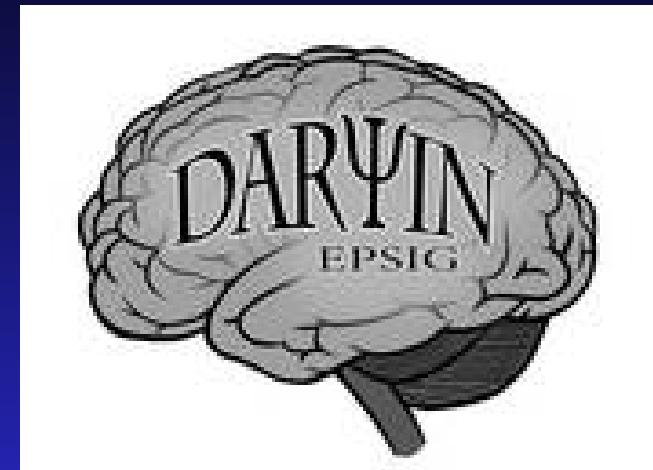


Why Anxiety is Usually Normal but Useless



Randolph M. Nesse

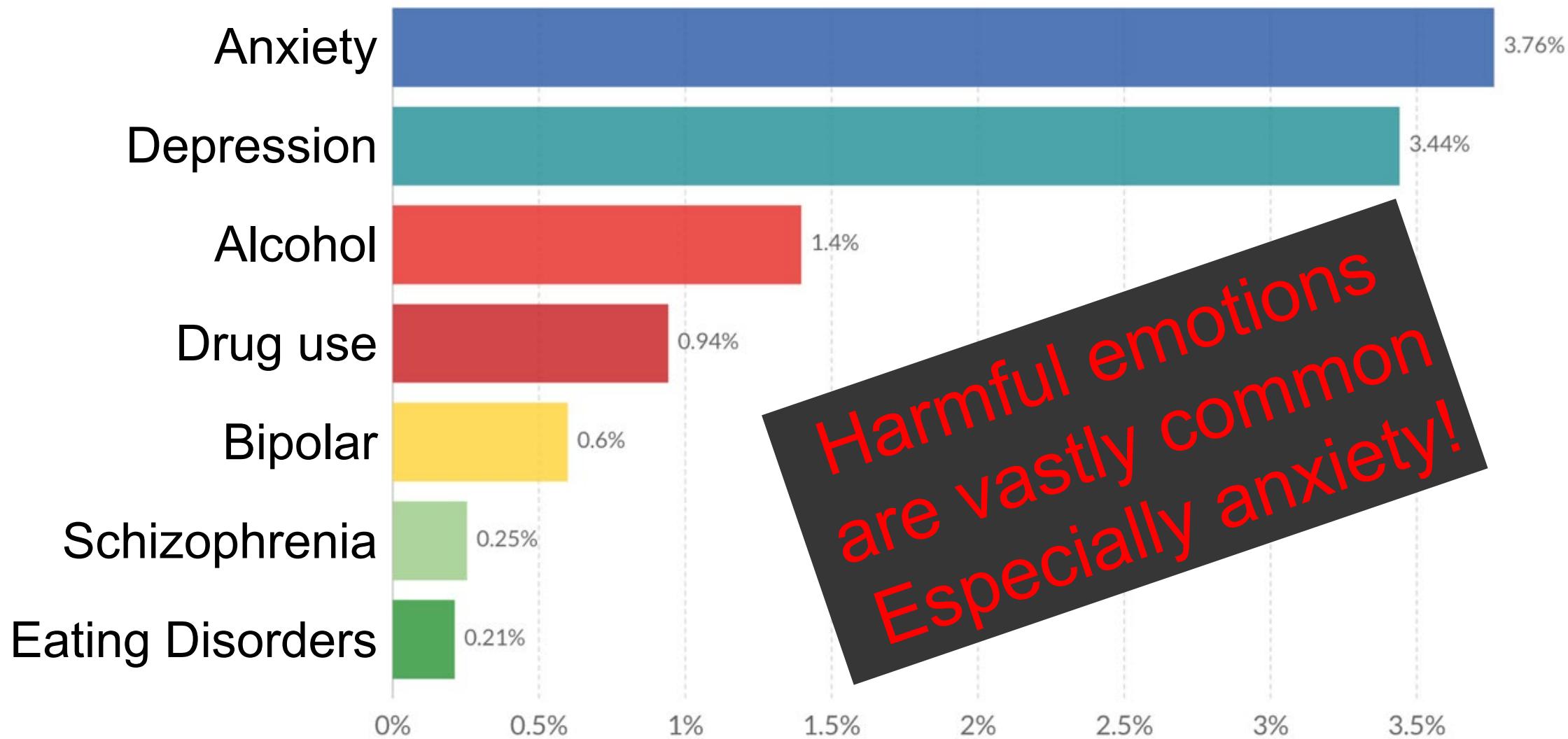


The University of Michigan Anxiety Disorders Clinic at 40

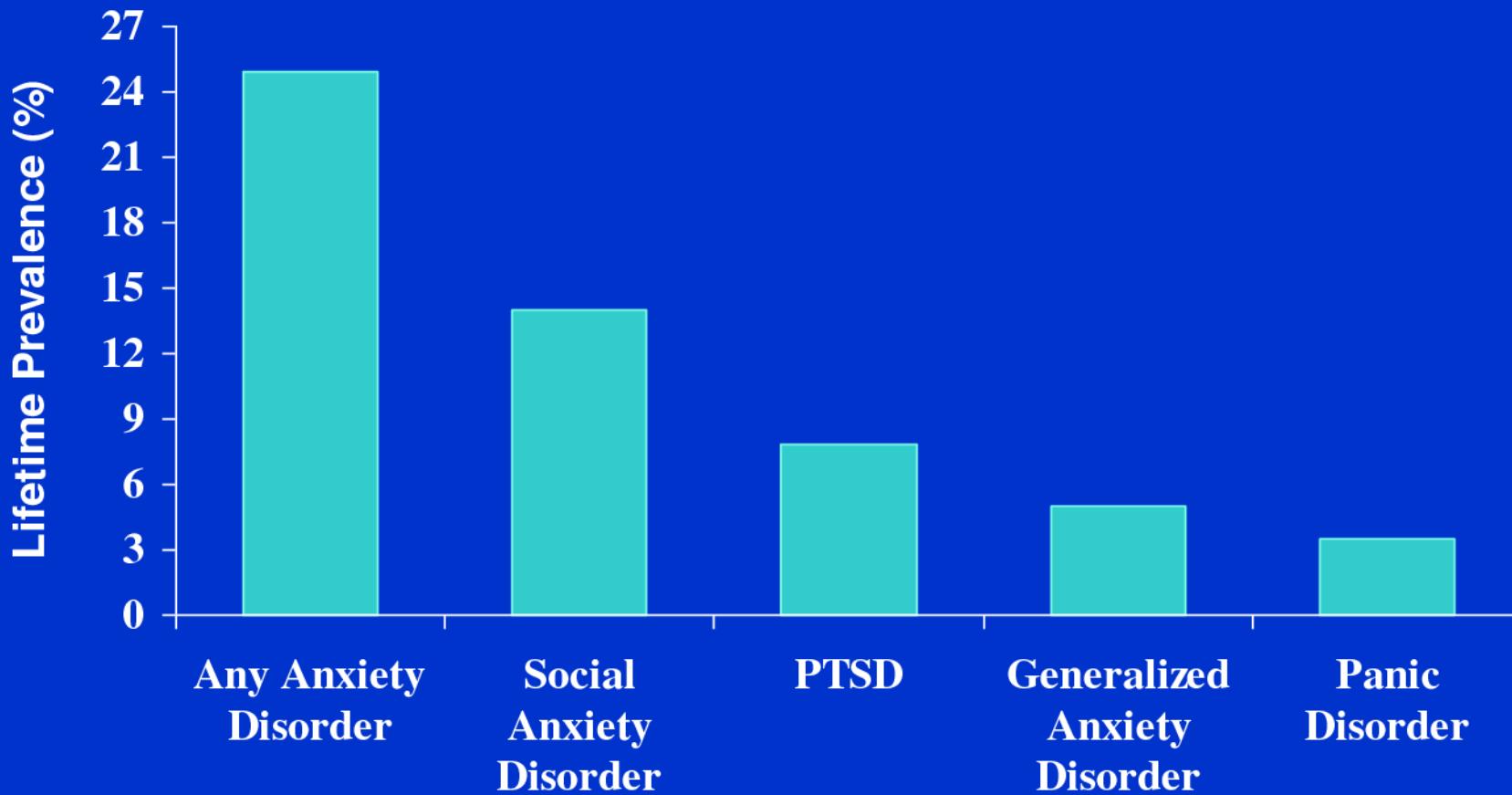


Prevalence by mental and substance use disorder, World, 2017

Share of the total population with a given mental health or substance use disorder. Figures attempt to provide a true estimate (going beyond reported diagnosis) of disorder prevalence based on medical, epidemiological data, surveys and meta-regression modelling.



