensity and timing of reproductive investment at earlier age. We analysed the phenotypic association between fecundity and post-reproductive survival in three nomadic-hunter populations living in Lappland, northern Finland (1640-1870). Contrary to predictions of the theory, lifetime reproductive success and post-reproductive survival were mainly independent or weakly positively associated in both sexes. However, the mean age at reproduction, i.e., the generation length, was positively correlated with female and male post-reproductive survival in two of the three study populations. This finding is consisted with the hypothesis suggesting antagonistic effects of pleiotropic genes that enhance reproduction at young age at the cost of lowered survival at later age. Our findings contrast the results of those recent studies where negative correlation between total fecundity and post-reproductive survival has been reported for humans. Our results suggest that long post-reproductive life span in these natural-state human populations may not be directly controlled by the antagonistic effects of fecundity as predicted. This led us to suggest that standard theories of senescence may be less applicable for humans than earlier thought, and thus emphasising the need to gain more information on the fecundity-longevity interaction before further generalisations are made. We also discuss an alternative point of view suggesting that less intense selection for early reproduction, extended parental care, and social structure allowing kin selection through the effects of close relatives, especially by maternal grandmothers, may enhance selection for longevity in humans.

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Lycett J.E.[1], *Voland E.*[2] **Longevity and the costs of reproduction in a historical human population**

The problem posed by the trade-off between reproduction and longevity underlies the disposable soma theory for the evolution of human ageing. The priority that natural selection places on reproduction negatively affects other processes such as longevity. Here we examine the relationship between reproduction and longevity in a historical human population (the Krummhörn , German 1720-1870). In our initial analyses, we find no support for the hypothesized negative effects of reproduction on longevity. However, once possible sources of confound are controlled for, we find an increasingly strong relationship with increasing poverty. Our results suggest that, at least for this population, the trade-off is context contingent.

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Josephson S.C.1 **Do humans trade quantity for quality in fertility?**

Although frequently invoked to explain aspects of human behavior, it has proven difficult to demonstrate that humans decrease their number of children in order to enhance their children's reproductive success. Here I present an example of a quantity-quality trade-off from 19th century Utah Mormons. Women who married polygynously enhanced the reproductive success of their children at the price of having fewer of them. They did this by marrying high-status men, and the timing of this decision has implications for discerning similar trade-offs elsewhere. Whether we should expect the correlation between fertility and fitness to be positive and linear or decreasing past some optimum depends on when trade-offs are made. If a trade-off is made before reproduction begins, we may see the outcome of the trade-off but not the trade-off itself.

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10.3 Symposium: Evolutionary developmental psychology
Organiser David Bjorklund

Symposium abstract: Evolutionary psychologists describe contemporary human functioning in terms of evolved psychological mechanisms. Most evolutionary research has focused on behaviors relating to adults functioning. Less theorizing has focused on development, in part because it is mature members of a species who reproduce. Yet, individuals must survive infancy and childhood before reproducing, and there is every reason to believe that natural selection has acted as much upon the early portions of the lifespan to promote survival as it has upon adulthood. Our purposes are introduce the field of *evolutionary developmental psychology*, believing that an understanding of the "whys" of development will helps us acquire a better understanding of the "hows" and "whats" of development.

The presentations in this symposium: (a) describe the basic principles of evolutionary developmental psychology; (b) discuss evolutionary factors in the development of theory of mind; (c) evaluate how comparative primate research can provide insight into human development; and (d) how an analysis of referential communication in apes can serve as a case of developmental exaptation, and as a good example of the kind of evidence we need to reconstruct the evolutionary origins of human cognitive abilities.

Bjorklund D.F.[1], *Bering J.M.*[2], *Hernandez Blasi C.*[3], *Yunger J. L.*[4] **Principles of evolutionary developmental psychology**

Evolutionary developmental psychology (EDP) is as the application the basic principles of Darwinian evolution, particularly natural selection, to explain contemporary human development. It involves the expression of evolved, epigenetic processes, as described by the developmental systems approach, from conception through old age. As such, developmental patterns are *not* conceived as genetically predetermined, but differences in the social and physical (including prenatal) environment are viewed as playing a critical role in development. EDP holds that (a) the extended juvenile period of *Homo sapiens* was necessitated by the need (and the time necessary) to master an increasingly complex social environment. This extended youth had implications for the evolution and development of the brain as well as for psychological development; (b) many aspects of childhood serve to prepare the way for adulthood and were selected over the course of evolution. Many sex differences in social and cognitive abilities are good examples; (c) there have been different selection pressures on organisms at different times in ontogeny, and some characteristics of infants and children were selected in evolution to serve an adaptive function at that time in development and not to prepare them for later adulthood; (d) many, but not all, evolved psychological mechanisms are proposed to be domain-specific in nature, such as those involved with language acquisition; and (e) because evolved mechanisms were adaptive in ancestral environments, they are not always adaptive for contemporary people, and this is seen in some children's maladjustment to aspects of formal schooling, among other contexts.

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Parker S.T.[1] **Comparative developmental evolutionary psychology (CDEP) versus developmental, comparative, and evolutionary psychology**

In this paper, I contrast what I call comparative developmental evolutionary psychology (CDEP) with evolutionary psychology (EP) from the perspective of Tinbergen's (1963) four complementary approaches to the study of behavior: proximate causes, function (ultimate causes), ontogeny, and phylogeny. Before making this comparison, I begin with a brief sketch of the two contrasting but compatible research programs and their disciplinary antecedents. The two differ primarily in their methodologies for generating and testing adaptive hypotheses and in their approaches to ontogeny. As its name implies, CDEP differs from EP in its use of comparative data on living primates to reconstruct the evolution of human development. The first purpose of this paper is to highlight similarities and differences between two compatible evolutionary

approaches to human psychology, CDEP and EP. The second purpose is to emphasize the importance of the comparative approach to evolutionary studies, and to urge EPs to return to their ethological roots by augmenting their adaptationist approach with a complementary phylogenetic approach based on comparative studies of nonhuman primates. The third purpose is to emphasize the heuristic value of truly developmental approaches, and to urge EPs to include a truly ontogenetic focus on the study of developmental stages in human and nonhuman primates, which facilitates reconstruction of the evolution of development. Finally, it is a plea to expand graduate curriculum in both EP and CDEP to include training in various comparative methodologies of evolutionary reconstruction including cladistics, phylogenetics, and heterochrony. Tinbergen, N.

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Gómez J.C.[1] **Can apes engage in referential communication? A case study in development as exaptation.**

I analyse exaptation (i.e., ontogenetically extending adaptations to new functions for which they may not be optimally designed by phylogeny) as a mechanism of cognitive evolution using the case of referential communication as an illustration. I review evidence in favour of and against apes possessing referential communication (defined as the ability to intentionally manipulate the attention of others in relation to external targets) comparable to that exhibited by human infants at 12 months of age. Some findings argue in favour of such an ability in apes: e.g., attention following skills, or use of reaching gestures; however, other findings suggest that they may lack a "genuine" understanding of attention and communicative intentions (e.g., inability to distinguish who can and cannot see them). I critically discuss examples of both kinds of evidence concluding that apes possess some component abilities of reference and a capacity to integrate them into a "genuine" system of referential communication in response to environmental pressures. These systems are literally "comparable" to those of human infants, i.e., they are both similar (e.g., they rely on joint attention skills) and different (e.g., they lack functions like 'protodeclaratives' and specialised gestures like pointing). I discuss referential communication in apes as a case of developmental exaptation, and as such a good example of the kind of evidence we need to reconstruct the evolutionary origins of human cognitive abilities.

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Smith P.K.[1] **Phylogenetic and ontogenetic origins of theory of mind**

It is recognised that language development has innate features in humans, but also that it needs environmental support; what Bruner (1983) called the Language Acquisition Support System. Another near-unique aspect of the human species is mindreading abilities, or theory of mind. This too appears to have innate features, but, I argue, it too has a support system for its acquisition, a Theory of Mind Acquisition Support System. I first summarise how ToM abilities might have been used in hominid evolution. Then, I discuss evidence from contemporary societies on what may support the ontogenetic development of ToM abilities. Finally, I put together this evidence with what we know about the environmental characteristics of recent hominid evolution, to speculate on how this might have supported ToM abilities in a phylogenetic perspective; this includes a discussion both of general ToM development, and of different strategies or pathways for forms of ToM development.

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Whiting B.A.[1] **Great apes: the mystery of the big size of the "little brain"**

Investigations into the evolution of the primate brain have consistently implicated the neocortex as the principal area of change. Humans, in particular, have been argued to possess an exceptionally large neocortex. New evidence is presented here to show that in great apes, including humans, it is the cerebellum, not the neocortex that has shown the most extensive increase in size over evolutionary time. The cerebellum, which is actively involved in the planning, execution and control of motor activity, has also been argued to play a part in various cognitive functions. This study considers possible explanations for why the cerebellum should have evolved to be particularly large in great apes by looking at which specific cerebellar regions changed in size relative to other primates, and what the functions of these particular areas are.

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Crow T.J.[1]*, Williams N.A.*[1] **A theory of the speciation of modern *Homo sapiens***

Several authors (eg Chomsky, Bickerton, Pennor) have argued that language has characteristics that are absent in other primate species. Because these characteristics evolved abruptly at some late point in the hominid lineage language constitutes a problem for evolutionary theory in the sense that it represents a saltation ie a discontinuity. A theory has been formulated that relates the change to the process of cerebral lateralization and to re-arrangements on the X and Y chromosomes. The theory predicts that a gene in the X-Y homologous class accounts for the torque of the human brain and that this has been subject to a process of sexual selection. Specifically it is suggested that the determinant of cerebral asymmetry is located within the block of sequences in Xq21.3 that translocated to (was reduplicated on) the Y chromosome short arm between 2 to 3 million years ago and that was subject to a subsequent (currently undated) paracentric inversion on the Y. The recent discovery of a gene (protocadherinXY) within this region that is expressed in the nervous system exposes the theory to molecular scrutiny.

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10.4 Perceptions and preferences in mate choice

Burt D.M.[1]*, Little A.C.*[2]*, Tiddeman B.P*[3]*, Perrett D.I.*[4] **Effects of other's ratings on perceptions of facial attractiveness in long and short term relationships.**

The value of a particular mate differs between individuals because of factors such perceiver attractiveness and personality. The relative importance of self and other's opinions might be expected to differ

for short and long-term relationships. For instance, it may be expected that own characteristics should be more important to females for long-term relationships since these relationships involve long-term co-operation where factors such as partner compatibility come into play. It may be more advantageous for short-term relationships to pick males that others perceive as most attractive because offspring will inherit a genetic profile that is broadly attractive. We presented faces together with the fictitious attractiveness ratings attributed to other individuals. We report the influence of other's opinions on attractiveness judgements of faces for short and long term relationships.

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Todosijevic B.[1], Ljubinkovic S.[2], Arancic, A.[3] **Mate selection criteria: a trait desirability assessment study of sex differences in Yugoslavia**

Cross-cultural studies demonstrate considerable universality of sex differences in mate selection criteria. Males tend to be more concerned with prospective mate's physical attractiveness, women with mate's resourcefulness. This empirical generalisation has been interpreted mainly from two theoretical perspectives: sociobiological and socio-structural. The present research examines predictions from the two models on the sample of 127 respondents from Yugoslavia. The respondents, mainly college students, were asked to asses the degree of un/desirability of sixty behavioural and personality traits in a potential mate, on the 7-point Likert type scale.
Sincerity, faithfulness, tenderness, reliability, maturity, and intelligence are the traits assessed as the most desirable. The least desirable or the most undesirable traits were, for example, selfishness, insecurity, aggressiveness, introversion, overweight, shyness. The sexes agree in this general ranking of the traits desirability.
Although the results suggest essential *similarity* of the sexes, a few obtained statistically significant differences tend to favour the sociobiological interpretation. The largest differences are in the perceived desirability of thinness, strength, fearfulness, self-pity, fragility, aggressiveness, and beauty. Males perceived all these traits as more desirable (or less undesirable) than females, except that females valued strength more positively. On the one side, male respondents are less troubled by the negative character traits of a potential partner than the females, while on the other side males more appreciate partner's look. Higher status of women positively correlated with their concern with mate's potential socio-economic status, contrary to the socio-structural model.
KEY WORDS: sex differences, mate selection, sociobiology, attractiveness, Yugoslavia.

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Haselton M.G.[1] **The sexual overperception bias: naturalistic evidence of a ystematic bias in men**

For males of many species, including humans, the fitness costs of missed reproductive opportunities are often greater than the costs of lost time or effort wasted on unsuccessful courtship. According to error management theory (EMT; Haselton, Buss, & DeKay 1998), such asymmetries select for the evolution of cost-minimizing biases in judgment, even when these biases result in an increase in overall rates of judgmental error. Based on EMT, I hypothesize that men possess an evolved bias designed to overestimate women's sexual intent on the basis of ambiguous signals. I present evidence of the sexual overperception bias from a survey of naturally occurring misperception events. Women (n = 102) and men (n = 114) reported past experiences in which a member of the opposite sex misperceived their sexual intentions. Women reported experiencing significantly more events in which a man overperceived her sexual interest than in which a man underperceived it. Men's reports of overperception and underperception mistakes by women did not differ. These data supplement evidence from prior experimental studies by providing naturalistic evidence of the bias and by providing evidence that the bias is specific to men.

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Saad G.[1], Eba A.[2] **Sex differences when rejecting potential mates**

Using a binary sequential choice paradigm, we investigated information search behavior when individuals were choosing and/or rejecting potential mates. Specifically, participants could acquire anywhere from 1 up to 25 attributes, prior to either choosing between a pair of potential mates or rejecting both of the potential mates. In the current work, we focus on rejection behavior, and ask two research questions: (1) Is one sex more likely than the other to reject potential mates as unsuitable? (2) Do men and women require a differential amount of information prior to outrightly rejecting the potential mates? Men rejected both mates 24% of the time while women did so in 41.8% of the cases. Furthermore, men seeking short-term mates were least likely to reject mating opportunities (14.3%) while women seeking short-term mates were most likely to do so (60.7%). Finally, men more so than women, acquired a greater number of attributes prior to rejecting a pair of mates (7.04 versus 4.73 attributes). Thus, men were not only less likely to reject a mating opportunity, but also required greater convincing to do so. The latter results fully accord with evolutionary principles (e.g., the parental investment model).

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Schubert J.[1], Curran M.A.[2] **Appearance effects in political careers: do politicians with good genes get more votes?**

This paper reports results from an ongoing NIMH supported study of appearance effects in political candidate appraisal. 20 male and 20 female members of the U.S. House of Representatives were randomly selected and still images and video clips, taken from C-Span footage of their speeches on the House floor, were rated by 300 subjects. Using both between and within subjects experimental designs, candidates were rated on electability, facial appearance (attractiveness, dominance, neoteny, and healthiness), and personality traits. Facial morphology was also measured following the procedure of Grammer and Thornhill (1994). This paper examines the impact of objective and subjective assessments of legislator's appearance upon dimensions of their career success, both in winning re-election, including vote margins and fund raising, and in attaining offices and positions within the legislature.

Among other findings, the data reveal that facial dominance has substantial and significant effects on electoral success.

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Pound N.[1], Wilson M.[2] **Facial electromyography (EMG): a promising technique for assaying preferences and social cognitions**

Emotional states (e.g. jealousy, anger) mediating adaptive behaviours in social domains have typically been inferred from self-report data and behavioural actions. Psychophysiological methods such as galvanic skin responses, heart rate, and facial electromyography (EMG) in response to emotionally-relevant stimuli hold promise as more direct and sensitive ways of inferring emotional states, especially for domains in which self-deception or social desirability may affect the interpretation of self-reports. In the present study, we used facial EMG measures to complement self-report data in a study of men's reactions to a photo-story of a couple in a romantic relationship. Cues of the woman's sexual infidelity were either present or absent in a between-groups experimental design. 99 men viewed the photo-story and then answered questions about the protagonists. Continuous EMG recordings were made from the *corrugator supercilii* (frown) and *zygomaticus major* (smile) muscles. The validity of the EMG activity was established in relation to control stimuli as well as differential responses to attractive and unattractive faces. The viewing times and EMG activity while viewing certain images were predictive of subsequent self-reports of the men's reactions to the characters in the photo-story. As expected, cues of sexual infidelity affected ratings of the female protagonist's desirability as a partner for either a long-term, or short-term, sexual relationship. Moreover, this effect was modulated by the subject's own experience of sexual relationships. These results will be discussed with respect to the potential value of EMG activity in complementing other assays of emotional responses in studies of adaptively relevant social situations.

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Chapter 3

Poster Abstracts

Ackerman J.[1], Ledlow S.[2], Kenrick D.T.[3], Keefe R.C.[4] **Teaching evolution in the social sciences**

During the last two decades, it has become increasingly clear that evolutionary theory is of fundamental importance in the social sciences. Since the application of evolution to social science is relatively new, few professors have sufficient educational background to teach these concepts, and few institutions have access to appropriate pedagogical materials. The Department of Psychology and Center for Learning and Teaching Excellence at Arizona State University are seeking funding to develop *Teaching Evolution in the Social Sciences Online* (TESSO), a searchable resource containing materials designed to improve the quality of college classroom presentations in a variety of topic areas. These include: 1) tutorials on basic concepts of evolution and human behavior; 2) visual materials, such as still pictures and videos drawn from animal and human research; 3) interviews with prominent evolutionary researchers; and 4) data and experimental results relevant to the evolutionary basis of human behavior. TESSO materials will be useful for integration into a wide variety of courses in the fields of psychology, anthropology, sociology, women's studies, and family studies, as well as in courses specifically designed to teach evolution and human behavior. Therefore, our first goal for the session is to obtain feedback from researchers in diverse fields about materials that would be most useful. Second, we are seeking collaborations with other researchers to develop the project (current advisors include John Alcock, David Buss, Steve Gangestad, Neil Malamuth, and Jeff Simpson). Finally, we hope to identify existing materials, resources, and strategies that are currently employed to teach evolutionary concepts.

