



GUTENBERG SCHOOL OF  
MANAGEMENT  
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# Emotional Economics

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## Current Emotion Research in Economics

(commissioned by Emotion Review)

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# 1 Introduction

We ask three questions

1. Which role do emotions play in utility theory?
2. How do economists model emotions (more generally)?
3. Why care about emotions at all? A bold conjecture
4. What do we learn from all of this?
  - (a) Do we learn something about emotions? (“Psychologists’ view”)
  - (b) Do we learn something about behaviour? (“Economists’ view”)
  - (c) Are there any predictions from emotion models that are observationally *different* from predictions made by other models?



- Which role do emotions play in utility theory?
  - What did classical economists think about emotions when discussing utility?
  - How does neoclassical economics think about emotions?
  - Utility and emotions in behavioural economics
- How do economists model emotions (beyond utility theory)?
  - Economists work on a long list of emotions (elation, surprise, fear, guilt, envy ...)
  - Some take psychological emotion research into account, some are motivated by economic findings
  - We go through central emotion models from economics to see who does what

- Why care about emotions at all? A bold conjecture
  - Hypothesis: Emotions are key to make (hu)mankind happier
  - Why: Mankind becomes happier through increasing self-knowledge (“Selbsterkenntnis ist der Weg zum Glück der Menschheit”)
  - Increasing self-knowledge is an emotional process
  - Sounds like 'Bahnhof'? See below for further details
- What do we learn from all of this?
  - See conclusion

## Some background from the literature

- Psychological literature: what is an emotion?
  - Kleinginna and Kleinginna (1981) present and discuss a list of 92 definitions of emotions
  - Discrete emotion terms: Shaver et al. (1987) → see their table
  - More recent list is in Sacharain et al. (2012) → see their figure
  - Various surveys by George Loewenstein on emotions and decisions (Rick and Loewenstein, 2008, Loewenstein and Lerner 2003)

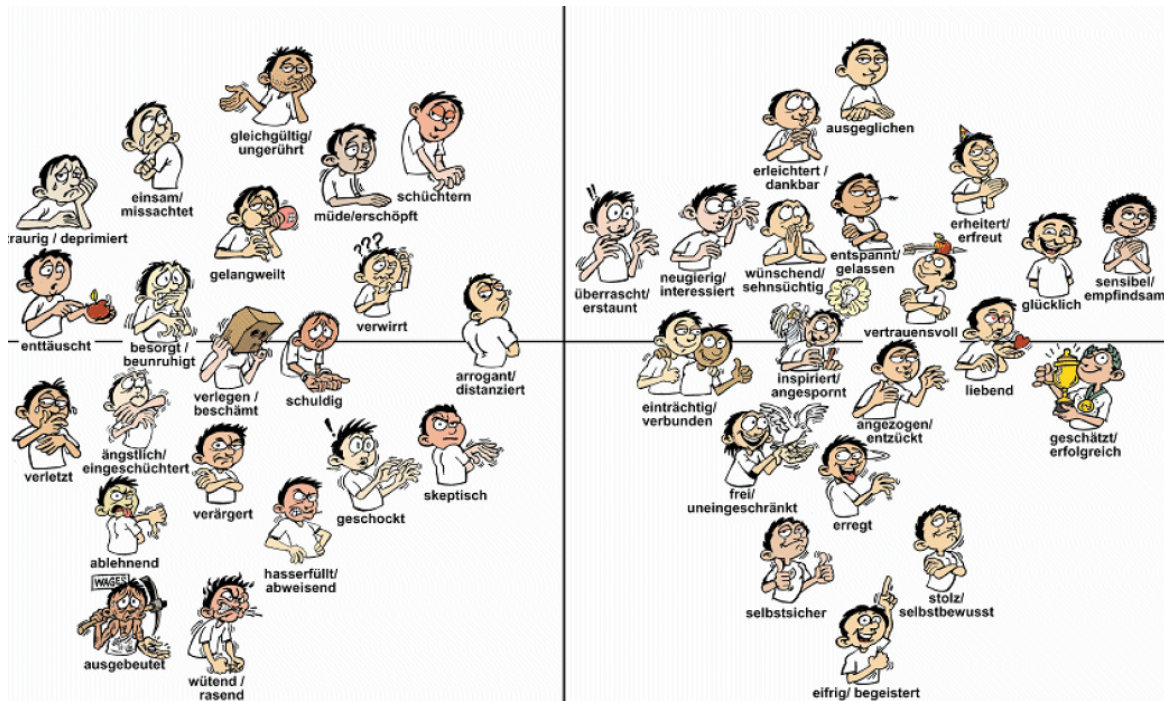


Figure 1 Valence vs arousal (<http://www.absatzwirtschaft.de/images/emotion.gif>)



## Some background from the literature

- Economic literature [selection of related surveys]
  - Elster (1998 JEL, philosopher, political scientist) “Emotions and Economic Theory”
  - “economists mainly try to explain behavior, emotion theorists try to explain emotions” (p. 47)
  - His central question: “How can emotions help us explain behavior for which good explanations seem to be lacking?” (p. 48)

- Elster classification of emotions

- Emotions directed towards oneself or other, towards behaviour or characteristic and positive or negative (2x2x2)

positive			negative		
	oneself	other	oneself	other	
behaviour	pride	admiration	guilt	anger	behaviour
characteristic	pridefulness	liking	shame	hatred	characteristic

- Anticipatory emotions: fear, hope, suspense
- Ex post emotion: joy and grief
- Counterfactual emotions (relative to expectation): regret, rejoicing, disappointment, elation
- Immediate emotions and visceral factors: hunger, thirst, tiredness, excitement, arousal, pain
- Emotion related to possession of others: envy, malice, indignation, jealousy
- More or less unclear cases: contempt, disgust, romantic love, boredom/stress, interest, sexual desire

## 2 Which role do emotions play in utility theory?

We look at the following economic fields

- Classical economics
- Neoclassical economics
- Behavioural economics

## 2.1 Emotions in classical economics

- The natural place to look for emotions in economic thinking is the field of 'utility theory'
- Adam Smith (1776) "The Wealth of Nations"
  - "value in use" of a certain good is called 'utility' as opposed to the
  - "value in exchange" (Stigler, 1950, p. 307)
- Jeremy Bentham (1789) "Introduction to the Principles of Morals and Legislation"
  - The hedonic concept of utility was made popular
  - He suggested to measure utility by measuring "pleasure and pain"
  - He also talked about "happiness" when discussing the effect of wealth on a person
- William Jevons
  - strongly denied that utility could be measured stating that "we can hardly form the conception of a unit of pleasure or pain" and
  - stated that the idea of "quantities of feelings" is out of question (Stigler, 1950a, p. 317)
  - Yet, he clearly perceived utility resulting from an object as a feeling

- William Jevons (1871) “Theory of Political Economy”
  - has an entire chapter on “Theory of Pleasure and Pain”
- Francis Edgeworth (1881) “Mathematical Psychics”
  - [usually known for his/ Marshall’s box]
  - “calculus of *Feeling*, of Pleasure and Pain” is the “more paradoxical subject of this essay” Edgeworth (1881, p.1, emphasis in original)
- Utility theory in economics, initially, was all about feelings

## 2.2 Absence of emotions in neoclassical decision making?

- Two approaches in economics to decision making (see Mas-Colell et al., 1995, ch 1)
  - Preference-based approach
  - Choice-based approach