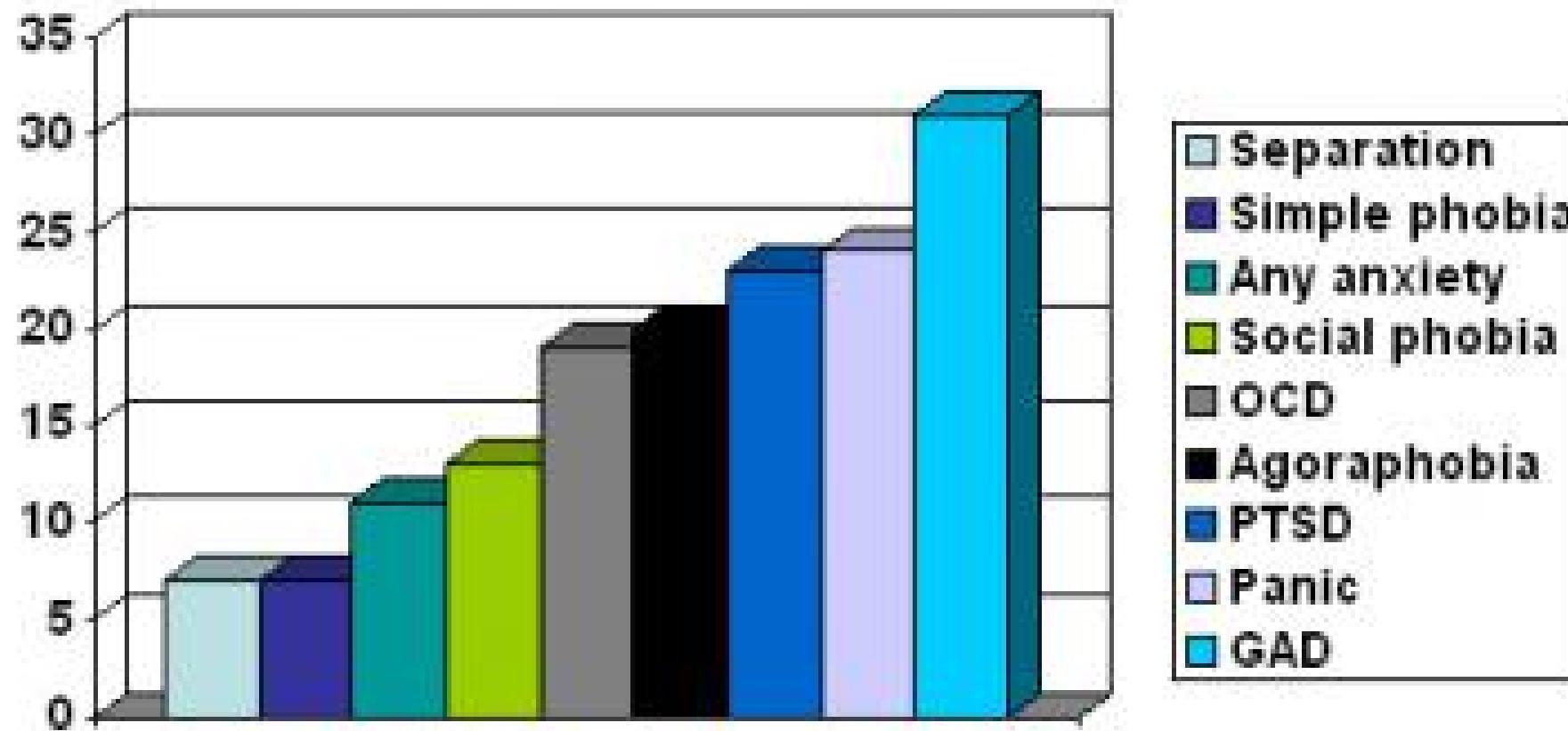
Prevalence of Anxiety Disorders



Kessler et al. *Arch Gen Psychiatry*. 1995;52:1048.

Kessler et al. *Arch Gen Psychiatry*. 1994;51:8.

Mean Age of Onset



Main point

- Most useless anxiety is from normal control systems
- Knowing why helps clinicians and patients

Two Assumptions

		Control System	
		Intact	Defective
Emotion	Intact	Useful	Useless or harmful
	Defective	Harmless	Harmful

- Useless or harmful negative emotions usually arise from defective control systems.
- Emotions arising from normal mechanisms should usually be useful.
- Lots of useless anxiety comes from intact mechanisms

Both false

Anxiety seems abnormal: The clinician's illusion

- Pain, cough, and anxiety seem abnormal because they are costly, painful, and aroused in bad situations
- But they are useful responses, and their unpleasantness motivates escape and avoidance

The Knowledge Gap Illustrated

(From the 2008 PNAS paper by Saksida et al.)

Rats exposed to

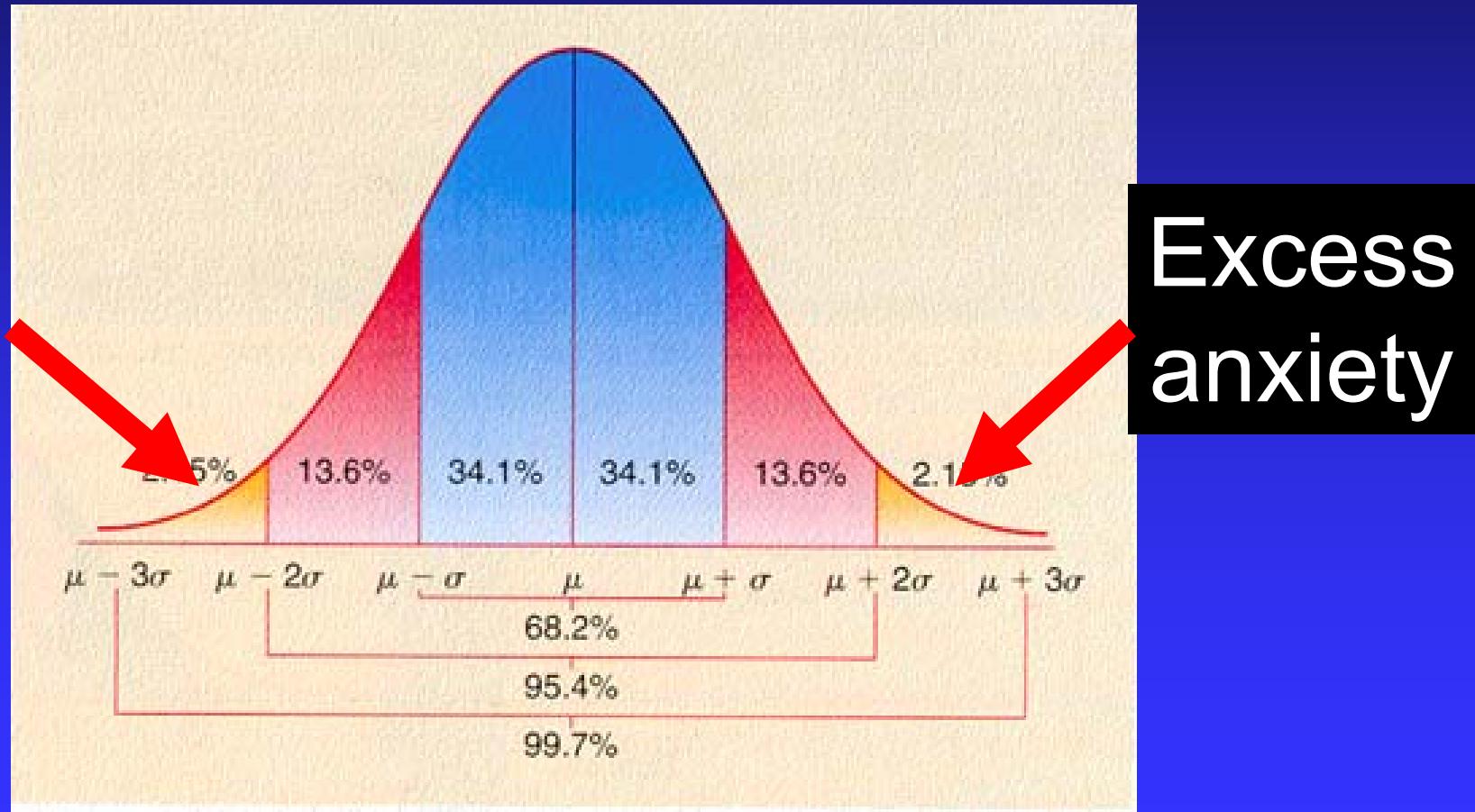
“Our results suggest that exposure to a mixture of androstenedione and androstanediol, which are the major metabolites of androgenic steroid precursors, can induce anxiety-like behavior in rats. This effect is not dependent on androgen receptor activation, as it is observed in male rats that have been castrated or treated with anti-androgens.”



exposure to a mixture of androstenedione and androstanediol, which are the major metabolites of androgenic steroid precursors, can induce anxiety-like behavior in rats. This effect is not dependent on androgen receptor activation, as it is observed in male rats that have been castrated or treated with anti-androgens.”