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Aktipis C.[1], Bulkley J.[2], Files J.[3], Gonyea J.[4], Lesko A.[5], McCaul J.[6] **Future discounting and prosocial decision making**

This study examines the relationship between future discounting and prosocial decision making in junior high students. Axelrod's (1984) evolutionary simulations suggest that a low discount rate, or valuing the future highly, increases the likelihood of cooperation in a when agents use a tit-for-tat strategy in a prisoner's dilemma game. Since the benefits from prosocial interactions are often non-immediate, having a long time horizon should make such interactions more likely. To test the hypothesis that future orientation is positively related to prosocial decision making, a moral reasoning questionnaire and an individualism/collectivism questionnaire were administered to subjects. Daily discount rates were derived from an intertemporal choice task in which the subjects choose between sums of money in the present (today) and future (tomorrow). Results suggest that there is a positive relation between valuing the future highly and making prosocial decisions, but this relationship might be gender specific: that is, the hypothesized relation between the variables exists for females in this sample, but not for males. This finding might be the result of developmental differences between the sexes, but an evolutionary explanation involving sex differences in risk aversion and differential investment in status (for males) vs. 'social insurance' (for females) is also considered.

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Archer J.[1], Benson D.[1] **Self-reported willingness to escalate to physical aggression as a function of opponent's RHP and provocation**

Based on information gathered in previous studies of socially-active young men, scenarios were constructed that manipulated RHP and provocation severity. Study 1 manipulated RHP by varying opponent's size, support, and reputation: when any one increased, the likelihood of escalation decreased, and all three interacted with one another. Study 2 investigated the relative provocation generated by eight different situations: insult to wife or girlfriend was rated as most provoking whereas spilling a drink was the least. Study 3 combined 3 levels of RHP and the most and least provoking situations, in 3 x 2 factorial design, using a range of DVs that could be summarised as direct aggression, non-provocation and delayed hostility (which involved revenge fantasies and plans): both high provocation and low RHP increased the likelihood of direct aggression, but a combination of high provocation and high RHP increased the likelihood of delayed hostility.

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Barclay P.[1] **Altruism as a courtship display: is it actually attractive?**

In addition to kin selection and reciprocal altruism, altruism has been suggested to have evolved via sexual selection as an honest signal that indicates mate quality (Zahavi, 1997) or the willingness of the altruist to invest energy and resources in a relationship and children (Tessman, 1995). Much of the past research describing the attractiveness of altruism has tended to contrast "nice guys" with "jerks". In the current study, research participants were presented simulated dating service advertisements, and were asked to form an opinion of each personality based on the self-descriptions and pictures. Altruistic self-descriptions were matched with control self-descriptions that differed only in the presence of a small mention of altruistic tendencies. Women rated men as being more desirable as mates in the altruistic condition than in the matched control condition. Interestingly, men rated women as less attractive in the altruistic condition. These results support the idea that altruism in males may serve as a courtship display that honestly signals good character.

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Bennett K.L.[1] **Emotional responses to infidelity**

Previous studies have shown that responses to infidelity differ between men and women as a function of the type of infidelity –

sexual or emotional. Although men, more than women, choose sexual infidelity over emotional infidelity as most distressing, there is still a substantial amount of variation within sexes to be explained. Differential responses to infidelity were explored among 200 undergraduates by looking at the relationships between sex, infidelity scenario, and jealousy related emotions. Analyses revealed robust sex differences in the previously tested forced-choice dilemmas (sexual vs. emotional jealousy). In addition, six emotion items interact with sex and scenario in a way that is consistent with evolutionary perspectives. Results are discussed in terms of an underlying psychological design for jealousy.

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Benson P.J.[1], Emery J.L.[2], Mason S.M.[3], Cohen-Tovée E.M.[4], Tovée M.J.[5] **Measurement of body size and shape perception in eating disordered and control observers using Body-Shape software**

A disturbance in the perception of personal body size and shape is a key feature of both Anorexia and Bulimia Nervosa, but it has proved difficult to quantify. Previous attempts have used methods like the Distorting Video Technique (DVT), which alters an image by stretching the figure in either the X- or Y-axis. This is a poor representation of the way fat is added or lost from the body, and the pattern of distortion provides a host of cues to the degree to which the image has been altered. To overcome these problems we have used a specially designed software system that uses biometric data based on real body shapes, instead of simply stretching or compressing images of bodies. This technique also allows individual body parts to be altered separately, so we can determine whether a specific body part is over-estimated relative to others. We can also calculate the apparent Body Mass Index (BMI) of our modified pictures, using the Perimeter-Area Ratio (PAR). This allows us to compare an observer's actual BMI with that calculated for their Estimated and Ideal bodies. We tested 31 Anorexic, 30 Bulimic and 143 control observers. Our results show that both Anorexic and Bulimic observers significantly overestimate their body size relative to controls, and that their ideal body size is significantly lower than their estimated body size. Both the Control and Bulimic observers prefer an ideal body with a BMI of 20, which is at the lower end of the "normal" BMI range. However, the Anorexics ideal BMI is 15, which straddles the border between the emaciated and underweight BMI categories.

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Bering J.M.[1], Yunger J.L.[2], Bjorklund D.F.[3] **Conceptual constraints on death representation: the biology of afterlife beliefs**

Previous research on death concept development has concentrated on non-representational aspects while overlooking the role of "higher-order" cognitive processes subserving transmission of cultural afterlife beliefs. In the current study, we asked children about the mental states of a dead organism, thus investigating the natural ontogeny of precursory afterlife beliefs. In the first experiment (Control), 64 children, aged 4-8, were presented with a puppet show in which an alligator attempted, but failed, to eat a mouse. Afterwards, the children were asked a series of questions about the mouse's current (post-escape) functioning. Questions were either 1) epistemic (e.g., is the mouse *thinking* about the alligator? why or why not?) or 2) psychobiological (e.g., is the mouse still *hungry*? why or why not?). Subjects' responses were coded as reflecting 1) continuity; 2) discontinuity; or 3) undetermined. Children's performance was at ceiling on continuity responses for both categories. Experiment 2 tested the same group of children using the same procedure, but involved the alligator killing the mouse. Younger children were significantly more likely to give continuity responses for both question categories, and all ages were somewhat more likely to give discontinuity responses for psychobiological questions. Experiment 3 did not require the children to represent the mental states of the dead organism. Rather, an independent sample (n=64) was asked to reason about general biological functioning (e.g., will the mouse ever be alive again?). As predicted, children in the final experiment were significantly more likely to provide discontinuity responses than children in Experiment 2. These findings suggest possible conceptual constraints on death understanding imposed by general metarepresentational abilities. Such a system might interact with culturally sanctioned views on the afterlife.

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Brody J.F.[1] **Sexual selection: mind your mother!**

Females assess prospective mates; females also assess their own and each other's sons. That is, more males are conceived than females, some of the mother's genes inhibit corresponding genes from the father, and more males than females are aborted in difficult niche conditions. Young males in several species are evicted selectively from the social group and die; others as adults achieve social rank according to female preferences. Correspondingly, human males are measured and sorted by mothers, teachers, and female supervisors. Males are assessed by mates twice: whether to marry them and whether to retain them later in age. Human mothers experience anger or anxiety and depression in response to their son's treatment by other females. It may be that female preferences for sexual characteristics in mates are also applied to the offspring that result from those matings. There are likely to be comparable assessments by mothers of daughters but the features of interest may, on the average, be different for daughters than for sons. These genomic and social battles may negotiate the balance of selfishness and cooperation that are one aspect of the fitness solutions for groups in a particular niche.

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Brody J.F.[1] **A cuckoo's egg in Darwin's nest?: Active genotype-environment correlation**

Natural selection emphasizes the cumulative effects of environments on occupants, whether organisms or gene frequencies. In contrast, Active Genotype-Environment Correlation (AGErxy) states: "Individuals seek or create environments correlated with their genetic proclivities." Thus, environments modify organisms but organisms also modify environments. A positive or negative covariance between organisms and

environments may be more frequent and more significant than is appreciated in raditional descriptions of natural selection. These relationships function like those between nodes in decision nets or in algebraic equations: A change at one point implies bi-directional adjustments with other points. Selective processes (variation, polling, and amplification) can work in either direction between organism and niche. For example, animals and plants that gain favor with humans are modified, tested for acceptability, and differentially copied. It follows that, in a statistical sense, environments, sampled at intervals, may compete with each other for survival as much as organisms do. The same positive feedback can be seen with popular music or movies: There are competing choices, sales, and repeats based on differences in sales. The process of AGErxy should be a powerful buffer to "mismatch" between environments and their occupants; furthermore, investigations of AGErxy should enhance our predictions about and influence over our own outcomes as individuals or as a species. The concept of AGErxy could be an expansion of the Neodarwinian model and prior investigations of predator-prey relationships. AGErxy, however, might be seen by some evolutionists as a cuckoo's egg, laid in Darwin's nest by behavior geneticists.

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Brown M.[1], *Brown S.*[2], *Sullivan M.*[3] **Increasing inclusive fitness: a mother to die for**

Inclusive fitness considerations suggest that our ancestors should have been sensitive to: (a) cues signaling prospects for reproductive success, such as health and mating success; and (b) cues for effects on the reproductive success of genetic relatives. Under rare but definable circumstances, the only effective way to enhance inclusive fitness may have been to respond to such cues by dying. The circumstances are these: The individual's reproductive prospects are poor, the individual interferes with the reproductive success of genetic relatives and, other than dying, there is little hope of changing the status quo. Evidence consistent with these ideas has been forthcoming in recent years, including results from our most recent investigations of young adults (N = 306). As hypothesized, our survey data show that when health status (or relationship satisfaction) is low, and perceived burdensomeness to parents is high, mother's age predicts suicide ideation significantly and inversely (ideation is highest when mother is young). This relationship does not hold when health status (or relationship satisfaction) is high. A similar pattern emerges for suicide attempts, which are disproportionately more likely when measures of individual reproductive potential are low and burden to parents is high, or when mother is young and burden to parents is high. Among other things, these findings suggest that young adults with poor reproductive prospects may consider dying in response to cues for being a burden to their parents, especially if their mothers are reproductively viable.

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Burkett B.N.[1], *Kirkpatrick L.A.*[2] **Cheater detection: modified by social status or specific to social exchange?**

Cummins (1999) recently reported results of two experiments suggesting that performance on a Wason task is moderated by the relative status of the participant and target, rather than by a social-exchange context as suggested by Cosmides (1989; Cosmides & Tooby, 1992). Specifically, performance was significantly better when participants imagined themselves as high-status individuals detecting rule violations by lower-status targets, relative to conditions in which participants imagined themselves as of lower rank, equally low rank, or equally high rank relative to the target. However, we identified a potential confound in Cummins' experimental design that can be interpreted as rendering the social-exchange hypothesis a viable alternative explanation for these results. We therefore designed an experiment, using Cummins' materials, to manipulate the confounding factor as a third independent variable (in addition to participant status and target status) in a 2 x 2 x 2 factorial design. We delineate the alternative predictions that follow from the relative-rank and social-exchange hypotheses, and present results from two independent samples, one of college students and one of adults waiting for flights in airports.

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Chasiotis A.[1], *Scheffer D.*[2] **Evolutionary psychology is more than cognition: implicit motives and risk-sensitivity**

Implicit motives are expressed as a recurrent concern for goal states like affiliation, achievement and power. A missing link in the development of an evolutionary psychological approach to decision theory might be the motivational state of an individual. A possible explanation of the ambiguity avoidance effect - known as "Ellsberg's paradox" in psychological decision theory - might be the relevance of the present motivational state of an individual which influences the "calculation" of the mean and variance of alternative options. The assumption here is that risk-prone individuals are overrepresented in groups with strong implicit motives. Because younger and/or male individuals may perceive their ecology as less predictable and secure, the biological marker variables age and gender have to be controlled when risk sensitivity is considered. 209 female subjects (mean age: 42 years, range: 17 – 82 years) and 148 male subjects (mean age: 42 years, range: 17 - 81 years) from Halle a. d. Saale and Osnabruck in Germany took part in a study linking these basic motives with risk-sensitivity. This was done by predicting the decisions in two risk-sensitive scenarios by the implicit motives measured with a projective instrument. Results point at the relevance of the biological marker variable gender, since there were confirmatory results in the male sample, but no significant effects in the female sample. Discussion focusses on the explicatory value of motivational and developmental approaches in evolutionary psychology.

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Clapp J.M.[1] **The Châtelperronian debate: a memetic perspective**

The possibility of biological and cultural interactions between Neanderthals and anatomically modern humans in Europe has long

been the subject of intense debate. The debate has focused on the issue of the Châtelperronian industry and it's identity as a suite of middle to upper Palaeolithic artefacts that date from approximately 30-35,000 years ago in Southwest France. Discussion has focused on whether the phenomenon of the Châtelperronian industry is an independent acquisition of Neanderthals or a result of their being acculturated by anatomically modern humans. Progress on this issue has been limited partly due to the complicated dating problems (e.g. stratigraphic sequences and contentious C^{14} data) and the small number of finds involved. The issue has also not been aided by the terminology of acculturation. I propose that by adopting a memetic perspective the issue may be further illuminated. In my paper I will give an outline to the underlying disputes and definitions with the memetic terminology and suggest that memetics may have a role to play in the understanding of the Châtelperronian.

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Colarelli S.M.[1] **Does an evolutionary psychological perspective justify random selection (above a threshold) in college admissions and hiring?**

Political and scientific controversy continue to surround the use of ability tests in the USA because group differences in test scores result in disproportionate admission and hiring rates among racial groups. An evolutionary psychological perspective (EPP) can provide a fresh perspective by questioning long-held assumptions. First, is it reasonable to make categorical distinctions and to emphasize group differences by race? The evidence from EP on human universals and human migrations suggests that these assumptions are problematic. Second, should tests for presumed hardwired abilities be regarded as major causal agents of long-term school and occupational performance? The small number of biologically primary abilities, their evolution during the Pleistocene, and the role of facultative adaptations suggest that individual differences play a smaller causal role in school and occupational outcomes than assumed. Third, how reasonable is the presumption of a valid index of merit? An EPP suggests that self-interest, deception, and conflicts of interest bias perceptions of merit. However, because people are prone to detect and retaliate against cheaters, perceptions of fairness are important in selection decisions. Basing admissions decisions on group membership or small test score differences are often perceived as unfair. Using one cutoff and randomly selecting applicants above that threshold may ameliorate problems associated with fairness and merit perceptions: it gives equal probability of access to individuals from all groups in the applicant pool, minimizes self-serving biases in assessing merit, and reduces the emphasis on minor (an probably irrelevant) individual differences.

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Cornwell R.E.[1]*, Hetterscheidt K M.*[2]*, Palmer C.T.*[3]*, Davis H.P.*[4] **The status of sociobiology/evolutionary psychology in sociology**

We have examined how sociobiology and/or evolutionary psychology (EP) have been treated in sociology during the twenty-six years since the publication of E.O. Wilson's *Sociobiology: A New Synthesis*. We expanded an earlier study of psychology (Cornwell, Palmer, & Davis, 2000) by reviewing introductory textbooks in sociology published since 1975, and characterize their treatment of sociobiology and/or EP. Introductory textbooks were chosen because they provide a snapshot of how these disciplines portray sociobiology/EP. We examined approximately 180 sociology introductory texts. The treatment of sociobiology/EP was reviewed using three criteria: (1) the amount of text devoted to the disciplines, (2) whether or not the treatment was positive/neutral or negative, and (3) whether or not the treatment was accurate. The following were the main findings: As opposed to our earlier findings for psychology, there has not been an increase in the amount of text devoted to sociobiology/EP within sociology. The treatment has been relatively stable and negative within sociology: and inaccuracies are commonly found within the discipline. We hypothesize that the differences in these findings from our earlier study of psychology reflect strong traditions within each discipline. That is psychology's beginnings are deeply tied to biology and animal behavior, while sociology traditionally has proposed a decoupling of biology from behavior. We also assessed the prevalence of the Standard Social Science Model, and found that although it is strongly represented within sociology, it is only marginally represented in introductory psychology text.

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Coultas J.C.[1] **'He will be mine': Female choice in soap opera**

Darwin was one of the first people to point to the possibility that female choice might have a direct influence on the behaviour and characteristics of the males of many species. Do the most popular and memorable themes within soap opera reflect human female sexuality and choice? This question is addressed by using focus group and individual interviews with adolescents and adults in order to elicit the range of soap opera that are watched and the most memorable themes within the most popular ones. This is an exploratory piece of research but initial findings point to a varied response to the themes within soap opera. The main themes that emerge include female sexuality and choice, conflict within relationships, and homicide (often linked to conflict within relationships).

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Cox G.[1] **"Epos" and kinship in Slavic: an evolutionary view**

It is widely accepted that oral epic poetry follows a remarkably uniform set of plot structures. Groundbreaking work was done earlier this century on the Slavic epos, setting forth an underlying plot structure involving departure from home territory and marriage in a foreign land, including displacement of the bride's royal father in the adopted land. This "heroic" story is actually consonant with a paradigm involving nomadic conquest rape. The literary genre may have the function of making such disturbing behaviors palatable as national history. This is consonant with the author's view that esthetic behaviors are used opportunistically by hominid groups to serve adaptive needs in specific situations, rather than having some overarching "function of art." Slavic and East European folklores, linguistics, archaeology, and ancient history are then examined for evidence of the behaviors in question, including

tension between nomadic pastoralists and sedentary horticulturalists, conquest of the latter by the former, conquest rape, males-only genocide, and so forth, some of which persist in the area today. The author submits that this behavioral complex is an "incipient system," enabled by the genome but selected by the ethnos in response to immediate environmental "needs." Such a behavioral complex, after centuries of repetition, may become priveleged by the ethnos as part of a cultural template. This terminology enables us to navigate the boundary between the evolved genetic program and the evolving cultural one, dealing with a behavioral pattern that clearly has elements of both.

