Stress, the Evolution of Mood and Clinical Depression

For UC Berkeley IB 139, Fall 2022

Julio Ozores, M.D.

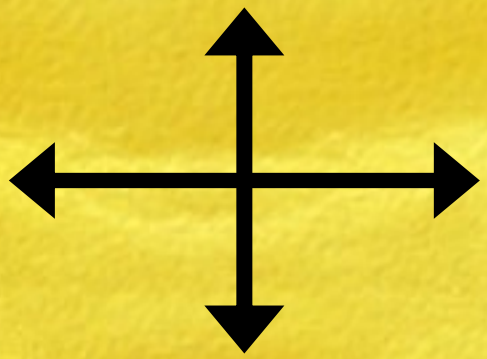
Four Days, Six Questions

- Day One: *Why do animals have moods?*
- Day Two: *How did animals evolve depressed mood as an adaptive response to social stressors?*
- Day Three: *Why and how does mood regulation go awry in the human depressive mood disorders?*
- Day Four: *How is disordered depressed mood treated? Why is there an increasing prevalence of depression in "Gen Z"? What to do about it?*

EVOLUTIONARY HYPOTHESES OF DEPRESSION: TWO CLASSICS BASED ON DEEP AND SHALLOW PHYLOGENETIC TIME-DEPTHS

"Middle of the highrise" evolutionary hypotheses of mood are almost all about stressors causing depressed mood.

(Side note: While there are evolutionary hypotheses about stress and anxious mood, there are hardly any about elevated mood or **mania** → → → → (*No good animal models!*)



As we get closer to explanations of human suffering and disorders…

- Remember "Congenital Insensitivity to Pain" and the adaptive c*apacity* to experience *physical pain?* Sometimes suffering has an *adaptationist* explanation - but sometimes not.
- Evolutionary *adaptationist* explanations of *universal capacities* cannot explain *dysfunctions* or *individual vulnerabilities* to dysfunctions. BTW, a *universal capacity* for suffering *X* ≠ ever suffering *X* !
  - Adaptationist arguments *are* valid to "reverse engineer" *universal* aspects of human nature...
  - ...but explaining the *individual occurrences* of, or the *persistence of genetic vulnerabilities* to disorders - say, Major Depression - requires another logic: Evolutionary Genetics.
- Recent theorists (ex. psychiatrist Randy Nesse, MD) insist: *Don't view diseases as adaptations*.

Explain the evolution of *normal moods* first, then explain why evolution left us *vulnerable to diseases* like severe depression

(chronological order)	Reasoning	Proposal	Depth	Basis	Prediction
Attachment	Securing parental care	–	Aves, Mammalia	**Yes ++**	Helplessness, care-eliciting
Learned Helplessness	"Learning"?	–	Animalia	**No** (Based on lab experiment, behaviorism)	Helplessness, failure adapt to change
Incentive Disengagement	Regulating deployment of effort	–	Animalia	**No**	Anhedonia
Social Competition	Strategy for predicaments of losing or low status	Psychological: "RHP" and low *self-esteem*	Vertebrata, Invertebrata...	**Yes! +++**	**+++** Low *self-esteem*, incapacity
Bargaining	Extortion for resources	Psychological: manipulation	*Homo sapiens*	**No**	"Going on strike" Suicidality
Group Utility of Guilt	Group selection		*Homo sapiens*	Altruism and group selection	+ Guilt
Social Risk	Strategy for predicaments of ostracism, low status	Psychological: "SIP", low *self-esteem*	Early *Homo sapiens*	**Yes +**	**+++** Low *self esteem*, wariness
Analytic Rumination	Rumination as adaptive problem solving		*Homo sapiens*	**No**	**+** Rumination
Pathogen Host Defense	**None** ("incidental cost")	Genetic: Persistence of susceptibility allelles , inflammation	Mammalia		**+/--** Sickness behavior - but **+++** *medical* comorbidities
	Yes/No	Psychoneuroimm			+/-- Sickness

How do these two classic hypotheses of *Non-Disordered Depressed Mood"* fit with "The Foundation of Mood"?

- "The Foundation", depressed mood *only explained the inhibition of resource seeking*, but not social features of human depressed mood, like low *self-esteem* or social withdrawal....

To the rescue:

- **The Social Competition Hypothesis of Depression (SCH)** and **The Social Risk Hypothesis of Depressed Mood (SRH)**

(Avoid confusion! "Classic stress science" does *not* consider depression "a stress response" *per se*, nor do evolutionary hypotheses like the **SCH** and **SRH** name " stress " *per se.*)

Overview of the two "middle of the high-rise" hypotheses

- **The Social Competition Hypothesis of Depression**
  - Deeper phylogenetic time-depth; "middle of the high-rise"
- **The Social Risk Hypothesis of Depressed Mood**
  - Shallow phylogenetic time-depth; "near the penthouse".

- Both tackle challenges *peculiar to sociality,* and claim that features of low mood are adaptive - a way to cope – with *social* predicaments.
- Both speculate on *self-esteem* – its "primordium" in animal behavior.
- **The theories *build on each other:*** We'll see how something *missing* from the earlier **SCH** is fixed by the later **SRH**
- (We are still only dealing with *normal* depressed mood).