### 2.2.1 Preference-based approach

- Starting point is the set  $X$  of alternatives with an element  $x$  and another element  $y$
- Tastes of decision maker are described by “preference relationships”
- Preference relationships are described by  $x \succsim y$  which means “ $x$  is at least as good as  $y$ ”
- A preference relationship  $\succsim$  is rational if it possesses the following two properties:
  - Completeness: for any  $x$  and  $y$ , either  $x \succsim y$  or  $y \succsim x$  or both hold
  - Transitivity: for any  $x$ ,  $y$  and  $z$ , if  $x \succsim y$  and  $y \succsim z$  then  $x \succsim z$
- A utility function  $u(x)$  that represents a preference relation  $\succsim$  is a function for which

$$x \succsim y \Leftrightarrow u(x) \geq u(y)$$

## 2.2.2 Choice-based approach

- Starting point (here as well) is the set  $X$  of alternatives
- Budget set  $\mathcal{B}$  is a set of subsets of  $X$  – in words: Budget set is exhaustive list of feasible choices
- Choice rule  $C(\mathcal{B})$  assigns a set of chosen elements for the budget set  $\mathcal{B}$
- Now impose some “reasonable” restrictions on budget set  $\mathcal{B}$  and choice rule  $C(\mathcal{B})$ 
  - originally proposed by Samuelson (1947, Foundations of Economic Analysis)
  - Weak axiom of revealed preferences implies: if  $C(\{x, y\}) = x$ , then  $C(\{x, y, z\}) \neq y$
- Definition of “revealed preference relation  $\succsim^*$ ”
  - Formal statement
$$x \succsim^* y \Leftrightarrow \text{if } x, y \in \mathcal{B} \text{ then } x \in C(\mathcal{B})$$
  - In words:  $x$  is revealed preferred to  $y$  if  $x$  is chosen whenever both  $x$  and  $y$  are feasible (i.e. are in the budget set, i.e. can be afforded)

### 2.2.3 Emotions in neoclassical decision making or not?

- Mainstream view
  - Emotions do not play a role in preference-based or choice-based approach to decision making
  - Mas-Colell et al. (1995) write (about the choice-based approach) “theory of individual decision making need not be based on a process of introspection but can be given an entirely behavioral foundation”
  - Varian (1992) writes (about preference-based approach) “A utility function is often a very convenient way to describe preferences, but it should not be given any psychological interpretation”
- My reading of the choice-based approach
  - clearly “observation-only” structure
  - behaviouristic approach (in the psychological sense), positivists (in philosophical sense) should be happy
  - Individual choice is analysed with fundamentals that can be observed
  - no emotions around, simply not needed, all based on objectively observable quantities



- My reading of the preference-based approach
  - As always with economic methods: open for any extension, extremely flexible setup
  - What are preference relationships? Tastes! (Mas-Colell et al., 1995)
  - I prefer  $x$  to  $y$  means (can be understood as) I have a more positive feeling when I own  $x$  as compared to  $y$
  - Preference-based approach is perfect to put emotions into economic model building
  - One would need a emotional micro-foundation for preference relationships (which might come from the literature on attitude and attitude change in psychology)
  - Economics is open for a “cognitive revolution” (cmp. Brandstätter et al., 2010) as it took place in psychology

## 2.3 Utility theory in behavioural economics

- Among the many departures, one big departure consists in making a distinction between
  - decision utility and
  - experienced (or true) utility
- People phrase this distinction in different ways
  - “What makes individuals happy (‘true utility’) differs from what they choose. Economic welfare analysis should use true utility rather than the utilities governing choice (‘choice utility’)” (Gul and Pesendorfer, 2008)
  - An example (from Kahneman et al., 1997): A person suffering from amnesia has two toasters in his kitchen. The toaster on the right functions normally. The toaster on the left delivers a painful electric shock when the toast is removed. Because of the amnesia, the person is always indifferent between the toasters, her decision utility for using the two toasters is equal. Experienced utilities are quite different
  - Maximizing decision utility will not maximize experienced utility
  - This example raises “doubts about a methodology in which observed choices provide the only measure of the utility of outcomes” (Kahneman et al., 1997, p. 376)

### 2.3.1 Back to Bentham

- Building blocks of Kahneman, Wakker and Sarin (1997): four building blocks
  - two notions of experienced utility
    - \* instant utility as “a measure of hedonic and affective experience” based on immediate subjective reports
    - \* remembered utility is based on subjective “reports of the total pleasure or displeasure associated with past outcomes”
  - total utility: normative concept based on instant utility “according to a set of normative rules”
  - decision utility: inferred from choices
- Basic idea
  - instant utility is how the individual feels at a certain moment
  - remembered utility is a biased account of instant utility
  - decisions are biased and do not maximize instant (or total) utility

- Character of this paper
  - suggests a research program – does not answer all questions that are raised
  - “The relations among the various utility concepts define a complex agenda for research”
- Can we measure all of this?
  - instant utility: Experience sampling (instantaneous report at random point in time of various preprogrammed questions)
  - remembered utility: questionnaires
  - decision utility: observe choices

- Summary
  - Feelings are at the center of understanding human behaviour
  - Decision does not necessarily maximize well-being
  - Individuals do not necessarily do what is best for them (“therapeutic approach” of behavioural economics)
  - BIG difference to neoclassical approach: utility maximization and decision are the same (by construction)

### 2.3.2 Happiness literature

- A by now well established (empirical) literature studies the determinants of “happiness”
  - Happiness is measured by self-reports of subjective well-being
  - Typical question read (from Benjamin et al., 2012, p. 2083)
  - “All things considered, how satisfied are you with your life as a whole these days?”
  - “Taken all together, how would you say things are these days—would you say that you are very happy, pretty happy, or not too happy?”
- The link between happiness research/ subjective well-being and (utility) theory
  - There is no link between choice-based approach (“objective well-being”, Frey and Stutzer, 2002) and measures of subjective well-being (“subjective well-being”)
  - Frey and Stutzer (2002) see measures of subjective well-being as “complementary path to study the world”

- Conclusion
  - Happiness research in economics is all about emotions
  - Integration into theoretical structures of economics still needed
  - Some interesting empirical questionnaire findings come from Benjamin et al. (2012)
    - choices are determined by their effect on (expected) subjective well-being
    - choices are also influenced by “sense of purpose”, “control over life”, “family happiness” and “social status”
  - Many ideas and “stylized facts” for explanations available, explanations (theory) still missing

### 3 How do economists model emotions?

- The analysis of emotions in economics is simplified by distinguishing
  - Ex-ante emotions
  - Immediate emotions and
  - Ex-post emotions
- This can be completed by analyses based on
  - belief-based emotions
- After having gone through these analyses, we will understand that this classification
  - is useful and will therefore be kept for our purposes
  - but that 'belief-based emotions' could in principle be integrated into the first scheme
- The structure of the presentation
  - Due to the historic development of economic thinking, we start with ex-post emotions, then cover immediate emotions and then look at ex-ante emotions
  - Belief-based emotions come afterwards for expositional purposes



### 3.1 Ex-post emotions

- Models that analyse regret and elation
  - Regret theory of Bell (1982?), disappointment theory of Bell (1985)
  - Regret and disappointment theory by Loomes and Sugden (1982, 1986)
  - See Bleichrodt and Wakker (2015) for an appraisal of regret theory
  - Disappointment aversion by Gul (1991)
  - Comparison of various approaches by Grant, Kajii, Polak (2001)

### 3.1.1 Loomes and Sugden (1982) – regret and rejoicing

- Fundamental aspect: individuals compare the outcome of their choices to certain alternatives
- Experienced utility includes (standard) utility from the choice per se but also regret or rejoicing relative to the alternative
- An example
  - Imagine an individual can spend holidays at the beach in Italy (option 1) or in France (option 2)
  - She decides to go to Italy ...
  - ... but there is less sun than in France → she would regret
  - ... and there is more sun than in France → she would rejoice