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Crabb P.[1] **The material culture of suicidal fantasies: more evidence for a "weapons module"?**

Human suicide appears to occur virtually always with the assistance of extra-organismic tools. Yet tools typically have been ignored in suicide research, as has their potential for motivating and organizing suicidal behavior. Hypotheses about the impact of tools on attention, memory, and motivation were tested by examining college students' suicidal fantasies. Study 1 examined retrospective accounts of suicidal fantasies. Nearly half of participants reported suicidal fantasies, and most fantasies included mentions of human-made tools. Study 2 examined prospective plans for suicide. Nearly half of the sample reported suicide plans, and most plans included human-made tools. Compared with participants who did not report suicide plans, those with plans had higher efficacy expectations (i.e., the belief that "I can do this") for suicide, reported more frequent thoughts about suicide, and reported more actual suicide attempts. These findings suggest that (a) attention is paid to tools that can be used for suicide, with a strong bias toward human-made tools, (b) memory resources appear to be dedicated to knowing about such tools, and (c) motivation to think about and attempt suicide appears to be enhanced by knowledge of such tools. Along with previous findings concerning tools in homicidal fantasies (Crabb, 2000), the present data may be interpreted as evidence for neural circuitry that is dedicated to the problem of using tools to kill others, but that incidentally can be activated under social-ecological conditions that favor self-destruction.

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Cummins R.[1]*, Cummins D.*[2]*, Poirier P.*[3] **A simulated comparison of learning biases vs. innate modules as a ground for the heritability of cognitive capacities**

A viable evolutionary cognitive psychology requires the heritability of cognitive capacities. This requirement would be satisfied by innate cognitive modules, but it seems possible it would also be satisfied by heritable learning biases that increased the canalization of a cognitive capacity (Cummins and Cummins, 1999). This claim can be investigated by constructing simulations of connectionist nets that learn a simple food gathering task. The systems vary in their learning biases. Some have innate food gathering strategies; some have simple perceptual preferences; others have neither. Following Nolfi, Elman and Parisi (1990), the systems in each group perform the task many times, and the most successful are selected and reproduced in their original pre-learning forms. This allows for an assessment of the relative effectiveness of learning biases as a ground for the canalization of a capacity that itself has direct consequences for fitness.

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Dane L.[1] **Examining the design of mate preference mechanisms: do sex-roles affect sex differences in mate preferences?**

Evolutionary psychologists hypothesize that men and women have different evolved psychological systems with respect to preferences for resources and physical attractiveness in a mate. These preferences were effective solutions to different ancestral problems faced by each sex. Theorists in the social structural perspective have also provided explanations for sex differences in mate preferences. Their explanations center around the placement of men and women into sex roles and do not include evolved mental mechanisms. This theory predicts that as social circumstances change and we move from traditional to more modern sex roles, sex differences in mate preferences will begin to disappear. One of the points on which evolutionary and social structural theories differ is their predictions regarding the stability of sex differences. Social structural theorists predict the disappearance of these differences with an increase in female equality, where as evolutionary theorists predict relative stability. This study was designed to examine the relationship between environmental inputs, such as sex roles or female equality, and mate preferences. Participants' scores on two measures, the Sex Role Egalitarianism Scale (SRES) and the BEM Sex Role Inventory, were correlated with preferences for 18 characteristics in a long-term mate. This paper presents preliminary findings as to the relationship between mate preferences and measures of sex roles. Results are discussed with respect to evolved mechanisms and their environmental inputs.

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DeBruine L.[1]*, Kemmelmeier M.*[2]*, Burnstein E.*[3] **Jealousy and sexual orientation: testing the double-shot hypothesis**

Previous research has found that men, compared to women, are more distressed by a female partner's sexual infidelity, whereas women tend to be more distressed by a male partner's emotional infidelity. Evolutionary theorists have related this observation to the differential adaptive strategies of men and women. However, this explanation was contested by the "double-shot" hypothesis (DeSteno & Salovey, 1996) proposing that differential reactions to infidelity are solely driven by individuals' expectations concerning their partners' behaviour. Thus, shared stereotypes about men and women are what drive the sex difference in jealousy. As this hypothesis should explain the behaviours of all types of people, the present study investigates this hypothesis in a sample of heterosexual, homosexual and bisexual men and women (n = 537). Results showed that only heterosexual men were most concerned about their partners' sexual infidelity whereas all other groups found their partner's emotional infidelity more distressing. Also, there was no support for the double-shot hypothesis. That is, with few exceptions, expectations of a partner's behavior did not predict jealousy response.

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diCarlo C.[1] **Hominid comparative reasoning skills in the EEA: The cognitive evolution of specific secondary epigenetic rules**

Our current reasoning skills from common sense to science, must have developed somewhere, somehow, and for some reason(s). It seems reasonable to assume that reasoning skills which were adaptatively advantageous would have been selected for while disadvantageous skills would have not. In the words of the late W.V.O. Quine, "Creatures inveterately wrong in their inductions have a pathetic but praise-worthy tendency to die before producing their kind" (*Natural Kinds, 1969, p. 126).* My research continues from where people like E.O. Wilson, Charles J. Lumsden, and Michael Ruse leave off–and that is with an inquisition into *how* specific epigenetic rules would have naturally developed and contributed to survival.
I have identified five such rules:
1. **The Law of Identity: P = P**
2. **The Law of Non-Contradiction: ~(P & ~P)**
3. **The Law of Excluded Middle: P or ~P**
4. **Analogical Reasoning: P is like/unlike Q.**
5. **Reflective Ignorance: Iap --> Kalap**

They are all characterized by a 'comparative element'. They deal with comparisons either between states of being, or the property of truth of statements. Based on this characterization, I have proposed that it is reasonable to maintain that they developed due to ancestral observations of naturally contrasting elements in the EEA such as:
1. **Hotness/Coldness**
2. **Hunger or Thirst/Satiation**
3. **Night/Day**
4. **Male/Female**
5. **Pain/Pleasure**
6. **Predator/Prey**
7. **Alive/Dead**
8. **Self/Others**

A primitive brain would have more easily detected sharp contrasts between objects, events, situations, etc., than it would have detected subtleties. The task now is to examine scientific research in various fields in the attempt to corroborate this hypothesis. The areas of study most appropriate for my research involve anthropology/archaeology (cranial development, tool making, hunting/gathering habits, etc.), areas of cognitive science, cross-cultural approaches to cognitive development, and animal/primate behaviour.

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Duntley J.D.[1], *Buss* D.M.[2] **Anti-homicide mind design: adaptations to prevent homicide victimization**

Cross-cultural, paleontological, and psychological evidence suggests that homicide was a recurrent feature of human ancestral environments. Buss & Duntley (2000) proposed that humans have evolved patterned sets of decision rules dedicated to the strategic use of murder as one effective solution to specific adaptive problems. We hypothesize that the evolution of a psychology of homicide would have created selective pressure for the co-evolution of decision rules and subsequent behavior to deter or inflict grave costs on intended killers. Anti-homicide psychology is hypothesized to have co-evolved, step for step, with the psychology of homicide, leading to greater complexity and specificity in the design of both. Specifically, we hypothesize that anti-murder mechanisms evolved to: (A) be activated by particular contexts (e.g., making a cuckold of a rival) and characteristics or states of would-be killers (e.g., displays of homicidal intent) that were ancestrally predictive of an increased risk of the murder of oneself, kin, or allies; (B) overestimate the likelihood of being a victim of homicide due to a recurrent cost asymmetry in errors of inference; and (C) instigate and coordinate the implementation of strategies to supplant would-be killers' cognitions for homicide and homicidal behaviors. Since men and women historically confronted the threat of being killed in somewhat different contexts, we hypothesize that men's and women's evolved anti-homicide mechanisms differ. Evidence supporting the hypotheses is drawn from large-scale studies of (1) homicidal thoughts, (2) anti-homicidal thoughts, (3) homicide scenarios, (4) anti-homicide scenarios, and (5) stalking. Discussion focuses on the viability of hypothesized evolved mechanisms designed to avoid being killed, on the co-evolution of killer and anti-killer psychology, and on the ways in which evidence for an anti-homicide psychology provides powerful evidence for an evolved psychology of homicide.

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Eba A.[1], Saad, *G.*[2] **Sex differences in mating preferences as a function of temporal context of mating**

Participants were shown 25 attributes of prospective mates in one of two temporal mating conditions, namely short-term or long-term mating. Using a computerized Q-Sort technique, participants' attribute importance weights were subsequently elicited. Finally, using the average attribute weights in each of the four conditions (gender x temporal conditions), the six possible pairwise correlations were calculated. The correlation for "short-term males" and long-term males" was 0.66 while that between "short-term females and long-term females" was the highest at 0.95. The lowest pairwise correlation was between "short-term males" and "long-term females" at 0.60. The ordinal ranking of the pairwise correlations fully accords with evolutionary predictions and with earlier work by several evolutionary psychologists (e.g., Buss and his colleagues).

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Ermer E.[1] **Risky decision making in context: effects of social status**

Social status has important effects on human behavior, yet this factor has largely been ignored in research on risky decision making. An evolutionary perspective suggests that social status can affect risk preference, provided that decisions concern relevant status determinants, e.g., resources for human males. Prospect theory, risk-sensitive foraging theory, and dominance theory make different predictions about such effects. On a decision problem about monetary resources, males favored the risky option only when they thought they would be viewed by others of equal social status, supporting predictions from dominance theory. Significantly, this pattern did not arise in a structurally equivalent control problem or within a female control group. These findings emphasize

the importance of both context and content in understanding human decision making.

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Fairlie D.[1], Swan T.[2] Lying by nature: strategies of deception

Why, how, and to what ends do people deceive? Current theories do not provide a fully developed conceptual framework. In this study, subjects responded to a series of hypothetical vignettes designed to ascertain their ability for generating strategies of deception for everyday, life-like scenarios. Building on prior research with primates, we hypothesized that our human subjects would display four primary types of deception strategies. The results supported the notion that the types generated for a particular situation in large part depend on the specific demands of the scenario. Deception strategies would appear not to be randomly chosen, nor are they "all-purpose" in nature. The number and types of deceptive strategies generated by each subject were compared with their *willingness to deceive*, measured via a new instrument devised for this research. As we hypothesized, the capacity for generating deceptive response options was independent of willingness to deceive. The results, however, suggest that cognitive complexity is predictive of the types of deception strategies produced.

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Fejerman L.[1] The African ancestry of the Buenos Aires population

In present day Argentina it would be very unlikely to meet someone exhibiting the physical characteristics associated with an African phenotype (e.g. Black skin, etc.). However, during most of the 19th century Afro-Argentines represented an important proportion of the Argentine population. Moreover, in 1810 they constituted approximately 30% of the entire population of the city of Buenos Aires.

An important piece of the demographic history of Argentina is missing. What happened to the Afro-Argentine population? Did they disappear without trace, because of warfare and disease, as popular myth believes? Or, is it possible that by a social process of selection against "African phenotypes", the biological heritage of the early African colonists has been assimilated into the general Argentine population without any evident morphological trace? To answer this question, I examined the distribution of "African alleles" at 7 loci in 90 individuals from Buenos Aires. The loci were chosen because they have a marked frequency differential between the two putative parental populations. The results of this analysis indicate that 4.8% of the genetic pool of the Buenos Aires population is derived from African ancestry. Estimates of African ancestry for individuals ranged from zero to approximately 12%.

The combined effect of warfare, diseases, and a low reproductive rate contributed to the decrease of Afro-Argentines in the population. However, this study suggests that admixture with the majority white population was equally important.

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Fraser M.[1] Ornament as a supertexture

Ornament, the only form of art found in *every* human culture, functions as a *supertexture*. This is a texture carefully designed to provide us with more visual rewards than natural textures do. This special kind of texture, an ornamental texture, incorporates features which we find attractive when they appear in various kinds of non-textures. These features include: *clear edges*, *centres of interest*, *stylised motion*, *symmetry*, *hierarchical order* and *purposeful ambiguity*. Some of these features appeal to us because they help us sort out objects in the world. Other features of ornament resemble those of an attractive landscape. As Kaplan showed, we prefer a landscape which is clearly organised as a whole, but still so rich in details that it invites us to explore it with our eyes. The best ornament offers this, too.

The most pleasing architectural facades can be seen as ornamental textures that clothe buildings. Both interior decorating and fashion can also be regarded in terms of ornamental textures. In fact, our appreciation of stylistic consistency is not completely due to the chance historical associations which unite the various features of a style, but also has biological roots. This biological component is our ability to identify the "same" texture - that is to say, to identify surfaces which *might* turn out to belong to the same object.

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Frost P.[1] Exogenous estrogen and possible psychosexual effects

A major source of exogenous estrogen is human urine, particularly when wastewater is untreated, separated from solid waste, and rapidly discharged into cold bodies of water. High exposure to this source in North America and Northern Europe would have begun in the late 19th century, with the widespread introduction of modern sewer systems, and ended in the 1970s, with the Clean Water Act and similar regulatory efforts to promote secondary sewage treatment. Allowing for a lead-time of 20-30 years, this period of high exposure anticipates the trend in testicular cancer rates, i.e., marked increase from c.1920 to the early 1990s followed by levelling off or even decline. Countries that first introduced modern sewerage were hardest hit by subsequent increases in testicular cancer. The beginning of this increase c. 1920 seems to rule out other exogenous estrogens or estrogen mimics (birth control pills, certain pesticides, industrial chemicals, etc.).

There may have been earlier periods of high exposure to exogenous estrogen. Phytoestrogens were especially important in the Japanese diet during the Tokugawa era, when soybeans replaced game meat as a major source of protein and calcium. Significantly, the Tokugawa era saw an aesthetic shift in female beauty from plump, wide-hipped bodies to leaner, narrower-hipped, and more "boyish" ones, a shift similar to the changes that women's fashion underwent in Western societies during the 1920s. Thus, in addition to increasing the incidence of testicular cancer, exogenous estrogen may also produce psychosexual effects.

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Fukui H.[1] Is music the peacock's tail?

Whether sexual selection could be applied to extraordinary talents for music (creativity) was examined from the viewpoint of

evolutionary psychology.
With 207 male composers of classical music, mainly in Europe, from the fourteenth century through the twentieth century and 128 male musicians of popular music in the twentieth century as the targets, comparisons of the numbers of compositions as well as the birthrates were made. As a consequence, the average number of the children of the classical music composers, 2.19 persons, was significantly fewer than the average birthrate of the then Europe, 3.3 persons, while there was no difference between the average number of the children of the popular musicians and the average birthrate. The results of the above examination indicate that extraordinary talents for music do not contribute to sexual selection, but deny the assertion that talents for music facilitate reproductive success, that is to say, the view that "music is the peacock's tail."
Then, what does music exist for? To put together the studies of cultural anthropology and ethnological musicology, the function of music in every culture is to integrate and sustain the community. From a physiological point of view, music has the function of relaxing anxiety and tension the humans feel while they lead a life in the society as well as controlling sexual desire and aggression. Music is considered to promote socialization through regulating sexual behavior.

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Garver C.[1], Gangestad S.[1], Thornhill R.[2] **Changes in women's sexual interests and their partners' mate retention tactics across the menstrual cycle: evidence for shifting conflicts of interest**

Because ancestral women could have obtained genetic benefits through extra-pair sex only near ovulation, but paid costs of extra-pair sex throughout the cycle, one might expect selection to have shaped female interest in partners other than primary partners to be greater near ovulation than during the luteal phase. Because men would have paid heavier costs if their partners had extra-pair sex near ovulation, one might also expect selection to have shaped male efforts to track their primary partners' whereabouts to be increased near ovulation relative to the luteal phase. Women filled out questionnaires about their sexual interests and their partners' mate retention tactics at two times: once within 5 days before a lutenizing hormone surge and once during the luteal phase. Results showed that: 1) women reported greater sexual interest in and fantasy about non-primary partners near ovulation than during the luteal phase; 2) women did not report significantly greater sexual interest in and fantasy about primary partners near ovulation; 3) women reported that their primary partners were both more attentive and more proprietary near ovulation.

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Gottsch J.D.[1] **Child sacrifice in the Old Testament as supporting evidence of dual inheritance theory**

Boyd and Richerson have proposed a dual inheritance model of human behavioral evolution based on genetic and cultural determinants. This global model reconciles opposing views that human behaviors must either originate from a biological or a cultural framework. Empiric evidence supporting dual inheritance theory must resolve how specifically heritable variations in human behavior are transmitted and modified from generation to generation. A neglected source of recorded human behaviors that could provide such supporting evidence are religious texts or canons, including the Old and New Testaments. These texts document many human behaviors which have been corroborated by historical and archeological study. Thus, the chronological and geographic distributions of a number of evolved human behaviors from these texts, many with profound fitness consequences, are known. The most striking negative fitness behavior documented in the Old Testament in the Hebrew and Canaanite populations is the ritual of child sacrifice. The record is quite clear that the practice was present in both of these two likely distinct gene pools and rapidly disappeared in one (Hebrew) and persisted in the other (Canaanite). The chronological appearance and the asymmetric extinction of the behavior in these two populations suggest non-genetic heredity. This evolved form of ritual sacrifice may best be explained as indirectly biased transmission with runaway variation that could and may have affected group selection.

