For evolutionary psychiatrists, psychologists and others interested in sociophysiological Integration

ASCAP

Volume 11, No. 06 (Cumulative #127) June 1998

"Every system of knowledge, including scientific knowledge, rests on some system of fiction."

Hudson Hoagland[1]

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ASCAP Society Mission Statement:

The ASCAP Society represents a group of people who view forms of psychopathology in the context of evolutionary biology and who wish to mobilize the resources of various disciplines and individuals potentially involved so as to enhance the further investigation and study of the conceptual and research questions involved.

This scientific society is concerned with the basic plans of behavior that have evolved over millions of years and that have resulted in psychopathologi-cally related states. We are interested in the integration of various methods of study ranging from cellular processes to individuals in groups.

The ASCAP Newsletter Aims:

- A free exchange of letters, notes, articles, essays or ideas in brief format.
- Elaboration of others' ideas.
- Keeping up with productions, events, and other news.
- Proposals for new initiatives, joint research endeavors, etc.

***The ASCAP Newsletter* is a function**

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The WWW Address for the The ASCAP Home Page is:

http://psy.utmb.edu/ascap

The WWW address for membership & subscription is:

http://psy.utmb.edu/ascap/aform.htm

The WWW address for the European ASCAP Home Page is:

http://evolution.humb.univie.ac.at/ascap/europe/index.html

World Psychiatric Association, Psychotherapy Section Home Page is:

http://www.psychiatry.ubc.ca/WPA/psychother.htm

The ASCAP Newsletter is the official newsletter of the *Psychotherapy Section* of the *World Psychiatric Association.*

ADDRESSED TO & FROM ...

Last Minute Change to the ASCAP Society Meeting Program

The ASCAP meeting sounds very interesting and I am really looking forward to Davis. I wanted to pass on that I am not going to be talking about control mastery theory per se, but about: *"Survivor guilt and empathy in depressed patients; another evolutionary perspective".* See you all in Davis, California.

Lynn O'Connor
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Editor's Note: The detailed program for the ASCAP Society Meeting is in the May 1998 issue of *The ASCAP Newsletter* on page 3, in the To and From section of that newsletter. Note the form for registration on page 25 of this issue. Hope to see you there.

Mania

Enjoyed the spirited Mania Sketches by Jim Brody in the May 1998 issue! Well done! Especially interested in the manic/enablerdyad. Good observations.

Especially interested in your sertraline observations. I have seen SSRIs produce mood stabilization in cases where I was wondering (and worrying) about possible bipolar illness. In fact, I'm about ready to give up my practice of starting suspected bipolars on mood stabilizers first.

Low dose SSRIs are probably a better idea. (In fact, I suspect that I am guilty of making a point of showing off my cleverness in sniffing out bipolars, then showing off my exemplary caution by starting the mood stabilizer... blush ...) The mood stabilizer rarely seems to do much good unless severity of mood swings is a robust complaint. Then mood stabilizers are great!

I think it is pretty well agreed that among bipolars a third will be helped by SSRI, a third helped by mood stabilizers, a few by antipsychotics (and Zyprexa will probably increase that yield), and a third by nothing at all.

Thank you for your helpful ideas,

John K. Pearce
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Learning from the Dirt Mover

I would like to make a few comments about Dave Evans entertaining and instructive vignette in the March 1998 ASCAP.

First, he seems to be using a ref raming technique similar to that used by Gurdjieff, which I described in the same issue of ASCAP. He is reframing "adverse experience" as "learning experience". This is presumably the message Walt Whitman is giving in the lines that Dave Evans quotes and which could bear repeating:

"Have you learned great lessons
from those who reject you,
and brace themselves against you?
or who treat you with contempt,
or dispute the passage with you?"

Those who learn great lessons from such experiences as Dave had with the satellite dish are building up their true selves, or their "will" as Gurdjieff put it. In my personal metaphor they are developing their "owl in the head", the owl standing for wisdom. Another way of ref raming adverse experience is to acknowledge that "it will make a fantastic story", and so the worse the experience, the better the story.

Second, I would dispute the idea that evolutionary theory leads to the conclusion that human beings are basically selfish. We know that our genes are selfish, but we do not interact with each others' genes. We deal with their personalities, which have evolved in the context of group

living and prolonged, intensive, repetitive social interaction.

People need to live in groups, and, to stay in groups, let alone to succeed, you need to be liked and respected by the other people in the group. And you do not achieve this liking and respect by being selfish. The group by its norms, standards, beliefs, and world-view, fashions individuals who may be inclined to be selfish into good citizens, who put the group and its other members before their own selfish interests. Anyone who lacks the capacity to be fashioned in this way stands out like a sore thumb and is either expelled from the group or allowed to stay with diminished prestige and diminished reproductive opportunity.

This process would occur with selection at the level of the individual, and would be accelerated by selection at the level of the group. It applies to groups which practice hedonic (prestige) competition rather than agonistic competition (see my essay on "Agonistic versus prestige competition" in the September, 1995 ASCAP).

Third, we can learn from our experience of post-traumatic stress disorder that reminders of trauma can be themselves traumatic. Therefore, something needs to be done about that hole (assuming the dirt-mover still hasn't filled it in). Why not make it into an ornamental pond?

Fourth, one must comment on the fact that the antagonist in the vignette is a "dirt mover". I do not know whether this is a fiction in order to conceal his true identity for reasons of confidentiality, or whether he was in truth a mover of dirt.

Dirt has certain connotations to an English ear. For instance, when I was doing pediatrics a mother brought her little boy to the out-patient clinic suffering from a boil on the perineum. "Where is the boil?", I asked the mother. "Down there, doctor," she replied, "between his dirt-box and his thruster."

Dirt is a synonym for shit. Are we meant to take on board the unspoken message that the satellite buyer was "a shit"? In India, of course, those who move shit are untouchables. Even if the buyer really was a mover of dirt (what we here would call soil, and I don't mean "night-soil"), I think the emphasis on his occupation in the vignette may be one way of expressing the author's aggression to his antagonist. Would we have felt differently about him if he had been a "landscape gardener"?

Lastly, perhaps the main lesson from this tale is that you have to get the sequence right when you are doing more than one related thing. If Dave had waited to cut down the tree which blocked the satellite dish until after the dish had been removed, he wouldn't have been so impatient to get rid of it so quickly - and wouldn't have been tempted into Kafka's true sin (impatience) and so would have waited another week for the dirt-mover to collect the dish. But then he would have missed out on a great learning experience.

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Bipolar Genes

I wish I had been able to understand Dan Wilson's reply to Don Klein (May 1998 issue). What I did make out was that frequency of bipolar genes, selected for good reason, is sufficient to comprise a balanced polymorphism. I will have to read Mayr to grasp the logic of how that is to be understood. I do understand how an illness can appear at the mutation rate, but I would think that mutation rates must vary a lot for different mutations.

The point about step-wise phenotypes (citing the switch between peppered and non-peppered moths) is a nice point. I had assumed this whole bipolar thing was a spectrum. Martha's Vineyard Island is a great gathering site for bipolar spectrum patients; in my clinic I see what is very much a spectrum with the hospital grade episode being uncommon. The real trick will be to show the genetic make-up of the lesser illnesses. Ideally they will have only a few of the genes.

By the way, I have one 8 year old boy (his father is an alco-

holic but never hospitalized for a bipolar episode) who has an extreme bipolar illness. Spring is the season of his illness. He shifts, very rapidly -- every few minutes in my office -- from supplication, to tears, to anger, to being helpful. A mixed state. Last year he went to the hospital. This year I have increased medication and avoided hospitalization. He has maxed-out with lithium, risperidone.

Now I am pushing gabapentine dose. (By the way, I have had wonderful luck with gabapentine -- it's Depakote without belly aches and some antidepressant effects.) Attends a special class half day, and soon will be able to return to full day. Part of his illness is extreme sadistic imaginings. Fortunately, he is pretty bright.

