Stress and Coping
–
An Economic Approach

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April 2016

1. Introduction

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    - … and not enough resources

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- Stress ...
  - ... has been introduced in 1936 by Selye (borrowing from physics)
  - ... is a disturbingly prominent topic
    - in academic (psychological) research
    - "Stressbericht 2012" by Bundesanstalt für Arbeitsschutz und Arbeitsmedizin
    - lot of talk about burnout syndrome
    - the rise of psychological diseases in overall diseases and more ...

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- Economic world hosts a large group of stress-inducers
    - (Biased) Technological change
    - Globalisation
    - Unemployment
    - Financial and Euro crisis
    - ... are all "good" sources of stress

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    - ... are all "good" sources of stress
- A conceptual framework is missing for economic model building
- We need to bring more psychology into economics (Rabin, 2013)

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  - Stressors: Anything that puts demand on resources of an individual
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    for well-being of a person
  - Stress: Subjective feeling resulting from current and past appraisals of
    stressors
  - Coping: Behaviour aimed at reducing stress

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      stressors
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- Apply this framework to understand optimal reaction to stress

    - Which coping strategies are chosen, i.e. which reactions to stress can
      be observed?
    - How does stress translate into more or less aggressive coping patterns
      (smooth stress regulation vs. "emotional outbursts")?
    - Beyond stressors and appraisal, understand the effect of (theory
      consistent) personality on coping

1. Introduction

How important are outbursts quantitatively?

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- Family disputes
  - USA: 75% of couples report verbal aggression (Stets, 1990, USA, random digit dialing)
  - Germany (GSOEP with weighting factors): 44% (women) to 52% (men) report "having arguments or conflicts"
  - conflict is with partner (45%), parents (14%), children (13%), siblings (7%), hardly with colleagues or outside family
- Communication and bullying at work
  - Pressure for productivity ... leads to an increase in aggressive workplace behaviour (Baron and Neuman, 1996)
  - Is verbal aggression the precursor of more violent aggression at workplace? (Andersson and Pearson, 1999)
  - Verbal aggression is common (experienced by $1/3$ of workers, Bjorkqvist et al, 1994)
- Domestic violence
  - USA: 10% of couples report physical aggression (Stets, 1990, USA)
  - much higher numbers for (biased) samples among students

1. Introduction

Related literature

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Related literature

- Economic literature
    - Theories of emotions
    - Optimal stopping problems
    - Stress in empirical work
    - The importance of communication in firms

- Psychological literature
    - Stress and coping
    - Appraisal theory
    - Stress and emotion regulation

- More to come during the talk ...

1. Introduction

Structure of the talk

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2. Stress, personality and coping (the model)
3. Optimal coping

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Structure of the talk

2. Stress, personality and coping

2.1 The origins of stress

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- .... occur rarely (death of spouse, new job, move house ...)

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    - Rare events imply positive or negative surprises $g(t)$
    - Random variable $h(t)$ and subjective expectation μ yield surprise

$$g(t) = h(t) - \mu$$

(Bell, 1985, Loomes and Sugden, 1986)

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- ... are of a daily nature (emails, traffic jams, smile of a nice person ...)
    - Flow of demand $p(t)$ paired with
    - abilities $a(t)$ of individual yields
    - intensity $p(t)/a(t)$ of stressor

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2.1 The origins of stress

The appraisal process

2. Stress, personality and coping

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- "... an appraisal is an evaluation of a situation in terms of its relevance for oneself, specifically one's goals or well-being (e.g., Lazarus 1968)"

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- "... appraisal as a temporal and causal antecedent to emotion (Scherer 1993b; 1999; Roseman and Smith 2001)" (all from Lewis, 2005)

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Modelling appraisal

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Modelling appraisal

- a known function $f\left(\frac{p}{a}, .\right)$ for daily hassles
- a known function $G\left(g\left(t\right), .\right)$ for surprises
- both functions are specific to individual (personality)

2. Stress, personality and coping

2.2 The impact on the individual

How do emotional tension and well-being interact?

2. Stress, personality and coping

2.2 The impact on the individual

How do emotional tension and well-being interact?