THE SOCIAL COMPETITION HYPOTHESIS OF DEPRESSION

Background: : Ethological observation.....competition...hierachies....pecking orders...
theoretical modeling of .animal contest behavior

An old classic (1994) ...

British Journal of Psychiatry (1994), **164**, 309–315

The Social Competition Hypothesis of Depression

JOHN PRICE, LEON SLOMAN, RUSSELL GARDNER, Jr, PAUL GILBERT and PETER ROHDE

Depressive personality and depressive illness are examined from an evolutionary adaptationist standpoint. It is postulated that the depressive state evolved in relation to social competition, as an unconscious, involuntary losing strategy, enabling the individual to accept defeat in ritual agonistic encounters and to accommodate to what would otherwise be unacceptably low social rank.

There is some agreement that depressive states represent 'a psycho-biological response pattern' which is part of the inherited behavioural repertory of the human organism (Lewis, 1934; Hill, 1968; Beck, 1987; Nesse, 1990; Gilbert, 1992; Powles, 1992). This means that depression performed some function over the course of our evolution and that those of our ancestors who had the capacity to become depressed survived at the expense of those who did not. However, it is easier to agree that there was a function than to agree on what that function was. To ignore the problem would be to limit our understanding of the biology of depression and possibly forego pointers to research into aetiology, classification and treatment.

Performance is limited in depression. There is impairment of perception, of execution and of the central processes which mediate between perception and execution, experienced as difficulty in making

Recent work in behavioural ecology has been concerned with situations in which an animal utilises only one from a set of two or more alternative behavioural strategies (Krebs & Davies, 1987). Depression may be identified as a losing or de-escalating strategy and elevation of mood as a winning or escalating strategy.

Since adopting a losing strategy often implies foregoing resources which may contribute to reproduction, depression might also fall into the category of altruistic behaviour, which has been of interest in recent evolutionary theory (Hamilton, 1963; Krebs, 1987).

Finally, the mathematical analysis of animal contest behaviour requires a variable to express the animal's knowledge of its own fighting capacity. This animal self-concept has been termed 'resource-holding potential' (RHP) and may be the evolutionary primordium of human self-esteem (Parker, 1974;

The Social Competition Hypothesis: Somewhere in the middle of the high rise ➔➔➔

(No longer at ”The Foundation” – now dealing with how mood states evolved for animals who *must cope with each other* -the realm of *sociality*).

A very widespread behavior pattern: *Fighting*.

"Fighting is a phylogenetically <u>ancient</u> mechanism that creates social asymmetry."

A widespread behavior pattern when you live with your "conspecifics"… *fighting*.

The fighting in question is **ritual agonistic behavior**. **Not** to be confused with...

- Play fighting...
  - (Why so much *play fighting*? To practice motor skills, AND to develop learning how to assess self –and- other in competition.)
- The coalitional violence (wars) of a few animals – esp. great apes...
- The *artificially* induced repeated aggression and helplessness used in the "Resident – Intruder" Social Defeat Model.

In **ritual agonistic behavior**, the loser may not be seriously hurt.

Still, winners and losers **must end up behaving differently, somehow**. What mechanism mediates the *change in behavior*?

The Social Competition Hypothesis

The adaptive challenge

- Fighting creates a social asymmetry : Someone wins, someone loses.
- **Losing** could be understood as a **stressor** (a threat to "social homeostasis")

(Remember *social defeat stress* as model **stressor** (though in the wild, there is much less "uncontrollability")

- **Losing** creates adaptive challenges for the losing contender: *Animals who lose must change their behavior* in order to cope.
- The challenges of losing *predict* there should be **adaptations** - behavioral strategies - for losing, and for its aftermath (having lost).

The Social Competition Hypothesis

The adaptation

- Claim: These "behavioral strategies" are "**depressive states**" that *function* to cope with losing and facilitate pulling away, by:
  - *inhibiting* challenging behavior
  - *inhibiting* resource-seeking
  - *signaling* "Fight's over!"
  - *facilitating acceptance* of low status
- How do the echoes of this show up in *human* depression?
  - **Negative cognitive distortions** (i.e. "*overvaluing* negative outcomes") (pessimism) *promotes withdrawal* from competition.
  - **Loss of interest (anhedonia)** (i.e. "*undervaluing* positive outcomes") resulting from the reduction in the perceived value and significance of all goals and incentives (reducing the estimates of "resource value") also *favors de-escalation of conflict*.
  - **A subjective feeling of incapacity** that pulls one out of competition. "*Indeed, **incapacity** is the main functional feature of depression*"

The Social Competition Hypothesis

Looking under the hood

Resource Holding Potential and *Self-esteem*

- How does an animal know it should switch to a losing behavioral strategy?
- Enter a "construct" from Behavioral Ecology, *Resource Holding Potential*. – how animals **keep track of** wins/losses, fighting capacity, and social status (alliances).