- The utility function

- (modified) utility of the individual is given by

$$u(c_{1j}, c_{2j}) = c_{1j} + R(c_{1j} - c_{2j})$$

where  $c_{1j}$  is utility from the choice of option 1 in state  $j$ ,  $c_{2j}$  is utility from choice 2 in state  $j$  and  $R(\cdot)$  measures regret or rejoicing

- The individual compares utility from action 1 with action 2
- This comparison leads to regret (when  $c_{1j} - c_{2j} < 0$ ) or rejoicing (for  $c_{1j} - c_{2j} > 0$ )
- When comparison reveals a difference of zero, then there is neither regret, nor rejoicing,  $R(0) = 0$

- Uncertainty

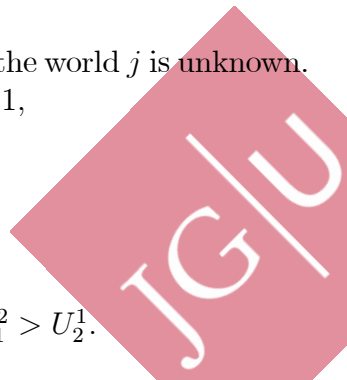
- When the decision between 1 and 2 is to be made, the state of the world  $j$  is unknown. The individual forms expectations about utility from option 1,

$$U_1^2 = \sum_{j=1}^n p_j u(c_{1j}, c_{2j})$$

and expected utility from option 2,

$$U_2^1 = \sum_{j=1}^n p_j u(c_{2j}, c_{1j})$$

- Obviously, an individual prefers choice 1 to choice 2 when  $U_1^2 > U_2^1$ .



- Why do Loomes and Sugden care about emotions?
  - What is the basic motivation for regret theory?
  - Kahneman and Tversky's (1979) 'prospect theory' paper
  - Kahneman and Tversky provide a fundamental critique of expected utility theory by
    - \* presenting a series of simple experiments where (hypothetical) behaviour of participants violated various assumptions of EU theory
    - \* providing an alternative theory – baptized prospect theory
- What are the (most important) violations of EU theory?
  - certainty effect: overweigh outcomes that are certain
  - reference point: individuals focus on gains and losses, not on absolute values
  - concavity: individuals are risk-averse and risk-loving
- Regret theory is intended to explain these deviations
- The emotion seems to have more of a “functional” role and does not seem to be of interest per se



### 3.1.2 Loomes and Sugden (1986) – disappointment and elation

- While regret refers to another possible choice, disappointment refers to something expected
- Reference point is therefore not another choice (there is no Italy vs France) but the average consequence of this choice (i.e. utility from being on the beach at various sun intensities)
- Formally, the reference point for an action 1 is

$$\bar{c}_1 = \sum_{j=1}^n p_j c_{1j}.$$

Expected utility from option 1 is now

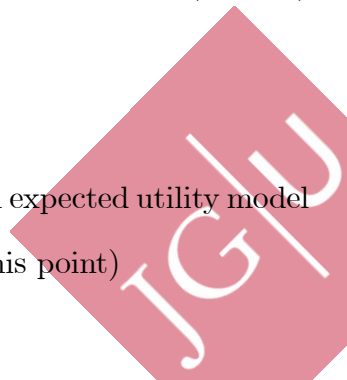
$$U_1 = \sum_{j=1}^n p_j [c_{1j} + D(c_{1j} - \bar{c}_1)].$$

This option 1 (the beach) is then chosen relative to option 2 (the mountains) if  $U_1 > U_2$

- Why care about emotions?
  - Similar idea to Looms and Sugden (1982)
  - “By incorporating a simple disappointment-elation function into a model of individual choice, many observed violations of conventional expected utility axioms—including violations of Savage’s sure-thing principle and the "isolation effect"—can be predicted and defended as rational and dynamically consistent behaviour”

### 3.1.3 Gul (1991)

- Offers an axiomatic approach (preference based) to understanding disappointment aversion
- Strong alternative to Loomes and Sugden (1982, 1986)
- Motivation is Allais (1979) paradox (which is nicely explained in the paper and which violates the so-called independence axiom)
- Offers a nice overview of how researchers respond to this paradox
  - need for descriptive theory (Kahnemann and Tversky, 1979, Loomes and Sugden, 1982, 1986) that ignores “basic desiderata of choice under uncertainty” (p. 669) (inter alia transitivity or stochastic dominance)
  - rejecting the normative appeal of the independence axiom
  - modifying the independence axiom (his approach)
- Offers a one-parameter extension of the von Neumann-Morgenstern expected utility model
- Details are very technical and beyond the scope of this talk (at this point)



## 3.2 Immediate emotions

### 3.2.1 Hunger, thirst, pain, desire

- State-dependent preferences - an example

- Individuals are hungry and thirsty

$$u(c_{Food}, c_{Drink}) = (c_{Food} - h)^\alpha (c_{Drink} - t)^{1-\alpha}$$

- Marginal utility from food  $\alpha \left[ \frac{c_{Drink} - t}{c_{Food} - h} \right]^{1-\alpha}$  rises, when hunger  $h$  rises
  - Same is true for drinks and thirst  $t$
  - One could call marginal utility from food or drink a 'desire' – this would be an example how standard neoclassical analysis would allow the modelling of feelings
- State-dependent preferences a la Loewenstein (2000)
    - General formulation by Loewenstein (2000)

$$U_t = \sum_{t=0}^T u(c_t, s_t)$$

where  $s_t$  is the state of the individual (which can be multidimensional, angry at one person, happy about some big personal achievement and excited about holidays coming soon)



- Caveat: People generally do not remember well emotions in past visceral states, leading to projection bias (Loewenstein, O'Donoghue and Rabin, 2003)

### 3.2.2 Laibson (2001) – Craving, strong desire, lust and greed

(“A cue theory of consumption”)

- The idea
  - Preferences of individuals are not stable and invariant over time and contexts
  - Preferences rather depend on the environment a person is in and on the cues present in this environment
  - There are clinical examples (think of addicts of alcohol or other drugs) but there are also everyday examples
  - “Consider cues like the smell of cookies baking, smell of perfume/cologne, sound of ice falling into a whiskey tumbler, sight of a bowl of ice cream, and sight of a pack of cigarettes” (Laibson, 2001, p. 82)
  - Yet, there are stable “meta-preferences”
  - Analysis builds on and combines earlier work by Becker and Murphy (1988, 1993(?))

- Evidence from psychological conditioning
  - Classic conditioning pairs a neutral stimulus (conditional stimulus, CS, in psychologists' terms) with a nonneutral stimulus (unconditional stimulus, UC)
  - Pavlov's dog heard a bell ring (CS) joint with injection of meat-powder in the dog's mouth (UC)
  - The meat-powder leads to salivation, to physiologically prepare the dog for food ingestion
  - When the two stimuli were presented jointly sufficiently often, the ring of a bell would also lead to salivation
- The idea in more detail
  - Central “translation” of psychological findings into economics: “Cue-triggered preparatory <...> responses tend to raise the marginal utility of consumption” (p. 85)
  - What is generally called a “craving”, “strong desire”, “lust”, “greed” or other is, in economic terms, “higher marginal utility”
  - The cue triggers a “preparatory process” (like salivation) which in affects marginal utilities and makes preferences conditional on cues

- The individual's environment
  - Individual lives in discrete time  $t = 1, 2, 3, \dots$
  - At each point in time  $t$ , the world can be in two states  $i$ : either the cue can be RED or GREEN
  - We denote these states by  $i \in \{R, G\}$  that occur with a certain probability

$$i_t = \left\{ \begin{array}{c} R \\ G \end{array} \right\} \text{ with probability } \left\{ \begin{array}{c} \mu^R \\ 1 - \mu^R \equiv \mu^G \end{array} \right. .$$