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Last Ever Comment on the EEA

Timothy Perper's remarks on the EEA *(The ASCAP Newsletter,* April 1998) inspired me to think about camels and aliens.

Imagine that an alien probe lands on planet earth at a time when there are no humans. They have with them a graduate student whose acumen they want to test. They take some camels from the Sahara desert and put them in a high Alpine environment. Then they assign the student to do f ieldwork on the species. The student observes the camels carefully, notes the hoofs, the hump, the ear flaps and whatever, travels around the planet in his UFO, and comes to the conclusion that the camels didn't evolve in the mountains. He argues rather that their environment of evolutionary adaptation was dry, hot desert. He is very proud that he passed the test.

Imagine next that when the student returns to his home planet, his advisor, a powerful figure who shares the views of Timothy Perper, points out that on earth, deserts have expanded and contracted, average rainfall in has varied by orders of magnitude, oases have shifted from place to place, camel fossils have been found in relatively wet areas, far from existing deserts, etc.

Imagine then that the advisor says to the graduate student what the real Timothy Perper wrote in ASCAP: "Talk.about 'the' environment of evolutionary adaptation is a kind of pseudo-paleoanthropological mind-candy: easy to eat, nothing to think about, nothing to know, least of all anything detailed about the past. The concept should be eliminated in all serious discussions of human evolution."

The student, of course, re-does his dissertation, and in the encyclopedias of this planet we find the following statement: 'The wide hoofs are marvelous adaptations that allow camels to slide easily on the ice from one patch of vegetation to another."

"The EEA didn't have cities, didn't require that people invest in hopes of realizing future profits, didn't allow for the possibility of major material inequality, didn't contain nude pictures of genetic stars, didn't force people to hobnob with strangers every day, didn't put the fate of individuals in the hands of distant bureaucrats, didn't encourage people to daydream about hitting a jackpot, didn't stockpile people in hives, didn't have polluted air and water, didn't allow anyone to live without physical exercise, didn't have heroin, didn't have a diet that was too high in fat, etc., etc. *ad infinitum."*

There were undoubtedly significant differences in environments at different periods, but since the evidence indicates that humans are one species, we must be adapted to conditions that were common to those environments. Those common factors constitute "the" EEA, and knowing them helps to make sense of current human behavior.

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ESS WebSite

Dear members of the ESS, friends, and acquaintances, with some (modest) pride I hereby inform you that the ESS (European Sociobio-

logical Society) website is now operational on the Internet. The URL is:

http://jurix.rechten.rug.nl/rth/ess/ess.htm

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Additional Notes: Anybody within the scientific community interested in the topic of sociobiol-ogy, (human) ethology, Darwinian psychology, psychobiology, evolutionary psychiatry, behavioural ecology, biopolitics, bioeconomics, or evolutionary aspects of human or animal behaviour, is welcome to apply for membership.

The ESS has the objective of serving as a forum for the study of the role of biological factors in the behaviour of animals and man, with special emphasis on evolutionary aspects. The Society will, according to its Statutes, refrain from using or abusing such studies for political purposes. Candidate members are accepted as full members at the annual business meeting.

The membership dues are D.fl. 40,- (about 25.00 US$), preferably to be paid by VISA or Euro/ Mastercard. Payment by Eurocheque or Dutch postal giro (in Dutch currency only) is also possible. Candidate members are exempt from payment in the year of application. After admittance to full membership, members will automatically receive an annual invoice from the ESS treasurer.

Members receive at least 4 ESS Newsletters a year (with interesting book reviews), plus an annual update of the List of Members, an annual update of the Books on Sociobiology, and the Book of Abstracts of the Annual ESS Meeting.

Publications of the Society include: *Essays in Sociobiology* (2 Volumes. 1985,1986), *The Sociobiology of Ethnocentrism* (1987), *The Sociobiology of Sexual and Reproductive Strategies* (1989), *Sociobiology and Conflict* (1990), *The Aquatic Ape Theory* (1991), and *The Nature of the Sexes: The Sociobiology of Sex Differences and the 'Battle of the Sexes'* (1992). Other volumes are in preparation.

European Sociobiological Society (ESS)

Upcoming WPA Conferences/Meetings

7-21 August 1998. XVI Congress of the World Association for Social Psychiatry -Vancouver, Canada.

February 1999. "Community Care for the Long Term Mentally Ill Patient" -- Granada, Spain.

1-4 August 1999. From epidemiology to clinical practice -Turku, Finland.

6-12 August 1999. XI World Congress of the World Psychiatric Association -- Hamburg, Germany.

MARRIAGE, MORALITY AND EMOTIONS — UPDATING EDWARD WESTERMARCK

An International Symposium
Helsinki, Finland,
November 19-22,1998

http://www.helsinki.fi/-jtakala/Westermarck.symposium.html

The symposium provides a forum for papers on Westermarckian themes, such as sex, the family, morality, social emotions, and others. We welcome attempts to update any of Westermarck's central analyses as well as investigations of the historical context of his work. Papers that touch upon two or more of the disciplines of sociology, anthropology, philosophy, psychology, and biology are encouraged. Keynote speakers include Maurice Bloch, jointly with Dan Sperber, Robin Fox, Frank Salter, Anita Segerberg, Frans de Waal, and Arthur P. Wolf.

The symposium is organized by The Westermarck Society, the scholarly association of Finnish sociologists, and sponsored by the Academy of Finland. **Proposals for papers are that arrive** by June 15, 1998, will be **considered next.** Send proposals for papers and inquiries to:

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ARTICLE:

by John S. Price

Agonistic Behaviour Portrayed by Milton

(Extracted from a paper presented to a meeting of the European Sociobiological Society at Christ's College, Cambridge, 3-6 August 1995.)

Darwin gave a clear description of sexual selection, but he wrote little about the fate of those unselected by sexual selection, or of those who became deselected after once being selected. He spoke of them being killed or driven away, but he does not appear to have speculated on the behaviour of those who were driven away. He did not recognise the need for any behavioural strategies with which this group could deal with their situation, or any psychological or emotional state which might pertain to them. In particular, he did not consider them as a special case in his book on the expression of the emotions.

It is ironic to note, therefore, that his favourite poet, John Milton, who had been at the same Cambridge college 200 years previously, and a copy of whose *"Paradise Lost,* Darwin took with him on his voyage in the Beagle, was at least interested and one might almost say obsessed by the fate of those who were "driven away". In two of his major poems, *"Paradise Lost* and *"Samson Agonistes",* he examines the situation of someone who is defeated by overwhelming force.

Paradise Lost

In *"Paradise Lost'* the rebel angel Satan, together with Beelzebub and his other followers, has been cast out of heaven because he challenged God, who:

"Hurled [them] headlong flaming from the ethereal sky, With hideous ruin and combustion, down To bottomless perdition, there to dwell In adamantine chains and penal fire"

The action of the poem opens as they regroup themselves in Hell and consider their options.

There is no hint of remorse or submission in the mind of Satan, who mixes his "deep despair" with "obdurate pride and steadfast hate". Reconciliation with his victor is rejected:

" *What though the field be lost? All is not lost; th'unconquerable will, And study of revenge, immortal hate And courage never to submit or yield And what is else not to be overcome; That glory never shall his wrath or might Extort from me: to bow and sue for grace With suppliant knee, and deify his power."*

Tauntingly, he asks his followers if they have "sworn to adore the conqueror". Even though his first lieutenant, Beelzebub, points out tactfully on • two occasions that, to have defeated the rebel army, God must be omnipotent, Satan determines to fight on with "force and guile", determined that it is:

"Better to reign in hell, than serve in heav'n."