Resource Holding Potential is "A hypothetical variable in the mathematical analysis of animal fighting behavior"

- **"Computing" a low *Resource Holding Potential* is what sets off depression.**
- Notice: *Resource Holding Potential* is *a kind of self concept.*

(And now a live demonstration by Dr. Ozores of Resource Holding Potential !)

Resource Holding Potential (RHP) posited as "the primordium of *self-esteem*" (human, moment-to-moment rising and falling *self-esteem*)

RHP Meter

RHP Meter

The Social Competition Hypothesis, applied to humans, sees the social world as mapping onto only ONE *"dimension of interpersonal relatedness"* that affects mood: **Agency/Rank**, up or down…

"What is happiness? The feeling that power increases - that resistance is being overcome."…
Nietzsche

Agency/rank

+ Victory, power, high status, holding control of resources, being respected or feared

- Defeat, humiliation, entrapment

The Social Competition Hypothesis

Critique

Strengths

- Grounded in Behavioral Ecology ✔
- Predicts depression's "incapacity", cognitive distortions and low *self-esteem* ✔
- Explains why social **stressors** of *defeat*, *humiliation*, *entrapment* are classic human *depressogenic precipitants* ✔
- Low rank and (clinical) depression are associated with increased activity of the HPA axis (increased "**stress hormones**").
- Fits (kinda?) with the **social defeat stress** model in lab animals ✔

Weaknesses

- Does not account for why loss, disrupted attachment, or social exclusion precipitate depression.
  - (Patch-up: "The support of significant others has become the main predictor of loss of rank"
- "Ritual agonistic behavior" is not the main form of human competition
  - (Patch-up: Human competition now occurs mostly by *attraction*"

THE SOCIAL RISK HYPOTHESIS OF DEPRESSED MOOD

Background: social competition hypothesis attachment theory social cognition
behavioral economics foraging theory

Psychological Bulletin
2003, Vol. 129, No. 6, 887–913

0033-2909/03/$12.00 DOI: 10.1037/0033-2909.129.6.887

The Social Risk Hypothesis of Depressed Mood: Evolutionary, Psychosocial, and Neurobiological Perspectives

Nicholas B. Allen and Paul B. T. Badcock
University of Melbourne

The authors hypothesize that depressed states evolved to minimize risk in social interactions in which individuals perceive that the ratio of their social value to others, and their social burden on others, is at a critically low level. When this ratio reaches a point where social value and social burden are approaching equivalence, the individual is in danger of exclusion from social contexts that, over the course of evolution, have been critical to fitness. Many features of depressed states can be understood in relation to mechanisms that reduce social risk in such circumstances, including (a) hypersensitivity to signals of social threat from others, (b) sending signals to others that reduce social risks, and (c) inhibiting risk-seeking (e.g., confident, acquisitive) behaviors. These features are discussed in terms of psychosocial and neurobiological research on depressive phenomena.

> No more fiendish punishment could be devised, were such a thing physically possible, that one should be turned loose in society and remain absolutely unnoticed by all the members thereof. If no-one turned around when we entered, answered when we spoke, or minded what we did, but if every person we met "cut us dead" and acted as if we were non existent things, a kind of rage and impotent despair would ere long well up in us, from which the cruelest bodily tortures would be a relief; for these would make us feel that, however bad might be our plight, we had not sunk to such a depth as to be unworthy of attention at all. (W. James, 1890/1948, p. 179)

Traditionally, theoretical conjectures concerning the nature of depression have focused on neurobiological, psychosocial, or more recently, evolutionary processes. Although these areas undoubt-

mechanism affects social–perceptual processes by initiating hypersensitivity for indicators of social risk. In the area of social behavior, the mechanism affects both communicative behavior (signaling in order to reduce threats and to elicit safe forms of support) and instrumental resource-acquisition behaviors (a general reduction in the motivation to engage in those behaviors that lead to social interactions with highly variable and uncertain outcomes, such as social competition or conflict).

It is worthwhile noting that the link between depression and risk-sensitive behavioral strategies is not a theoretical novelty. Indeed, Nesse (2000), Leahy (1997), and Klinger (1975) have all proposed that depressed states represent a risk-management strategy that has evolved to alter an individual's behaviors in contexts

The Social Risk Hypothesis (SRH):
Close to the penthouse ➔➔➔

Cooperative sociality is intrinsic to human nature.

How would you engineer mood for our human, ultra-cooperative way of life?