- Preparatory process
  - (simplified version as compared to the paper)
  - Bodily state  $x_t$  is a function of the cue

$$x_t = x(i_t)$$

- We assume that  $x(R) > x(G)$ , i.e. the body is better prepared for e.g. food when the cue is RED (i.e. present)

- Preferences

- (simplified version as compared to paper)
- In state  $i$ , the utility function of our consumer is given by

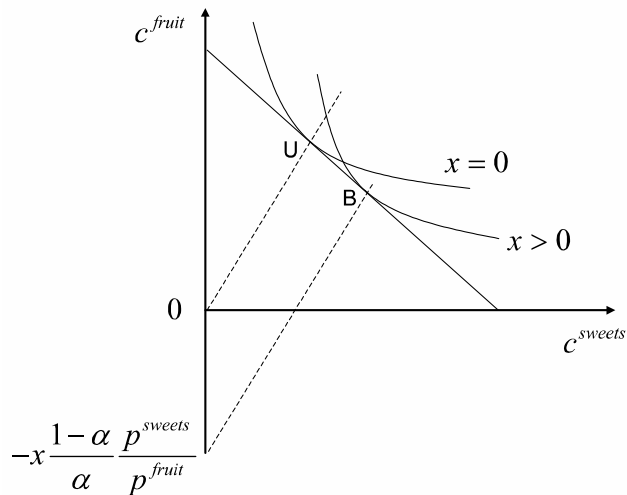
$$u(c_t^{\text{sweets}}, c_t^{\text{fruit}}) = (c_t^{\text{sweets}} - x_t)^\alpha (c_t^{\text{fruit}})^{1-\alpha}$$

- Preferences are clearly “cue-contingent”
- As the cue is a state variable (it describes the state of the world/ environment of the individual), preferences are (again) state-dependent
- Laibson writes “the functional form of this meta-utility function is not chosen by the consumer but is instead biologically predetermined”
- In other words,  $\alpha$  and functional structure is stable, but  $x_t$  changes

- Constraint
  - There are prices  $p^s$  and  $p^f$  and endowment  $E$
  - This gives a standard budget constraint

$$p^s c_t^{\text{sweets}} + p^f c_t^{\text{fruit}} = E$$

- Optimal behaviour
  - Optimal behaviour similar to hunger and thirst setup: Marginal utility from sweets rises in  $x_t$
  - As  $x_t$  is higher in the presence of the RED cue (adds for chocolates or ice cream), cues induced individuals to change their consumption choices
  - see figure on next slide



**Figure 2** Optimal consumption of sweets and fruit in the absence ( $x = 0$  implies Unbiased consumption) and in the presence of cues ( $x = 1$  implies Biased consumption)

- What is the difference to hunger or thirst?
  - We have a formal theory of how external (non-chosen) cues affect human behaviour
  - Hunger and thirst can be seen as natural determinants of consumption behaviour
  - With advertisements (or cues, more generally), individual behaviour can be influenced from the outside
  - Individuals might experience certain desires only because of this influence
  - Individuals still behave optimal, but only subject to the exogenously given cues
  - If individuals were able to choose cues, they would experience higher utility
- Any real-world relevance?
  - The latter is to some extent the idea behind self-control and official control of advertisements
  - no ads for baby food in British maternity wards (Geburtsstationen in Kliniken)
  - no ads for sweets in kindergartens/ nurseries
  - no ads for tobacco and alcohol close to schools and kindergartens (only being discussed?)
  - for self-control, see e.g. [www.werberat.de](http://www.werberat.de)



### 3.2.3 Stress (Wälde, 2015)

- **Definition:** Stress occurs when demands exceed resources (Lazarus and Folkman, 1984, Stress, Appraisal and Coping)
- Psychological background
  - A standard view in psychology on stressful episodes can be illustrated as follows

Stressor  $\rightarrow$  appraisal  $\rightarrow$  (change in) stress  $\rightarrow$  coping

- Two sources of stressors: daily hassles (e.g. 'losing keys'), rare events (e.g. 'getting married')
- Appraisal process: Evaluation of a stressor with respect to one's objectives
- Outcome of appraisal leads to more (or less) stress
- Coping: behaviour targeted at controlling stress level
- Coping can be controlled vs. automatic, problem-focused vs. emotion focused and functional vs. dysfunctional

- What is captured in model?
  - Two sources of stressors
  - A (simple) appraisal process capturing personality of a person
  - Two coping styles: controlled and automatic ('emotional outburst')
  - Emotion-focused approach of coping (not problem-focused)
- Why care and what to do about stress?
  - Individual (experienced) utility  $u(c(t), W(t))$  falls in stress  $W(t)$
  - Stress also reduces labour effort (cognitive load argument)
  - Stress (=distress) is bad here (think about distress vs eustress)
  - Individual maximizes utility by choosing controlled coping  $m(t)$  in an optimal way anticipating the outbursts

- A sketch of the economic modelling of stress
  - Stress is a (subjective) state variable and changes as a function of daily hassles and rare events
  - Looking only at daily hassles, stress  $W(t)$  follows an ordinary differential equation

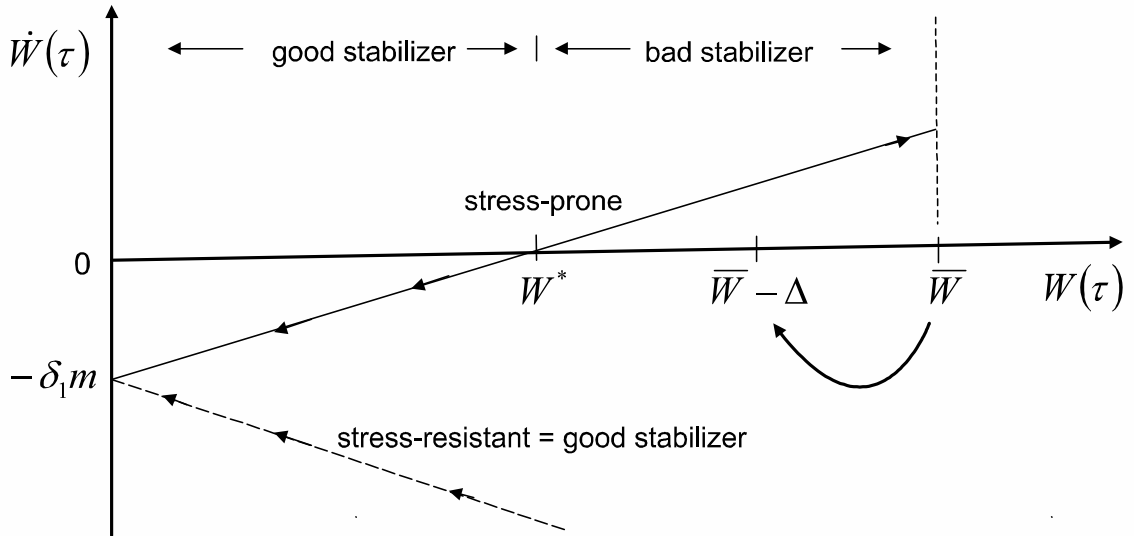
$$\dot{W}(t) = \Phi W(t) - \delta_1 m$$

- the parameter  $\Phi$  is the growth rate of stress

$$\Phi \equiv \phi \frac{p}{a} - \delta_0$$

- daily hassles (the number of emails  $p$  relative to ability  $a$ ) is the intensity of the stressors
- controlled stress reduction methods  $m$  (talking to a friend, doing sports) is coping
- the optimal amount (measured e.g. in hours per day) is constant (see paper, but not for exam)
- the appraisal of the stressors is captured by the parameter  $\phi > 0$
- the effect of coping on stress reduction is described by  $\delta_1$
- the parameter  $\delta_1$  describes an 'autonomous stress reduction potential'