Satan then calls a Council, at which he determines to set out in search of mankind, and to devote himself to undermining God's influence with them. While on this quest in Book IV, he soliloquises further on the impossibility of submission:

"Me *miserable! Which way shall I fly Infinite wrath, and infinite despair? Which way I fly is hell, myself am hell; And in the lowest deep a lower deep Still threat'ning to devour me opens wide; To which the hell I suffer seems a heav'n. O then at last relent: is there no place Left for repentance, none for pardon left? None left but by submission; and that word Disdain forbids me, and my dread of shame*

Among the spirits beneath, whom I seduced
With other promises and other vaunts
Than to submit, boasting I could subdue
Th'Omnipotent....."

And almost immediately he considers, only to reject, the possibility of regaining his former place by false submission:

"But say I could repent, and could obtain By act of grace my former state; how soon Would highth recall high thoughts, how soon unsay What feign'd submission swore: ease would recant Vows made in pain, as violent and void. For never can true reconcilement grow Where wounds of deadly hate have pierced so deep; Which would but lead me to a worse relapse And heavier fall: so should I purchase dear Short intermission bought with double smart."

At the end of Book V, there is a further debate about submission. Satan says that he would not return to heaven on any other terms than equality with God, and certainly he does not want to be subordinate to God's Son, as has been commanded by the Almighty:

"But what if better counsels might erect Our minds and teach us to cast off this yoke? Will ye submit your necks, and choose to bend The supple knee?'

One of the Cherubim, Abdiel, then takes issue with Satan, and advises him to submit to the one who created him, and thus has the power to uncreate him. Satan dismisses Abdiel's advice, maintaining that he was not created by anyone, but has always been as he now is.

In contrast to the intransigence of Satan, Adam and Eve show a capacity for reconciliation. Towards the end of the poem, they repent of their disobedience in eating of the Tree of Knowledge, and submit to God. Although they are escorted out of Paradise, they have achieved the promise of salvation.

Samson Agonistes

In"*Samson Agonistes"*, Samson, betrayed by Dalilah, blinded and imprisoned by the followers of the god Dagon, is visited by his father who is planning to arrange a ransom and who tells him to keep on fighting. But Samson rejects this advice, and expresses his depressive position:

"All otherwise to me my thoughts portend
That these dark orbs no more shall treat with light,
Nor the other light of life continue long,
But yield to double darkness nigh at hand:
So much I feel my genial spirits droop,
My hopes all flat, nature within me seems
In all her functions weary of herself,
My race of glory run, and race of shame,
And I shall shortly be with them that rest."

Samson's father then tells him to be calm and to accept helping words from his friends, but Samson does not accept this advice; he expresses the idea that his mental torment is even worse than his physical torment:

" *O that torment should not be confined*
To the body's wounds and sores,
With maladies innumerable
In heart, head, breast and reins;
But must secret passages find
To th'inmost mind,
There exercise all his fierce accidents,
And on her purest spirits prey,
As on entrails, joints, and limbs,
With answerable pains, but more intense,
Though void of corporal sense."

He gives a vivid description of psychosomatic affliction, and he contemplates the idea of suicide:

"My griefs not only pain me
As a ling'ring disease,
But, finding no redress, ferment and rage,
Not less than wounds immedicable
Rankle, and fester, and gangrene,
To black mortification.
Though my tormentors, armed with deadly stings,

Mangle my apprehensive tenderest parts,
Exasperate, exulcerate, and raise
Dire inflammation, which no soothing herb,
Or medicinal liquor can assuage,
Nor breath of snowy air from snowy Alp.
Sleep hath forsook and given me o'er
To death's benumbing opium as my only cure:
Thence faintings, swoonings of despair,
And sense of heav'n's desertion."

Then Samson's father leaves, and he is visited by Harapha of Gath, a champion of the Philistines who was not involved in the previous battles with Samson. Here Samson is roused out of his depression and challenges Harapha, finally dismissing him with the words:

"Go, baffled coward, lest I run upon thee,
Though in these chains, bulk without spirit vast,
And with one buffet lay thy structure low, Or
swing thee in the air, then dash thee down To
the hazard of thy brains and shatter'd sides.

The chorus then counsels him to an alternative course of action:

"But patience is more oft the exercise
Of saints, the trial of their fortitude,
Making them each his own deliverer,
And victor over all
That tyranny of fortune can inflict:
Either of these is in thy lot,
Samson, with might endued
Above the sons of men; but sight bereaved
May chance to number thee with those
Whom patience finally must crown."

But patience, acceptance, and reconciliation are not a part of Samson's reaction to defeat, and the poem concludes with his splendid act of vengeance in which he destroys both himself and his conquerors.

A copy of this poem can be found at:
http://darkwing.uoregon.edu/-rbear/samson.html

Discussion

In both these poems, Milton is exercised about the reaction of the man who is defeated and cast down. Does he fight back, in spite of his depression and his chains? Or does he accept his lot; in the one case to accept the advice of Beelzebub that his opponent is omnipotent, and in the other to accept the advice of the chorus which is to be patient?

In both poems, Milton portrays a fallen hero who is chained and in deep despair, but in both cases the despair does not inhibit pride or the determination to retaliate. He is portraying a society which does not admit voluntary submission and reconciliation.

That this determination to fight back, in spite of all mental and physical restraints, represents one basic human strategy is confirmed by other poets, for instance Tennyson describing the attitude of Ulysses:

" *We are not now that strength which in old days*
Moved heaven and earth: that which we are, we are';
One equal temper of heroic hearts, Made weak by
time and fate, but strong in will To strive, to seek, to
find, and not to yield."

And Rupert Brooke in his poem Failure:

"Because God put His adamantine fate
Between my sullen heart and its desire, I
swore that I would burst the Iron Gate, Rise
up, and curse Him on His throne of fire."

The message seems to be that the ancient way of man, illustrated in the tales of gods and heroes, is one of unmitigated fighting and retaliation; the only way to keep a defeated enemy down is to bind him in adamantine chains, and if, as in the case of Satan, this is not enough, to:

"transfix him with linked thunderbolts to
the bottom of the gulf

Whereas the new way, characterised by Christianity, is one of forgiveness, repentance, voluntary submission, and reconciliation.

Depressed Emotion or Depressed Mood?

The human problem of how to conduct oneself as a subordinate is the subject matter of much of philosophy and religion. These disciplines usually counsel patience and self-abnegation, as did the chorus to Samson. But there is another way, which was taken by both Satan and Samson, and appears also to have been taken by Milton and Darwin.

In order to understand human subordination, it is necessary to appreciate that a decision between an escalating (fight) strategy and a de-escalating (flight) strategy is taken relatively independently at three levels of the mind/brain (Stevens & Price, 1996).

There is a lower, reptilian level (MacLean, 1985) at which there is a decision to provide or withdraw the basic materials needed for fighting; here, the escalating strategy takes the form of an elevation of mood, giving energy, optimism and sense of ownership, while the de-escalating strategy of depressed mood takes away these armaments, leaving the individual tired, pessimistic and with no sense of entitlement.

At a middle level, which MacLean called the neomammalian brain and located in the limbic system, the strategies take the form of emotions; escalation takes the form of anger, indignation and excitement, while de-escalation takes the form of depressed emotion, sadness, guilt, shame, feeling chastened, and other dysphoric emotions.

At the higher level, in the neomammalian brain, another type of decision is made, and this is conscious, rational, voluntary, deliberative - and takes the form of deciding whether to give in or fight on. Even the individual who suffers the incapacity and torment of depression (metaphorically expressed by Milton as "adamantine chains and penal fire") can fight on by an act of will - even though willpower itself is sapped by the depression.