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Grammer K.[1], Fink B.[2], Juette A.[3], Ronzal G.[4], Thornhill R.[5] **Female faces and bodies: N-dimensional feature space and attractiveness**

Many studies show that female attractiveness plays an important role in human mate selection. Research in the past has focused on the influence of single features, e.g., eye size or breast size, in attractiveness judgements. In recent years, bilateral symmetry and averageness or prototypic appearance have been discussed as possible general principles of attractiveness. The puzzle remaining is which features actually contribute to the perception of attractiveness and how are these integrated to result in attractiveness attribution. In this work we propose that attractiveness perception and judgment takes place in a multidimensional feature space. If attractiveness signals mate quality honestly, the single features making up the multiple dimension should actually correlate positively and thereby compose a single ornament of mate value.
In a rating study, three sets of males (each $\underline{n}$ = 10) rated three views (face alone, nude back, and nude front with face covered) of digital images of women ($\underline{n}$ = 92) in Austria as well as in the USA. Symmetry, averageness, skin color, hair color, stimulus complexity and surface texture were assessed with digital image analysis. Thirty-six features on the digital images were measured by hand at anatomically defined points. A principal component analysis reveals that the n-dimensional feature space can be reduced to four main dimensions.
Computer simulations of the possible underlying cognitive decision making imply that a fast and frugal algorithm, which uses the rule "*simply avoid the worst*," best explains attractiveness ratings. Thus, beauty could be a negative concept, which finds its expression in the avoidance of ugliness.

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Grinde B.[1] **The mismatch between our genetic inheritance and modern living as a public health problem**

It is generally assumed that forcing animals to live under conditions different from those for which their genes are designed causes stress and aberrant behaviour. The principle may very well apply to humans as well. Thus the concept of EEA (Environment of Evolutionary Adaptation), as the environment our genes are adapted to, may be useful in connection with questions of health. The difference between the EEA and present ways of living has been referred to as a mismatch. The question is: How do the conditions of modern societies differ from those to which our genes are adapted, and does this mismatch influence public health, or the quality of life?
The physical environment that best caters to the human genes, e.g. the problems of nutrition, pollution, and ergonomics, has attracted considerable attention; however, it may be equally important to consider factors that more directly affect our mental constitution – such as the social environment. The purpose of this presentation is to discuss whether the evolutionary perspective should be consulted with the intention of adjusting the social environment to accommodate our innate behavioural tendencies.

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Heath K.M.[1]*, Sheets V.* [2] **The butcher, the baker, the candlestick maker but not the pauper: who gains from hypergyny marriages?**

Historic and ethnographic accounts strongly suggest that women, not men, marry into families of higher socioeconomic status than their own. Evolutionary thinking would argue that, in many instances, women may gain fitness advantages for herself and for her offspring by mapping onto males with resources. In the current study, we examine the relative fitness of women against the change in family wealth at time of marriage using life history data from a 19th century American polygynous group. We argue that women do indeed marry hypergynously but that, in a polygynous society, men rather than women benefit from this marriage arrangement.

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Hetterscheidt K.M.[1]*, Cornwell R E.*[2]*, Palmer C.*[3]*, Davis H.P.*[4] **The status of sociobiology/evolutionary psychology in cultural anthropology**

We expand on an earlier study by Cornwell, Palmer, & Davis (2000) that explored the treatment of sociobiology and its successor (i.e. evolutionary psychology (EP)) within psychology. Specifically, we examined over 100 introductory texts in cultural anthropology published since the appearance of E.O. Wilson's *Sociobiology: A New Synthesis* in order to see how sociobiology/EP would be introduced to individuals entering the discipline, and how scholars portray the role of sociobiology/EP in cultural anthropology. Three main features were the focus of attention: (1) amount of text devoted to the disciplines, (2) positive/neutral or negative expression of treatment, and (3) accuracy of treatment. When treated, sociobiology was the terminology used in virtually all texts. In contrast, EP as a discipline was seldom if ever mentioned. The amount of text devoted to sociobiology showed a slight decline, but treatment remained relatively positive (or neutral) and relatively accurate. We hypothesize that the lack of treatment within cultural anthropology may be due to the following: (1) cultural anthropology seeks differences between cultures rather than universals of human behavior; and (2) the discipline of anthropology traditionally has distanced itself from biological explanations.

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Hill E.M.[1]*, Craig A.S.*[1]*,Ziemba R.*[2]*, Kwantes C.*[1]*, Hannah M.E.*[1] **Early parental investment, socioeconomic resources, and mid-life health**

It is well known that morbidity and mortality are highly correlated with socioeconomic status (SES) and health-promoting behavior, but the mechanism is unclear. Using life-history theory, we conceived of investment in health as somatic effort, which is expect to yield lower benefit in environments with adverse mortality and resource patterns. Health-related behavior should be responsive to early environment (i.e., parental investment). This model was tested using public data from the Wisconsin Longitudinal Study (WLS), including 3981 Men and 4512 women who were high school seniors in 1957. Structural-equation modeling (SEM) was employed to predict morbidity (M: illness, discomfort, and subjective health) from lower early parental investment (PI: later birth order, short inter-birth-interval, middleborn, female sex, and shorter height), socioeconomic resources (SES: education, occupational prestige, income, and assets) and health-damaging behavior (HDB: smoking, exercise, alcohol-related problems, and body mass index). A model with good fit was obtained (NFI=.955; RMSEA=.090); M was strongly affected by HDB and SES. However, PI and HDB were only weakly related. The effects of PI on adult SES were stronger; for example, middleborns had a 10-20% disadvantage in education, occupational prestige and assets. Nevertheless, PI had no direct influence on morbidity, after accounting for SES, and a parsimonious model omitting PI fit well (NFI=.990, RMSEA=.053). These results support a primary role of adult socioeconomic factors in health, beyond their relationship with health behavior patterns. A model that includes siblings is being developed, to examine both within- and between-family variation in early PI. (Supported by NIA R03 AG16142)

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Hill R.A.[1]*, Koyama N.F.*[2]*, McGain A.*[3] **Feminist attitudes influence female mate choice patterns**

Patterns of female mate choice have been shown to be remarkably uniform across cultures, and have indicated a consistent sex difference with females preferring mates offering high potential earning capacity and cues of ambition and industriousness. However, little attempt has been made to examine the factors that account for the variance in female preferences. Here we propose that in contemporary western society, the financial resources afforded to females by equal opportunities may cause a deviation in their patterns of mate choice from those predicted on the basis of current theory. To address this possibility, we collected data on the mate choice preferences of 234 female subjects (following Buss *et al.*'s (1986) study) to assess whether variance in response could be

traced to differences in feminist attitude (based on a subset of questions from Morgan's (1986) Liberal Feminist Attitude and Ideology Scale). Overall, patterns of female preferences did not differ from those previously published. However, within this sample, the relative importance of 'Good Earning Potential' declines with increasing feminist attitude, with 'Creative' and 'Kind and Understanding' of increasing importance in a potential mate. These findings suggest that personality features leading to the enhanced stability of a pair bond are replacing cues of financial investment in situations where females perceive an ability to secure equal financial opportunities to males. As a consequence, the expansion of feminist ideologies coupled with more equal opportunities for females in contemporary societies could lead to long-term shifts in patterns of female mate choice.

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Hiraishi K.[1] **What is important is your share? Examining the sharing-rule on the Wason Selection Task**

Hiraishi and Hasegawa (1999 HBES meeting, in press) showed that people reason to detect two types of free-riding on the Wason Selection Task with a Sharing-rule, "if one is in-group, one gets the share." These are (a) failure to share by the resource-provider (in-group free-rider), and (b) reception of the resource by out-group members (out-group free-rider). They also reported that tendency to check for the latter was stronger, as some respondents only checked for the out-group free-rider while ignoring the in-group free-riding. This study examined the factors important in making such a bias. We controlled the amount of the resource to be shared (full vs. shortage), relationship between the in-group and the out-group (competition vs. neutral), and the dominance relationships between the respondents and the resource-provider to be checked (high checking low, low checking high, low checking low). None of these factors produced reliable effect, and the bias remained. On the other hand, when we gave a context in which respondents themselves played a roll as a potential recipient demanding the share, the tendency to check for the in-group free-rider was enhanced. These results suggest that what is important in a sharing situation is not resource amount, relationship between groups, dominance relationship within a group, but whether one can get the deserved share. This might support the "tolerated theft" model of the food-sharing among hunter-gatherer societies.

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Hudman J.H.[1]*, Buchanan-Smith H.M.*[1] **Baby it's you: The role of childcare in human mate choice**

We investigated parental investment as a factor in human mate choice, from an evolutionary perspective. We hypothesised that a person engaged in childcare would be considered more attractive, rated more likely for a future long-tern relationship and viewed as possessing a range of desirable characteristics to a greater extent than a person not engaged in childcare. Using a between-subjects design, 144 male and 144 female undergraduates rated one of three images of the opposite sex either engaged or not engaged in childcare. Both men and women rated opposite sex stimuli engaged in childcare as being more "caring" and "attractive" and said they were more likely to have a long term relationship with them than with stimuli not engaged in childcare. These findings provide strong support for the evolutionary-linked hypothesis that willingness and ability for parental investment should play a role in mate selection. However, the results suggest that ability and willingness of an opposite sex partner to engage in childcare is relatively more important to women than men.

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Hunter J.A.[1]*, Figueredo A.J.*[2]**, Malamut N.M.*[3]*, Becker J.V.*[4] **Developmental pathways in youth sexual aggression and delinquency: risk factors and mediators**

Childhood exposure to violence against females and male-modeled antisocial behavior were examined as risk factors for sexual aggression, and non-sexual aggression and delinquency, in a sample of 182 adolescent male sex offenders using structural equation modeling. Both risk factors produced direct and indirect effects on non-sexual aggression and delinquency with Psychosocial Deficits and Egotistical-Antagonistic Masculinity playing important mediating roles. Exposure to violence against females helped explain sexual aggression through the mediating role of Psychosocial Deficits. As hypothesized, youth who sexually offended against prepubescent children manifested greater deficits in psychosocial functioning, committed fewer offenses against strangers, and demonstrated less violence in their sexual offending than offenders against pubescent females. Findings are discussed within the context of two major evolutionary psychological concepts for explaining human sexual behavior: intrasexual selection and intersexual selection.
*Presenter

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Imber C.E.[1]*, Aiello L.C.*[2] **Postcranial robusticity and rugosity patterning in modern humans**

We report here the results of an analysis to relate the patterning of musculoskeletal stress markings (MSM) to classic indices of robusticity in modern human long bones. A scoring system was developed and tested to assess postcranial MSMs from selected sites on the long bones and clavicle. Multivariate and factor analysis showed that the metric and non-metric data provided subtly different information about the skeleton, and that the correlations and disjunctions between the two sets of data allowed the distinction of groups in terms of ethnicity and sex. This shows that MSMs can provide useful accessory information to the common range of techniques for exploring human morphology. We also discuss the extent of robusticity and rugosity variability in modern human postcrania.

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Janicki M.G.[1], *Renaud M.*[2] **A closer look at types of reciprocity: how resource class and category of relationship affect concern over being repaid in Type I and Type II reciprocity**

According to evolutionary psychologists, our mental mechanisms governing social exchange should elicit a negative response when we have not been reciprocated. The importance of reciprocity in close relationships, however, has been questioned by some social psychologists. Considering the existence of more than one type of reciprocity may help resolve the issue. What we call Type I reciprocity refers to receiving something for helping someone (e.g., your neighbour brings you chocolates for feeding his cat). Type II reciprocity refers to getting help returned at a later date from someone you have previously helped (e.g., the same neighbour feeds your cat when you go away). We consider Type II reciprocity to be at the heart of human reciprocal exchanges, and predict that people will be concerned about obtaining it in all relationships. The less important Type I is what is often investigated in experimental settings. Relationship type should have some effect on reciprocity concerns because short-term relationships offer fewer opportunities for repayment. In two studies, we investigated the effects of the types of reciprocity, relationship (friends/acquaintances), and resource (money/help) on the concern over being reciprocated. The results yielded several interesting findings. Across relationship and resource categories, concern for Type II reciprocity was higher than for Type I. Significant relationship effects were as expected. Also, reciprocity concerns for exchanges with money differed significantly from those with help. Overall these findings suggest that evolved mental mechanisms underlying exchange distinguish between types of reciprocity, and process information differently for different kinds of resources and relationships.

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Jobling I.[1] **The psychological foundations of the Hero-Ogre-Story: using evolutionary psychology to understand narrative universals**

This paper contributes to the growing body of work that shows that evolutionary psychology's theories of human psychological universals can help us develop more effective theories of narrative universals. Stories in which a hero, a man of exceptional strength and courage, defeats a semi-human, physically abnormal ogre occur much more frequently in unrelated cultures than chance alone can account for: such stories were found in 70% of a random sample of 40 cultures in the HRAF Probability Sample. The tendency to tell these stories must, therefore, have its source in the innate human nature discussed by evolutionary psychologists. Many evolutionary psychologists have argued that the positive biases in the perception of self and ingroup and the negative biases in the perception of outgroups that have been much discussed by social psychologists are part of our innate, species-general psychological design. This essay argues that the reason why the hero-ogre-story occurs so frequently cross-culturally is that it strengthens these adaptive biases in perception: the figure of the hero strengthens positive biases in the perception of self and ingroup, and the figure of the ogre strengthens negative biases in the perception of outgroups.

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Keenoo H.T.[1] **Early hominid burial practices and the evolution of grief**

The study of emotions in evolution is fundamental to the understanding of human behaviour. Basic emotions evolved to act as survival mechanisms and motivators. The more complex emotions appear to have been designed by natural selection to allow hominids to manage in an increasingly complex social environment (Evans, 2001; Turner, 2000). This paper aims to develop an evolutionary model of grief and to highlight the role of archaeology in the study of the emotions. Grief is a combination of basic emotions such as anger and sadness. Its primary function is to prevent the loss of an attachment figure (Frijda, 1994). However, over evolutionary time it appears to have also developed a social role. Evidence of burial practices in the archaeological record may provide an indication of a deliberate generation of emotions to maintain the complex bonds within society. The role of grief in primate societies will be examined. Literature on the Neanderthal and early modern human burials will be reviewed and evidence for cannibalism and cremation considered. Other sources of data will be derived from ethnography, psychology and sociology. The paper not only aims to enhance the knowledge within evolutionary theory but also aims to further the understanding of modern day grief and its pathological forms.

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Keller M.C.[1], *Nesse R.M.*[2] **Subtypes of low mood provide evidence for its adaptive significance**

Much evidence suggests that low mood is aroused by recognition that a valued goal is unreachable. The reduced motivation that characterizes low mood has been thought to facilitate disengagement so efforts can be reallocated to more productive activity. When a person continues to pursue an unreachable goal, low mood often escalates to depression. It seems likely that certain kinds of situations probably have recurred often enough in the course of evolution to shape partially differentiated subtypes of low mood with characteristics well-suited to cope with the distinct adaptive challenges of those situations. If this is correct, then the symptoms of low mood and depression should vary in predictable ways depending on the nature of the goal and the reasons it cannot be reached. In particular, loss of a hierarchy conflict to a much more powerful foe is predicted to stimulate a special form of low mood characterized by social withdrawal, submissiveness, anxiety and unrealistically low estimates of self-worth in order to prevent attacks by the victor. If, however, the unreachable goal is not directly social, such as trying to grow crops on nonviable land, the symptoms should have fewer characteristics of self-abasement. This paper extends and makes explicit a series of such predictions, and considers them in the light of available evidence. This evidence supports the hypothesis and indicates the specific kinds of new data needed to assess the hypothesis in more detail.

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Ketelaar T.[1] **An emotional basis to Loss Aversion: evidence that emotional states map onto subjective utility functions**

Research on human preferences reveals three robust descriptive

properties of subjective utility functions: 1) loss aversion, or the tendency to value losses more heavily than gains; 2) the carriers of value are changes in value (relative to some reference point) rather than net worth, and 3) diminishing marginal returns. From the perspective of the Rational Choice School, some of these descriptive properties appear "irrational and bird-brained." By contrast, when viewed from the perspective of Behavioural Ecology, these same properties appear "sophisticated and bird-brained," with many of these properties (e.g., "Losses loom larger than gains") observed in the utility functions of birds (and other species) that have been historically confronted with the adaptive problem of value representation. In a series of four experiments, this paper considers the possible emotional basis to loss aversion in humans. Participants are exposed to varying amounts of gains and losses and their emotional (affective) reactions to these gains/losses are shown to map exactly onto the three descriptive properties of utility functions. In particular, the amount of negative emotion produced in response to a given increment of loss is shown to be significantly greater than the amount of positive emotion produced in response to the equivalent amount of gain. The implications of these findings for our understanding of the adaptive design of emotion mechanisms and a possible emotional basis to loss aversion are discussed. Preliminary data on the role of emotion in economic behavior (the endowment effect) are also discussed.