- Direct channel affects well-being (utility) directly (Stress symptoms like headache, dizziness, sweating, sleeplessness ...)
- Indirect channel affects labour income of the individual via an (person-specific) appraisal process and "cognitive load"
- Both channels affect instantaneous utility $u\left(c\left(t\right), W\left(t\right)\right)$

The indirect channel of cognitive load

2. Stress, personality and coping

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The indirect channel of cognitive load

- Stress is the result of appraisal of stressors, which can be automatic and very fast

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- Reflections on how to react to stressors is resource consuming ("high-level appraisals", e.g. Kalisch et al., 2006)

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- Both processes lead to "cognitive load" (Sweller, 1988, Eysenck and Calvo, 1992, Hoffman, von Helversen and Rieskamp, 2013)
- Cognitive load stands for all the thoughts and worries, constructive or not, related to stressors and strategies on how to best react to stressors

2. Stress, personality and coping

Modelling cognitive load by a mental resource constraint

2. Stress, personality and coping

2.2 The impact on the individual

Modelling cognitive load by a mental resource constraint

- An individual is endowed with a certain amount of working memory M (see Smith and Kosslyn, 2007, esp. ch. 6 as a starting point)
- Stressors and coping use up resources of the working memory

2. Stress, personality and coping

Modelling cognitive load by a mental resource constraint

- An individual is endowed with a certain amount of working memory M (see Smith and Kosslyn, 2007, esp. ch. 6 as a starting point)
- Stressors and coping use up resources of the working memory
- Memory/ resource constraint in the case of "stress" and "effort"

$$M(W) + M(e) = M$$

- Higher stress levels imply cognitive load and leave less working memory for other purposes
- If effective labour input rises in effort, consumption falls in stress, $c = wl(e)$

2. Stress, personality and coping

2.3 Strategies for coping with tension

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Emotion-focused (not problem-focused) and automatic vs. controlled processes

2. Stress, personality and coping

Emotion-focused (not problem-focused) and automatic vs. controlled
processes

- controlled process
    - talking to a friend, a colleague, a therapist (reduces tension by "sorting
      things out", i.e. by rationalizing events)
    - practice some (endurance) sport
    - take a break and enjoy leisure
    - stress reduces gradually due to depreciation function $\delta\left(m\left(t\right),.\right)$

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- automatic process – emotional outbursts
    - individuals feel overwhelmed by stressors
    - emotional tension rises to much, they "can't help" but explode
    - individuals start crying, shout at others, call other people names
    - relatively short event
    - outburst reduces tension by a fixed amount Δ

$$W(\tau) = W(\tau_-) - \Delta$$

2. Stress, personality and coping

2.4 Formal modelling (functional forms)

2. Stress, personality and coping

- Emotional tension $W(t)$ is a state variable

$$
\begin{aligned}
dW(t) &= \left\{\phi\frac{p}{a}W(t) - \delta_0 W(t) - \delta_1 m(t)\right\} dt \\
&\quad -\chi\left[h(t) - \mu\right] dq(t)
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- Deterministic part displays
  - stressors p and ability a, both are exogenous and fixed
  - ϕ as appraisal parameter of stressor
  - δ_0 as autonomous stress reduction ability
  - coping $m(t)$ that leads to
  - smooth reduction of tension given productivity δ_1

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    - surprises $h(t) - \mu$, exogenous and random in level
    - appraisal of surprises captured by χ
    - Poisson process $q(t)$ with exogenous arrival rate

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- "Outburst technology"

$$W(t) = W(t_-) - \Delta$$
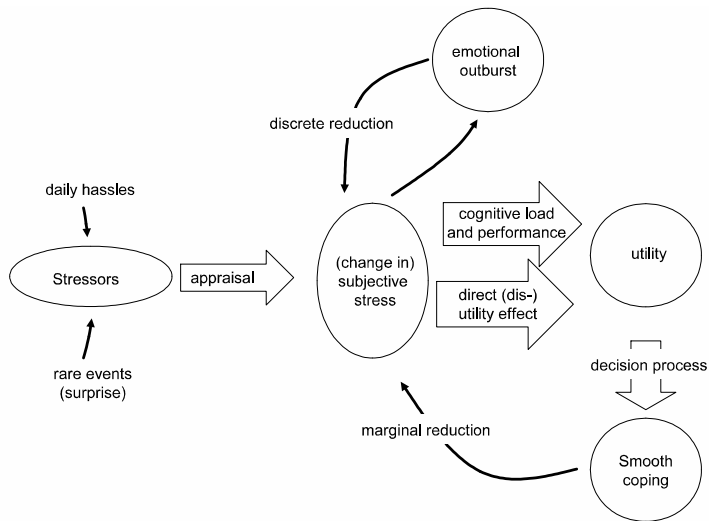
3. Optimal coping

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How does an individual behave?