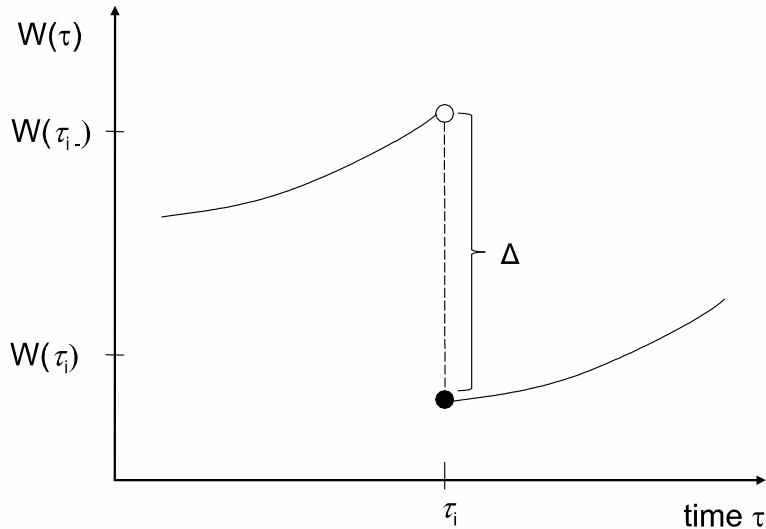
- A phase diagram illustration



- The outburst level  $\bar{W}$ 
  - Whenever the stress level rises too much, i.e. whenever it hits  $\bar{W}$ , the individual is 'overwhelmed', loses control over behaviour and experiences an emotional outburst
  - An emotional outburst can be anything from 'shouting at friends' to 'drinking excessively' (see the 'conflict tactic scale', e.g. Straus et al., 1996)
  - This is the uncontrolled (not rational expectations, behavioural) part of coping (behaviour)

- The good side of outbursts
  - Stress falls following an emotional outburst

$$W(\tau_i) = W(\tau_{i-}) - \Delta$$



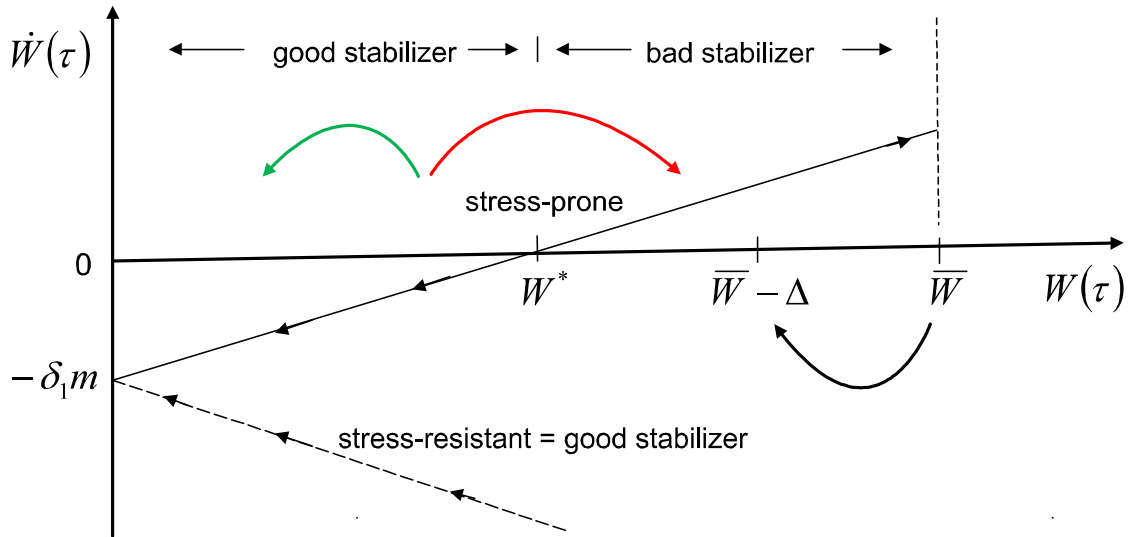
- The role of surprises
  - Coming back to rare events (like 'getting married', 'losing a job', 'publishing a paper' and other), they are modelled as surprises
  - Surprises  $g(t)$  can be positive or negative
  - Random variable  $h(t)$  and subjective expectation  $\mu$  yield surprise

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

(Bell, 1985, Loomes and Sugden, 1982, 1986)

- surprises occur at a certain arrival rate
- (dynamic continuous time model with Poisson uncertainty)

- Another (more complete) phase diagram illustration ...

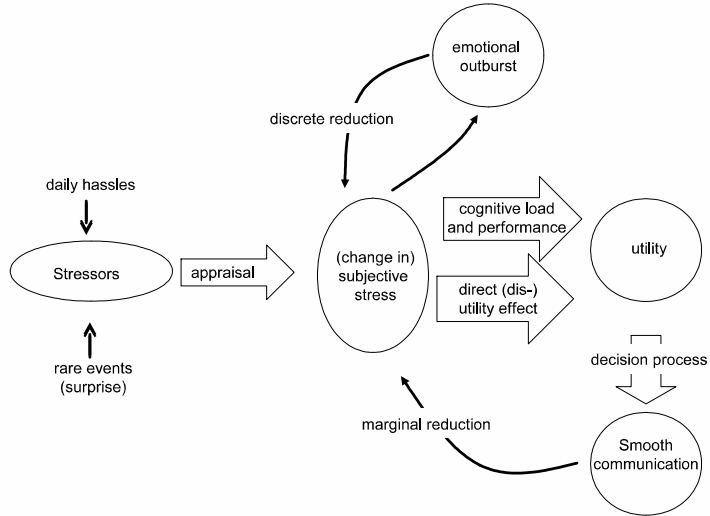


- ... that also shows surprises and outbursts





- A graphical illustration of the model



- Results

- Theory-consistent personality definitions: *stress-resistant* individuals never display outburst, *stress-prone* individuals do if stress level is too high
- Outburst theorem: any individual will turn from stress-resistant to stress prone if e.g. work-load rises
- For a given work-load, (endogenous) coping measures can make outbursts disappear
- Outbursts should not be suppressed
- Temporary stressors can have permanent effects, but only for stress-prone individuals
- Structural estimation of personality parameters possible
- Analysis of therapy shows: being emotional and pessimistic maximizes subjective well-being

### 3.3 Ex-ante emotions – Anxiety, worry and fear

- Ex-ante or anticipatory emotions (fear, anxiety, positive anticipation, suspense ...) are studied by Caplin and Leahy (2001)
- Applications include Caplin and Leahy (2004) and Kőszegi (2006)

- Consider a two-period setup
- Individual enjoys utility from consumption and from (anticipatory) feelings
  - Extended utility function

$$U_t = E_t \{ \gamma u(c_t, a_t) + (1 - \gamma) u(c_{t+1}) \}$$

where  $a_t$  is anticipatory feeling

- Following Caplin and Leahy (2001), we model feeling as a function of the variance and of the mean of consumption in  $t + 1$

$$a_t = a(\text{var}_t c_{t+1}, E_t c_{t+1}) \quad (1)$$

- The anticipatory feeling is assumed to rise in the variance and fall in the mean

$$\frac{\partial a_t}{\partial \text{var}_t c_{t+1}} > 0$$

$$\frac{\partial a_t}{\partial E_t c_{t+1}} < 0$$

- The feeling is therefore a negative feeling like anxiety



- To obtain tractable results, we need a more specific utility and anxiety function
  - We assume a Cobb-Douglas structure for anxiety

$$a_t = (\text{var}_t c_{t+1})^\zeta (E_t c_{t+1})^{-(1-\zeta)}$$

- The “personality parameter”  $\zeta$  captures the weight of the variance as opposed to the mean
- Applying the log, we get

$$\ln a_t = \zeta \ln (\text{var}_t c_{t+1}) - (1 - \zeta) \ln (E_t c_{t+1})$$

- (Log of) Anxiety can take positive or negative values, depending on the variance and mean
- In the case of a negative (log) anxiety, we would rather talk about ‘pleasant anticipation’ (“Vorfreude”)
- Why all these functional forms? To capture some intuition and make properties of anxiety plausible