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Kirkpatrick L.A.[1] **Classifying altruistic relationships and the theoretical problem of mutual altruism in mating relationships and friendships**

People in close friendships and romantic/mating relationships appear to engage in mutually altruistic behavior out of genuine concern for each other's welfare, an observation that is difficult to explain in terms of either of the two traditional evolutionary theories of altruism (viz., kin selection and reciprocity/social exchange). Numerous theories in the social-psychological literature implicitly or explicitly place mating relationships and close friendships in the same category as kin relations -- e.g., as "communal" (Clark & Mills, 1979) or "attachment" (Hazan & Shaver, 1987) relationships -- in contrast to exchange relationships. Others (e.g., Batson, 1983) see mutual altruism between mates and between friends as a variant of reciprocity/social exchange, in contrast to kin-based altruism. Tooby & Cosmides (1996) suggest that the "deep engagement" evident in friendships (as well as, I argue, in mating relationships) might represent a third distinct category, in which altruism is adaptive to the extent that one's own welfare is somehow yoked to that of another. Thus there at least 3 different ways of categorizing altruism: (1) exchange vs. kin/friends/mates; (2) exchange (including friends/mates) vs. kin; and (3) exchange vs. kin vs. a third category (e.g., "yoked welfare"). I suggest that all three of these classification systems provide useful insights into the nature of altruism, depending on whether the level of analysis concerns ultimate adaptive function, proximal functions or mechanisms, or vehicles of inclusive fitness.

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Kirsner B.R.[1]*, Figueredo A.J.*[2]**, Jacobs W.J.*[3] **Personal and partner mate value: the role of depression in the estimation of mate choice parameters**

124 female and 115 male university undergraduates were sampled to examine the relations between self-reported depressive symptoms and ratings of mate value from four perspectives: The persons' perceptions of (1) their own mate value, (2) the mate value of an idealized long-term partner, (3) the mate value expected in the long-term partner the person could realistically attract, and (4) how their own mate value is perceived by others who know them well. A multisample structural equations model indicated that the parameters of the model were statistically equivalent between female and male subsamples and provided an adequate fit to the data. The model revealed a significant relationship between the mate value ascribed to the self and that ascribed to the long-term partner, each from either of the two perspectives taken. Furthermore, higher depression scores significantly predicted lower ratings of mate value for the self, and thus indirectly predicted lower ratings of mate value for the long-term partner. We used the model to derive testable predictions concerning the dynamics of relationships between depression and long-term mate choice.
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Kobayashi T.[1]*, Hasegawa T.*[1]*, Hiraiwa-Hasegawa M.*[2]*, Kurashima O.*[1] **The Effect of birth order on personality and familial sentiment in Japan**

We conducted three studies to investigate the effect of birth order on personality and familial sentiment. In Studies 1 & 2, Japanese undergraduate students (N = 777) rated their siblings (including themselves) on 'The Big Five' personality dimensions (openness, agreeableness, conscientiousness, extraversion and neuroticism) plus rebelliousness and conservativeness. Firstborns were more likely to be nominated as most conservative and most conscientious; laterborns were more likely to be nominated as most rebellious. These results are similar to those of Sulloway (1997). However, when the self-rating method was employed, results diverged from Sulloway's findings. In Study 3, we attempted to replicate Salmon & Daly's (1998) finding that middleborns are less likely to nominate their parents as the person to which they feel closest than are first and lastborns. However, Japanese students failed to show the same pattern of results. Birth order does appear to influence personality and familial sentiment among Japanese, but it does so in a fashion not totally consistent with that described in other cultures.

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Kukulsk, P.[1] **Human mating and information, and futuristic implications for natural resource consumption**

The demographic transition has lowered birthrates, but if each human consumes vastly more, there is no progress toward sustainability. With the growth of the Internet, new and seriously

needed possibilities for altering human behaviors might emerge. When humans lived in bands, everybody knew all about everyone else including what each brought in and distributed. Innate human tendencies are not adapted to modern life. Modern economic institutions permit personal wealth and debt - a novel environment. Common male-male competition leads to displays of status and to mating opportunities, but a fancy car and money to burn could be the result of furtive deficit spending. Deception manipulates and alters female choice. This paper postulates a future where records on others are readily available and accurate, more like the information on-hand in our evolutionary history. A survey of adult females in the United States measured interest in hypothetical electronic information and resulting mate preferences. The results are compared to other lists of mate preferences and deception, mutual honest assessment, polygyny, and economic rationality. If this future comes about and preferences lean toward financial management, conspicuous consumption by males may lose potency.

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Little A.C.[1]*, Burt D.M.*[2]*, Perrett D.I.*[3] **Assortative mating for hair and eye colour: possible influence of parental characteristics**

Past research has shown that human partners are more similar on a variety of traits than would be expected by chance. Studies examining hair and eye colour are few and have provided inconsistent results, although there is some evidence of positive assortment. Positive assortment may reflect attraction to self-similar characteristics but is also consistent with attraction to parental traits. Here we examine self-reported ideal and partner hair and eye colour and the influence that own and parental colour characteristics have on these variables. Generally, we found positive correlations between self, ideal and partner hair and eye colour. Parental characteristics were found to correlate positively with both ideal and partner characteristics for both men and women. Regression analysis predicting ideal and partner characteristics from mother and father traits revealed the importance of the opposite sex parent for eye colour. Parental hair colouration also predicted ideal and actual partner hair colour, although these effects were not exclusively due to the opposite sex parent. Attraction to opposite sex parental characteristics is seen in a wide variety of animals where it is usually described as imprinting. The data presented here is consistent with human preferences and partner choice reflecting the learning of parental colour characteristics, which, although the mechanism is unclear, may be construed as a form of imprinting in humans.

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Machin A.J.[1] **Are there sex differences in the use of landmarks and spatial gradients to locate novel sources of food?**

One of the first empirical studies exploring the issue of whether the sex differences in navigational abilities in humans are exhibited in our closest relatives. The aim was to contribute to the debate concerning the evolution of this phenomenon in humans, and to add to the growing body of knowledge concerning non-human primate cognition, and focuses specifically on the theories of Silverman and Eals (1992) and Wynn *et al* (1996). Analysis of results from a controlled foraging exercise on a captive group of Sulawesi Macaques (*Macaca nigra)* failed to show a significant result due to the confounding factors associated with rank, age and hormonal status. However, the fact that, as in humans, the ability of females to navigate successfully appeared to be affected by their reproductive status and that individuals tended to show a strength in one form of navigation, landmark or spatial gradients, as opposed to the other was encouraging for further research. Proposals for further research involving individual trials in combination with hormone level analysis are suggested.

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Martinon-Torres M.[1]*, McNally D.*[2]*, Robson-Brown K.*[3] **Evidence of left-side cradling preference in human females: an analysis of the pelvic cancellous bone**

Given the adaptive nature of the bone, it has the ability to respond to changes in the environment. Consequently, the trabecular orientation will be determined by forces acting on the bone through adaptive remodellation. Using Fast Fourier Transforms (FFT) analysis, we are able to quantify the angular distribution of the trabecular pattern to map out core life-long forces acting on the bone. FFT from the digitised x-rays of the corpus of the ilium of 23 archaeological modern humans (12 females, 11 males) and 20 adult archaeological *Pan troglodytes* (10 females, 10 males) were examined. Modern human species showed notable differences between left and right pelves spectrum in contrast to chimpanzees' uniformity. Chimpanzees' pelves presented a major uniformity between left and right pelves, related to an apparently more symmetrical paw use of this species. Human female pelves displayed a FFT spectrum consistent with a relatively increased vertical charge when compared to males. This may be related with pregnancy and its charge effect enhanced by the bipedal posture when compared to female chimpanzees. Moreover, this weight transfer force vector appeared to be higher in the left pelvis for females. This is correlated with a particularly distinctive sex related habit of predominant cradling on the left side which is linked to the left foot being the weight-supporter during the rest-standing position for right-dominant individuals. Also this practice is sex dependent, and is hence not present in the male counterpart – a conclusion supported by results from FFT on human males.

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McBurney D.H.[1]*, Simon J.*[2]*, Gaulin S.J.C.*[3]*, Geliebter A.*[4] **Matrilateral biases in the investment of aunts and uncles: replication in a population presumed to have high paternity certainty**

Gaulin, et al. (1997) found that college students reported both matrilateral and sex biases in the investment of aunts and uncles. (Aunts invested more than uncles.) They interpreted the matrilateral bias as a consequence of paternity uncertainty. We replicate that study with Orthodox Jewish college students, selected because they come from a population we presume to have high paternity certainty. The Orthodox sample also showed matrilateral and sex biases. Comparing the two data sets, the Orthodox sample reported more investment, and slightly less matrilateral and sex biases, but the differences were not statistically significant. We did find an interaction between sex of relative and

group membership, resulting from greater investment by Orthodox uncles. We interpret the results as reflecting the operation of a facultative investment mechanism whose upper limit is tuned to the maximum levels of paternity certainty found in ancestral environments. Lack of a difference in matrilateral bias between groups may result from levels of paternity certainty near to, or above, that maximum in both groups.

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McCullough J.M.[1], Heath K.M.[2] **Culling the cousins: kingship, kinship and competition in mid-millenial England**

Hamilton's Rule argues that, all else equal, individuals should give preferential treatment to relatives, based on degree of relatedness (rb>c) over non-relatives. However, one may observe instances of competition for scarce or unique resources between members of a kindred. Such a situation existed between 1377 and 1603 with intense competition for the throne of England among descendants of Edward III. At least 5 monarchs were executed or assassinated and many collateral relatives were executed or killed, most dramatically during the Wars of the Roses. Despite the widespread destruction of kindred, the cumulative Coefficient of Relatedness (R) of those destroyed by each monarch never equaled the cumulative coefficient (R) of the monarch or monarch plus immediate descendants. We propose a corollary of Hamilton's Rule that one should be willing to sacrifice relatives up to R = 1 in order to secure such resources for one's self and, where applicable, one's descendants.

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McGuire A.M.[1] **Evolutionary origins of human pair bonds: implications for mating psychology and Darwinian algorithms**

How have parental investment strategies shaped the evolution of mating psychology (e.g. mate choice, sexual vs. emotional jealousy, preferred waist-to-hip ratio)? Evolutionary psychologists often stress a sex difference such that females provide most parental investment and males invest as little as possible. While this imbalance obtains in many species, it is less pronounced in humans. An alternative model proposed here postulates that changes in resource ecology during hominid evolution (1.9 million years ago) caused male and female parental investment strategies to converge, and that only since the advent of food production has selection for convergence weakened. This model attributes the origin of pair bonds to changes in feeding ecology, and argues that these pair bonds permitted increased male parental investment (rather than that increasing male investment selected for pair bonds). This model has extensive implications for currently observed sex differences in mating psychology. Observed sex differences, rather than being expressions of domain-specific psychological mechanisms shaped by selection for relatively low male parental investment, are here hypothesized to be vestigial remains of incomplete selection *against* low male parental investment. The proposed male-female convergence model accounts both for the considerable similarities in male and female mating psychology (often downplayed in evolutionary psychology) and for observed sex differences. By questioning the reification of Darwinian algorithms, this model also accounts for numerous findings that are anomalous for minimal-male-investment evolutionary explanations. Examples drawn from outside the domain of mating also illustrate this dynamic model of how selection processes shape human psychology.

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Mehdikhani M.[1] **Parental investment and physical aggression among males**

Sexual selection (male-male competition and female choice) is the oldest evolutionary explanation for sex differences. Parental investment theory suggests, however, that '*competitors'* and '*choosers'* are determined not necessarily by biological sex but by relative contributions of parental effort. The fact that males can follow differing - and parentally investing variable - reproductive strategies ('Dad' v. 'Cad') when combined with the sexual selection-parental investment explanation for sex differences can lead to the following predictions:
Where an actual sex difference exists and assuming a mix of reproductive strategies,(i) variability within males will be greater than variability within females, including in areas such as risk taking and the willingness to escalate an intrasexual conflict towards a physically violent resolution (ii) the magnitude of the effect size will be related to the extent to which males adopt a 'Dad' versus 'Cad' reproductive strategy.
In humans the above can be termed the 'man does/ woman is' principle; in general a man's paternal investment may be determined by his *behaviour* ('Dad' v. 'Cad'), whereas a woman's maternal investment is decided simply by her *being* female (since all women potentially follow the parentally investing '*Mom'* strategy). The first of the above predictions may be tested by using existing data on within gender variability in physical aggression, an area where sex differences are already well established. Although meta-analyses of sex differences in aggression usually focus on mean scores, the same samples can potentially be employed to investigate variability (i.e. using Fisher's *variance ratio test*). Preliminary results support greater within male variability.

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Miklósi A.[1], Topál J.[2], Csányi V.[3] **Homologue versus convergent models in the analysis of human behavioural evolution: the case of the dog**

Traditionally the one main approach in the study of human behavioural evolution is based on the comparative analysis of humans and our closest primate relatives, the apes. Similarities in behaviour suggest that some traits have been evolved well before the emergence of man. By definition negative results on the part of the apes indicate human specific behaviours. In addition many species specific differences hinder the direct comparison of human and apes. Alternatively one could search for convergent cases in evolution where there was an ecological background that forced the emergence of human-like behavioural systems. The dog was the

first animal to be domesticated, and in contrast to other domesticated animals, it was selected mainly for being a companion of humans. Today most dogs live in human families which represent the natural environment of the dog. Therefore we would argue that in the course of their evolution (domestication) dogs adopted behavioural mechanisms that were advantageous for them to survive in a human environment. We take illustrative examples of dog-human communication to show that dogs' communicative abilities share many features of human communicative behaviours. Dogs are able to understand referential aspects of human pointing gesture, and are also using functionally similar behaviour actions to direct human attention to places of their interest. We suggest that the study of dog behaviour could shed light on how particular human specific traits could have emerged during evolution in a given environment.

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Mulhern B.[1], Fieldman G.[2], Hussey T.[3] Female beauty: an example of human sexual selection by male choice

It has been shown elsewhere that men are preferentially sexually attracted to younger women. As age increases, attractiveness decreases. Youth is a signal of reproductive potential and is therefore chosen by men to maximise their reproductive success. Medical evidence offers further support for this. Female fecundity peaks in the early 20's and then begins to decline; this decline becomes more severe after 30. A woman's chances of becoming pregnant at 40 are half of those of a woman aged 25. Hence men should gain more reproductive success from choosing younger (and therefore more fecund) mates. We report here a study in which assessed female beauty has been titrated against age. Male participantswere asked to choose a prospective long term partner based only upon a series of photographs of women of a range of (separately assessed) beauty and different ages. If the men's priority were to choose partners who would be most fecund they should principally have chosen women who were young. However, it was found that men principally chose long term prospective female partners on the basis of their beauty. Only when a very beautiful woman was labelled as being 45 years old did her age begin to count against her when compared with plainer and more youthful females. Facial beauty conveys information on phenotypic and genotypic quality, the latter of which bears upon the reproductive success of progeny. Hence female beauty may be an example of sexual selection by male choice.

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Mysterud I.[1] A name for the evolutionary baby? A guide for the confused

Evolutionary studies of human behavior and design are increasing in popularity. There are few topics or disciplines where an evolutionary perspective is not applied. For the past 40 years, evolutionary approaches to human behavior and design have been described by numerous names, e.g. human ethology, human sociobiology, human behavioral ecology, and evolutionary psychology. The diversity of names may be confusing when one first gets interested in evolutionary studies. Different names have come and gone -- often because they have become unpopular in someone's eyes – while some names have remained, but are often used with different meanings. This poster will present the result of a scrutiny of names used in the evolutionary literature and what they mean. I will also briefly discuss if we should attempt to find one name for the field or if we should continue with the diversity.

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Naficy S.[1] Wolves (Canis lupus) and the evolution of central-place foraging in the genus Homo

Three behavioral adaptations are attributed to modern human groups: presence of a central place or home base, frequent sharing of food, and division of labor. Although no extant primate shares these adaptations, the wolf (*Canis lupus*), has been shown to have all three. In this paper, it is argued that central-place foraging (i.e., bringing food back to a secured location), was the behavioral response of both *Canis lupus* and *Homo erectus* to the high cost of rearing altricial young while competing for animal tissue in semi-open to open habitats with high predator densities. Food sharing could have been a secondary outcome of this pattern of increasingly centralized foraging, delayed food consumption, and short-term food surpluses. Kin selection in small groups and the "tolerated theft" model are both used to explain the frequency of food sharing among modern humans and wolves.
It is argued that the need to care for altricial young and to meet the environmental exigencies of a hunting lifestyle forced both human foraging bands and wolf packs to adopt complex, albeit flexible, divisions of labor. Homo erectus, if not earlier species of Homo, may have engaged in central-place foraging, and thus perhaps employed a dual-unit foraging strategy, similar to wolves and other social canids.

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Nakanishi D.[1], Kameda T.[2] Evolution of social learning strategy in a lattice-structured habitat: an evolutionary computer simulation

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. However, when there is an asymmetry in information-search cost between individual and social learning (e.g., the former being more costly than the latter, as in many realistic situations), this conclusion may not be warranted. In the last year's conference, we extended the Henrich & Boyd simulation by incorporating the asymmetry in information-search cost explicitly into the model, and showed that individual learners and social learners often constitute a Hawk-Dove game like equilibrium in a group (Kameda & Nakanishi, 2000; see Kameda & Nakanishi, this conference, for an empirical test). In this paper, we extend our previous model further in a lattice-structured habitat (a 40 x 40 torus), where social learning is possible only with neighbors. The previous model assumed that any member in a group could be a "cultural parent" in social learning. However, this assumption may not hold in many realistic situations where targets for social learning are not random; we tend to learn selectively from parents, close relatives or neighbors. Given this, the new model incorporates a spatial structure by which only

"neighbors" (e.g., parents, relatives) can serve potential cultural parents. This paper reports a series of evolutionary computer simulations, exploring the functioning of individual and social learning strategies in the environment where social transmission is fundamentally local.