- Individual chooses smooth coping $m(t)$ ...
- ... taking outbursts into account
- Outbursts occur automatically when tolerance level $\bar{W}$ is hit

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Formal structure

- Optimal stopping problem with exogenous stopping

$$E_t \int_t^\infty e^{-\rho[\tau-t]} \left[u\left(c\left(\tau\right), W\left(\tau\right)\right) - v\left(m\left(\tau\right)\right) \right] d\tau - \Sigma_{i=1}^n e^{-\rho[\tau_i - t]} v^M$$

- Choosing a path $\{m(\tau)\}_t^\infty$ anticipating outbursts at $\bar{W}$ and taking constraints on $W(t)$ into account

Closed form solution (under mild parameter restriction)

- Optimal constant coping level

$$m = \left(\frac{\delta_1}{v_0} \frac{v^M}{\Delta} \frac{1}{1+\zeta} \right)^{1/\zeta}$$

4. Stress and coping patterns

4.1 Dynamics of stress and coping and personality

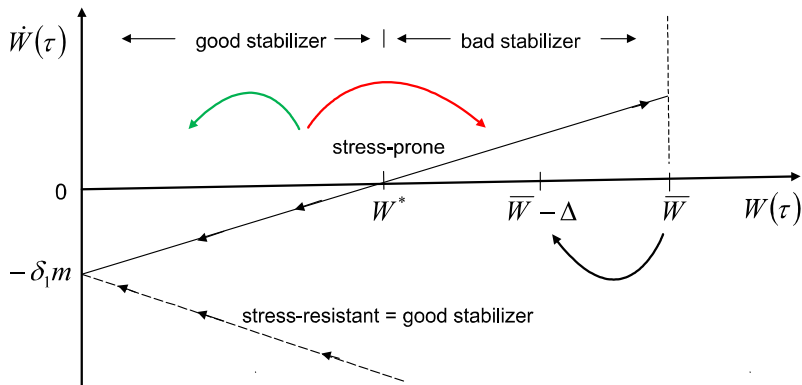# 4. Stress and coping patterns

4.1 Dynamics of stress and coping and personality

- How does stress translate into more or less aggressive coping patterns (in a world *without* surprises)?

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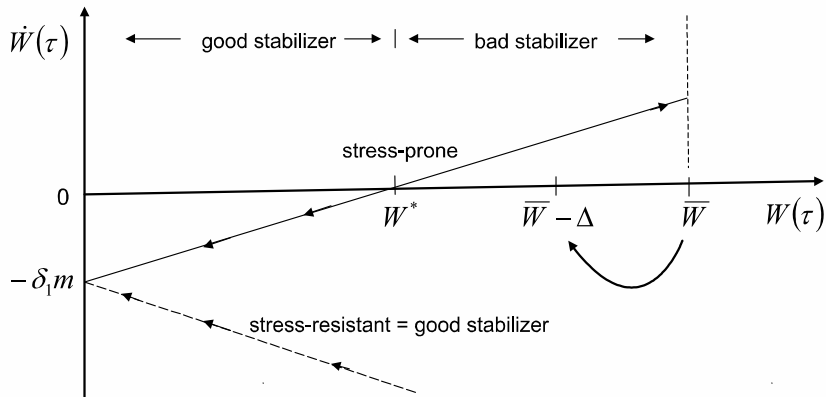
$$\dot{W}(t) = \Phi W(t) - \delta_1 m, \quad \Phi \equiv \phi \frac{p}{a} - \delta_0 \quad \text{"growth rate of stress"}$$

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- How does stress translate into more or less aggressive coping patterns (in a world *with* surprises)?