Satan was portrayed as escalating at the higher level: he would not submit, even though he preferred a devious escalating strategy rather than an all out frontal attack. He was portrayed as de-escalating at the middle level:

> Me miserable! which way shall I fly Infinite wrath, and infinite despair? Which way I fly is hell, myself am hell;

Depressed emotion is focused on an object, whereas depressed mood is unfocused or self-focused, and is associated with a lowering of RHP and resource value.[1] Is Satan expressing depressed emotion or depressed mood? One could argue that hell is a metaphor for depressed mood, but I would favour the view that Milton focuses Satan's despair on his defeat, nor does he indicate loss of RHP or resource value, so that the diagnosis should be middle level de-escalation. It is tempting to think that Milton knows of the possibility of lower-level de-escalation for someone in Satan's position:

> "And in the lowest deep a lower deep Still threat'ning to devour me opens wide; To which the hell I surfer seems a heav'n.

Whichever level the de-escalation is at, we can say that it is maintained by stubborn and inappropriate escalation at the higher level. In the case of Samson, the despair seems more unfocused and seems to indicate depressed mood as well as depressed emotion.

Milton and Darwin as Non-Yielding Rebels

Milton rebelled against the State (he was the principle roundhead pamphleteer, attacking the monarchists) and lost; Darwin rebelled against the Church (the doctrine of Creation) and although he did not actually lose, his diaries and letters reveal his constant anticipation of losing, and as a result of which, he withdrew from the London arena and delayed publication of his theory for twenty years, suffering almost constant nervous symptoms.

In spite of their real and imagined defeats, and in spite of their depressive reactions to those defeats,

they both fought on, Milton writing pamphlets and poetry, Darwin elaborating his theory of natural selection. They were both "blooded but unbowed". Of course, they were engaged not only in agonistic competition with church and state, but also in prestige competition for the respect and approbation of their fellow men, especially those on their own side.[2] Fame was the spur.

Acts of submission, or the giving up of goals, at the higher, neomammalian level would have preempted or relieved their suffering, but their resources of ambition, pride and courage enabled them both to bend their adamantine chains and make their unique contributions to the human record. It is this triumph of the will over the flesh which Milton celebrates in the first books of *Paradise Lost. c8*

John Milton, Poet - WebSite:

http://www.luminarium.org/sevenlit/milton

This WebSite contains, his Quotes, information about his Life, his Works, his Essays, and his Books.

To "check" other 17th Century authors go to the **Luminarium WebSite** which hosts the Milton WebSite at:

http://www.luminarium.org/lumina.htm

For more information on the ***"Paradise Lost'*** Book go to the following Home Page:

http://www.wwnorton.com/college/english/nce/paradise.htm

(Norton Critical Edition) by John Milton, Scott Elledge (Editor) Published by W W Norton & Co, April 1,1993 U.S. Dollars--$11.95

" *This revised Norton Critical Edition reprints The text of Milton's 1674 edition except for its spelling and use of capital letters and italics, which have been modernized."* - Norton

The ***"Samson** Agonistes"*Home Page is at: **http://www.luminarium.com/sevenlit/miltonbook.htm**

Price: $14.95 - Paperback - Published by Oxford University Press -- Publication date: August 1957

("Samson the Athlete" or "Samson the Wrestler") Tragedy by John Milton, published in the same volume as his epic Paradise Regained in 1671. It is considered the greatest English drama based on the Greek model and is known as a closet tragedy (one more suited for reading than performance). The work deals with the final phase of Samson's life and recounts the story as told in the Old Testament Book of Judges. Himself blind when he wrote Samson Agonistes, Milton depicts Samson, the once mighty warrior, as blinded and a prisoner of the Philistines ("eyeless in Gaza at the mill with slaves"). Samson conquers self-pity and despair, however, and is granted a return of his old strength. He pulls down the pillars that support the temple of the Philistine god Dagon, crushing himself along with his captors.

ARTICLE:

by Paul Gilbert

Social Rank Theory of Depression and Update

New evolutionary theories of depression are appearing constantly. These include Nesse's development of the conservation withdrawal theory, varieties of theories on attachment loss, learned helplessness and control theory, and social rank theory. New theories now should attempt to generate empirical research. Until five years ago, social rank theory was mainly still theory. However, in the last ten years, my colleagues and I have been developing measures to test some of the ideas in humans. The social rank theory is fairly well supported from animal studies.[1,2,3a,3b]

However, our recent research has suggested some refinements to the rank model maybe needed, or at least clarification. In the first phase of our work we looked at submissive behaviour and negative social comparison. These two aspects of:

1. Seeing oneself to be inferior to others, **and**

2. Behaving submissively (e.g. backing down in conflicts, not able to initiate resource acquiring behaviours) seemed to me to represent involuntary submissive behaviour.[4]

Subsequently, the term involuntary subordinate strategy was coined by Leon Sloman. Although I use the term involuntary subordinate self-perception (it came from an idea of RG's, I think[4]), the idea of an involuntary subordinate strategy was always slightly problematic for me since there are many strategies for subordinates, some of which do not have any negative implications for mental health. Nonetheless, we have now (along with many others working in assertiveness research) demonstrated fairly clearly that submissive behaviour and unfavourable social comparison[5] are key experiences to depression.[8] However, there are a subgroup of patients who are aggressive and see themselves as superior. But they do not do that well with antidepressants and are probably personality disordered. We do need to study this group better and I wonder if depression is the right term for them?

However, be that as it may, John Price's original rank theory was much more focused on issues of defeat than subordinate behaviour *perse.* So we developed a new line of work which argued that it was/is a particular kind of experience that was related to depression. In the early 1990's, I spent some time with Keith Dixon in Switzerland, who impressed upon me the importance of escape behaviour and arrested flight.[7,8] He directed our attention very much to the strength of the flight motive. (He has a fascinating paper coming out in the special issue of the *British Journal of Medical Psychology,* which I have edited and is devoted to evolutionary approaches: Due September 1998).

To cut a long story short, by 1993-4 our unit was beginning to develop measures to look at the strength of experiences of defeat and also entrapment and escape motivation. In 1992 I re-interpreted some of George Brown's ideas on life events within the context of entrapment. I made the point that entrapment may be better than helplessness because entrapment implies an issue of movement, or inability to move.

George Brown and his colleagues then conducted the first major study on the relationship of entrapping life events and subordinating (humiliating) life events in depression.[9] In this landmark paper they showed that entrapment and humiliation (serious put down) were much more powerful predictors of depression in working class women than were loss events. I have to say that a number of theories ignore this very clear demonstration that compared to unwanted changes in status, loss events are less powerful than defeats (not to mention

Hammens, review of loss in depression[10]). Now people are developing models based on entrapment (e.g., although there is often scant recognition of where these ideas are situated[11]).

My discussions with Keith clarified the issue about the focus on the flight motivation. So by 1995-1996 we were ready to go with our research programme which is focused on measures of entrapment and defeat. Unlike George Brown's study, our measures are to do with subjective experience. The first big study is now out in the May issue of *Psychological Medicine.* We were more than delighted as well as slightly surprised to find the power of these variables in their association with depression in hospitalised depressives. Indeed, controlling for defeat, hopelessness, long believed to be a key factor in depression, loses its association with depression.

Subsequently, Michael McGuire raised the important issue that there were many types of goals that one could be feel personally defeated and thwarted about. This means that the evolved mechanisms for defeat in flight may be activated through a process of key biosocial goals becoming blocked in some way. Its possible that the blocking of a path to biosocial goal (e.g. obtaining a sexual partner, reproducing, forming collaborative alliances etc.) is read by the brain as a major defeat and begins to run a defeat programme. This means that our conceptualisation of defeat probably needs to be broadened from being routed in conflicts to the thwarting in the pursuit of biosocial goals.

Nonetheless, issues of status are probably going to still be important because its going to make a big difference if we feel everybody's goals are thwarted (we are all in the same boat) as opposed to you are the only one who is missing out. I did recently note some ideas about Niche theory in ASCAP but do not yet know much about this. It might fit, however, with the notion that failing and being blocked in certain environments could generate strong desires for escape. If escape routes are blocked, depression might result.