A neglected anxiety disorder

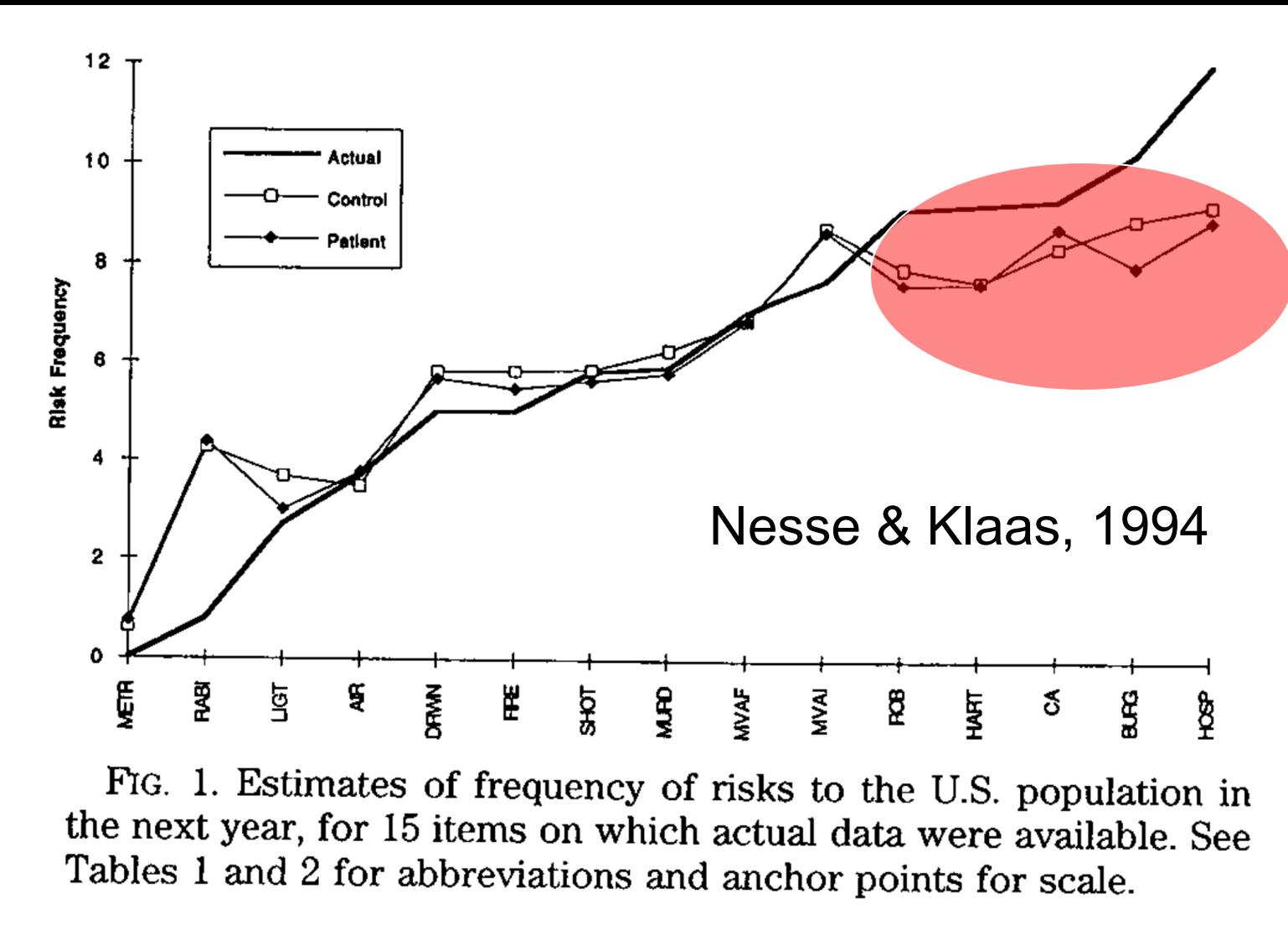
Hypophobia
Thanks to
Isaac Marks



Maybe most anxiety is useful

Are anxiety patients just more realistic?

Anxiety patients do not overestimate risk



Most people underestimate common dangers

Does anxiety reduce mortality?

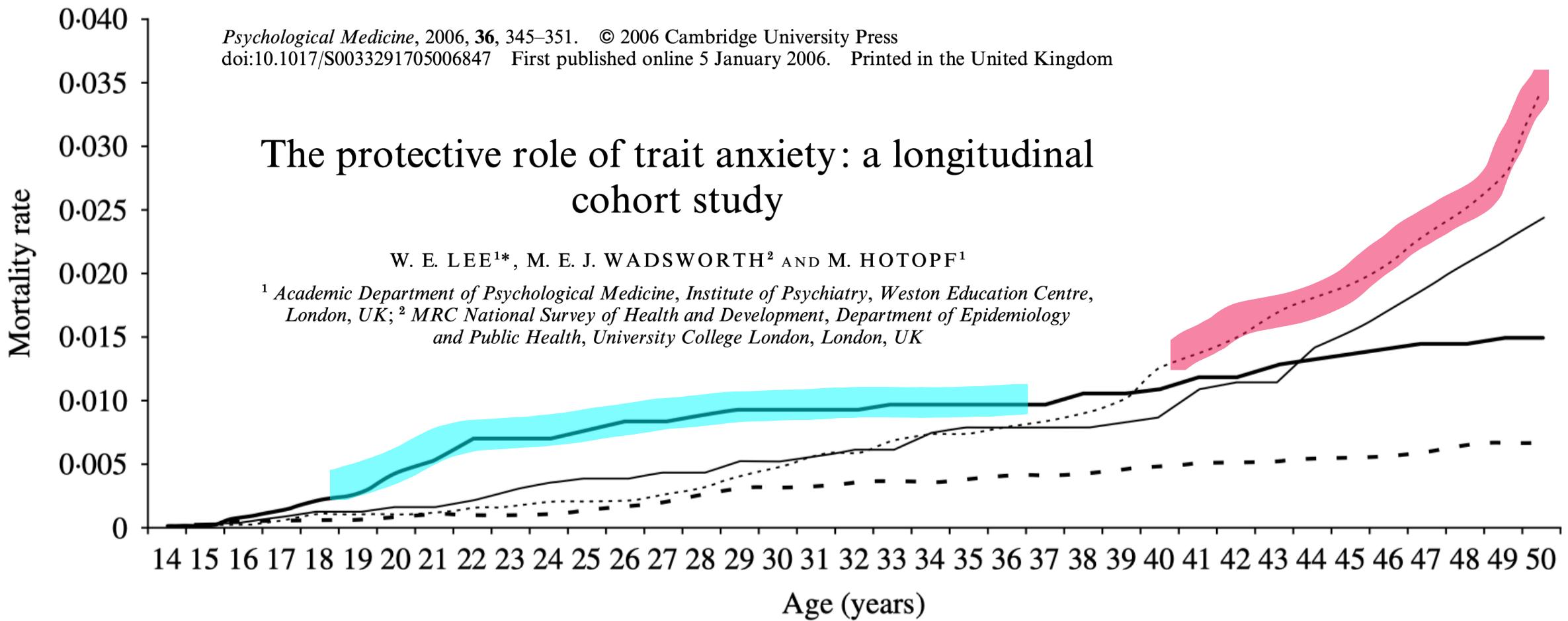
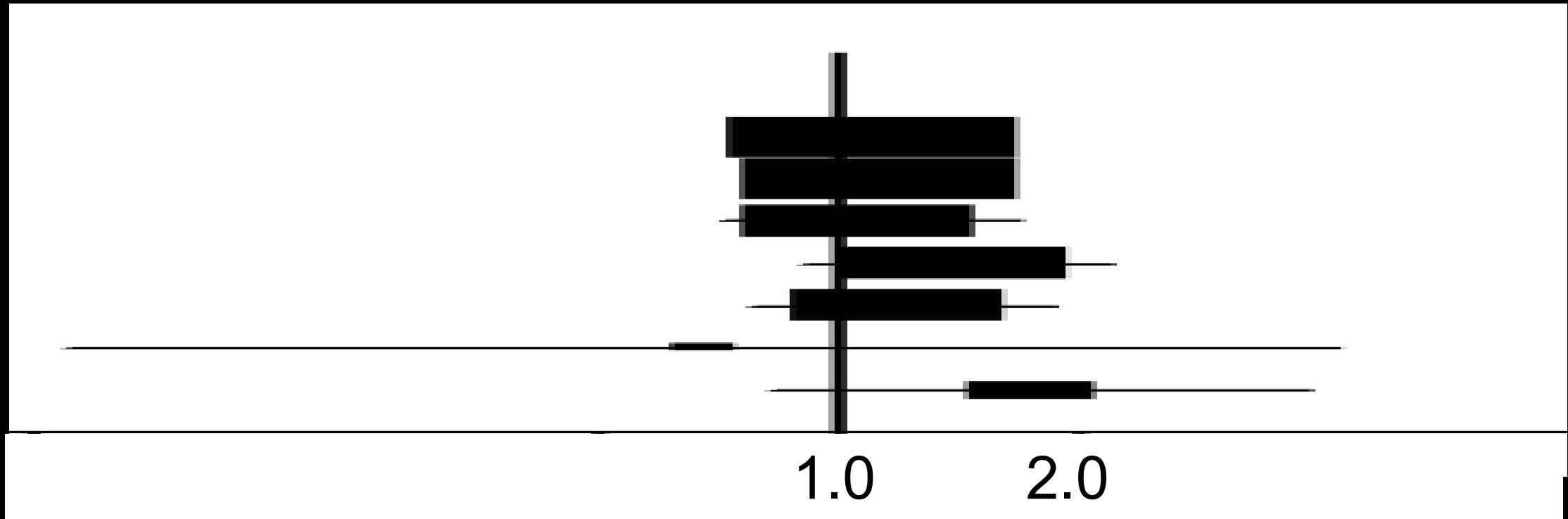


FIG. 1. Accidental and other mortality rates *versus* trait anxiety at 13 years. —, Low anxiety group (accidental deaths); —, low anxiety group (non-accidental deaths); ---, high anxiety group (accidental deaths); high anxiety group (non-accidental deaths).

But anxiety does not decrease mortality
William Lee, dissertation



What causes anxiety disorders?

- Learning?
- Psychodynamics?
- Genes?
- Brain abnormalities?
- Bad life situations?

ALL
SO

CONFUSING!