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Nell V.[1] **The weight of blood: continuities between predation and human cruelty**

Is cruelty - the deliberate and sometimes manifestly enjoyable infliction of pain on other living creatures - an exaptation that derives from the predatory adaptation? One aspect of the required proof would be to demonstrate continuities between nutritional predation, intraspecific violence among the great apes, and human gratulance at bloodshed.
Evidence to support the claim that powerful rewards have been attached to bloodshed and the cries of the victim (which are among the principle reinforcers of cruel acts) comes from ethology, psychology, and history. For this brief presentation, I will touch briefly on the first two, with which this audience is familiar, and focus on the third by looking at the portrayal of cruelty in Greek and Roman literature. These cultures, unlike our own, regarded cruelty not as an aberration, but as normal and sometimes praiseworthy behaviour, and were therefore able to absorb cruelty into their understanding of human nature with a frankness unthinkable to our tender-minded sensibilities. This frankness is helpful in detecting continuities between predation, pongid aggression, and human cruelty.

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New J.[1] **An animate/inanimate distinction in the detection of changes to scenes: a "Visual Foraging"hypothesis**

The visual environment contains immeasurably more information than can be processed and retained in detail by the human visual system. Therefore, an effectual internal representation of the environment relies on the efficient sampling of the entire visual array. I propose that some classes of objects in the evolutionary environment were of enduring importance to human beings' survival and reproductive success, and that a visual sampling procedure should be designed to track those objects more closely than others. Animate objects such as people and animals can be assessed along a far greater number of informative and important dimensions than inanimate objects. Further, animate objects are able to rapidly and meaningfully change many of their previously noted characteristics. Animate objects, by constituting both more informative and labile events than inanimate objects, require more extensive and frequent visual attention. A sampling procedure, in order to optimally "forage" the visual environment for information, should allot more extensive and frequent visual attention to people and animals than to inanimate objects. From this "visual foraging" hypothesis, it was predicted that the greater allotment of visual attention to animals and people would make their modification in a change-detection experiment more quickly and frequently determined than those to inanimate objects. These predictions were supported by the first experiment and replication. Further experiments eliminated the alternate hypothesis that the observed advantages for detecting changes to animate objects were due to low-level visual salience, rather than the objects' semantic categories.

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Núñez-de la Mora A.[1]*, Mascie-Taylor N.C.G.*[2] **Short gestational lengths in a group of chronically malnourished rural Bangladeshi women**

The characterisation of the post-partum endocrine profiles of a group of women under adverse nutritional and energetic conditions provided information to estimate gestational lengths. Patterns of urinary steroid metabolites (pregnanediol- 3a- glucuronide (PdG) and oestrone -3- glucoronide (E_1-3-G)) were examined in a small group of rural Bangladeshi women who became pregnant while lactating a previous child. Women had either begun menstruating post-partum or were still amenorrhoeic. Hormonal profiles of the initial post-partum period during which the second conception occurred were used to determine the incidence of ovulation during lactational amenorrhoea and to estimate gestational lengths of such pregnancies.
The analysis revealed a high incidence of ovulation preceding the return of menses and a longer, more abrupt attainment of normal ovarian function compared to well nourished fully breastfeeding western women. In one third of the sample, fecundity was restored in the absence of regular menstruation cycles. Estimated gestational lengths were on average shorter (34.4 weeks) than the reference average for normal uncomplicated pregnancies (38- 42 weeks). This finding could be partly accounted for by the chronic malnutrition, negative energy balance and persistent anaemia experienced by these Bangladeshi women. From an evolutionary perspective, the reduction of the gestational period may reflect a maternal strategy to cope with limited food availability in late pregnancy (Peacock, 1991). By switching provisioning from the placenta to lactation, the growth of the infant is ensured and the risk of adverse effects of energetic constraints in the womb is reduced.

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O'Connor K.[1] **Sexual selection and big game hunting**

Big game hunting is evident in the archaeological record from approximately 500,000 years ago. I propose that the proliferation and consequent appearance of big game hunting in the archaeological record is a result of its value as a sexual selection device. I suggest this hypothesis because the nutritional returns from hunting megafauna are often small in relation to the time and energy invested in the strategy. In this paper I will briefly summarise sexual selection and its relevance within the context of the archaeological record. I propose that evidence for big game hunting as a potential sexual selection tool can be found in the archaeological record of the Americas. Additionally, Anthropological evidence will be utilised in conjunction with the archaeology to support the notion that big game hunting is used in many modern societies as a fitness indicator. The notion that such costly behaviour appeared at least half a million years ago, and still occurs today, supports the notion that big game hunting is a device through which individuals can assess genetic fitness.

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Oda R.[1] **Sexually dimorphic mate preference in Japanese: an analysis of lonely hearts advertisements**

Lonely hearts advertisements (LHA) published in Japan were examined in a comparative study on sexually dimorphic mate preference. I analyzed 944 LHA written by Japanese (730 by males and 214 by females) seeking short-term relationships and 780 LHA (577 by males and 203 by females) seeking long-term relationships. Some universal patterns of mate preference were confirmed and others were not. Female advertisers in both categories sought more traits than they offered; they also sought more traits than male advertisers. Males tended to offer their financial and social status, and females tended to seek those traits. More females requested family commitment than males. While there was no sex difference in offering and seeking physical appearance and health, females tended to request photographs of their potential mates. Males were more likely than females to be willing to accept children from previous relationships, while there was no significant difference in refusing such children. More females seeking long-term mates requested family commitment than females seeking short-term mates. In both males and females, more advertisers seeking long-term mates offered family commitment than advertisers seeking short-term mates. Some predictions for contingent preference were also examined. One prediction confirmed was that females offering physical appearance and health sought more traits than those not doing so. However, males offering financial and social status did not make higher demands than those who did not, which does not support one prediction.

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Page W.[1] **Taking control of how the human genome is controlling behavior and emotions**

My Vermont State government colleagues and I are taking control of how genes are influencing behavior and emotions, for example in situations where crime exists. Our methodology for doing this is to study why the genes are determining the behavior existing in any given situation. Then we arrange to change the conditions in the social environment so that the new conditions induce the desired behavior through their influence on the genes. The crime rate in Vermont is much lower than it would have been if human nature had not been taken into account. We do this within a governance process which we call natural democracy, governance which takes human nature and the genome into account in its design. I report tests of natural governance also in the town that calls itself "the birthplace of American liberty", Lexington, Massachusetts. Lexington has demonstrated an expanded form of democracy designed with a conscious awareness of the epigenetic rules and evolutionary psychology. In that experiment, we provided the conditions that encouraged reciprocal altruism throughout the whole community and in the community's relationships with the state and nation. The information on the human genome sequence and its influence on behavior, published by Nature and Science in February of this year, identifies a rapidly expanding foundation of theory to support a trend toward a form of ultimate personal freedom. Coupled with that freedom, an ultimate but realistic responsibility is projected. What role does HBES have in this eventual transformation?

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Pietrzak R H.[1]*, Laird J.D.*[2]*, Stevens D.A.*[3]*, Thompson N.S.*[4] **Sex differences in human jealousy: an experimental evaluation of the module notion**

Previous investigators have confirmed the evolutionary hypothesis that the sexes should differ in their responses to sexual versus emotional infidelity and have taken their results as suggesting the existence of a mechanism (module) that regulates the perceptions of threat, the physiological reactions, and the emotional responses that constitute jealousy. This module notion implies that these three categories of response should occur systematically in the same individuals. However, no study has been done that confirms this implication. This study is the first to demonstrate the traditional findings concerning these three categories of response on the same group of subjects. It also extends Buss, Larsen, Westen, and Semmelroth's (1992) demonstration of sex differences in physiological responses to sexual versus emotional infidelity by finding significant sex differences for measures of heart rate, peak electrodermal response, electromyographic (forehead muscle) activity, and skin temperature. Finally, it extends Geary, Rumsey, Bow-Thomas, and Hoard's (1995) results by demonstrating a wider range of feelings related to sexual versus emotional infidelity, and also confirms Geary et al.'s (1995) finding that males are more angry in response to sexual infidelity, females to emotional infidelity. Overall, the results of this investigation are partially consistent with the module notion.

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Raymond M.[1] **On the significance of the handedness polymorphism in humans…**

Handedness is a specialization of one hand or arm for a particular function. This trait is inheritable, and present a polymorphism in human populations. Is there a cultural variation of human handedness? This question remains curiously without a clear answer in the literature, although the significance of handedness will greatly vary depending whether or not this trait is variable in populations. The obscurity of the present situation is probably the result of a wide variety of distinct handedness measures used by different authors, precluding a direct comparison between most studies. In addition, these measures were generally defined arbitrarily, i.e. outside the context of a theoretical background..
I propose that handedness polymorphism in humans is maintained by frequency-dependent selection, left-handed individuals having an advantage over right-handers in aggressive interactions. This theory assumes (as well as any other adaptive hypothesis) the existence of a variation of handedness frequency across cultures. It also assumes that for sports that mimic some forms of aggressive interactions, the frequency of left-handed is high in the winner category (e.g. champions). Data supporting both points will be presented. Within the context of this theory, which needs further direct supports (in progress), handedness should be measured using tasks related to fight and aggressive interactions.

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Renaud M.[1] **Decision framing and mate choice: an evolutionary analysis of single and multi-attribute decision-making**

The effects of choice and reject framing on male and female participants' decisions in a long-term mating context were investigated. A variety of theories have been proposed to explain people's behaviour given this type of manipulation. These theories, however, do not take into consideration the possibility of sex differences in decision-making. Evolutionary theory suggests that such differences should be considered in any such investigation, especially in the context of mating decisions. Two studies were conducted. The first study investigated the effects of sex and framing on the ratings of forty individual adjectives. In either a choice or a reject framing context, participants were asked to rate how important each adjective would be in an ideal long-term partner. The ratings of males and females were significantly different and novel patterns of responses were observed due to framing. The second study used the data from study 1 to test three theories of multi-attribute framing. Sets of four adjectives were constructed so that there were four equally undesirable sets and four equally desirable sets. Participants were asked to complete two tasks, a pair-wise comparison task and a rating task, in either a reject or a choice frame. Contrary to the predictions of the previous theories of multi-attribute framing, the results revealed a sex by framing interaction for both tasks. The discussion addresses some of the implications of these findings for decision research in mate choice and non-mate choice contexts.

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Roberts, P. Jr.[1] **Why we turned out like Captain Kirk instead of Mr. Spock: the mechanics of genetic indeterminism**

Thanks to his momentous discovery of "the qualities by which the mind is conveyed from one idea to another", the venerable David Hume has managed to decipher some of the logic of how value behaves. By relying on this logic, and with the help of a few diagrams, I have found it possible to account for the sustained presence of non-self-serving concern for others in a naturally selected world presumed to statistically favor selfishness. In this scenario, the cumulative effect of Hume's laws operating over millennia of cultural evolution has become sufficient to overwhelm nature's incessant culling of the valuatively unfit (other-interested individuals). Although less than optimal, the resulting valuative profile has been tolerated by natural selection as a necessary premium for reaping the considerable rewards that attend a rational species. Paradoxically, this would also entail the intriguing implication that we have become less determined (conatively/valuatively) by natural selection as a result of natural selection.

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Roberts S.C.[1]*, Petrie M.*[2]*, Gosling, L.M.*[3] **Does the contraceptive pill alter female preferences for body odours?**

Body odour is believed to be important in both human and animal mate choice. Recent studies have indicated that, in common with females of other species, women tend to prefer the odour of individuals who are dissimilar from themselves at loci in the major histocompatibility gene complex (MHC). However, users of the contraceptive pill appear to prefer odour of MHC-similar men. To date, there has been no direct test of the possibility that pill use can cause changes in odour-mediated mate preferences. We describe our current research which aims to do this by comparing odour preferences of individuals before and after use of the pill. Furthermore, we are investigating the putative hormonal mechanism for such alteration in preferences, by comparing potentially pill-induced effects with those associated with pregnancy.

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Rocha J.[1] **The biological role of religion and of the Messiah**

It is argued that Darwinism has not "*deprived morality of its very foundation."* A general sociobiological law is inducted from observation and proposed: *without a powerful biological mechanism of generalized sexual repression, there can be no highly sophisticated social species. Religion* is the designation attributed to the emotionally and intellectually based biological mechanism that in human communities *("hives")* organizes and manages the sexual repression that is absolutely essential for the species to remain "social," organized, and thus successful. The *religious agents,* Messiah and others, are enhanced sexuality individuals that are to our species like to what a queen is to a hive of bees or to a colony of ants. Their sociobiological functions, nature and origin, as well as the organizational structure of the human *"hive"* are described.

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Rohde P.A.[1]*, Fetchenhauer D.*[2] **Riskproneness in the mating context**

According to sexual selection theory (Trivers 1972), the prevailing sex difference in reproductive variance selects for male-male competition and for female choice for cues of successful males. Wilson and Daly (1985) extended this theory by showing that a general riskproneness is conducive to successful male-male competition and will therefore be more strongly developed in males. In a series of studies with Dutch and German students, we assessed for the first time the role of riskproneness as a criterion for mate selection in humans for both sexes and their alternative mating strategies. Subjects were asked to rate the desired level of riskproneness of their ideal longterm versus shortterm sexual partner. Strong effects of both sex and mating context were found. As predicted, women´s ideal longterm partner was more riskprone than themselves, but less riskprone than the shortterm partner. For men, the ideal longterm partner was equally riskprone as themselves, but the ideal shortterm partner was desired to be very much more riskprone, herein exceeding the corresponding ratings of women. In accordance with these results, riskproneness was positively correlated with sociosexuality in men and women as measured by number of lifetime sex partners. Our findings contribute to an integrative sexual selection framework of inter- and intrasexual differences in personality.

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Roney J.R.[1] **Effects of visual exposure to the opposite sex: evidence for mate attraction mechanisms in human males**

This research is a preliminary investigation into the cognitive aspects of mate attraction in human males. Two experiments demonstrate that visual exposure to women (in person or within photographs) can prime large changes in the attitudes, mood states, and personality trait descriptions of male subjects. These changes, furthermore, are such that subjects show greater conformity to female mate preferences as described in the extant literature: In particular, men exposed to potential mates reported higher valuations of material wealth, greater momentary feelings of ambition, higher valuations of other indicators of social status, and personality trait descriptions indicative of high surgency/extraversion. All such effects occurred without subjects' awareness that their responses had been affected by the experimental manipulations. These findings suggest a model of mate attraction mechanisms in which input cues from potential mates can nonconsciously prime those psychological representations that facilitate the behavioral expression of courtship tactics. Discussion centers on the neurobiological pathways likely to implement such mechanisms.

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Saad G.[1]*, Gill T.*[2] **Consilience in consumer behavior: adopting evolutionary psychology as the integrative framework**

Tooby and Cosmides (1992) argued that evolutionary psychology should be the unifying framework for all of the social sciences, including the disparate subfields of psychology. More recently, Wilson (1998) discussed how the natural sciences have been more successful at identifying such unifying frameworks (e.g., Darwinian principles in biology). In a recent article published in Psychology & Marketing, we proposed that evolutionary psychology is a viable and relevant framework to the marketing discipline. Given that the HBES audience might be unfamiliar with the marketing literature, our first task here is to summarize the key points of the paper. Secondly, we extend the latter work by arguing that the consumer behavior literature lacks a unifying and integrative framework. Specifically, we contend that for the consumer behavior discipline to achieve consilience, it too should adopt a Darwinian framework as its organizing supra-level theory.

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Sakura O.[1] **"Pop" biological determinism in Japan: why they like it?**

"Pop" or shallow biological determinism is quite common in Japan at present. Some popular magazines and books are filled with cheap and misleading genetic/biological determinism. One of the reasons is apparently rapid development of life sciences and biotechnology, and another is popularity of evolutionary narratives. The Japanese word representing "evolution" includes two Chinese characters: "to advance" and "to transform." Then, the word of "evolution" more easily connects with the image of "progress" for Japanese lay people. Such condition is quite unhappy to specialist of evolutionary biology. I report some typical examples of "pop" biological determinism in recent Japan, and argue how to change the situation. More careful style of "propaganda" would be required for specialists.

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Sakurai Y.[1] **Why do people demand "culture"(as an ethnoconcept) ?**

I investigate why people demand "culture"(as an ethnoconcept),and what the culture as an ethnoconcept is .?I survey Toshio YAMAGISHI's theory on culture as a noteworthy work.?I try to improve the points with which I?feel dissatisfied on his theory.?By referring to Trivers' theory on "self-deception" ,I think that there can be the mechanisms that should be called as "self-deception" but "honesty to others".?I think that one of the mechanisms is "culture" as an ethnoconcept.?Especially,I think "culture" is a strategy by which the people will console themselves,by appealing to their communality, who are anxious to commitment relationships with others.?I present some data that support the above hypothesis.

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Salmon C.A.[1] **Pornotopia/Romantopia: an evolutionary exploration of erotica**

Many types of data can illuminate male and female sexual psychologies. Unobtrusive measures, those that do not require the cooperation of respondents and do not themselves contribute to the response, can complement questionnaire studies, providing additional insight. Commercial erotica can provide us with a wealth of information about human sexual psychology. The design features of porn and romance constitute unobtrusive measures of male and female sexual psychologies. Real-life heterosexual interactions inevitable compromise and, thus, blur differences between male and female sexual desires but erotica has no need for such compromise, since it is targeted to sex-specific audiences.
Male-oriented pornography and female-oriented romance novels, the main components of commercial erotica, are multi-billion dollar global industries. In the United States, video porn sales and rentals account for 25% of the video market with revenues over $4 billion, while the romance novel industry makes up 40% of mass market paperbacks, bringing in $4-6 billion. The characteristic features of these two very different genres have been shaped in free markets by the desires of millions of men and women who have "shaped" them with their money.
This presentation attempts to identify the essential ingredients of erotic genres, or to distill their essences, illuminating the psychological significance of commercial erotica..