So, for us, the focus is on escape motivation, particularly in relationship to being in a subordinate, thwarted position, but not just that. This approach also opens up a whole new area for research. Indeed some colleagues and I are about to explore this in relationship to schizophrenia with the hypothesis that the strength of escape motivation either to current social relationships and/or internal hostile voices mediates depression and suicidality.

So to come back to the issue of update, it looks like submissive strategies can increase vulnerability to a variety of psychopathologies such as social anxiety, shyness, dependency disorders, etc., but the key elements of the anhedonic, and loss of motivation symptoms of depression may come from being defeated and unable to escape. Indeed we have just finished a study looking specifically at anhedonia and this looks to be exactly the case. Submissive behaviour and unfavourable social comparison are associated with negative affect, whereas defeat and entrapment are fairly specific to loss of positive affect.

We are going to have to look at the data quite carefully, of course. So as John Price noted, all those years ago, when he focused on Schjelderup-Ebbes description of depressed farmyard fowl, the key features were being defeated and unable to get away. Maybe this just goes to show that we are all a bunch of overgrown chickens after all. *c8*


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ARTICLE:

by Claire Russell & W.M.S. Russell

Population Crises and Population Cycles - 8. Monsoon Asia

(Reproduced with permission from the Galton Institute Newsletter, September 1995.)

Monsoon Asia is dominated by the monsoon winds, which bring a dry season in winter and a rainy season in summer. Here irrigation was developed not only from great rivers, but also by collecting rainwater during the rainy season in huge reservoirs. One built in Ceylon in the 5th century A.D., had a dam 5.6 kilometers long, and a delivery channel of 80 kilometers. High population density, and the importance of water control, produced hydraulic societies exactly like those of China and the dry belt.

The core of the region is the subcontinent of India. (The modern nation of *India* is distinguished throughout by italics.) Civilization appeared here in the Indus Valley **(Figure 2A),** in about the 23rd century B.C., with two large cities, a seaport, and dozens of smaller sites. The upper-class houses had bathrooms, and there was an excellent sewer system. Stone seals were inscribed with pictures and a written script, not yet deciphered, and there was trade with the cities of Sumer and Akkad.

Early in the 2nd millennium B.C., population crisis set in. Rooms were subdivided, mansions were converted to tenement blocks, and the quality of seals and pottery declined. By the 18th century B.C., the civilization had succumbed to invaders from the West, an Indo-European speaking people, the Aryans. They first sacked outlying villages, and then the cities themselves; skeletons found in the later levels bore marks of violence.

Over the next millennium, civilization re-emerged, this time on the Ganges plain. From the 4th century B.C., we can discern population cycles in *Indian* history **(Figure 1, Table 1).** During relief periods, there were unified empires based on the fertile Ganges plan, and controlling more or less of the Northwest and the South **(Figure 2B, 2C, 2D, 2E,** & **2F).** During population crises, as in China, when these empires disintegrated into many small states, there were dreadful famines (e.g. in 1342-1345 A.D., 1768-1770 A.D., & 1782 A.D.) and destructive invasions.

The Maurya Empire was emphatically a police state, with extensive use of torture and an army of spies and informers, including prostitutes. The Gupta Empire was far more humane, and did not even use capital punishment. Under the Guptas and King Harsha, with exceptionally low population density, the Indian civilization reached its peak, with marvellous achievements in poetry, drama, visual arts, mathematics, astronomy, surgery, and metallurgy.

By this time, Hinduism had assumed its final form, through the fusion of the Aryan religion. Western influences, and elements from the Indus Valley civilization, where Shiva and the Mother Goddess appear on sealstones. Much earlier, in the 6th century B.C., Buddha had established his philosophy, which soon became a religion. Both Hinduism and Buddhism flourished under the Mauryas, Guptas, and King Harsha.

The subsequent invaders and the next two empires were Moslem. They extirpated Buddhism in its homeland, though by then it had been diffused over much of Asia, and often persecuted Hinduism, though an admirable toleration was practised by Sultan Muhammed bin Tughluq (1325-1351 A.D.) and the Mughal Emperor Akbar (1556-1605 A.D.).

The British dangerously intensified Indian agriculture, producing a population explosion, and failed to supply large-scale birth control **(Figure 1 and caption).** When they withdrew in 1947, severe population crisis set in. As usual, the empire disintegrated, into *India,* Pakistan, Bangladesh (1971), and the Himalayan states. In 1947,200,000

to 500,000 people died (estimates vary), as Hindus, Sikhs, and Moslems murdered each other. Since the *Indian* government has made serious efforts at birth control, but in 1992 the population growth rate was still 2.0%. Hence the usual crisis effects --unemployment **(Figure 3),** communal riots, growing again in frequency and intensity since the 1960's, and environmental damage -- 70% of the available water is polluted, and 1.5 million hectares of forest lost every year. But overpopulation is far worse in Pakistan, with a growth rate of 3.1 %, and 68% of irrigated land is waterlogged or salinized.

As in China and the dry belt, recurrent population crises generated stress culture, especially the subjection of women. By the crisis following the Guptas, Hindus had begun to burn their widows alive *(satl).* Sultan Muhammed bin Tughluq and the Mughal Emperor Akbar both tried to suppress this hideous practice, but with each crisis it grew more frequent. The British and the modern *Indian* government finally made it a rare crime. The *Indian* authorities have improved the condition of women, especially in higher education, but in 1991 female literacy was still only 39%, compared with 64% for men. The problem is complicated by water and fuel shortages, which increase the workload of peasant women.

Islamic civilization lasted longer in India than elsewhere, so there were distinguished women, such as Raziyyat-ud-din, ablest of the Delhi sultans (reigned from 1236 to 1240 A.D.), who rode in armour at the head of her troops, and the gifted historian Gul-Badan (1523-1603 A.D.). But eventually seclusion of women set in here. Muhammad Ali Hinnah, founder of Pakistan, planned to promote equality between the sexes. But in 1977, and more completely in 1991, the desperately over-populated country became a Fascist state, like Saudi Arabia, Iran (1979), and Afghanistan (1992). These states are mis-leadingly called Islamic, but (as we saw in the 3rd paper) their subjection of women contravenes the teaching of Mahommed and the practice of high Islamic civilization and of genuine modern Moslems in these countries and elsewhere (for instance a genuine Moslem reform movement in Indonesia, dedicated to promoting equality between the sexes). Goodwin (1994) has established that in Pakistan women are officially sent to prison *as* a *punishment for being raped.*

Hydraulic civilization diffused from *India* all over Southern and Southeastern Asia, along with Hinduism, Buddhism, and strange mixtures, such as the cult of Shiva-Buddha in 13th century Java (A.D.). The kingdoms of the region were typical hydraulic states; except for Vietnam and Korea, influenced by China, they showed a specially close relationship between religion and water control. They flourished at different times **(Table 2),** (after invasions by Thai barbarians and the Cholas, respectively). They both had to evacuate their lands and withdraw to much less fertile areas.