Different causes for
different people

$B = \text{Person} \times \text{Situation}$

Kurt Lewin

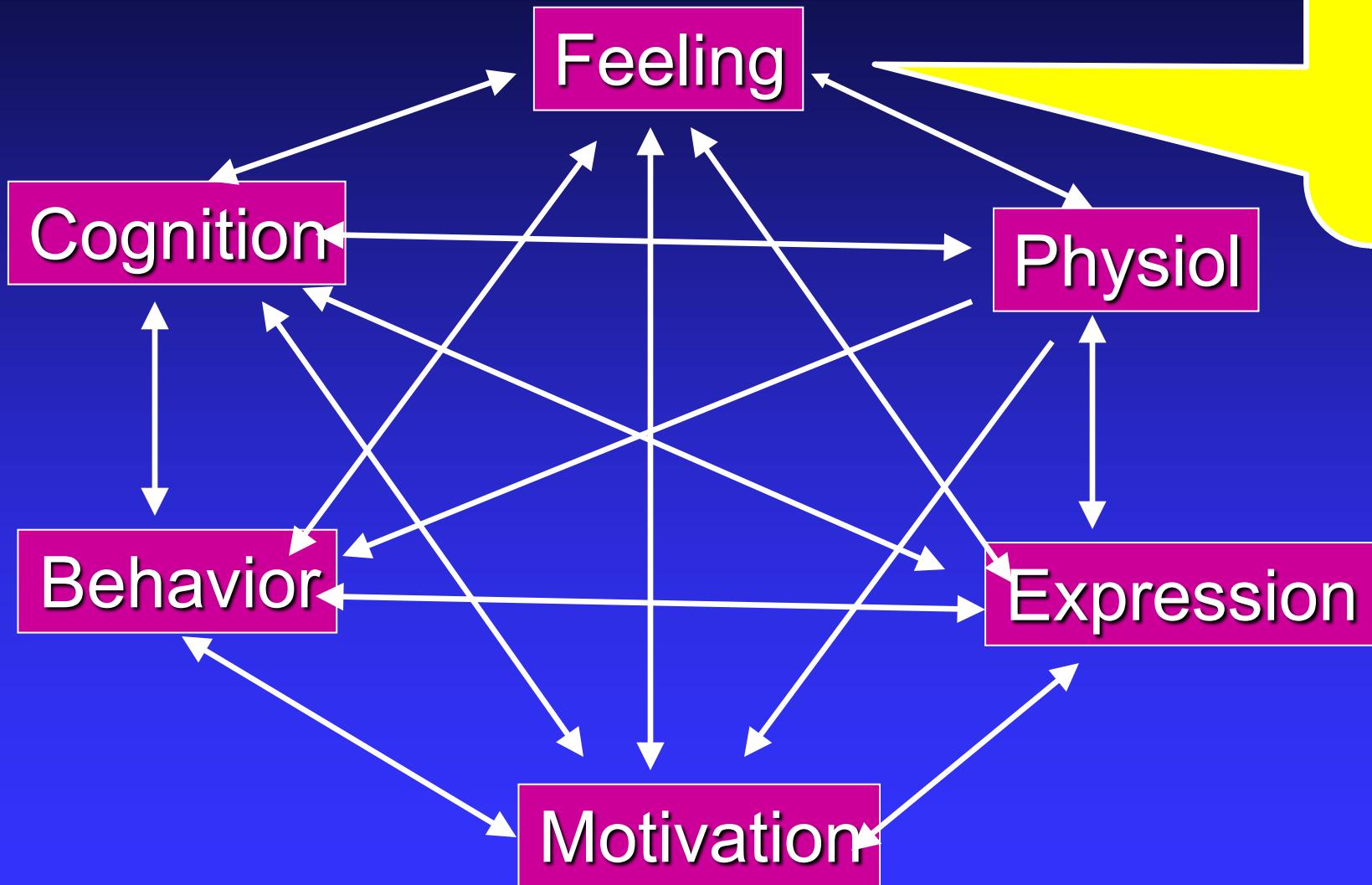
Fundamentals first

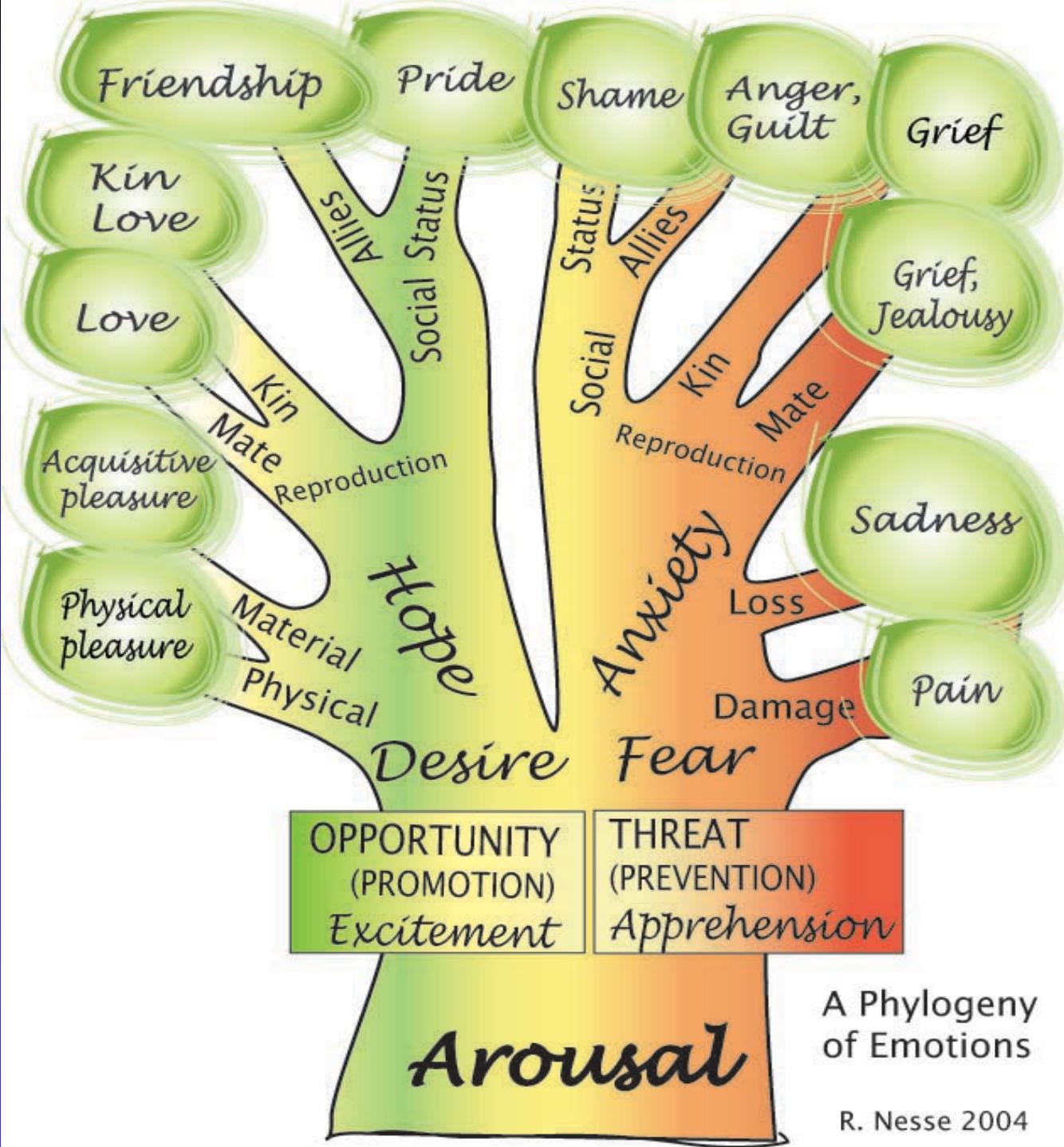
- Why do emotions exist at all?
- How are they regulated?

- Disorders make more sense if you know the normal function
- Just like in the rest of medicine

Aspects of Emotions

Subjective
feeling
not
required





Emotions evolved to cope with SITUATIONS

Overlapping fuzzy boundaries

Negative emotions

- Useful defenses
- Like, sweating, pain, fever,
- Regulated by control systems
that detect the **SITUATION**

Negative emotions are useful in SITUATIONS of risk or loss

- Risk → Anxiety
- Loss → Sadness
- Wasted effort → Low mood
- Guilt, anger, grief, jealousy, etc.

Situations that shaped anxiety subtypes

- Attack → Panic and agoraphobia
- Dangerous animals → Phobias
- Lost → Separation fear
- Falling → Height phobia
- Exclusion → Social phobia
- Near death → PTSD



“Fear and Fitness”, Marks and Nesse, 1994

Emotions for the Situations that Arise in Pursuing Goals

	Before	After success	After failure
Opportunity (Promotion)	Hope (desire)	Happiness (pleasure)	Disappointment
Threat (Prevention)	Anxiety (fear)	Relief	Sadness (pain)

What goals?

- Get resources
- Avoid losing resources

What resources?