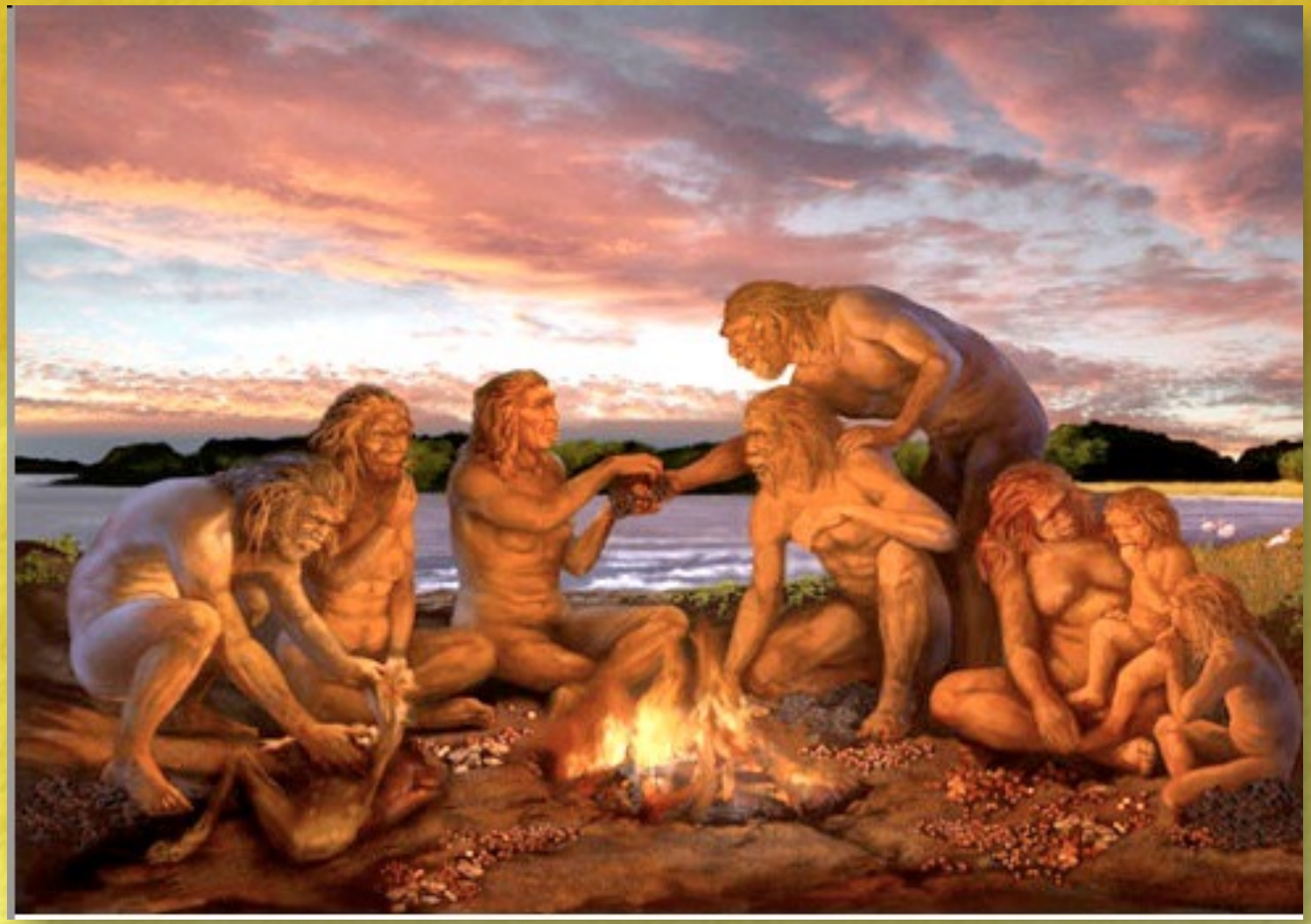


Illustration: Karen Carr

The Social Risk Hypothesis
The adaptive challenge

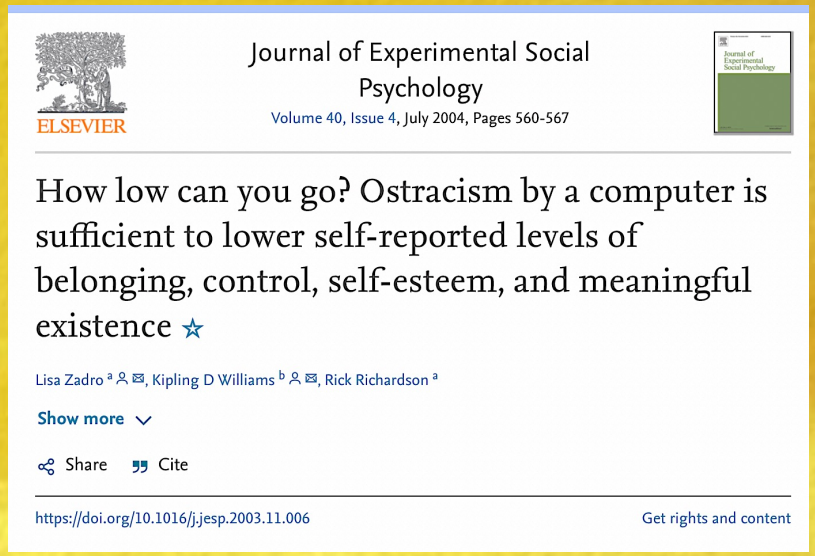
- Humans are extremely **cooperative** social animals that **depend on group belonging** to survive and prosper.
- We are uniquely able to "mesh our minds together". (Tomasello)
- Beyond mere **belonging**, once you belong, lots depends on your "position" – your **social standing**.
- Social standing can vary in two orthogonal dimensions: **Agency/Rank** and **Communion/Affiliation:**

How well are you respected?