The whole region is involved in the modern world population crisis. For instance, the anti-malarial campaign in Ceylon in 1946-1947, raised the population growth rate from 1.71 % to 2.74%, ushering in decades of violence between Sinhalese and Tamils. The phenomenal population growth of Indonesia, especially Java and Madura (from 4.5 million in 1815 to 107.5 million in 1989), resulted, in 1965-1966, in an outburst of violence in which some 1/2 million communists were murdered. Since then, the Indonesian authorities have made laudable efforts at birth control. But the whole of Monsoon Asia needs voluntary birth control on a much more massive scale to save a region with wonderful past contributions to civilization. G8

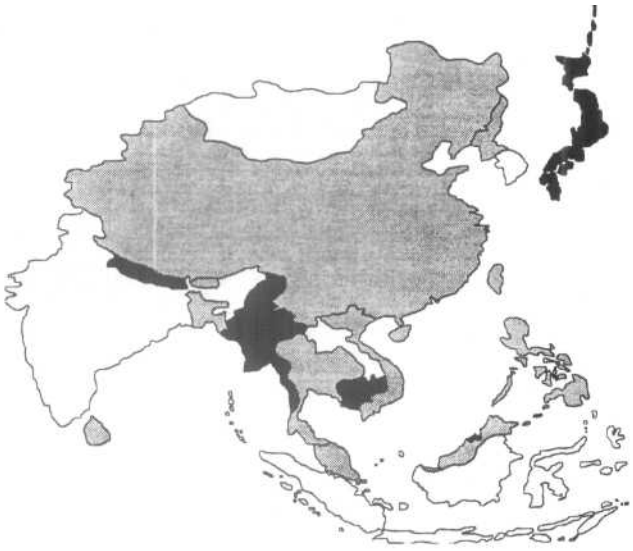
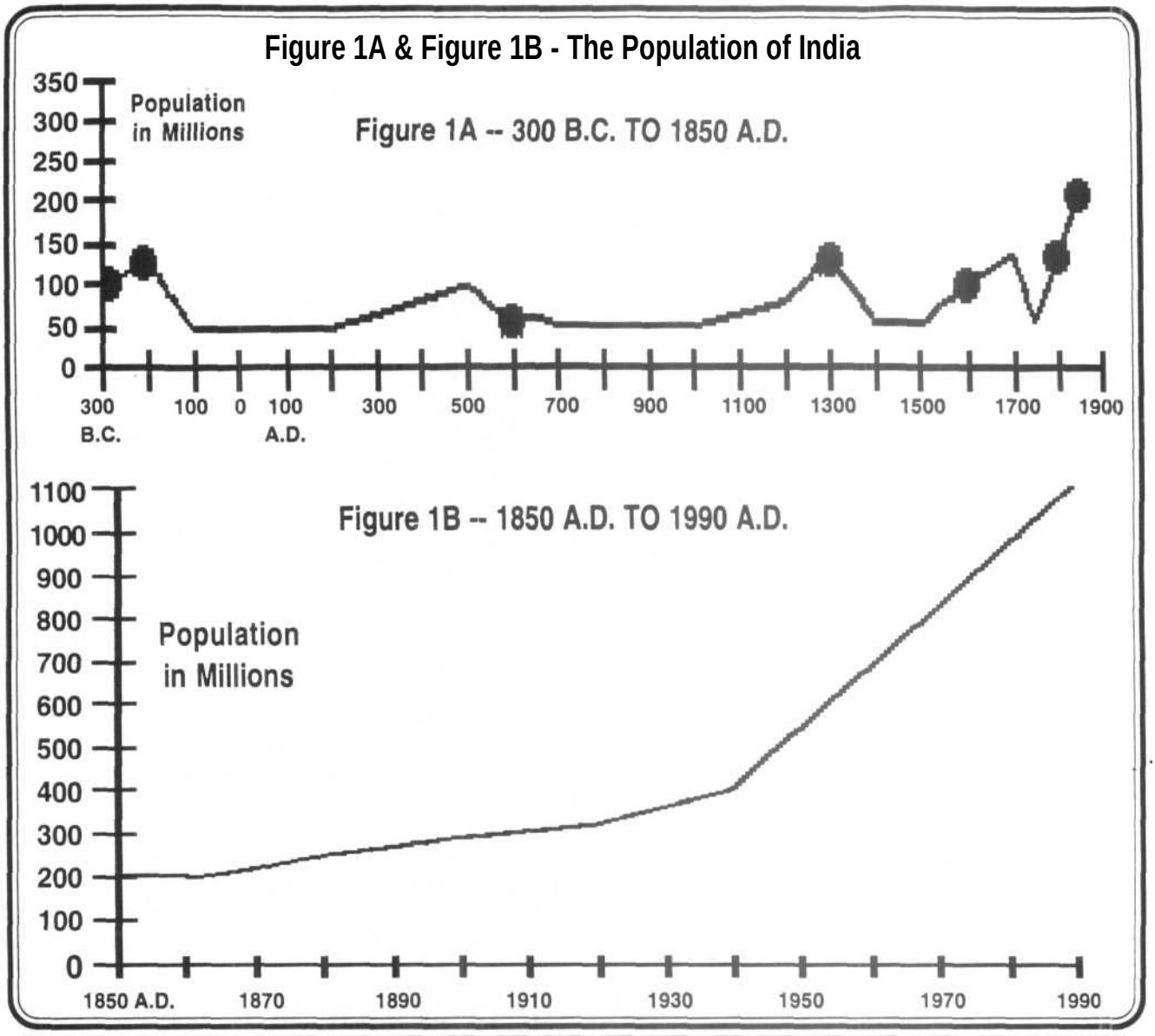


Figure 1A & Figure 1B - The Population of India



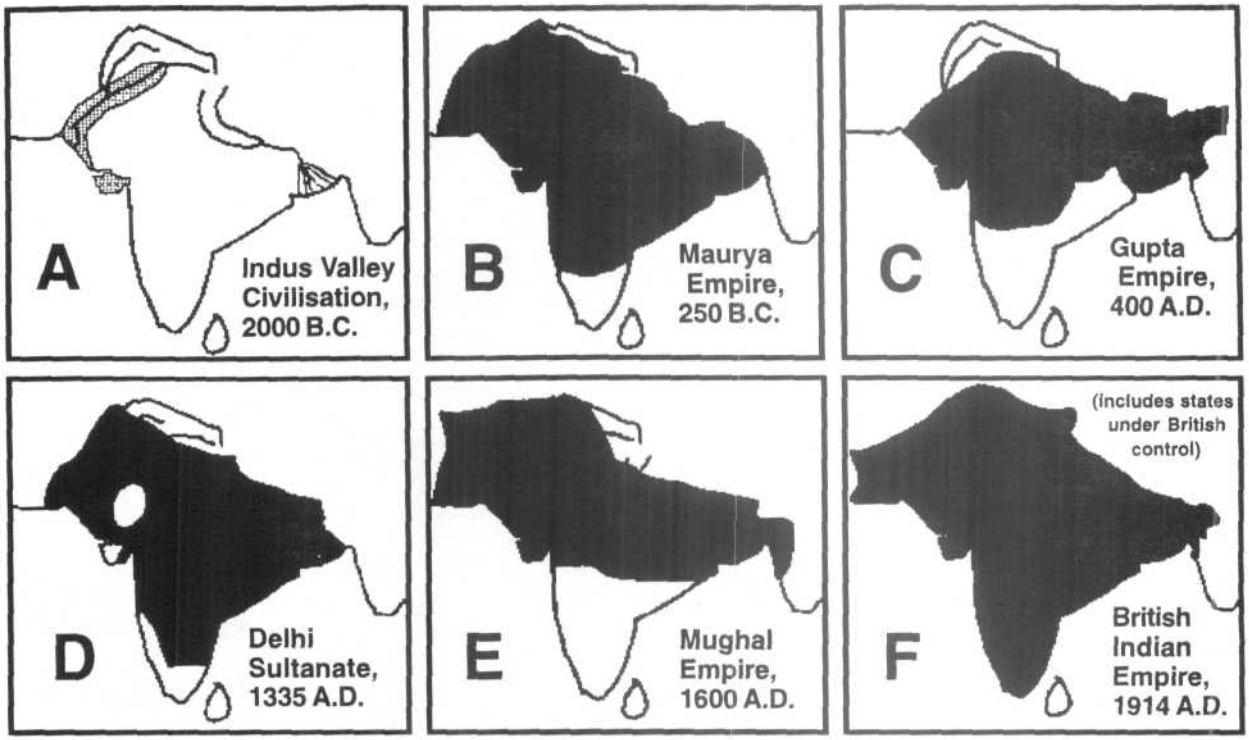
Hollingsworth (1969) has drawn attention the general tendency of counters of population to under-count, notably in the case of *India,* and this has meant a tendency to underestimate or even ignore the population cycles of *India,* which must have been on the same sort of scale as those well established for Europe and China. We have sought to correct these tendencies in our graphs.