Social support

Occupation

Children/Family

Income

Abilities/Appearance

Love

Subtypes of anxiety for different resources

Social support Social anxiety

Occupation Social role threat

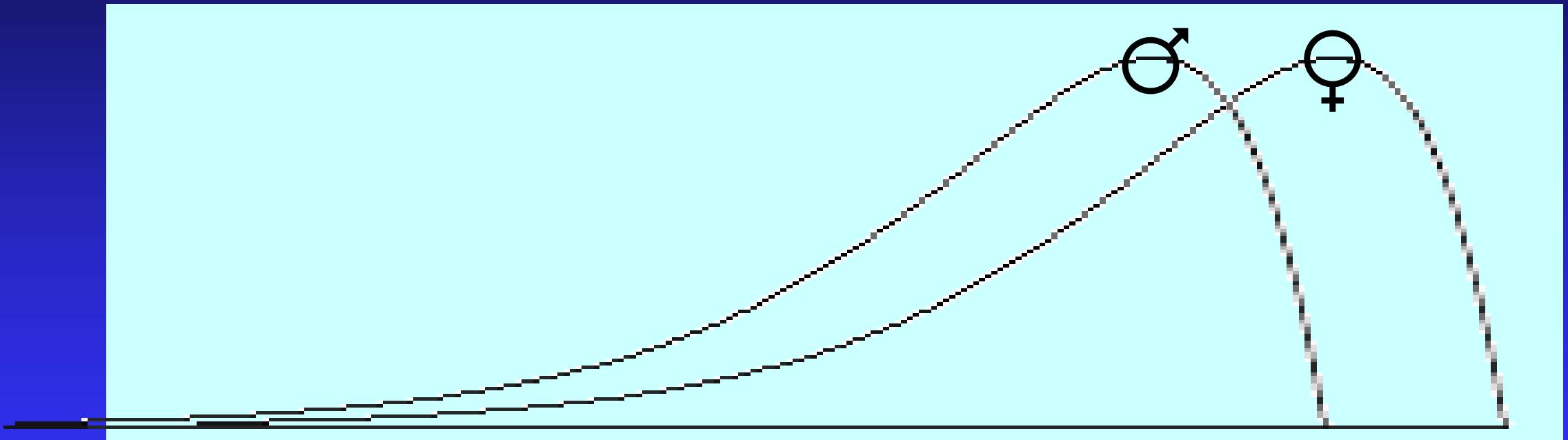
Children/Family Fears for loved ones

Income Fear of material loss

Abilities/Appearance → Personal loss

Love Jealousy

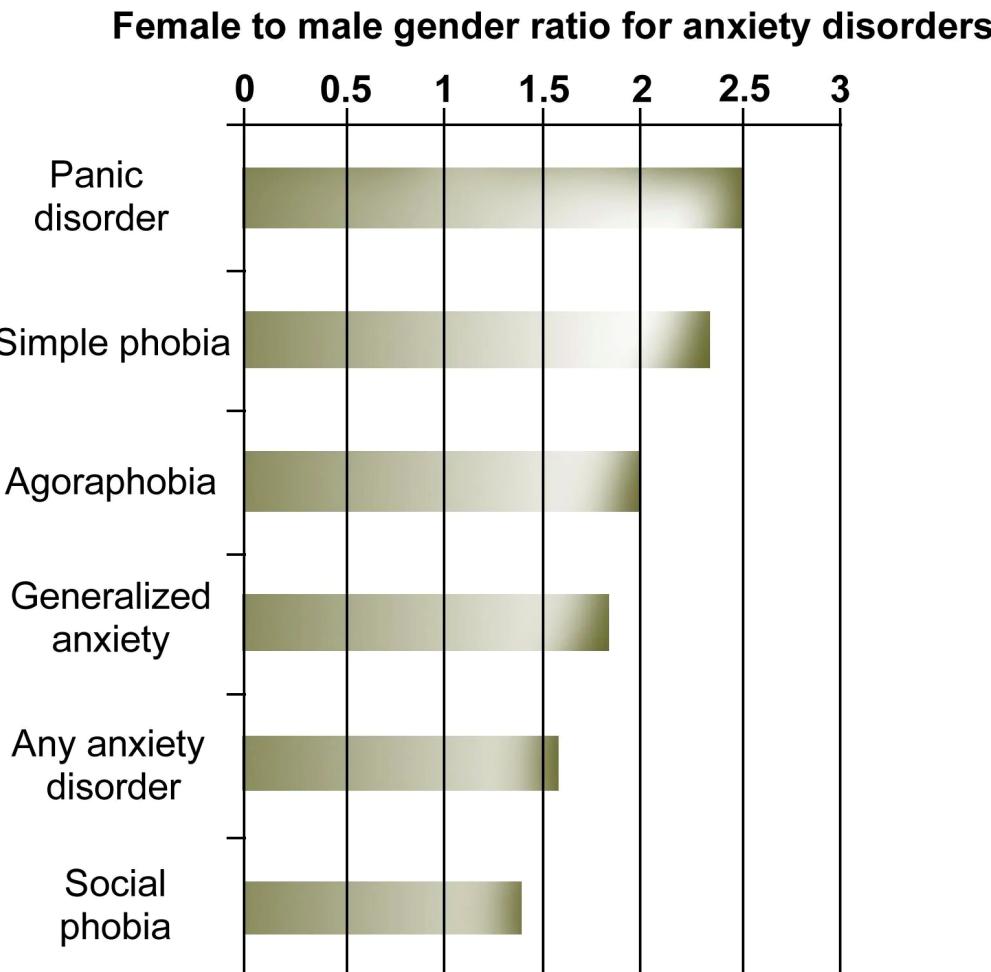
Why so much anxiety in so many people?



Hypophobia

Excess anxiety

Why don't men have enough anxiety?



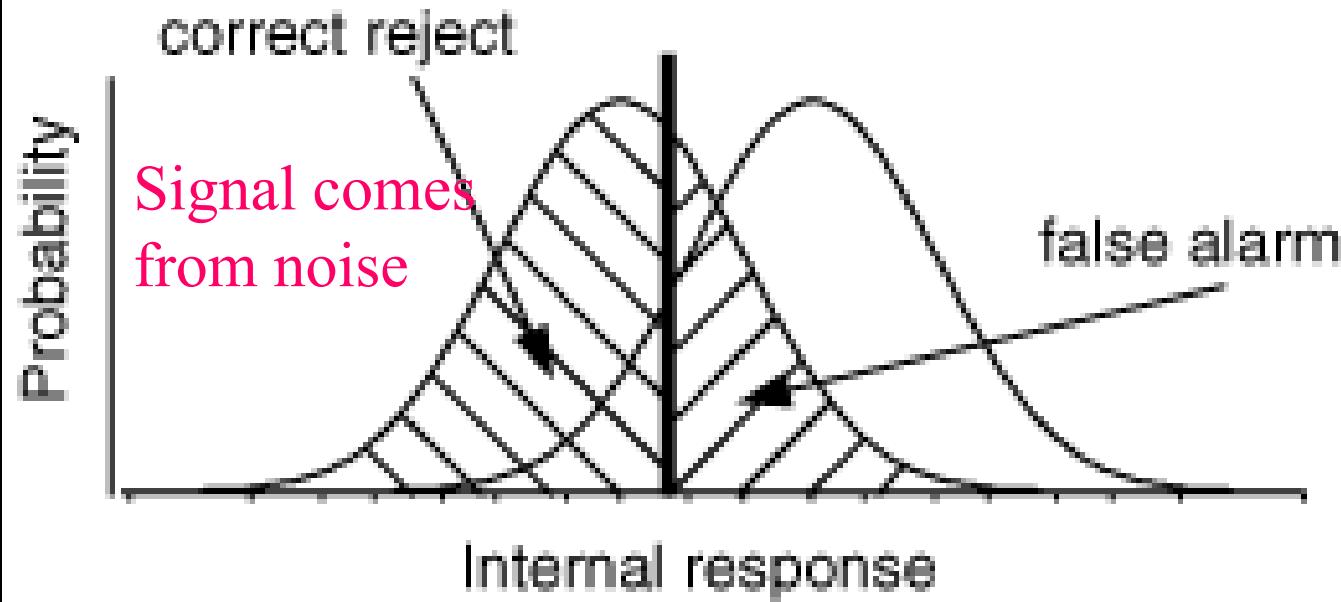
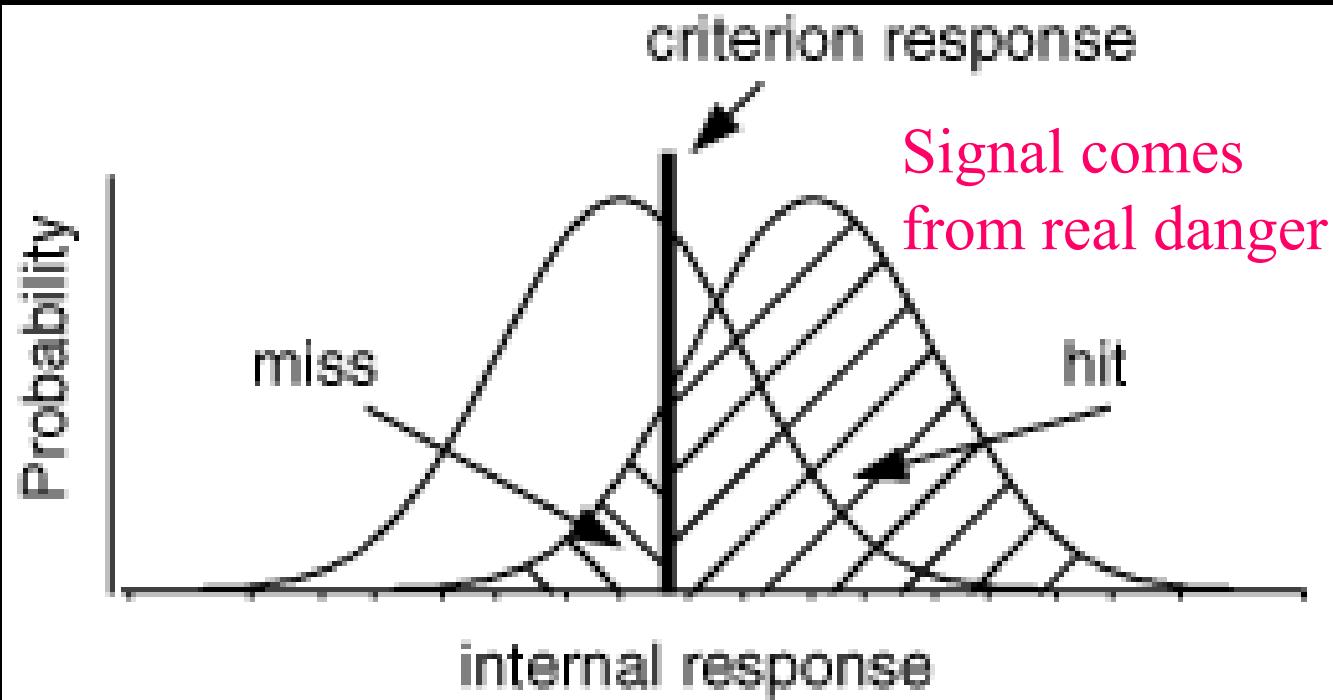
Useless anxiety from intact control systems