How well are you accepted?

The Social Risk Hypothesis
The adaptive challenge (continued)

- Sociality ("groupishness") brings great benefits to "belongers".
- But *the flip side* is discrimination against whomever is not *deemed* a profitable social partner. There is the potential for *exclusion, shunning, ostracism...*
- Since humans are so groupish, and belonging and social status are so important, what would you expect us to be ***obsessed with***?



ELSEVIER

Journal of Experimental Social Psychology

Volume 40, Issue 4, July 2004, Pages 560-567

How low can you go? Ostracism by a computer is sufficient to lower self-reported levels of belonging, control, self-esteem, and meaningful existence ☆

Lisa Zadro [a], Kipling D Williams [b], Rick Richardson [a]

Show more

Share Cite

https://doi.org/10.1016/j.jesp.2003.11.006 Get rights and content

Ostracism *by a computer* hurts!

"We interpret these results as strong evidence for a very primitive and automatic adaptive sensitivity to even the slightest hint of social exclusion."

The Social Risk Hypothesis

The adaptation –how to tinker with the "foundational mood system" so that it works for our "groupishness" – making our mood species-unique?

- Experiencing a "need to belong" - an *exquisite sensitivity* to how one fares in *belonging.*
- Automatically and unconsciously assessing **the ratio of one's *social value* to one's *social burden:***
  - Social Value/Social Burden = ***Social Investment Potential (SIP)***
  - This "SIP" is based on **clues** about where one stands on TWO dimensions of relatedness - Agency/Power and Communion/Affiliation.
  - Signals of dropping status (defeat, humiliation, loss of control) or threats to affiliation (ex. dissolution of relationships) - lower SIP – i.e. "depressogenic **stressors**" lower one's Social Investment Potential.

Position in human society mapped onto *two dimensions of interpersonal relatedness*

"... a question arises: whether It be better to be loved than feared or feared than loved? It may be answered that one should be both,.." (*"LOVED": X axis; "FEARED": Y axis)*

Agency/Rank

+ RESPECTED: Victory, Power, Having Control of Resources, Being Honored or *Feared*

Communion/Affiliation

- Rejection, Shunning

+ ACCEPTED: Belonging, Being *Loved*, Being Esteemed

- Defeat, Humiliation, Entrapment

The Social Risk Hypothesis

Looking under the hood:
Self-esteem

- The "construct" of **Social Investment Potential (SIP)** is "kinda" an updating of Resource Holding Potential, modified for extremely groupish humans.
- **Social Investment Potential** is a "best guess" of the *ratio* of one's **social value** to **social burden**
- Think of it as the "*capital*" that one has to determine what *risk strategy* too gamble on when *investing* in social gambits/behavior. (Notice influence of economic theory)

- Social Investment Potential (SIP) **is "experienced as"** ***self-esteem***
- Observation that supports the link:

"Virtually all events that raise ***self-esteem*** maintain or improve the individual's chances of being included, whereas events that lower ***self-esteem*** decrease inclusion likelihood."

Leary, Mark R. (1990)

- So, ***self-esteem*** is ***central*** to human mood:

Social World →

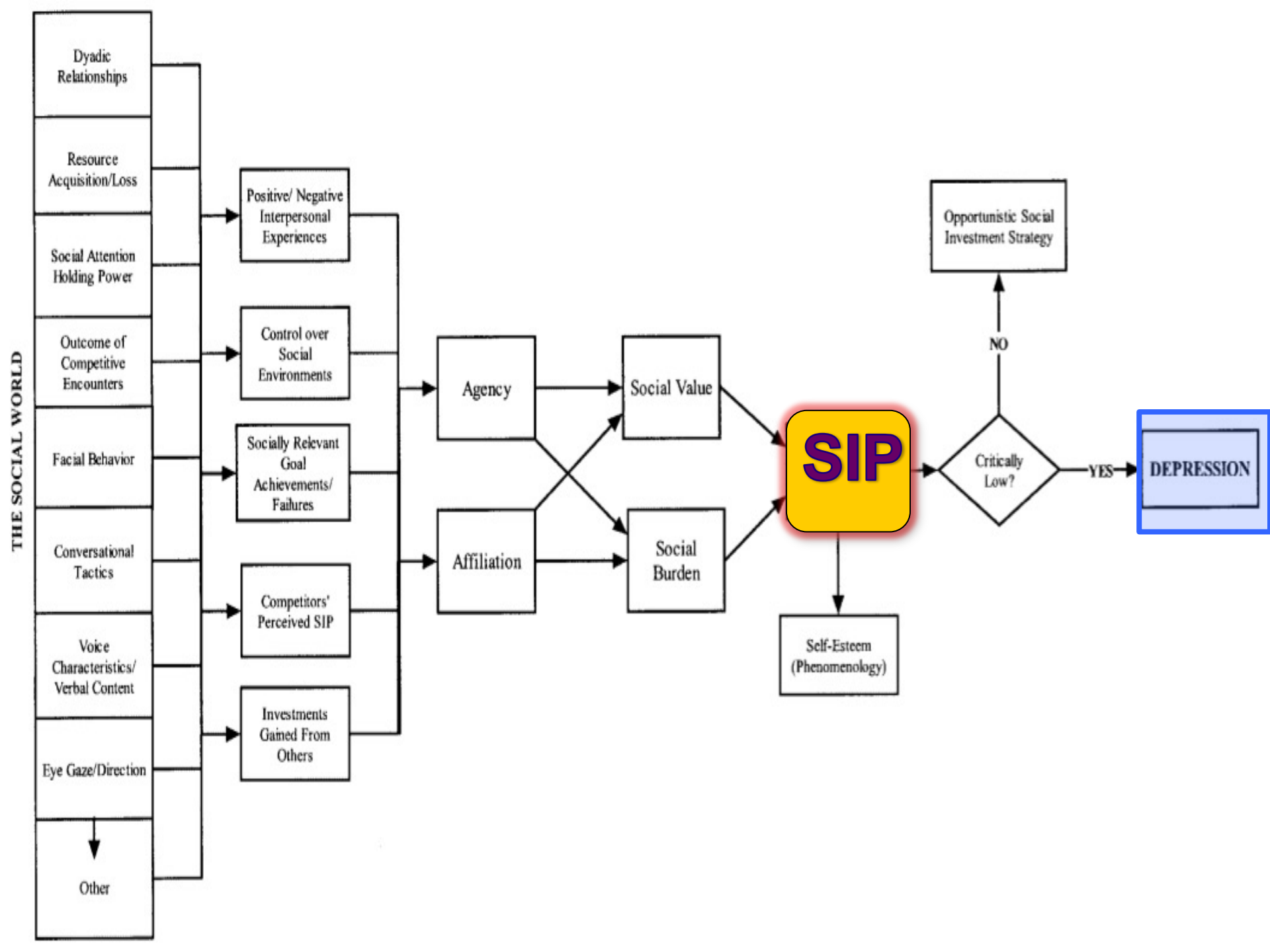
SIP (experienced as ***self-esteem***) **→**