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4. Stress and coping patterns

4.2 The outburst theorem

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Questions

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- What are the conditions under which "emotional outbursts" occur?
- Based on fundamentals of the model, who will display outbursts under which circumstances?

4. Stress and coping patterns

Questions

- What are the conditions under which "emotional outbursts" occur?
- Based on fundamentals of the model, who will display outbursts under which circumstances?
- Of interest also for psychology: "one intriguing puzzle is why people use one emotion regulation strategy rather than another" (Gross, 2008, p. 505)

4. Stress and coping patterns

Findings
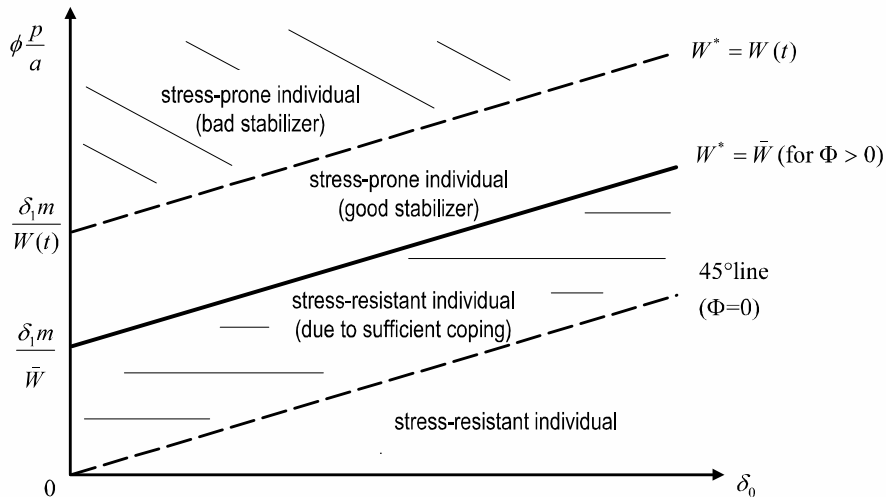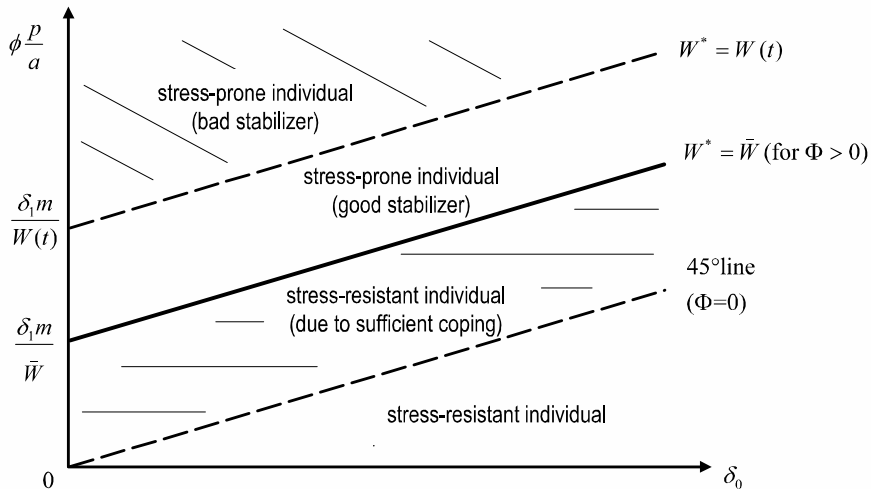
δ_0 – autonomous stress-reduction potential

$\phi p / a$ – appraisal ϕ of intensity p/a of stressors (daily hassles)

$\Phi = \phi p / a - \delta_0$ – growth rate of stress

W^* – threshold level (beyond which stress rises)

$\bar{W}$ – tolerance level (beyond which outbursts)

4. Stress and coping patterns

4.3 Can surprises have permanent effect on stress?

4. Stress and coping patterns

The evolution of stress after negative surprises for a stress-prone and a stress-resistant individual

4. Stress and coping patterns

The evolution of stress after negative surprises for a stress-prone and a stress-resistant individual