1. Useless instances, but net benefits over the long run
2. Useless for the individual, but useful for genes
3. Useless now, but useful in ancestral environments
4. Useless anxiety from an adaptive sensitization
5. Useless anxiety from happenstance unlucky events

1. The Smoke Detector Principle

When the presence of a threat is uncertain,
cheap false alarms are worth it to prevent catastrophe



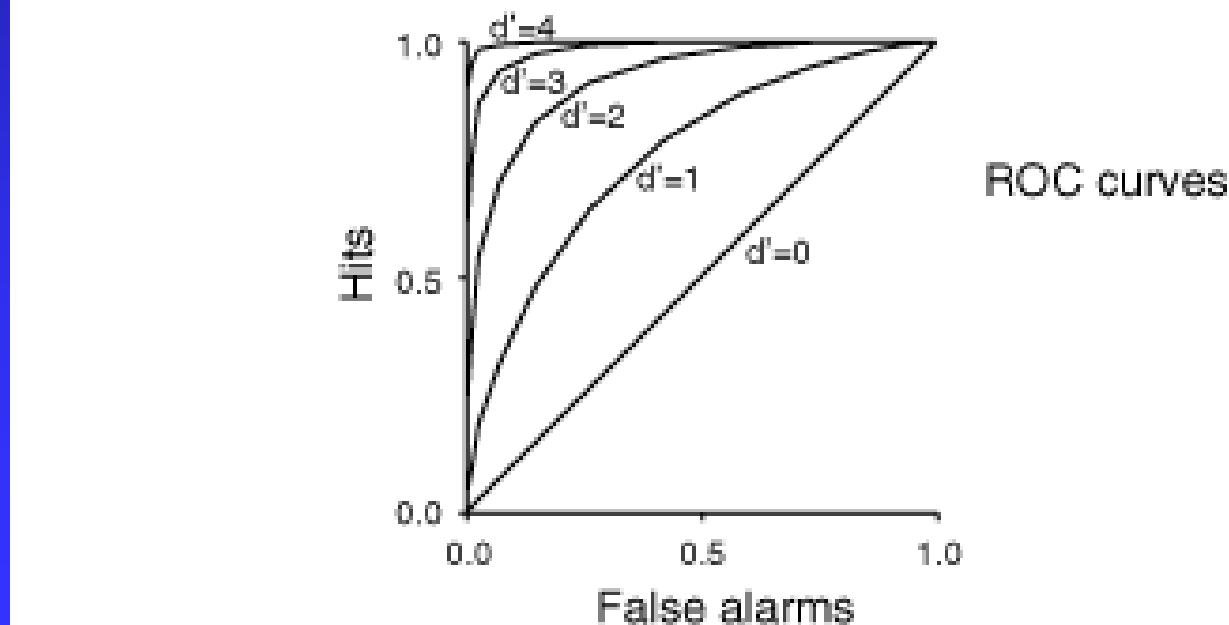
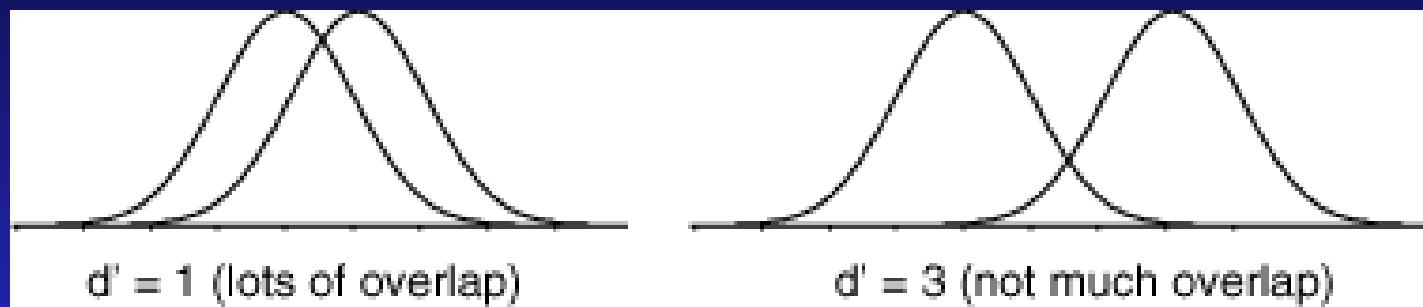


Optimal Response Threshold

$$\frac{p(x|s)}{p(x|n)} > \frac{p(n)}{p(s)} \times \frac{v(\text{rej.}) + v(\text{f.a.})}{v(\text{hit}) + v(\text{miss})}$$

ROC curves

More info → More hits per false alarm



Situation: Possible Lion



- Cost if no defense if it is a lion = 10,000
- Cost of defense = 100
- Panic worth it whenever $p_{\text{lion}} > 1\%$

- So 99/100 panics will be normal false alarms

PTSD

- Terrible symptoms that are worth it?
- Or a mechanism that just is not very good?
- Or a useful system pushed beyond its limits?

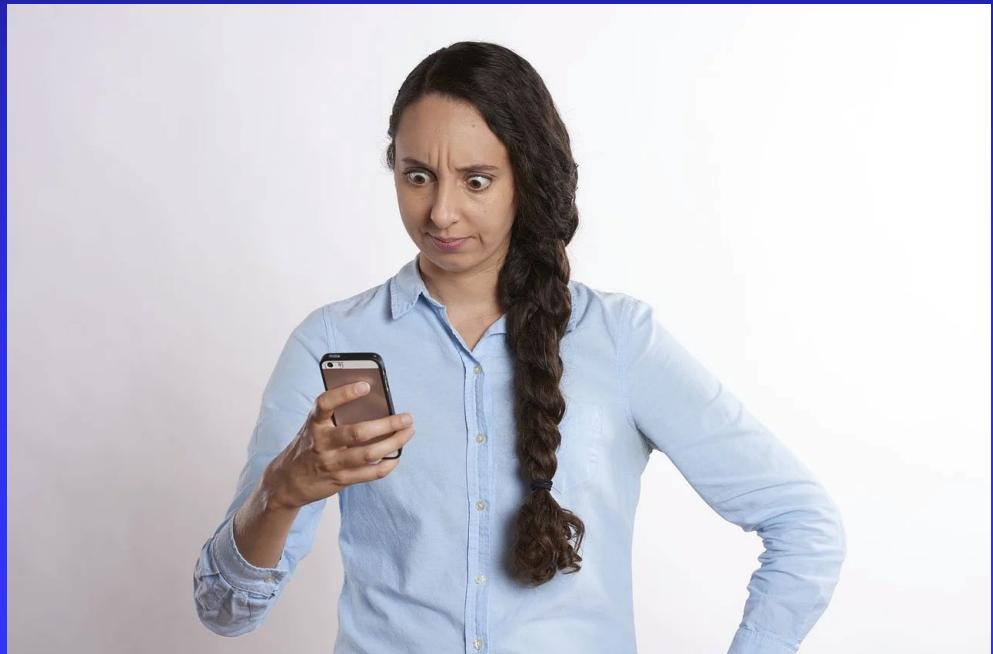
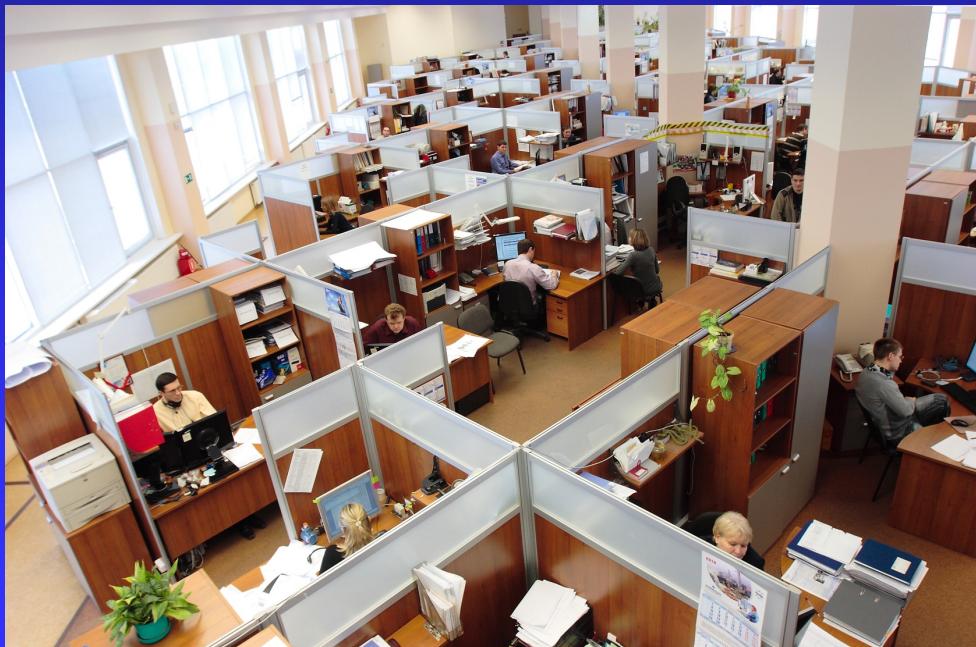
Clinical utility

- Knowing false alarms are normal reframes the problem
- Helps avoid patients feeling defective
- Safe to block anxiety and depression
(Except for that 1 time in 1000!)