All the points on Figure 1B, and those on Figure 1A (which are marked with a dot), are derived from published estimates. The other points on Figure 1A are more conjectural, based on indirect evidence such as records of drastic falls in population, notably in the 6th century A.D. and the 18th century A.D. The relative changes shown on Figure 1A are probably valid. A brief population crisis in the mid-19th century A.D. was marked by the Indian Mutiny and the famine of 1861.

The development of the Ganges plain was achieved earlier than that of the rivers of China, and there was no great further increase in food production before the British. The huge population growth of the 19th century A.D. and the 20th century A.D., was due to intensified irrigation and high-energy input agriculture, at first under the British and later during the "Green Revolution". These developments have had harmful long-term effects on the environment, and hence the carrying capacity, of the sub-continent.

The last point on Figure 1B represents the summed population of *India,* Pakistan, Bangladesh, and the small Himalayan states, and therefore refers, like all of the other points, to the whole sub-continent of India.

Figure 2A, 2B, 2C, 2D, 2E, & 2F -- The Indus Valley Civilisation and the North Indian Empires.



The rivers shown in Figure 2A, are the Indus, with its tributaries (south of the mainstream), the Jhelum and the Sutlej, in the West, and the Ganges, with its tributary (also south of the mainstream), the Jumna (also called the Yamuna), in the East. Also, the gray area in Figure 2A is the area of the Indus Valley Civilisation, however, all other figures have their respective empires colored in black. This was done to "show" the rivers more clearly.

Figure 3 - Population and Unemployment in *India,* 1961 to 1991
(data from Indian Express -- Vans, 1993)

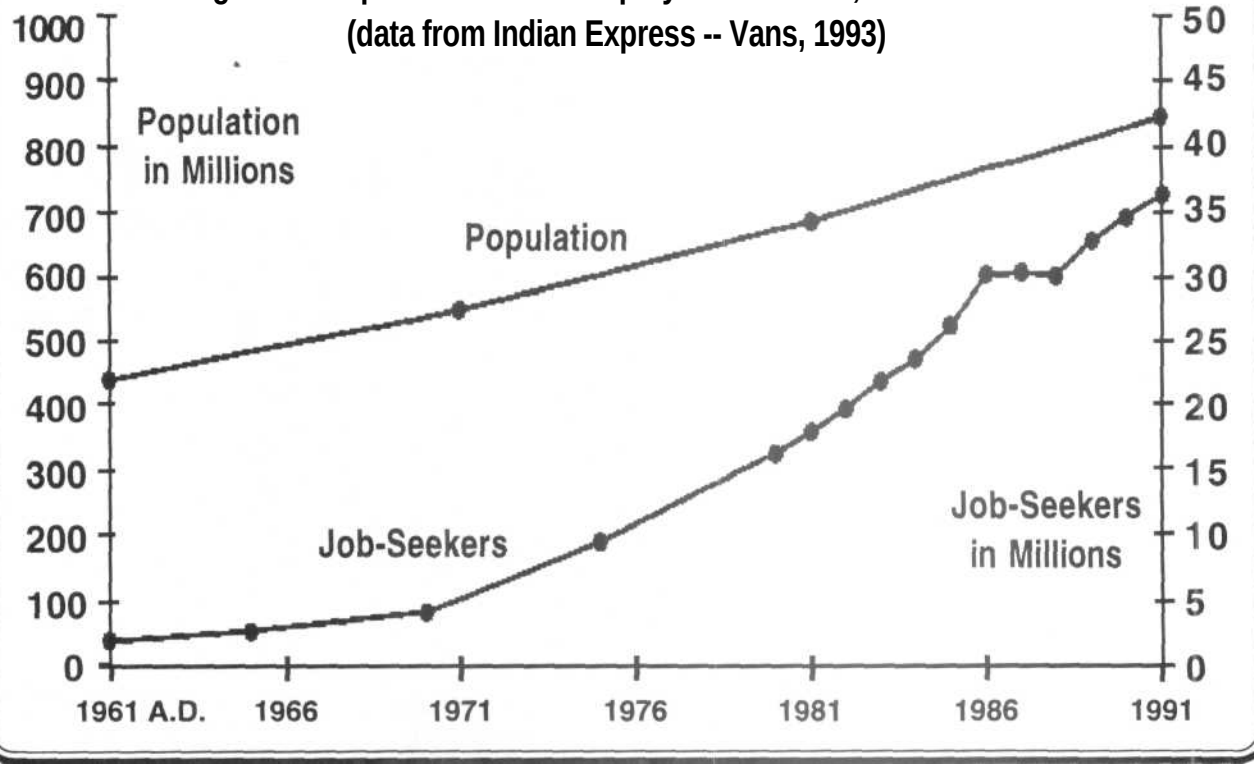


Table 1 - Outline History of Northern India from the 4th Century B.C.

Dates	Political Unit, Ganges Plain	Internal Condition	Foreign Invasions
322-185 B.C.	Maurya Empire	Controls Indus Valley much of South India and Afganistan	
185 B.C. to 320 A.D.	Many small states	Prolonged population crisis	Greeks, Sakas, & Kushans
320-480 A.D.	Gupta Empire	Influence extends to the Indus and to the Deccan	
480-606	Many small states	Population crisis	Huns
606-647	King Harsha	Brief revival of empire	
647-1206	Many small states	Prolonged population crisis	Arabs, Turks, & Afghans
1206-1340	Moslem Sultanate of Delhi	Turkish or Afghan dynasties; control briefly over most of South India	
1340-1526	Many small states, including the remnant of the Sultanate	Prolonged population crisis	
1398			Devastating raid by Timur the Lame of Samarkand
1526			Babur, descendent of Genghis Khan (Mongol) & Timur (Turk), finally overthrows the Delhi Sultanate and founds:
1526-1707	Moslem Mughal Empire	Controls Afghanistan, influence over South India	
1707-1818	Many small states, including the remnant of the Mughal Empire	Prolonged population crisis	Persians, Afghans, French, & British
1818-1947	British Indian Empire	Control over the whole sub-continent	
1947-Present	India, Pakistan, Bangladesh,	Population crisis (1971), & Himalayan small states	

Table 2 - Some Hydraulic Kingdoms in Southern and Southeastern Asia

Kingdom	Capital	Location in Modern Terms	Centuries A.D. when Flourishing	Sea Power and Maritime Trade
Sinhalese	Anuradhapura	Sri Lanka (Ceylon)	1 st-12th	
Funan	Vyadhapura	Coast of Cambodia/Vietnam	3rd-6th	+
Champa	Vijaya	Southern Vietnam	5th-15th	
Srivijaya	Palembang	Sumatra	7th-13th	+
Khmer	Anghor	Cambodia	9th-15th	
Chola	Cholapuram	Southern *India*	10th-13th	+
Burmese	Pagan	Myanmar (Burma)	11th-13th	
Vijayanagar	Vijayanagar	Southern *India*	14th-16th	

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ABSTRACTS & EXTRACTS...

Kumar S & Hedges SB: A molecular timescale for vertebrate evolution. *Nature,* 1998;392:917-920.

Abstract: A timescale is necessary for estimating rates of molecular and morphological change in organisms and for interpreting patterns of macroevo-lution and biogeography. Traditionally, these times have been obtained from the fossil record, where the earliest representatives of two lineages establish a minimum time of divergence of these lineages. The clock-like accumulation of sequence differences in some genes provides an alternative method by which the mean divergence time can be estimated. Estimates from single genes may have large statistical errors, but multiple genes can be studied to obtain a more reliable estimate of divergence time. However, until recently, the number of genes available for estimation of diver-gence time has been limited. Here the authors present divergence-time estimates for mammalian orders and major lineages of vertebrates, from an analysis of 658 nuclear genes. The molecular times agree with most early (Paleozoic) and late (Cenozoic) fossil-based times, but indicate major gaps in the Mesozoic fossil record. At least five lineages of placental mammals arose more than 100 million years ago, and most of the modem orders seem to have diversified before the Creta-ceous/Tertiary extinction of the dinosaurs.