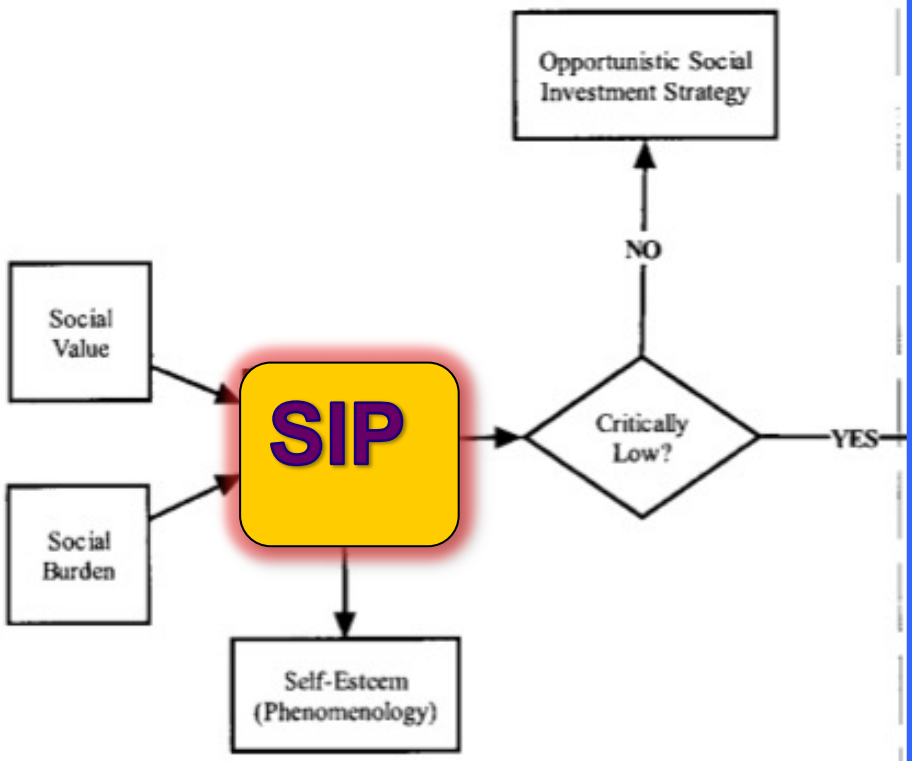
Mood

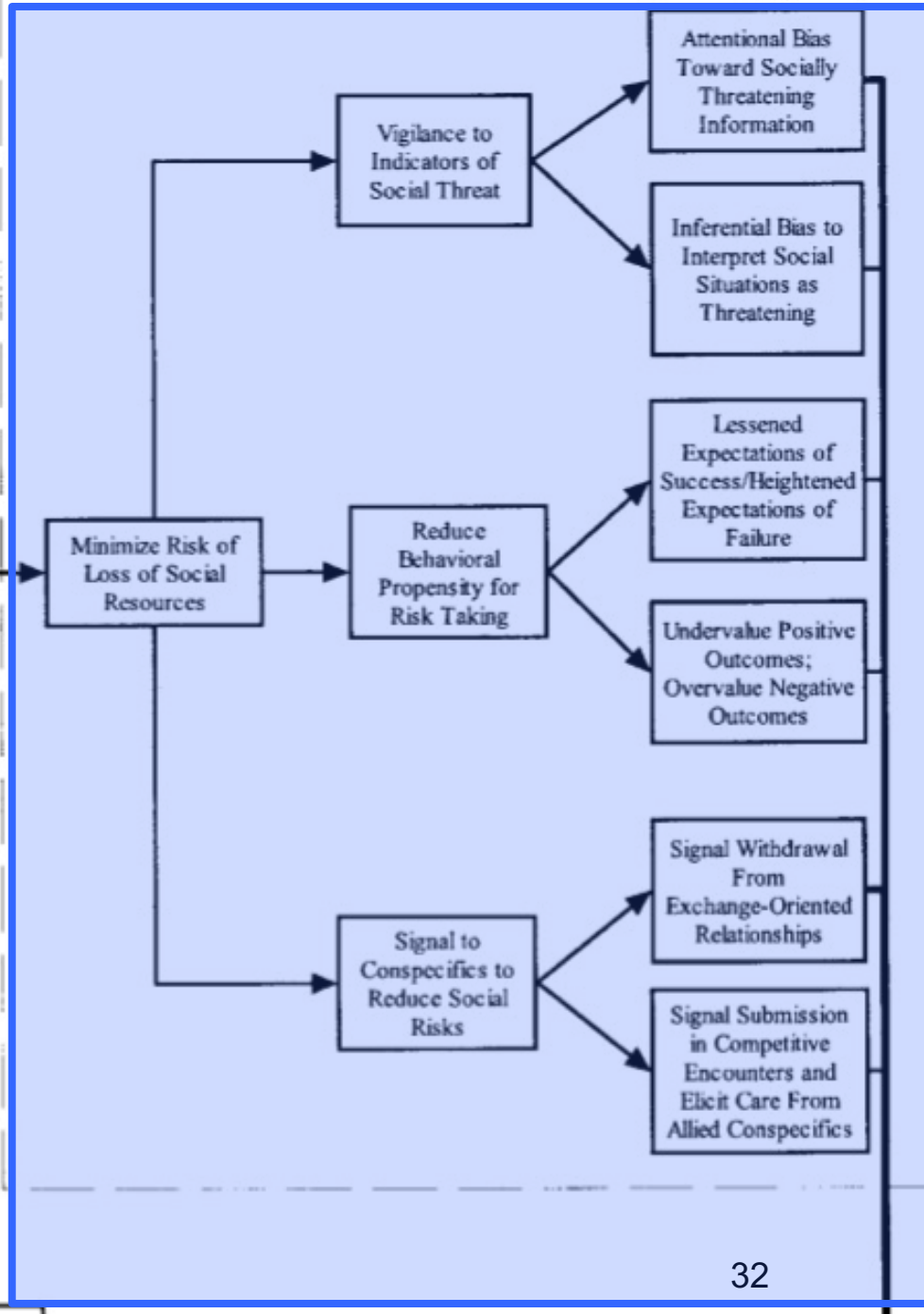
The Social Risk Hypothesis

How to cope when your SIP is not looking good

- When **Social Investment Potential** drops, **adaptive behavioral strategies** are deployed: Your *investment strategy* turns *risk-averse* in **three ways**:
  - **1.** In social perception, **"hypersensitizing"** to indicators of social threat (*Attentional* and *inferential* biases).
  - **2.** In resource-acquisition behavior, **reducing risk-taking** by skewing *cognitive* biases: *Lowering expectations of success*, *raising expectation of failure*, *undervaluing* positive outcomes, *overvaluing* negative outcomes. Also, *reducing appetitive motivation* (Thus, reducing interactions with uncertain outcomes, such as competition or conflict).
  - **3.** In communication, **signaling** *submission* to competitors, *withdrawal* from exchange partners, and for *care-eliciting* from allies (ie, for support - signs that one is socially valued).


THE SOCIAL WORLD
Dyadic Relationships
Resource Acquisition/Loss
Social Attention Holding Power
Outcome of Competitive Encounters
Facial Behavior
Conversational Tactics
Voice Characteristics/ Verbal Content
Eye Gaze/Direction
Other
Positive/ Negative Interpersonal Experiences
Control over Social Environments
Socially Relevant Goal Achievements/ Failures
Competitors' Perceived SIP
Investments Gained From Others
Agency
Affiliation
Social Value
Social Burden
SIP
Self-Esteem (Phenomenology)
Opportunistic Social Investment Strategy
NO
Critically Low?
YES
DEPRESSION