Evolution of stress under surprises

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The evolution of stress after negative surprises for a stress-prone and a stress-resistant individual

Evolution of stress under surprises
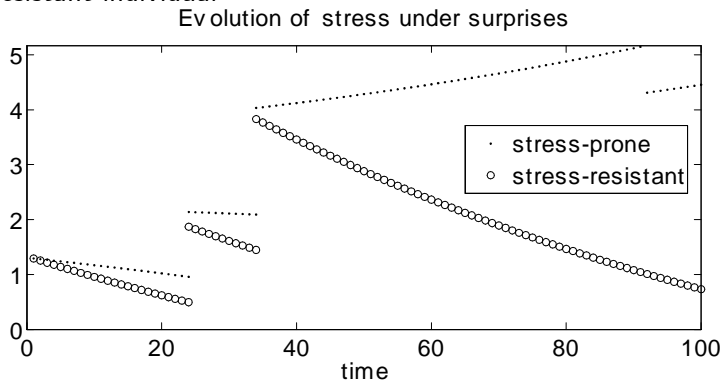
- Identical sequence of shocks pushes
  - stress-prone individual to outburst while
  - stress-resistant individual stays calm (remains a good stabilizer)

4. Stress and coping patterns

Can a single negative event have a permanent effect on an individual?

- No: if we look at stress-resistant individual
- Yes: if we look at stress-prone individual
- Stress-prone individual can remain permanently stressed by a unique negative event

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What about positive events?

- Crucial difference between stress-resistant and stress-prone individual here as well

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Can a single negative event have a permanent effect on an individual?

- No: if we look at stress-resistant individual
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What about positive events?

- Crucial difference between stress-resistant and stress-prone individual here as well
- Stress-prone individual can permanently reduce stress level by a unique positive event

5. How to deal with outbursts?

5.1 The frequency of outbursts

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How often do outbursts occur?

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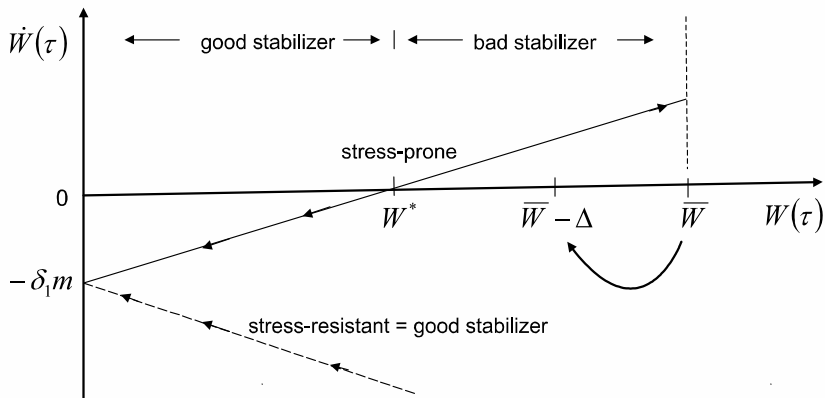
How often do outbursts occur?

- We consider a bad stabilizer (in a world without surprises)

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How often do outbursts occur?

- stress level change exponentially in time τ

$$W(\tau) = (W(t) - W^*) e^{\Phi[\tau - t]} + W^*$$

- growth rate of stress is $\Phi \equiv \phi \frac{p}{a} - \delta_0$ (measures also (in)stability of an individual)

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5.1 The frequency of outbursts

How often do outbursts occur?

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- growth rate of stress is $\Phi \equiv \phi \frac{p}{a} - \delta_0$ (measures also (in)stability of an individual)
- The frequency of outbursts is $T^{-1} = \Phi / \ln \frac{\bar{W} - W^*}{\bar{W} - \Delta - W^*}$ and
  - rises in the growth rate of stress Φ
  - rises in the tolerance level $\bar{W}$
  - falls in (the endogenous) threshold level W^*
  - falls or rises in Δ