- The overall utility function

- We choose a Cobb-Douglas utility function as well and apply logs

$$u(c_{t+1}) = \gamma [\ln c_t - \phi \ln a_t] + (1 - \gamma) E_t \ln c_{t+1}$$

- Consumption enters utility in the usual logarithmic way
- Log-anxiety decreases utility in period  $t$  in a linear way due to parameter  $\phi > 0$  and minus sign (which translates strong anxiety into negative utility)
- Parameter  $\gamma$  captures impatience, with  $\phi = 0$ , we are back to emotion-free individual
- Expectations  $E_t$  need to be formed about  $\ln c_{t+1}$  only

- Optimal solution

$$s_t = \frac{1 - \gamma - (3\zeta - 1)\gamma\phi}{1 - (3\zeta - 1)\gamma\phi} w_t$$

- In the absence of anxiety ( $\phi = 0$ ), a rational individual would save  $s_t^* = (1 - \gamma)w_t$  (which is the standard 2-period expression)
- In the presence of anxiety and when only variance matters ( $\zeta = 1$ ), the individual would save less,  $s_t < s_t^*$
- Why? To avoid anxiety due to consumption variance, the individual would save less as this reduces the consumption level in  $t + 1$  and therefore its variance
- In the presence of anxiety and when only mean matters ( $\zeta = 0$ ), the individual would save more,  $s_t > s_t^*$
- More generally, the more emotional the individual becomes ( $\phi$  rises), the more s/he saves if  $\zeta < 1/3$

- Why do authors care about emotions?
  - The intention of this paper is to understand the role of anticipatory emotions on decision making
  - Psychological background on anticipatory emotions is provided
  - The emotion is at the center of interest (and is not just a means to attain some goal)



## 3.4 Belief-based emotions

### 3.4.1 Psychological game theory

- There is a general framework in economics that does *not* focus on one specific emotion but that proposes a general setup that can cover *classes* of emotions
- Geanakoplos, Pearce and Stacchetti (1989) model emotions that are based on *beliefs*
- Battigalli and Dufwenberg (2009) provide a generalization
- Downside of generality: they do not focus on one specific emotion and thereby can not cover all the specific aspects of this one specific emotion
- Why is this of interest?
  - First, it allows us to understand emotions and their role in decision making
  - Second, models with beliefs are very common in economics
  - Third, game theory is also very useful tool
- Are belief-based emotions immediate, ex-ante or ex-post? Let's see ...

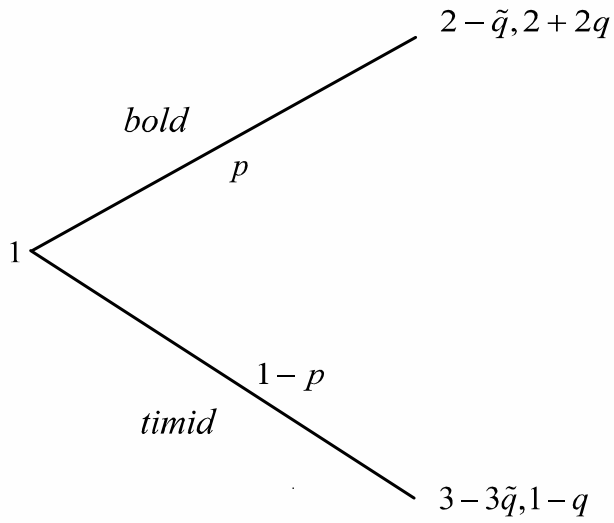
### 3.4.2 Psychological game theory: The bravery game

Geanakoplos, Pearce and Stacchetti (1989, p. 66)

- The idea (first part)
  - Imagine there are two individuals, called player 1 and player 2
  - Player 1 must take a decision and is concerned what his friends (player 2) think about him
  - His strategy space is  $A = \{\text{bold}, \text{timid}\}$ , player 2 does not make any decision
  - Player 1 can choose pure strategies or attach a probability  $p$  to being bold when playing mixed strategies

- The idea (second part)
  - While player 2 does not make a decision, it is good for player 2 if player 1 is actually bold
  - This is what we see in the extended figure with payoffs for both players depending on the decision of player 1

- The idea (interesting and final part – which makes this a psychological game)
  - Beliefs of player 2
    - \* Player 2 prefers to think of his friend as bold
    - \* This “materializes” in payoffs of player 2 to depend on his belief  $q$  about the probability  $p$  that player 1 acts bold (formally,  $q$  is the mean of  $p$ :  $q = Ep$ )
    - \* As player 2 *prefers* to think that player 1 is bold, the payoff of 2 rises in  $q$  when 1 *acts* bold and falls in  $q$  when 1 *acts* timid (big disappointment)
    - \* [ $\rightarrow$  is this minus sign in  $1 - q$  convincing?]
  - Beliefs of player 1
    - \* As player 1 is also concerned about what his friend thinks about him (see above), player 1’s payoff also depends on what he believes about what player 2 believes
    - \* This belief is denoted by  $\tilde{q} = Eq$
    - \* We assume that player 1 does not want to disappoint player 2 (who wants to think of player 1 as bold). As a consequence, the payoff of player 1 falls in  $\tilde{q}$
  - Psychological game theory: games where payoffs depend on beliefs and not only on actual real outcomes



**Figure 3** *The full structure of the bravery game*

- What is equilibrium behaviour?
  - Big question: How does player 1 behave?
  - What if there were no beliefs (i.e. if this was not a psychological game)?
    - \* Then we would be back to fig. ?? and player 1 would act timid
    - \* There would be a unique equilibrium
  - If there are beliefs, various equilibrium assumptions are imposed: Equilibrium requires (by definition of equilibrium) that
    - \* beliefs are consistent with behaviour: an outcome would *not* be called an equilibrium if e.g. player two believes that player 1 is bold but player 1 acts timid
    - \* beliefs are shared among players:  $p = q = \tilde{q}$
  - How does player 1 behave under these assumptions?
  - We will now see that the introduction of beliefs introduces more equilibria than in the absence of beliefs

- Equilibrium behaviour

- Let us try: Can  $p = 1$  (and thereby  $q = \tilde{q} = 1$  as well) be an equilibrium?
  - \* In this case, payoffs are  $(1, 4)$  for bold and  $(0, 0)$  for timid
  - \* Player 1 would choose bold
  - \* ... which is consistent with the belief of player 2 that player 1 is bold
  - \* One equilibrium found
- Can  $p = q = \tilde{q} = 0$  be an equilibrium?
  - \* In this case, payoffs are  $(2, 2)$  for bold and  $(3, 1)$  for timid
  - \* Player 1 would choose timid
  - \* ... which is consistent with the belief of player 2 that player 1 is timid
  - \* Another equilibrium found
- Any other equilibrium on offer? Looking at fig. ?? suggests  $p = q = \tilde{q} = 1/2$ 
  - \* In this case, payoffs are  $(1.5, 3)$  for bold and  $(1.5, .5)$  for timid
  - \* Payoffs for mixed strategy are  $(1.5, 1.75)$
  - \* Player 1 would be indifferent
  - \* ... which is consistent with the belief of player 2 that player 1 is indifferent
  - \* Another equilibrium found