2. Mismatch

Novel situations generate useless anxiety





Thanks to
David Hirshleifer

Modern environments

- Wage economy and specialized social roles
- Lack of local family
- Inequality and media → envy
- Rigid hierarchies → trapped
- Maturity delayed a decade
- Need non-WIERD data on anxiety

But mismatch also causes hypophobia

- Drugs
- Guns
- Fast cars
- Fast food
- Social media

3. Good for genes at cost to individuals

- Fearing loss of belonging
- Fearing loss of status
- Fearing loss of a lover
- Fearing loss of children

Sexual anxiety

- Organism timing benefits genes at the cost satisfaction
- Positive feedback maintains erectile dysfunction

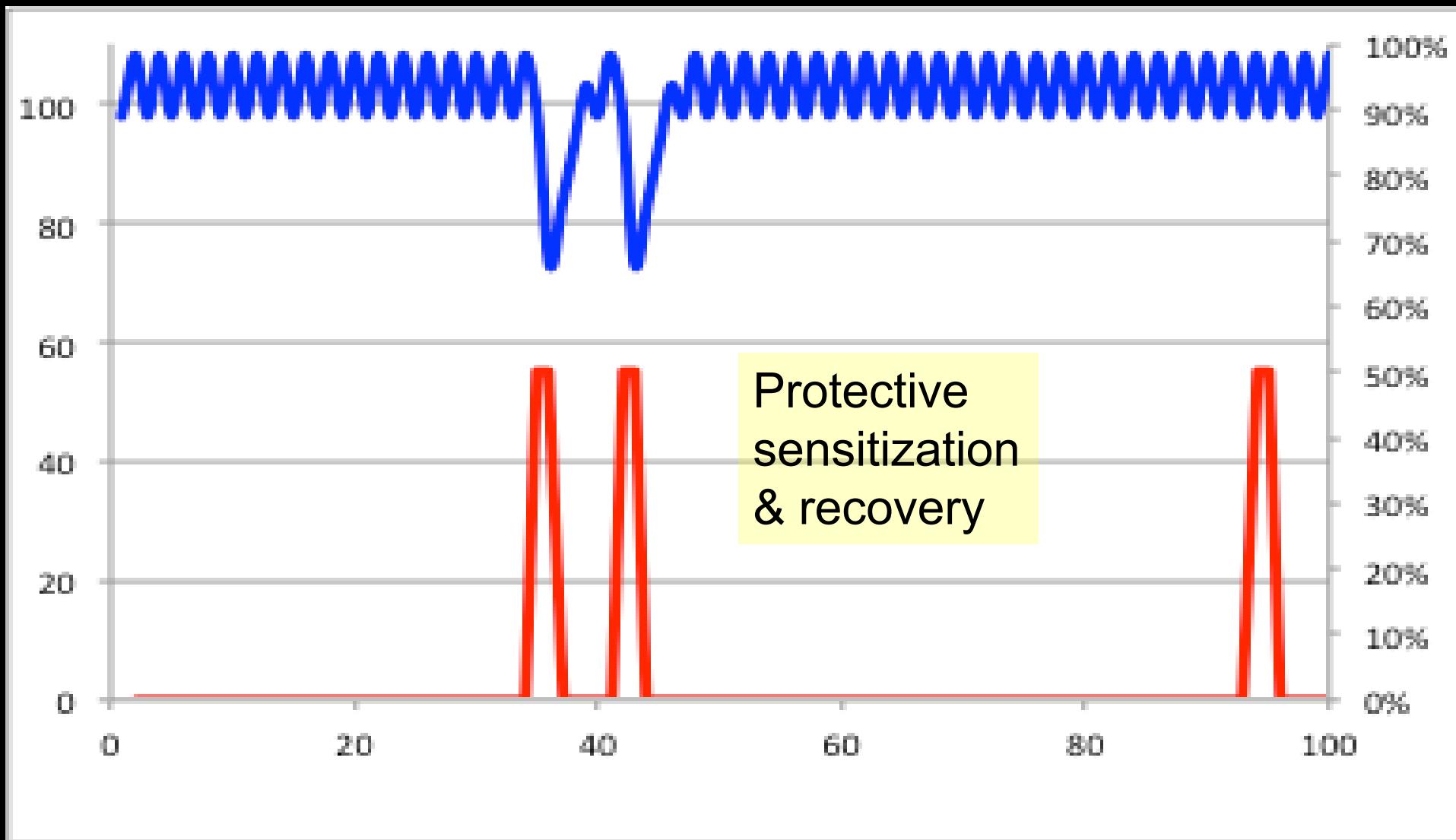
4. Sensitization Gone Wrong

- Repeated arousal indicates more protection needed so response threshold decreases
- Adaptive sensitization → positive feedback
 - ◆ Chronic pain
 - ◆ Anxiety
 - ◆ Kindling for depression

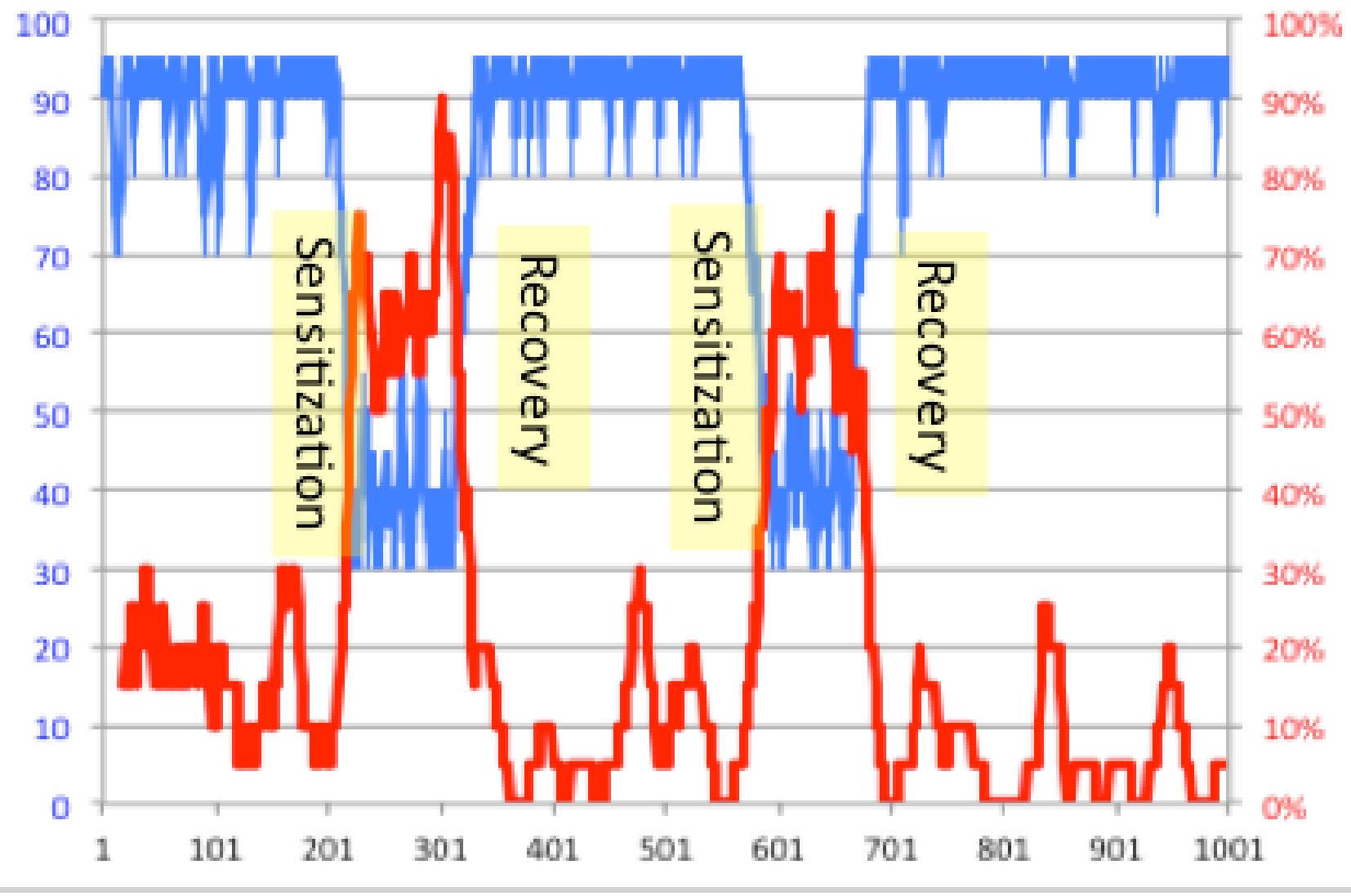
Defense Regulation Model

- Danger (D) is a random # 1-100 for 1000 iterations.
- If Threshold $T_i < D$ then Response & $T_{i+1} = T_i - TDecr$.
- If $T_i > D$, then No response, & $T_{i+1} = T_i + Tlncr$
- T Initial and T Minimum specified
- If $T > T$ Initial, or $< T$ Minimum, T is reset to the value in the previous iteration in order to limit the range.