5. How to deal with outbursts?

5.2 Should outbursts be suppressed?
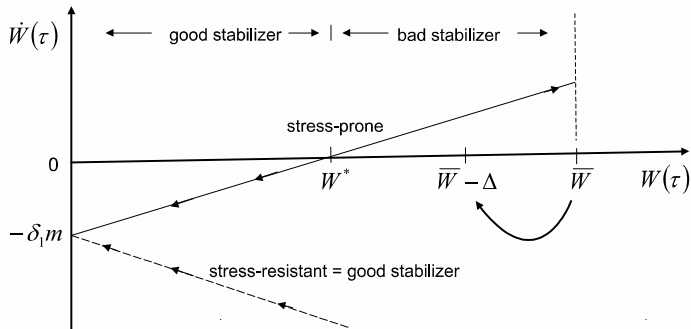
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Should outbursts be suppressed by increasing the tolerance level $\bar{W}$?

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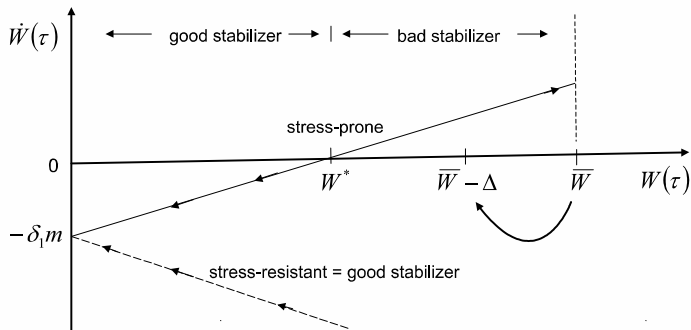
- The setup (a world without surprises)

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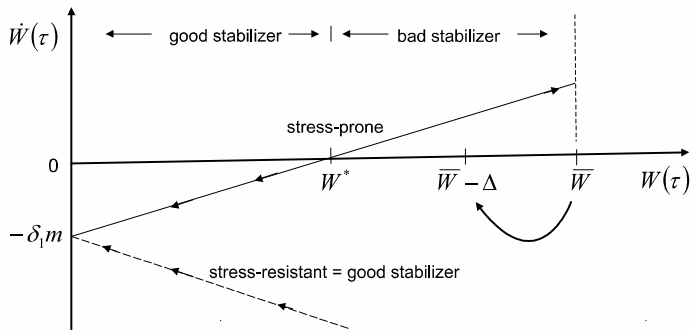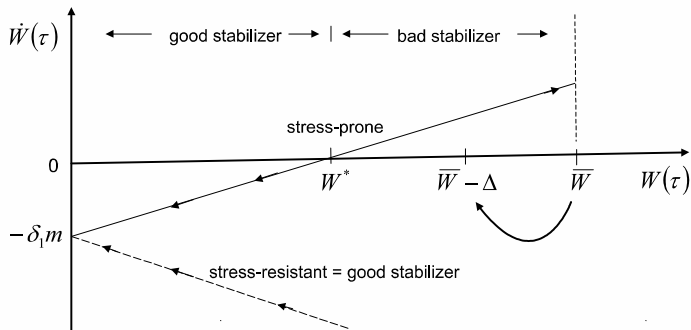- The setup (a world without surprises)

- What happens when $\bar{W}$ rises?

5. How to deal with outbursts?

Should outbursts be suppressed by increasing the tolerance level $\bar{W}$?

- The setup (a world without surprises)

- What happens when $\bar{W}$ rises?
  - sounds good: outburst at least comes later

5. How to deal with outbursts?

Should outbursts be suppressed by increasing the tolerance level $\bar{W}$?

- The setup (a world without surprises)

- What happens when $\bar{W}$ rises?
    - sounds good: outburst at least comes later
    - but what about: "let it out", "do not bottle your anger up inside", "air-cleaning quarrels" (Bushman, Baumeister and Phillips, 2001)

5. How to deal with outbursts?

Should outbursts be suppressed by increasing the tolerance level $\bar{W}$?

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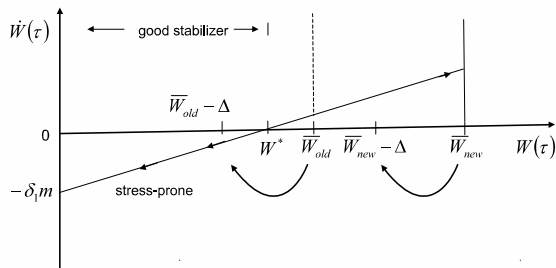- It might actually *not* be such a good idea!