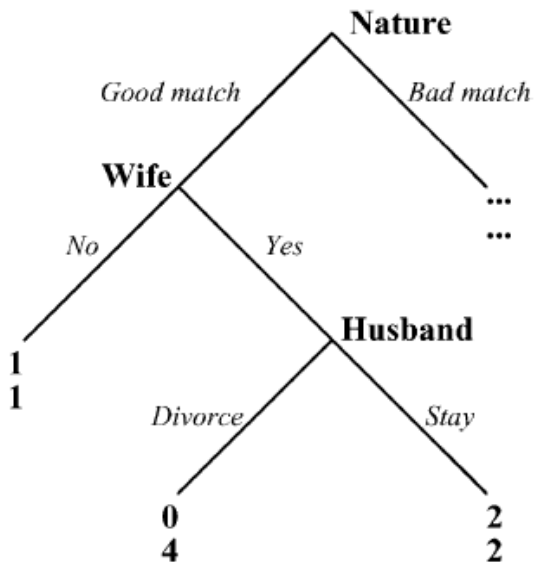
- Why do authors care about emotions?
  - Maybe not so much?
  - Emotion words are used (timid, bold), but they can be replaced by anything (red-green, up-down, left-right, ...)
  - Beliefs are very important and obviously play a huge role in determining behaviour of individuals
  - But why do beliefs stand for emotions? Is there any surprise (as in regret theory) or any anticipation, any tension between demands and resources (as in stress theory)?
  - Maybe emotion words are only colourful and bloomy words for an important but simple concept: expectations
- Let us see whether applications of this theory bring us closer to understanding emotions (see next section)



### 3.4.3 Guilt

- Psychological background
  - Baumeister et al. (1993) document that a person who rejects a relationship partner often suffers from guilt
  - Baumeister et al. (1994, 1995, p. 174) report that: “the prototypical cause of guilt is inflicting harm or distress on a relationship partner”
- Economic models
  - Dufwenberg (2002) guilt in marriage seems to be the paper where guilt is first introduced
  - Charness and Dufwenberg (2006) “promises and partnership” models guilt and guilt aversion joint with communication
  - They stresses that this is important more generally – analysis of guilt in trust games (Battagalli Dufwenberg 2007)
  - Battagalli Dufwenberg (2007) have two concepts of guilt aversion - “simple guilt” means that “a player cares about the extent to which he lets another player down” and “guilt from blame”
  - Charness and Dufwenberg (2011) is application to experiments

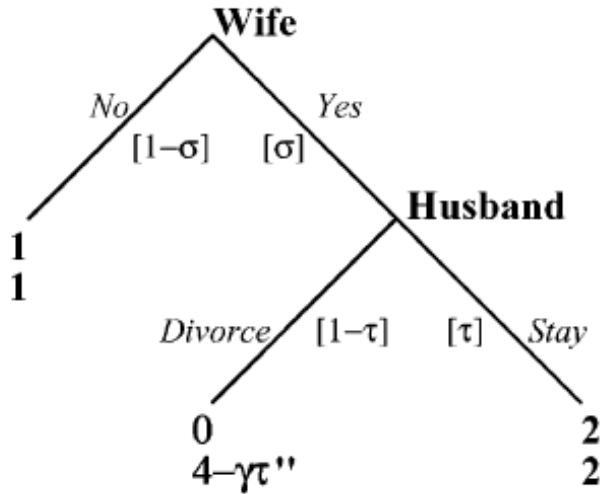
- The simplest model (Dufwenberg, 2002, on marriage)



**Figure 4** *The marital investment game (Dufwenberg, 2002, fig. 1)*

- The idea of the game
  - A man and a woman meet – and nature determines whether it is a good or bad match
  - If nature leads to a good match, the wife can support her husband and take care of the kids or not
  - (or the other way round as well, given that we live in modern times)
  - If she does not support the husband, they both earn some income leading to a payoff of  $(1,1)$
  - If she does support the husband, he can study and get a rewarding job
  - The husband can now be opportunistic and divorce. His payoff would be 4, the wife's payoff would be zero
  - If the husband stays, he would share his income and payoffs are  $(2,2)$

- Adding guilt to the marital investment game



**Figure 5** *The psychological marital investment game with guilt  $\tau''$  and guilt sensitivity  $\gamma$  of the husband (Dufwenberg, 2002, fig. 1)*

- The idea of the game
  - Individuals might not necessarily play only pure strategies – we therefore add probabilities  $\sigma$  and  $\tau$  to capture mixed strategies
  - Individuals form beliefs about probabilities (as in psychological game theory above)
    - \* Belief  $\tau'$  of wife about husband's probability  $\tau$  to stay, called her trust (first feeling in game):  $\tau' = E\tau$
    - \* Belief  $\tau''$  of husband about wife's belief  $\tau'$ :  $\tau'' = E\tau'$
  - In case the husband divorces, he experiences a loss in his utility the more he believes his wife trusts him
  - The loss in utility is given by  $\gamma\tau''$  and consists of  $\gamma$ , his “guilt sensitivity”, and his guilt  $\tau''$  (second emotion in this game)

- Equilibrium definition

- Equilibrium is defined in analogy to equilibrium definitions in psychological games
- **Definition** (Dufwenberg, 2002, p. 65): A profile  $(\sigma, \tau)$  is a marital equilibrium if
  - (i)  $(\sigma, \tau)$  is a subgame perfect equilibrium for a given  $\tau''$
  - (ii)  $\tau'' = \tau' = \tau$  and
  - (iii) If  $4 - \gamma/2 < 2$  then  $\tau = 1$

- What does this mean?

- If we know  $\tau''$ , then we have a normal (aka non-psychological game) game where equilibrium is found by imposing subgame perfection
- Beliefs must be consistent across individuals
- If  $\gamma$  satisfies this condition, then the husband must choose 'stay'. Why
  - \* Condition requires  $\gamma > 4$ . Why should husband stay with  $\gamma > 4$ ?
  - \* Wife knows that  $\gamma$  equals, say, 4.00001. Assume she plays 'yes'. She would do so only if she believes that  $\tau = 1/2$  or larger as only then her expected payoff from 'yes' ( $\frac{1}{2} * 0 + \frac{1}{2} * 2 = 1$ ) exceeds the payoff from 'no' (which equals 1)
  - \* When the husband believes that  $\tau' = 1/2$  or larger, his guilt implies a payoff of  $4 - \gamma\tau'' = 4 - 2.000005 < 2$  for divorce and therefore he stays. Hence  $\tau = 1$

- Equilibrium behaviour for  $0 \leq \gamma < 2$ 
  - In words, the husband does not care a lot about guilt (guilt sensitivity  $\gamma$  is low)
  - Even if  $\tau'' = 1$ , the payoff from divorce,  $4 - \gamma$  is larger than the payoff from staying, 2
  - When the wife knows the husband will divorce ( $\tau = 0$ ), she will say 'no'
  - Equilibrium beliefs are  $\tau'' = \tau' = 0$
  - Unique equilibrium strategies are (no,divorce) and equilibrium payoff is (1, 1)
- Equilibrium behaviour for  $\gamma > 4$ 
  - In this case, the husband cares a lot about guilt
  - Equilibrium beliefs are  $\tau'' = \tau' = 1$
  - Unique strategies are (yes, stay) and payoffs are (2,2)
  - Idea as for equilibrium property (iii) from above



- Equilibrium behaviour for  $2 \leq \gamma \leq 4$ 
  - Three equilibria exist, belief of the wife selects which one is implemented
  - If she believes he will divorce, i.e. if  $\tau' = 0$ , she will say 'no' and payoff is (1,1)
  - If she believes he will stay, i.e. if  $\tau' = 1$ , she will say 'yes' and payoffs are (2,2)
  - Third equilibrium has  $\tau = \tau' = \tau'' = 2/\gamma > 1/2$ . Then strategies are (yes,sty) and payoffs are (2,2)
- (Note that divorce is never observed in equilibrium)
- What have we learned
  - A lot about (psychological) game theory
  - About applications of feelings written into payoffs
  - In the present case, feelings of
    - \* husband, guilt, seem to be ex-post feelings as they occur after the decision to divorce
    - \* wife, trust, seem to be ex-ante feelings