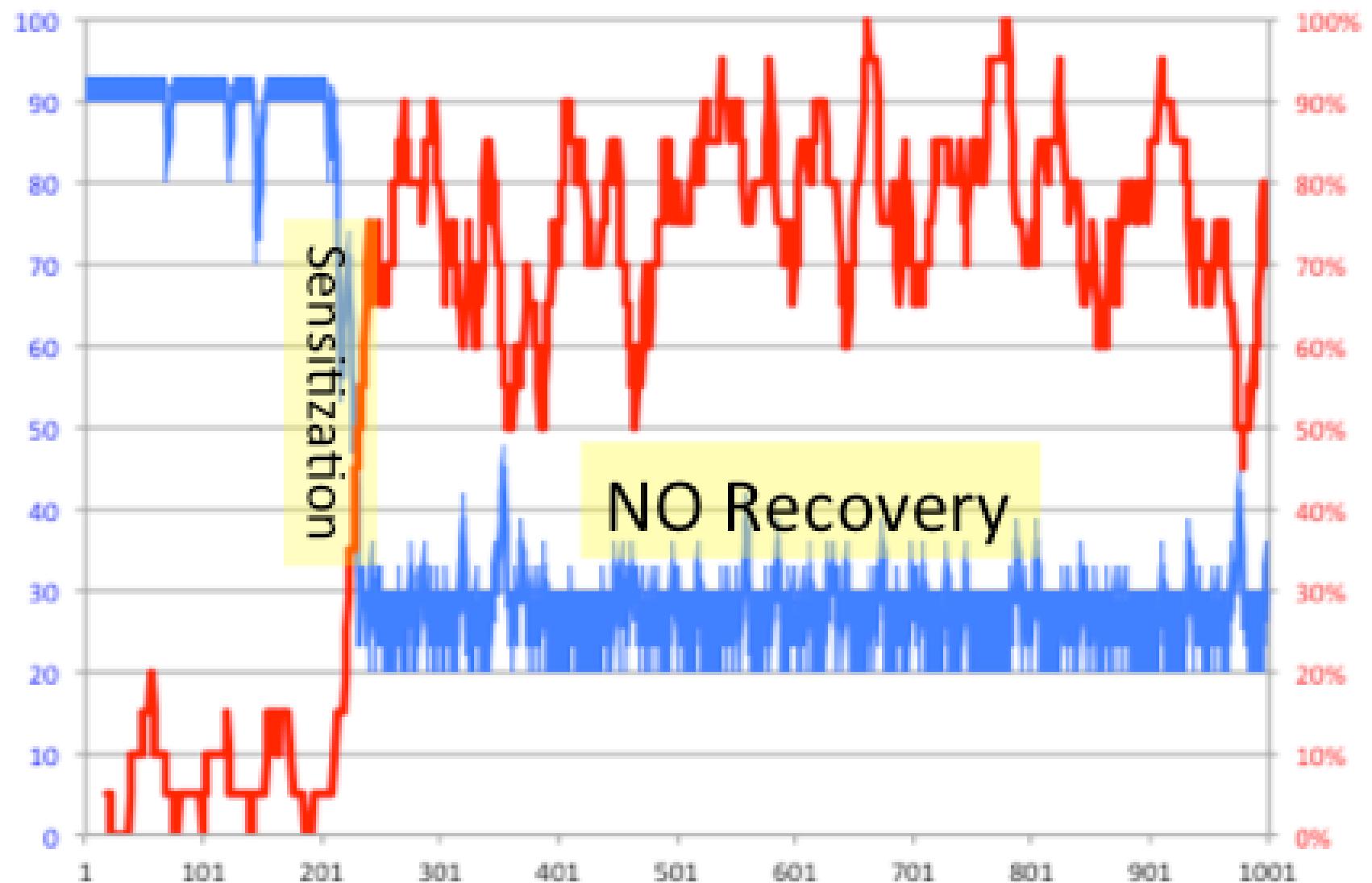
Threshold Response%



T initial=98 T minimum=30 TIncr=10 TDecr=-25



T=90 M=40 Tlincr=5 TDecr=-10
Cycles of excess response



T=90 M=30 TIncr=3 TDecr=-10
Chronic excess response

Clinical utility

- Patient's worry antidepressants are just “covering over the real problem”
- But blocking anxiety desensitizes the system

5. Happenstance Unlucky Sequences

270

ORIGINAL
RESEARCH
ARTICLE

Evolution, Medicine, and Public Health [2016] pp. 270–285
doi:10.1093/emph/eow024



EVOLUTION,
MEDICINE, &
PUBLIC HEALTH

Adaptive behavior can produce maladaptive anxiety due to individual differences in experience

Frazer Meacham and Carl T. Bergstrom

Department of Biology, University of Washington, Box 351800, Seattle, WA 98195, USA
*Corresponding author. Department of Biology, University of Washington, Box 351800, Seattle, WA 98195, USA. E-mail:
fmeacham@uw.edu
Received 31 December 2015; revised version accepted 15 June 2016

Relative importance of routes to useless anxiety

1. Smoke detector principle—Ubiquitous
2. Modern environments—Common
3. Good for our genes but bad for us—Common
4. Sensitization gone awry—Occasional
5. Happenstance sequences—Occasional

Social anxiety: a separate talk

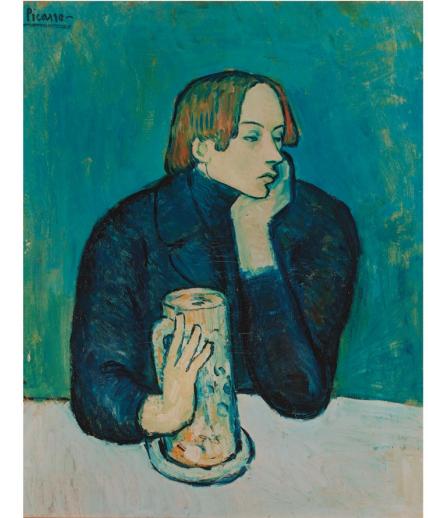
Come to the free online World Psychiatric Association Symposium on Evolutionary Psychiatry in May 2022

“How understanding why relationships exist makes us better therapists.”

Conclusion

Intact regulation mechanisms
often generate useless anxiety.

But proper studies are needed



Good Reasons for Bad Feelings

Insights from the Frontier of Evolutionary Psychiatry

RANDOLPH NESSE

allen lane

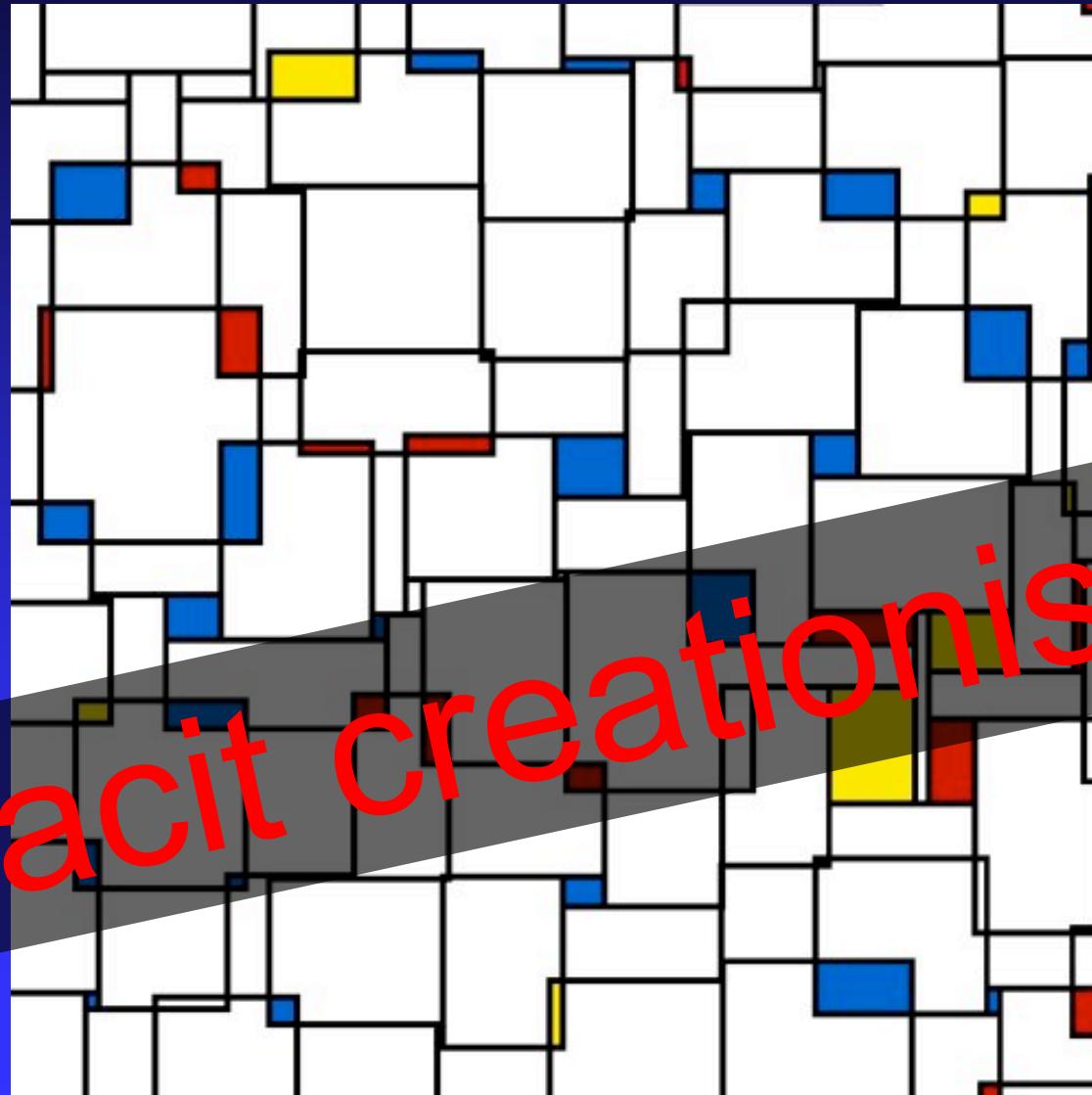
GoodReasons.info
Nesse.us

Tacit creationism

- Humans want clear categories and simple causes.
- We view minds as if they were designed, with discrete parts, each with a function and simple connections.
- But mind is a product of millions of years of tinkering, with overlapping structures with multiple functions.

Tacit creationist view	Evolutionary view
Emotions are discrete entities	Emotions are overlapping suites of responses that evolved from precursor emotions that gave selective advantages in certain situations.
Each emotion has a specific function	Each emotion serves multiple functions and specific functions are served by multiple emotions
Negative emotions are harmful	Negative emotions are useful
The components of an emotion are generally be expressed concordantly	Different aspects may be expressed differently depending on the situation
Mechanisms that mediate emotions should be the same for different individuals	Variations in genes and environment create substantial individual variation
Emotions benefit individuals	Emotions maximize gene transmission, often at a cost to individual health and welfare

We expect bodies to be like machines



With distinct parts
Each with a function
And sensible connections

What selection shaped