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Scheyd G.[1]*, Thornhill R.*[2]*, Gangestad S.*[1]*, Miller R.*[2]*, Knight J.*[2]*, Franklin M.*[2] **MHC, symmetry and body scent attractiveness in men and women**

Previous research has indicated that couples tend to assort negatively on genes coding for major histocompatibility complex (MHC), and that individuals of both sexes prefer the scents of men

and women with MHC types different from their own. Three major hypotheses have been advanced to account for this finding. The first invokes an olfactory adaptation to avoid inbreeding. The other two suggest that the preference has evolved in response to parasites – one, that the preference increases the likelihood of MHC-heterozygous offspring, who would therefore have increased immunocompetence; the other, that the preference is not designed to seek out different MHC alleles per se, but for rare alleles, which would confer a benefit upon offspring (whom parasites would be poorly adapted to exploit). We found that males prefer the scents of MHC-dissimilar females. Additionally, females rated the scents of MHC-heterozygous males as significantly more attractive than those of MHC-homozygous males. This preference did not vary across the cycle. A previous finding that females at mid-cycle prefer the scent of males with low fluctuating asymmetry (FA) was replicated. We also replicated the finding that males prefer the scent of females at mid-cycle (high fertility). Evidence suggests that a number of independent olfactory adaptations may be operating in MHC and FA preferences.

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Schmitt D.P.[1] **Desires for sexual variety and mate poaching experiences across multiple languages and cultures**

Previous investigations have found that men tend to express a more potent desire for sexual variety than women do (e.g., Buss & Schmitt, 1993), and that personality factors play a key adaptive role in the process of human mate poaching (i.e., attracting a mate who is already mated). For example, sexy people tend to report more mate poaching attempts, whereas disagreeable people tend to go along with poaching attempts (Schmitt & Buss, 2001). In a cross-cultural collaboration involving a dozen languages and over 30 countries, preliminary findings largely replicated past results. Discussion focuses on potential facultative variations in human sexuality across cultures.

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Schroeder I.[1] **The dissociation of reproductive and socioeconomic success in industrialized countries**

Low birth rates characterizing populations after the demographic transition still pose a problem to evolutionary biology: the observed behavior of minimizing reproduction does not correspond with the expectation that individuals should maximize reproductive success.
Though there are approaches from different fields of research to explain the dissociation of reproductive and socioeconomic success in industrialized countries, they are mutually incompatible. This is particularly true for evolutionary explanations on one side versus demographic and economic explanations on the other side.
It is the aim of this contribution to link demographic and economic considerations to evolutionary explanations. This attempt requires to shift the focus from males to females, since reproduction in industrialized countries is predominantly controlled by women. Any viable evolutionary explanation of low fertility has to answer the question why women either significantly reduce the number of offspring or even completely refrain from having children.

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Senju A.[1, 3], *Tojo Y.*[2], *Hasegawa T.*[1] **Eye gaze triggers autistic children's reflexive attention**

Children with autism are known to suffer a deficit in joint attention, a natural tendency to spontaneously follow another person's attention. General attentional dysfunctions among autistic individuals are also reported. However, the relationship between attentional difficulties and impaired joint attention amongst autistic individuals is still unclear. Here we investigate whether social attention to others, especially to the direction of eye gaze, triggers autistic children's reflexive attention shift in an experimental situation. Eleven children with high functioning autism and 14 typically developed children participated in an experiment involving the spatial cueing paradigm. The task involved localization of a target which appeared either to the left or right of a fixation point. Before the target appeared, the direction of eye gaze of a computerized face cued subject's attention either to the right or to the left. Although instructed to ignore the eye direction, both groups of children responded to the cued target significantly faster than to the uncued one. The results indicate that children with autism shift their attention reflexively towards the direction of another person's eye direction, in the same way as children with typical development. Therefore, it is suggested that children with high functioning autism have the attentional capacity to follow another's gaze.

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Sheets V.[1], *Herrmann D.*[2], *Hartzog T.*[3] **"Was I that obvious?" Evidence of facial cues for lust**

The ability to perceive sexual interest would seem essential for the success of any sexually reproducing species. Numerous researchers have therefore explored the cues that men and women use to assess each other's sexual interest. The length of a glance, tilt of the head, touching a face, and body posture all play a role in communicating one's sexual or non-sexual interest to another. Surprisingly, the specific role of facial cues in displaying sexual interest (or "lust") is relatively unstudied. Yet the face is the primary mechanism for communicating emotions to others in ours and other cultures. In the current study, we explored whether people can accurately identify "lust" from the face of an unknown person. We obtained "target" photos of people while they were looking at others they were interested in as "friends" "sexual partners" or whom they found "repulsive." We then had naïve subjects rate each photo for "degree of sexual interest." We found that subjects were able to distinguish "sexually interested" faces from both "friendly" and "repulsive" faces. Sex differences were also observed. Practical and theoretical implications are discussed as well as suggestions for further research.

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Singleton B.[1], *Green K.*[2], *Bridgeman C.*[3], *Tovée M. J.*[4] **The perception of attractiveness, health and fitness in the female face and body**

It has been suggested that the perception of physical attractiveness

is based on cues to health and fitness. To explore this hypothesis general health and cardiovascular fitness measures were taken from 40 women volunteers. We also took measures of body shape (including the waist-to-hip ratio) and measures of body mass (the Body Mass Index or BMI) and body fat composition using the both the calliper technique and Bio-Impedance. We then took digital photographs of our women volunteers: these included a portrait picture of their faces and a full body picture of the women in leotards (the face on these latter pictures was subsequently obscured). The images were then rated for attractiveness, health and fitness by male observers. The ratings of the faces and bodies were not significantly correlated. In the body, the ratings of attractiveness, health and fitness were strongly correlated with each other, and the cardiovascular measures were strongly correlated with BMI and body fat composition. There were also strong correlations between the ratings of bodies with the measures of cardiovascular fitness, BMI, and body fat composition, but not with the general health measures. The measures of body shape were not significantly correlated with any of the ratings of either the face or body. Our results suggest that observers are able to accurately judge some aspects of physical fitness, and that the perception of female attractiveness is strongly linked to the perception of physical fitness and health.

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Skoyles J.R.[1] **Post Homo erectus brain expansion is unrelated to IQ: the "expertise" hypothesis**

Human brains expanded roughly by half between Homo erectus and Homo sapiens sapiens to around 1400 cc (male), and 1250 cc (female) but this happened at the cost of prolonged neonatal dependence, obstetric complications and compromise of female location (wider pelvis). Whatever early cognition selected for brain-size expansion thus must have offered a strong compensating benefit. Here I argue that, even though a moderate 0.4 - 0.5 correlation exists between brain size and IQ, brain-size expansion since Homo erectus does not link to the cognitions that underlie IQ. The clinical literature reports individuals with psychometrically normal IQ but Homo erectus sized brains (MRI volumetric outliers, microcephaly and hemispherectomy). Thus, the compensating benefit offered by large brains is unlikely to be intelligence as measured by IQ - since why should evolution have increased brain size with its associated problems when Homo erectus sized brains can possess normal IQ? "Expertise", (as understood by investigating researchers, not the everyday or dictionary understanding of the word), I argue was responsible. "Expertise" refers to cognitions that require a massive accumulation of "information chunks" (acquired through deliberative daily practice over a minimum of ten years). For storage and processing, these chunks depend upon large numbers of neural columns - and therefore expanded brains. In the survival of simple hunter-gatherers, expertise plays a critical role (prey tracking, foraging, tool making, communication). Thus, expertise not only requires brain enlargement, but aids fitness and so could explain why post Homo erectus had expanded brains.

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Smaniotto R.C.[1] **Emotional-behavioral mechanisms underlying human sociality**

The study to be presented focuses on the emotional-behavioral mechanisms producing human social behavior. Although the literature about the evolutionary origins of human sociality or cooperation is troubled by a multitude of different terminologies, we can distinguish two accounts. First, born from the traditional sociobiological tradition, the idea of *(generalized) Tit-for-Tat-like reciprocity* focuses on cooperative behavior aimed at acquiring material rewards or prestige (reputation). In this account, to be social means to maintain strict reciprocity, that is: cooperating with other "socials", avoiding being indebted, and avoiding to be cheated on. Examples of emotions accompanying this kind of behavior are obligation, gratitude and sense of fairness.
According to the second account, human sociality is based on a *need to belong to a group*. Here, emphasis is on behavior aimed at maintaining the group and one's position as a group member, like caring for one's group members and avoiding being excluded. Some relevant emotions are attachment and care on the one hand, and sense of guilt following a transgression on the other.
Based on both accounts I will present a number of emotional-behavioral mechanisms of the form *cue → emotion → behavior*, as well as some preliminary ideas for experimentally testing those mechanisms.

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Squires A.M.[1] **The several roles of body fat in human evolution and behaviors**

The paper's viewpoint arises from Tobias's (1998) counsel¾that evolutionary science will likely profit by entertaining Hardy's (1960) suggestion that hominids were "more aquatic in the past." Our line remained semi-aquatic, the paper argues, well after our brain achieved its extraordinary size. Sexual dimorphism in disposition of body fat begs for explanation. Insulated by fat, having invented speed swimming, men robbed distant rookeries and killed dugong and sea turtles browsing on eelgrass. Women kept closer to "home," diving for fish and mollusks. Late in gestation, a neonate acquired fat affording a buoyancy that (together with instincts for holding its breath and swimming spontaneously, when in water) eased a new mother's tasks. Like an inshore dolphin mother, she could safely park her newborn in seaweed. (In a modern neonate, fat level at birth does not correlate with survival beyond a first birthday.) Already fat in the buttocks, a woman accumulated additional fat therein early in pregnancy, acquiring extra buoyancy and a keel holding her face upward when, floating, she used a rock (like the sea otter) to smash open shellfish. Near term, weights of her new fat store and fetus converged, balancing her body front to back. With agriculture, population growth brought hard times, and the mother's fat store became an exaptation conferring "metabolic plasticity" (Prentice & Goldberg, 2000). A food-deprived woman (in either Third World by economic circumstance or First World through choice) can bring off a successful pregnancy at an excess caloric intake near zero.

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Steadman L.[1] **On Taboo**

The key question in regard to taboo is, why do ancestors direct their descendants to restrain themselves from doing things they have been selected to do? Taboos, by usually being traditionally inheritable, should have influenced their own frequency in subsequent generations, yet they have received little attention from Darwinian selectionists.
We have argued that the distinctive feature of social behavior is not interaction but sacrifice, sacrifice of reproductive and survival potential, sacrifice of "r" to achieve "K". What theories of taboo there are attempt to explain it by its reproductive, psychological, survival or group benefits. However, by focusing on the behavior and its identifiable consequences, rather than alleged beliefs and psychological mechanisms, it is proposed here that taboos encourage sacrifice of reproductive and survival potential, and thereby promote social behavior, the basis of human society. Taboo functions in a way similar to initiation pain and religious sacrifice. The main effect of this increased social behavior is to increase cooperation and decrease competition among the co-descendants (or co-followers), and to enhance their ability to compete with outsiders.

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Stebbing P.D.[1] **The evolutionary origin of artistic behaviour in Homo sapiens**

Hypotheses exist for the origin of human artistic behaviour but they tend to ignore the consistency of visual composition aesthetic constants favoured by human perception in the arts which can be empirically identified. Therefore a new hypothesis is proposed that humans possess an aesthetic meta-grammar composed of Contrast, Rhythm (pattern), Balance (symmetry) and Proportion (CRBP) which originally evolved to aid our recognition of the diversity of organic forms and in which these organisational components occur in various combinations. As Lovelock states:"Our recognition of living things, both animal and vegetable, is instant and automatic, ..." It is proposed that the ability to recognise the diversity of organic form was an important evolutionary step to enabling mankind to leave the niche of his origin and migrate all over the world. It can be proposed that human aesthetic ability evolved as a 3 stage evolutionary sequence:
1.) the "given" organisation of organic form,
2.) the evolution of human perception to respond to the perceptual primitives of organic forms (CRBP)
3.) the same perceptual primitives provided humans with an aesthetic visual grammar.
Support comes from the sensitivity of our perception to (CRBP) and also from the idea of the artwork as a "living form" (organicism) and gestalt perceptions. Although gestalt perceptions lack an accepted explanation for their origin, it is proposed here that they evolved as an aid to organic form recognition. In conclusion, our evolved ability to recognise the diversity of organic form through the organisational components of CRBP "pre-adapted" our species with a universal aesthetic meta-grammar.

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Sullivan T.[1] **The unity of science: a philosophical explication and resolution**

Evolutionary psychologists stress that science is a unified enterprise. Where, for example, science is held to be an increasingly seamless system of interconnected knowledge. Moreover, psychology benefits greatly from conceptual integration with the natural sciences.
However, there appears to be an ambiguity in what exactly is mean by the 'unity of science'. At times it appears to imply that the behavioral sciences should be consistent with the natural sciences, and, further, that the former are not reducible to the latter. This seems undoubtedly to be correct although I will show that it is largely uninformative. However, at other times the 'unity of science' appears to entail something significantly stronger than consistency. For example, Cosmdies and Tooby argue that conceptual integration generates important growth in knowledge because it allows scientists to use knowledge developed in other disciplines to solve problems in their own. However, this conceptual integration appears more like the reduction that on the earlier account of the unity of science was rejected. Namely, explaining phenomena in one domain of sciences in terms of laws governing phenomena at another.
I will suggest, however, that the above ambiguity is no such thing. The reason for its appearance is that because at times reductionistic explanations are valid while at other they are not. Further, I suggest that a complete explanation of a singular phenomenon will require knowledge developed from different sciences or levels of explanation, and thus a complete explanation will contain elements that are both reductionistic and non-reductionistic.

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Svenstrup M.[1] **The human cooperative uniqueness problem reconsidered**

I analyse two simplified different evolutionary games (interactive categories) deduced from socio-ecology. Analysis of these games indicates different dynamics constraints. That is, both in terms of cognitive style, and cooperative efforts. My work suggests (manuscript in progress) that generally groups are caught in a trade-off about cooperative behaviour. This trade-off exposes difficulties in explaining how members of a group can unite in interest. That is, as an evolutionary phenomena by means of individual selection. The human social uniqueness includes an evolved potential to escape this constraining trade-off.
Analysing the origin of human cooperative behaviour, the traditional focus is to explain a transition from a population state of no cooperative effort to a state of a lot of cooperative effort (for instance, Svenstrup & Christiansen. 2000, Selection 1-3, p147-152). Within this traditional paradigm evolution of cheater-detection and punishment of those who cheat is a key element in human social evolution.
I argue if we include historic adaptive and socio-ecology considerations, for the human species, it is another transition about cooperative behaviour that unfolds. A transition from cooperative efforts bound within sub-alliance games to a population state where high levels of individualistic or non-alliance cooperative efforts are potentially favoured over within sub-alliance cooperative activity. Thus, the key-element in explaining the human social potential

within this model is the evolution of refraining from acquiring resources through sub-alliance activity within the group. I discuss and analyse such a transition.

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Swan T.[1], *Benack S.*[2] **Cheater detectors or permission rules: alternate explanations of performance on the Wason Task**

People are notoriously bad at solving logic problems which ask them to select information which could falsify a rule. In the standard Wason task, people are given a statement of the form "if p, then q." They are then presented with four cases in which they are given information about either p or q, then asked in which cases would they need to know the other piece of information in order to determine whether the rule was ever violated. Cosmides and Toobie (1992) claim that people do well on falsification problems which involve social contracts, those which involve finding violations of the rule "If you take the benefit, you must pay the cost," because humans have evolved "cheater detectors," a specific cognitive adaptation which functions independently of general logic. Alternately, people might perform better on social-contract tasks because everyday knowledge of the structure of social-contracts rules leads them to correctly interpret the rule as meaning "q permits p" rather than "q requires p." If this explanation is correct, people should also do well on other Wason tasks which communicate "permission rules" rather than logical implication rules, even if they do not involve social costs and benefits. To test this hypothesis, 125 high school seniors and college students completed one of three types of Wason tasks: a standard logic task, a social contract task, or a permission rule task which did not involve social contracts. Performance on permission rules tasks was intermediate between that on social contract tasks and standard logic tasks. Chi squares revealed that differences between each type of task were statistically significant.

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Szlendak T.[1] **Self-portraits, frugal heuristics, and theory of mind. On the ability to read intentional social announcements from the photographs**

The qualitative research based on a method used in visual anthropology proves that people have amazing ability to intuitive estimation of these features of character which are essential for their social relationships. Moreover, looking only and exclusively at someone's photographic self-portrait people are able to estimate such concrete social features as membership in political party, vegetarianism, degree of authoritarianism, introvertism or extravertism, and even favorite color or TV program. The self-portraits were intentionally prepared, i.e. investigated people had assignment to make a photo which in the greatest degree – in their opinion – would present who they are. The aim of the research was to seek explanation of such phenomenon in cognitive and evolutionary psychological hypothesis which found that evolution of social behavior led to producing such "fast-and-frugal" heuristics which on the ground of very little coefficients would permit in a very short time to rate potential value of other individual as a partner of interaction. At the basis of these heuristics lies multimodularity of our mind which is an adaptation to specific conditions prevalent in natural environment during the evolution of *Homo*, while basic feature of mind which makes survival possible in a complicated social environment is our inborn ability to penetrate minds of others what psychologists call "theory of mind".