5. How to deal with outbursts?

Should outbursts be suppressed by increasing the tolerance level $\bar{W}$?

- It might actually *not* be such a good idea!

- While higher outburst level $\bar{W}$ postpones next outburst ...

5. How to deal with outbursts?

Should outbursts be suppressed by increasing the tolerance level $\bar{W}$?

- It might actually *not* be such a good idea!

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- ... higher $\bar{W}$ might also make the permanent stress-reduction effect obsolete

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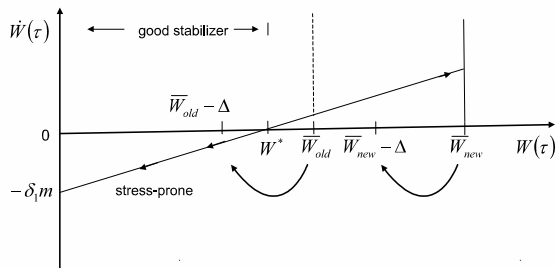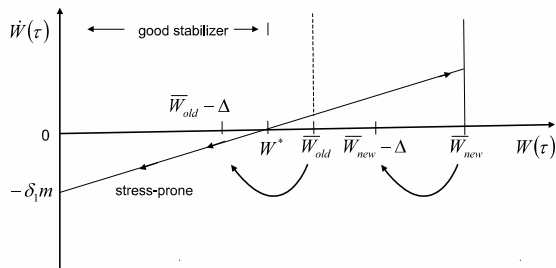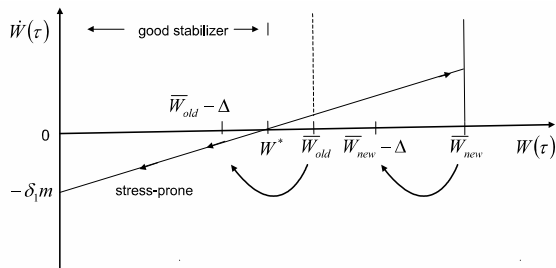- It might actually *not* be such a good idea!

- While higher outburst level $\bar{W}$ postpones next outburst ...
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- The individual might be caught in an outburst cycle

5. How to deal with outbursts?

5.3 The gains from psychotherapy

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- How can this be achieved?
  - See the outburst theorem for the first objective
  - Look at the value function (given the parameter restriction) for the second

$$J(W) = \Lambda_0 - \frac{v^M}{\Delta} W$$

where

$$\rho \Lambda_0 = \nu w M - v_0 m^{1+\zeta} + \frac{v^M}{\Delta} \left[\delta_1 m + \lambda \chi \left[E^h h - \mu \right] \right]$$

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    - the individual's productivity δ_1 in coping m rises
    - the individual becomes emotionally more *stable* (χ falls) conditional on the individual being on average *negatively* surprised
    - the individual becomes more *emotional* (χ rises) conditional on the individual being on average *positively* surprised,
    - the individual reduces her expectations with respect to surprises (μ falls) as this makes her more often positively surprised

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- What is optimal personality?
    - Make an individual more emotional (increase χ) but
    - let her expect less (decrease μ)

6. Conclusion

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- This paper looked at smooth coping and emotional outbursts
  - Smooth coping stands for controlled and cognitive approach to emotion regulation
  - Emotional outbursts stand for more impulsive, costless and fast approach
  - Emotional outbursts tend to be socially harmful (in contrast to constructive smooth coping)

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Dynamics of stress and coping and personality

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- Stress can rise or fall for stress-prone individuals ("good stabilizers" or "bad stabilizers")
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  - cost and benefits of smooth coping
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Prevalence of outbursts (outburst theorem)

- personality: stress-prone vs. stress-resistant individuals
- appraisal type ϕ, situation p, ability a and autonomous stress-reduction potential δ_0

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Do temporary shocks have permanent effects?

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The gains from psychotherapy

- Permanent effects achievable via personality changes
- Reappraisal of daily hassles and life-time events
- Don't expect too much and be emotional!

Thank you!