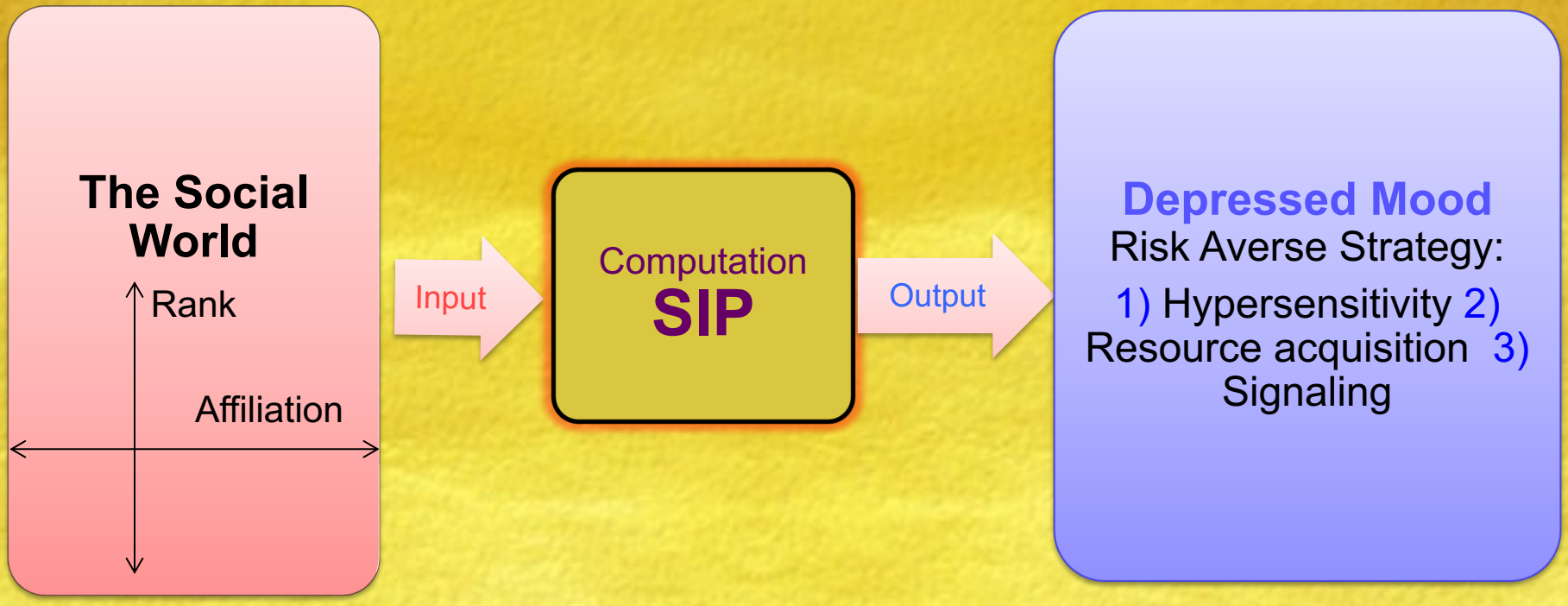

Opportunistic Social Investment Strategy
NO
Social Value
Social Burden
SIP
Critically Low?
YES
Self-Esteem (Phenomenology)


Minimize Risk of Loss of Social Resources
Vigilance to Indicators of Social Threat
Attentional Bias Toward Socially Threatening Information
Inferential Bias to Interpret Social Situations as Threatening
Reduce Behavioral Propensity for Risk Taking
Lessened Expectations of Success/Heightened Expectations of Failure
Undervalue Positive Outcomes; Overvalue Negative Outcomes
Signal to Conspecifics to Reduce Social Risks
Signal Withdrawal From Exchange-Oriented Relationships
Signal Submission in Competitive Encounters and Elicit Care From Allied Conspecifics

The Social Risk Hypothesis

Looking under the hood:

Simplified algorithm



The Social Risk Hypothesis
Critique

Strengths

- Incorporates strengths of the Social Competition Hypothesis ✔
- Predicts that not only **defeat**, but *also* breakdown of **relationships, exclusion,** etc. would trigger depression ✔
- Predicts that social support would be important for recovery ✔
- Has some empirical support ✔
- Predicts the sharp rise in incidence of depression during late adolescence/early adulthood ✔

Weaknesses

- Won't "depression" decrease "social value"? (Because of stigma, and because people often shrink from depressed others).
  - Patch-ups?: 1) "The proposed ecological function works only for *mild* depressed states"... 2) Depressed mood is *not meant to* raise **SIP**– it's only a *risk-averse strategy* (a retreat to safety)

Takeaways

- We suffer, in common with other animals, depressed states that are responses to *certain kinds* of stressors, namely loss, social exclusion, social defeat, and helplessness/entrapment.
- There are many evolutionary hypotheses of depression. Two classic hypotheses link depressed states to ancestral behavioral strategies:
- The Social Competition Hypothesis considers the *adaptive challenge* posed by social competition and status hierachies, positing that primitive mechanisms to cope with defeat and subordination persist and/or may be homologous with human depressed mood.
- The Social Risk Hypothesis considers the *adaptive challenge* posed by our human, species-specific "groupishness", in which not just competition and hierarchy affect fitness, but also acceptance and belonging. It posits that mechanisms to cope with danger of exclusion or ostracism modulate social by "retreating to safety"
- Both hypotheses posit that *self-esteem* is not a mere "by product" of mood, but the key, central determinant.