Keywords: theory of mind, multimodular model of intellectual software, fast-and-frugal heuristics, adaptive toolbox, adaptation to social environment, visual anthropology, qualitative analysis of photographic pictures

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Takezawa M.[1] **The evolution of concession strategies: how can bargaining under incomplete information achieve equality of welfare?**

Imagine that you bargain with your partner over the benefit produced from a joint venture. You each know only the total amount of benefit and the amount of your own cost. Thus, both parties can't know the amount of profit the other party will receive from a particular division. What will be the outcome of bargaining? The results of experiments conducted by social psychologists surprisingly showed unimodal distribution around an equal division of the surplus (=total benefit minus sum of costs) – *people achieved equality of welfare without even being aware of it.* The purpose of this study is to provide an explanation to this interesting phenomenon from evolutionary game theoretical perspective.
We first focus on the possibility that bargaining may allow comparison of the degree of demand through the series of concessions. If we can assume that a player who demands less than the other also makes concession more quickly, then bargaining may end with demand being balanced – both parties receive the same welfare. This assumption seems to be implausible, however, because it is rational to concede as slowly as possible. We next focus on the fact that the game of concession is analogous to Hawk-dove game -- it may be an evolutionary equilibrium in which people reflect their demand in their concession behavior. Through a series of evolutionary computer simulations and experiments, we will discuss how and when bargaining under incomplete information can be a social device to achieve equality of welfare.

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Teehan, J.[1] **Evolution and the possibility of ethics**

It is not unusual to hear the assertion that without religion there can be no basis for living a moral life. While the influence of traditional religions is waning, there still remains a suspicion that a purely naturalistic understanding of the human condition will somehow undermine morality and virtue. This may partially explain the antipathy toward evolutionary theory, in general. However, when evolution is used to analyze human behavior this perceived threat to human dignity is thrust to the forefront. It is important to note that this antipathy is not restricted to religious adherents alone, but finds expression in a number of significant philosophical works. This paper examines the asserted necessity that morality be grounded in some transcendent concept as that position is worked out in the philosophy of Immanuel Kant. Kant argues that to base morality on the contingencies of human nature is to promote "the euthanasia of all morals." Since any evolutionary account of ethics is going to be specifically concerned with the contingencies of human nature this is a relevant critique of such a project. This

Kantian argument is assessed and countered with an evolutionary perspective on the issues. Kant's position is based on a distinction between reason and emotion not supported by contemporary science and incorporates a decidedly non-evolutionary conception of self-interest. The paper concludes that an evolutionary approach to human behavior can yield a sufficiently firm grounding for morality.

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Tischler B.[1], *Atzwanger K.*[2] **Hydrophilia – effects on exploration and interaction**

Vitruvius, a Roman architect (70 AD), dedicated the eight volume of his "De Architectura Libri Decem" to the topic of water and starts with the following words: "Aqua est maxime necessaria et ad vitam et ad delectationes et ad usum cotidianum." "Water is indispensable for life, for the joys of life and its daily use."
Inspired by this statement the present study proves the immediate effects of water as a feature of interior design on human behaviour in an everyday environment. While the assessment and the preference for waterscapes have been focused on in several previous studies the immediate effects on human behaviour have not been documented thoroughly so far. For the present study we hypothesised that water as an element of interior design would increase the rate of interaction and exploration. Data were recorded by a hidden camera in a shopping mall. The passer-by's were observed on a monitor. In addition to conventional ethological methods, we introduce a motion sensitive software to measure these parameters. Data show an increase in the frequency of behavioural patterns which are relied upon as relevant parameters for place-attachment, communication and wellbeing. Studies like this introduce ethology as sensitive tool to understand the influence of urban environment on human behaviour and to evaluate and optimise our living conditions.

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Valencia L.[1], *Kirkpatrick L.A.*[2] **Differentially predicting violence against romantic partners from domain-specific self-esteem**

Research on the empirical relationship between self-esteem (SE) and aggression has long produced equivocal results. In a series of laboratory experiments testing Kirkpatrick & Ellis's (2001) evolutionary theory of domain-specific self-esteem, Kirkpatrick et al. (2000) found that distinct functional domains of self-esteem were differentially predictive of a behavioral measure of aggression in the laboratory: Self-perceived superiority to others and self-assessed mate value predicted greater aggression in the respective studies, whereas perceived social inclusion was inversely related to aggression. The present research was designed to examine these SE-aggression relations within the context of ongoing dating relationships. In Study 1, self-reported social dominance predicted higher levels of self-reported aggression towards a romantic partner, whereas self-perceived social inclusion was inversely related to aggression. Also a trend suggesting that participants perceiving their partner did not have sufficient alliances (collective esteem) reported more aggression towards their partner. Study 2 [in progress] is designed to replicate and extend these findings by collecting measures of mate retention tactics, conflict resolution tactics, jealousy, and physically/psychologically abusive tactics from both partners in dating couples, to examine the degree to which one partner's domain-specific SE predicts both self-reports and partner-reports of these variables.

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Vargas-Hernández J.G.[1] **The economic and political transition of the Mexican State in the threshold of the twenty first century: from the entrepreneurial state to the state of entrepreneurs**

This paper has the purpose to analyze most recent economic and political changes in the Mexican States, which show a clear transitional tendency from an entrepreneurial state toward a state of entrepreneurs through the following stages: The PRI-presidential Mexican Entrepreneurial State with an emphasis in the welfare state model,followed by a period marked by the transition of the Mexican State focused on a neoliberal PRI-presidential reinventing of the state, as the result of the economic and political impact of globalization and its pervasive effects on an inequal income distribution, weak governance, political instability and lack of property security, besides a new relation´s interface between government and entreprises. Finally, the regime's transition under the change of party in power opens the stage of a Mexican State of Entrepreneurs in the new period PAN-presidentialist.

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Voracek M.[1], *Fisher M.L.*[2] **Sex differences in subjective nonpaternity estimates**

Human nonpaternity (HNP), the occasional discrepancy between social/legal paternity and biological paternity, is predicted by evolutionary theories. Although a tabooed biomedical research topic, incidental genetic-related findings directly evidence a wide range of HNP rates (0.5–30%; Baker & Bellis, 1995). Further, rates have been indirectly estimated from extra-marital sex prevalences (Baker & Bellis, 1990), emotional closeness to kin ratings (Russell & Wells, 1987), and discriminative kin investment ratings (Gaulin et al., 1997), all of which suggest rates of approximately 10% or beyond. Surprisingly, to date no one seems to have directly asked lay persons about their beliefs (subjective estimates) regarding HNP rates. Hence, we implemented such an item in three survey instruments concerned with intimate relationship issues, and administered it to Austrian community samples (n = 954, 243, and 157). We hypothesized a sex difference in naïve participants' subjective HNP estimates, with females stating higher estimates, owing to "tacit knowledge", relative to males. Across all three samples, an effect in the predicted direction emerged (Cohen's d: 0.47, 0.35, and 0.16). Generally, both sexes' subjective HNP estimates were high (around 10% levels), more in accord with indirect HNP estimates than with genetic HNP data for a comparable population (Switzerland: 0.8%; Sasse et al., 1994). We conclude that, while the sex effect in subjective HNP estimates may reflect some enduring HNP circumstances (i.e., "*the cuckold is the last that knows it*"), both sexes' estimated HNP levels may more accurately reflect (pre)historical rather than contemporary HNP frequency levels (cf. Gaulin et al., 1997).

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Wagner J.[1], *Flinn M.*[2], *Gangestad S.*[3], *Thornhill A.*[4], *England B.*[5]
Male coalitions, status, FA, and hormone response to domino competition

We investigate relations among social status, basal testosterone (T) and cortisol (C) levels, fluctuating asymmetry (FA), and T and C response to domino competitions among adult males in a rural Caribbean village. We speculate that because humans have evolved to cooperate extensively in inter-group competition (Alexander 1989), mechanisms for competing within and between coalitions will be different and are mediated by hormone release. Humans secrete T and C in response to challenges and T is positively associated with dominance behaviors (Elias 1981; Mazur and Booth 1998). Social rank may affect hormone response to challenges (Sapolsky (1991; 1992) and FA may be related to social dominance (Thornhill and Gangestad 1994). We predict that male hormone response to competition within coalitions will usually be lower than that between coalitions because the former involves more subtle status maneuverings and would not be marked by high T increases associated with dominance displays.
Results indicate that both T and C increase more during between, rather than within, coalition matches. No significant relations were found among basal T and C levels and status. Social status did not predict the amount of hormone response to competition, although it was significantly correlated with FA. This study indicates that hormone response to a psychosocial stressor, domino competition, is sensitive to the context of male coalitions in this sample. Individual differences and the importance accorded to the competition by the participants may influence hormone response.

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Wallin A.[1] **The role of causal information in domain-specific cognitive abilities and when introducing the cognitive niche**

One of the big theoretical advantages of domain-specific abilities is that they lessen the need to explain the relation between context and the cognitive processes/darwinian algorithms that are active in that context. The hypothesized evolutionary history of the ability provides an explanatory framework for the relation. However this is not enough even for domain-specific competencies, and certainly not enough if we want to broaden the type of cognitive processes that are to be explained by introducing the idea of a possible cognitive niche. Even when a cognitive process is strongly domain-specific, it will have to be able to identify certain significant factors. And introducing meta-representations or other types of context-markers in order to explain our ability to deal with contingent information faces similar problems. I argue that sufficient care has not been taken to find out what *type* of information that is utilized in either domain-specific or possibly more general cognitive processes. Favouring causal information will make the context problem partly disappear. Causal relations hold between different contexts, and their existence or non-existence will lessen the importance of decoupling: the type of information that is used will take care of this on its own.

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Webster G. D.[1], *Valencia A.*[2], *Burkett B.N.*[3], *Kirkpatrick L.A.*[4]
Level and instability of global and domain-specific self-esteem as differential predictors of aggression

Drawing on Kirkpatrick & Ellis' (2001) evolutionary theory of the domain-specificity of self-esteem (SE), we have shown in 2 previous experiments that functionally distinct types of SE are differentially predictive of aggression in a laboratory task (Kirkpatrick, Waugh, Valencia, & Webster, 2001). In a replication and extension of this research, participants completed a variety of trait-level SE and aggression measures, and later completed state-level versions of these measures twice daily for a week in order to assess their mean level and instability across time. Finally, in a subsequent laboratory task, participants (ostensibly) received either positive or negative feedback from other participants regarding essays they had written about themselves and were given an opportunity to aggress against their evaluator by allocating hot sauce for them to consume. Controlling for the significant effects of sex, feedback, and relationship status, self-assessed mate value emerged as the only significant (positive) predictor of aggression among the SE trait measures. This result was reproduced when mean (over time) SE state measures were used in lieu of the trait measures. However, the instability of these state-SE measures (i.e., their standard deviations across time), did not contribute significantly to the prediction of laboratory aggression. Multilevel random coefficient modeling was also used to examine the covariation of the SE measures within each individual, and how the trait-level SE measurements moderate within-person covariation.

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Weisfeld C.C.[1] **In the company of men**

This film presents behavioral sex differences in human males and females across the lifespan, from an evolutionary and functional point of view. Basic principles of sexual selection are discussed. Documentary and field experimental film of children's playground behavior is shown, from Chicago, Illinois and Second Mesa, Arizona. Boy-girl interactions are discussed in terms of dominance and submission. Footage of married couples from Detroit, Michigan includes men and women of various ages, as they talk about commitment in marriage. Behavioral synchronies and asynchronies are discussed in terms of their functioning to promote stability and satisfaction in long-term relationships between human males and females.

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Wettlaufer J.[1] **Perspectives in Darwinian history**

So far, Darwinian interpretations of historical data have focused on the relationship between despotism and differential reproduction or have tested the Trivers-Willard Hypothesis of differential parental investment into children of different sex. Given the methodological controversy between evolutionary psychology and human behavioural ecology, further insights into the biological foundations of culture and the mechanisms of cultural transmission is needed. Therefore, in a first step, the most important achievements of Darwinian history of the past 25 years will be reviewed and the present state of the research will be summarised.

In a second step, I will sketch a new perspective for further research, based on my work on the adaptive background of particular cultural traits, for example literary themes (topoi) or social gestures. These cultural traits preserve knowledge about social standard situations and either describe them or suggest problem solving strategies. Although the substance of these customs and traditions differ from society to society, they seem to have developed in every culture over the course of time due to insights into problems of social competition or resource conflicts. It is hypothesised that (unconscious) knowledge of these problems and mechanisms to solve them has been adaptive for individuals in the past and therefore was preserved through language for transmission from one generation to another. This new approach may be labelled as "Darwinian cultural history".

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Wichary S.[1], Keller M.[2], Takezawa M.[3], Barrett H.C.[4] **Emotional adaptations for social exchange: the role of guilt and anticipated anger**

Moral emotions elicited in the context of social contract violation, have an adaptive function in regulating social cooperation (Gibbard, 1992; Cosmides and Tooby, 1992). According to this view, anticipated moral anger of others and guilt in the self are adaptive emotions which commit people to follow social rules in order to avoid retaliation from others. The intensity of guilt and anticipated anger may depend on the likelihood of retaliation by the cheated person, which in turn may depend on the degree of relatedness and the authority structure between the parties in a contract. Following up on past developmental studies (Keller, Lindsey and Wang, 2000a, b), we explore how differences in relatedness and authority between child and his/her partners influence the intensity of the emotions of guilt and anticipated anger when children face the violation of contract. 6-7 and 9-10 year olds were given scenarios of a contract violation involving a child with a peer friend, a sibling, the mother or an unrelated adult. Children were asked how they and their partner would feel as either violator or victim in the presented story. We found, for example, that children feel less guilty and anticipate less anger if they cheat their mother than if they cheat a peer friend, because the likelihood of retaliation from mother is lower than from a friend, with whom the relationship is based solely on reciprocity. In the poster, we will present how and why emotions differ depending on the types of relationship between parties.

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Wilke A.[1], Todd P.[2] **Emotions as adaptations: the effects of fear and anger on judgement and decision making**

Recent work has shown that two basic emotions, despite having the same valence, can have quite distinct effects on judgement. Fearful people made higher estimates and angry people lower estimates on life threatening risks. Building on this finding, we hypothesized that these two emotions also result in different choice preferences in risky decision making: people in a fearful state will be more risk-avoiding, whereas people in an angry state will be more risk-seeking. This can be partly explained through an evolutionary analysis of the functions of each emotion, with fear being linked to avoidance, and anger linked to taking action against the arousing object.
We ran an experiment to test the hypothesized influence these two basic emotions have on risky decision-making and judgement. Fear and anger were induced and participants where then presented with two tasks. First, participants saw a set of scenarios dealing with everyday decision-making were they could choose between safer and riskier options. Second, to replicate the earlier findings, participants were asked to estimate yearly frequencies of different causes of death. Finally, their current emotion states were assessed via standardized questionnaires.
We discuss our findings, which follow the hypothesized pattern, in terms of a functional approach to specific human emotions.

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Williams B.[1] **The role of evolutionary psychology in the success of an eco-travel company**

As a non-academic marketing an eco-travel company's corporate compensation programs, I've focused on evolutionary psychology as the link between successful business and wild nature. Passage to Utah (P2U) brings corporate executives, managers, and employees to the sandstone canyons of southern Utah for five days of hiking in wild places, fishing, and exploring ancient history. To date, most marketing has been done by word-of-mouth. My goal, using the work of writer/philosophers Paul Shepard, and Mihaly Csikszenimihaly, and deep ecologist, Dolores LaChappelle, is to first describe how people respond to wild places using an internal reservoir of evolutionary information that is often ignored, and then speculate as to why P2Uprograms are profitable to corporations.

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Yunger J.L.[1], Bjorklund D.F.[2], Bering J.M.[3], Nesci J.[4], Ragan P.[5] **The generalization of deferred imitation in juvenile enculturated chimpanzees (Pan troglodytes)**

Although chimpanzees show impressive social learning abilities, there is debate about the cognitive abilities underlying such performance. According to Tomasello, true imitative learning requires an ability to take the perspective of the model. One technique effective in discriminating mimicry from true imitation is the generalization of imitation, in which target behaviors are modeled on one set of materials (e.g., clanging metal symbols together) but imitation is assessed on a second, somewhat different set (e.g., clanging wooden trowels together). The participant would have to identify not only the target behaviors, but also the goal of the model, and understand that a similar goal can be achieved by executing similar, though not identical, actions. In this experiment, deferred imitation of object-related actions and generalization of imitation was assessed on seven different tasks in three human-reared (enculturated) chimpanzees, ranging in age from 6 to 9 years. Each ape displayed high levels of deferred imitation and only slightly lower levels of generalization of imitation. The youngest two chimpanzees were more apt to generalize the model's actions when they had displayed portions of the target behaviors at baseline, consistent with the idea that learning is more likely to occur when

working within the "zone of proximal development." The results provide evidence of true imitative learning in chimpanzees, and also suggest that great apes have some latent cognitive abilities, similar to those observed in human children, that are expressed only in certain environments, which have implications for theories of human cognitive evolution.

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Zvoch K.[1] **Contextual effects on adolescent reproductive behavior: a multilevel-multivariate analysis**

Data from the U.S. National Education Longitudinal Survey of 1988 (NELS: 88) were analyzed to investigate macro-level effects on adolescent reproductive behavior. Consistent with hypotheses derived from the logic of life history theory, residence in an economically disadvantaged neighborhood (i.e., a high mortality context) significantly increased the odds that an adolescent female would produce a child before reaching adulthood. Neighborhood influence was robust to individual and macro-level controls. Adjusting for the effects of family type, familial SES, sibship size, parental involvement, adolescent cognitive test performance, and several aspects of the school environment (i.e., student body composition, availability of sex education), neighborhood context, an average of within-neighborhood familial SES scores, remained the strongest macro-level influence on reproductive timing. The observed propensity for context sensitive life history allocations suggests that initiatives aimed at modifying individual life course trajectories will be of little utility until policy makers explicitly address the underlying social and economic inequities that lead impoverished individuals to discount the future.

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