Brooke NM; Garcia-Fernandez J; & Holland PWH: The ParaHox gene cluster is an evolu-tionary sister of the Hox gene cluster. *Nature,* 1998;392:920-922.

Abstract: Genes of the Hox cluster are restricted to the animal kingdom and play a central role in axial patterning in divergent animal phyla. Despite its evolutionary and developmental significance, the origin of the Hox gene cluster is obscure. The consensus is that a primordial Hox cluster arose by tandem gene duplication close to animal origins. Several homeobox genes with high sequence identity to Hox genes are found outside the Hox cluster and are known as 'dispersed' Hox-like genes; these genes may have been transposed away from an expanding cluster. Here the authors show that three of these dispersed homeobox genes form a novel gene cluster in the cephalochordate amphioxus. They argue that this 'ParaHox' gene cluster is an ancient paralogue (evolutionary sister) of the Hox gene cluster; the two gene clusters arose by duplication of a ProtoHox gene cluster. Furthermore, they show that amphioxus ParaHox genes have co-linear developmental expression patterns in anterior, middle and posterior tissues. The authors propose that the origin of distinct Hox and ParaHox genes by gene-cluster duplication facilitated an increase in body complexity during the Cambrian explosion.

Billuart, et al: Oligophrenin-1 encodes a rhoGAP protein involved with X-linked mental retardation. *Nature,* 1998;392:923-926.

Abstract: Primary or nonspecific X-linked mental retardation (MRX) is a heterogeneous condition in which affected patients do not have any distinctive clinical or biochemical features in common apari from cognitive impairment. Although it is presert in approximately 0.15-0.3% of males, most of the genetic defects associated with MRX, which may involve more than ten different genes, remain unknown. Here the authors report the characteriza-tion of a new gene on the long arm of the X- chro-mosome (position Xq12) and the identification in unrelated individuals of different mutations that are predicted to cause a loss of function. This gene is highly expressed in fetal brain and encodes a protein of relative molecular mass 91K, named oligophrenin-1, which contains a domain typical of a Rho-GTPase-activating protein (rhoGAP). By enhancing their GTPase activity, GAP proteins inactivate small Rho and Ras proteins, so inactva-

tion of rhoGAP proteins might cause constitutive activation of their GTPase targets. Such activation is known to affect cell migration and outgrowth of axons and dendrites in vivo. The authors' results demonstrate an association between cognitive impairment and a defect in a signalling pathway that depends on a Ras-like GTPase.

Smith, et al: $GABA_A$ receptor alpha 4 subunit suppression prevents withdrawal properties of an endogenous steroid. *Nature,* 1998;392:926-930.

Abstract: The hormone progesterone is readily converted to 3a-OH-5a-pregnan-20-one (3a,5a-THP) in the brains of males and females. In the brain, 3a,5a-THP acts like a sedative, decreasing anxiety and reducing seizure activity, by enhancing the function of GABA (g-aminobutyric acid), the brains major inhibitory neurotransmitter. Symptoms of premenstrual syndrome (PMS), such as anxiety and seizure, susceptibility, are associated with sharp declines in circulating levels of progesterone and, consequently, of levels of 3a,5a-THP in the brain. Abrupt discontinuation of use of sedatives such as benzodiazepines and ethanol can also produce PMS-like withdrawal symptoms. Here the authors report a progesterone-withdrawal paradigm, designed to mimic PMS and post-partum syndrome in a rat model. In this model, withdrawal of progesterone leads to increased seizure susceptibility and insensitivity to benzodiazepine sedatives through an effect on gene transcription.

Specifically, this effect was due to reduced levels of 3a,5a-THP which enhance transcription of the gene encoding the a4 subunit of the GABA. receptor. The authors also find that increased susceptibility to seizure after progesterone withdrawal is due to a sixfold decrease in the decay time for GABA currents and consequent decreased inhibitory function. Blockade of the 4 gene transcript prevents these withdrawal properties. PMS symptoms may therefore be attributable, in part, to alterations in expression of GABA. receptor subunits as a result of progesterone withdrawal.

Adler NE; Horowitz M; Garcia A & Mover A: Additional validation of a scale to assess positive states of mind. *Psychosomatic Medicine,* 1998;60:26-32.

Abstract:

Objective: Numerous studies have linked stress and negative states to adverse health outcomes. However, in addition to engendering negative states, stress may impair capacities to experience positive states. Such failure to experience positive states may represent a risk factor for poor health in an of itself. The research reported here examines a brief, easily repeated measure of positive states of mind (PSOM) including: focused attention, productivity, responsible caretaking, restful repose, sharing, sensuous nonsexual pleasure, and sensuous sexual pleasure.

Method: The PSOM Scale and measures of psychological distress, stress, and physical symptoms were administered in 4 independent samples: 2 samples of college students and 2 samples of pregnant women, one undergoing a potentially stressful medical procedure (amniocen-tesis). The relationship between PSOM scores and several conceptually related, but distinct, psychological variables was examined, controlling for the effect of social desirability where necessary.

Results: The range of scores on the items of the PSOM indicated that impairments of ability to have the relevant experiences did occur in the subjects who were experiencing stress. The overall PSOM Scale score consistently showed an inverse relationship with anxiety and with indicators of stress. In addition, lower scores on the PSOM Scale were associated with more somatic symptomatology.

Conclusion: The results provide evidence that positive states of mind are linked to negative psychological states and are responsive to stressful events. The PSOM Scale provides a useful, brief measure for research in stress and health.

Pennisi E & Roush W: Developing a new view of evolution. Special News Report. *Science,* 1997;277:34-37.

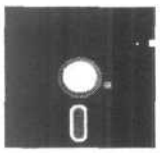
Exstract: [S]imilar genes often generate quite different body plans. Perhaps the best known example is hox genes, regulatory genes that help establish major body structures. In some cases they define similar structures in different animals. But in others, they serve as versatile tools to establish very different structures. In the fruit fly embyro, for example, a hox gene called Abd-B helps define the posterior end of the embryo, while a similar family of genes in chicks helps to partition a developing wing into three segments.

New cases of such genetic tool kits keep turning up almost every month. For example, evolutionary developmental biologist Sean Carroll of the University of Wisconsin, Madison, and his colleagues have been studying a gene called distalless, which causes cells to bud off from a main body axis. Biologists once thought that the branched limbs of crustaceans like lobsters and the unbranched limbs of fruit flies evolved independently, but 2 years ago Carroll's team showed that distalless intitiates the development of both: In Crustacea, the gene is simply recruited twice to bud a branch off the existing leg.

Now Carroll has teamed up with other researchers and taken that work much further, demonstrating in May in the Proceedings of the National Academy of Sciences that distalless is expressed in outgrowths to the existing body axis in all sorts of creatures, from the fleshy appendages of polycha-ete worms to the tube feet of starfish. Thus, the limbs of many different creatures all start with a genetic program to bud that somehow involves distalless. This doesn't necessarily mean that all these kinds of appendages evolved just once, notes Eric Davidson, a molecular developmental biologist at the California Institute of Technology:

"No one in the world would conclude that a [sea urchin] spine is homologous with a limb. It just shows that there are these little genetic programs for setting up proximal-distal axes, or whatever, that are used over and over and over again."

Rather, such work reveals that "a lot of evolution represents the commandeering of genes from one form to another," says David Jablonsky, a paleobiologist at the University of Chicago. "You're taking what's already there and using it in a different way," agrees [Neil] Shubin [from the University of Pennsylvania]. "Just how pervasive tinkering is is amazing."



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