### 3.4.4 Fairness and altruism

- Rabin (1993) “Incorporating fairness into game theory and economics”
- Builds on and extends psychological game theory
- Explains why people reward and punish other people at own costs
- – to be covered next time –

## 4 Why emotions matter so much – going beyond economics

### 4.1 The general idea: Why emotions are so important

- Human behaviour
  - We argue that human behaviour is to a large extent driven by ill-guided behaviour
  - This behaviour has many disadvantages for the individual himself and for his environment
  - Ill-guided behaviour is understood as behaviour building on
    - \* “distorted preferences” – just as market can be distorted
    - \* defence of self-concept

- How to overcome these distortions?
  - Increase self-knowledge
  - Self-knowledge is the avenue to happiness of mankind – “Selbsterkenntnis ist der Weg zum Glück der Menschheit“?
- Overcoming these distortions can be an emotionally painful experience
  - “distorted preferences” might appear as the “true preferences”
  - Self-concept might differ from true self (Definition of distorted preferences)
  - Correction of self-concept is emotionally painful
- In a nutshell
  - If we want truly self-determined and autonomous behaviour (as this maximizes true preferences), we need more self-knowledge – which is emotionally costly

## 4.2 Some examples

- The focus on material success
  - A sufficiently large share of the population (numbers to be found), and surely the most relevant share of the population that forms explicit and implicit rules in a society, are oriented towards material success
  - Why is there so much focus on material success?
  - Yes, we need to live on something. Yes, we want a good health system. But why is material success, status and fame so important to so many people?
  - Focus on success can have many reasons
    - \* Evolution makes success important for survival
    - \* Socialization through childhood and youth makes growth and success a normal condition
  - Hypothesis: True preferences are distorted towards success due to evolution and socialization
  - Adjustment is emotionally costly

- Conflicts in teams and partnerships
  - Certain conflicts exist as there are true objective trade-offs
  - But some conflicts occur as individuals
    - \* do not get along with each other
    - \* do not want to lose face
    - \* are stubborn and much more ... (should be elaborated)
  - These individual traits are (to some extent inborn but also) the outcome of some socialization process: personality of a person (a person's preferences in economic 'parlance') is endogenous
  - Preferences can be changed and adjusted to circumstances
  - Again, this is emotionally costly and might require to adjust one's self-concept

## 4.3 Towards an elaboration of this hypothesis

- We need a model of
  - endogenous preferences
  - self-concept
  - adjustment of the self-concept given emotional costs
- We also need some systematic evidence ...

#### 4.3.1 What is self-knowledge? (Selbstkenntnis)

- Individuals differ in their personality – see personality psychology
- Individuals differ in how well they are aware of their personality
- Vazire and Carlson (2011) “Others Sometimes Know Us Better Than We Know Ourselves”
- blind spots due to
  - lack of information
  - “motivated distortions in our self-perception”

- An example from consumption  $c$  - leisure  $l$  choice

$$u = (1 - \sigma) \ln c + \sigma \ln l$$

- Parameter  $\sigma$  related to Rosenstiel and Nerdinger (2000): “Karriereorientierung, Freizeitorientierung, alternatives Engagement”
  - Perfect self-knowledge: individual knows  $\sigma$
  - Imperfect self-knowledge: individual *believes* that  $\sigma$  is his/her true preference for leisure
- What is the problem of imperfect self-knowledge?
  - “motivated distortions in our self-perception” are costly
  - costs time, energy to act against one’s true preferences
  - Disappointment when insight comes can be large (“Lebenslüge” à la Ibsen)
- Difficulties with social environment (who partially perceive the inconsistency)



### 4.3.2 What is learning about self? (Selbsterkenntnis)

Definition (Smith Mackie, 2008, Social Psychology)

- ... process of constructing self-knowledge by inferring own characteristics from observed own behaviour, from other people's reactions and the like
- Big gap in economics, theory of endogenous preferences, of incomplete knowledge about own preferences needed
- How could it work in principle?
  - Process of learning (Bayesian or other)
  - Central question: is there learning of the truth?
  - Central determinants: emotional and other costs, time, awareness, willingness ...

### 4.3.3 The overall story (a sketch)

- Individuals have genetic dispositions which are evolutionary determined
  - Starting from a Darwinian idea of “survival of the fittest”, humans are endowed with a basic inclination towards “competition”, towards “trying to be better than others”
- Individuals learn that “growth is good”
  - Continuing with a standard account of childhood and youth, individuals grow up with the idea of “growth”, “learning” and “achievements” as being normal and natural ingredients of life
- Some individuals are “extra-aggressive”, “extra-competitive” or overly ambitious
  - This form of over-the-top ambition can result from deprivation (Mangel) while growing up (development psychology argument)
  - More generally speaking, over-the-top ambition is the result of some learning process (mostly taking part while young, in family, with friends and other)
  - The learning process forms opinions and the concept of the self – it forms preferences, economically speaking

- Increasing self-knowledge
  - It is the duty of every citizen to increase self-knowledge (stark normative statement)
  - There is a trade-off between gains from learning true preferences and emotional costs from adjusting one's attitudes and self-concept
  - Studying this trade-off and learning about the distortions to be overcome will be a topic of research for the years to come

## 5 Conclusion

We asked three questions

- What is the role of emotions in utility theory?
- How do economists model emotions?
- Why should we care about emotions at all?

Utility theory has been developed by

- Classical economists with a lot of emphasis on emotions
- Neoclassical economists with a more or even explicit emotion-free interpretation
- Behavioural economics with explicit focus on subjective feelings and experiences
- Preference-based approach seems to leave room for emotions

How do economists model emotions?

- Allow for experienced-utility as opposed to decision-utility (ex-ante and ex-post emotions)
- Make preferences state-dependent (immediate emotions, cue theory)
- Model emotions as state variables (stress)
- Let payoffs (utility) depend on beliefs (psychological games)



## Why care about emotions?

- Economists outside their office would all agree that emotions matter for decisions
- Emotions in decision models allow to understand deviations from predictions of expected utility theory
- Many individuals are not aware of their true preferences
  - Understanding one's true preferences can lead to a personally more fulfilling life
  - Many problems of society can be overcome only if individuals change their attitudes (preferences)
  - Learning one's own preferences is emotionally (and other) very costly
  - Emotions need to be understood better, individuals should be more aware (and open) about their emotions, we need a better understanding of emotional processes
  - Then the world can become a more peaceful and enjoyable place

What do we learn from all of this?

- Do we learn something about emotions? (“Psychologists’ view”)
  - Question should be more broadly understood: what can we learn from formal approach to understanding emotions?
  - Precise definitions (think about distinction between regret and disappointment)
  - Clear description of cognitive processes when emotions affect decision making (think of anticipatory emotions)
  - A simple characterisation of embodied view (think of ‘somatic markers’) of emotions via state variables (think of hunger, cues and stress)
  - The inseparability of embodied and cognitive processes (the control of state variables, aka ‘the body’, is always a cognitive process)
  - Psychologist needed for a better elaboration of all these promises

What do we learn from all of this? (cont'd)

- Do we learn something about behaviour? (“Economists’ view”)
  - A lot
  - Kahnemann-Tversky departures from EU framework can be explained by regret
  - Allais paradox can be explained by disappointment
  - ‘Errors’ and harmful consumption behaviour can be understood
  - Beliefs in games enrich predictions about behaviour considerably
  - much more ...
  - Using emotions as determinant of decisions is an absolute must
- Are there any predictions from emotion models that are observationally *different* from predictions made by other models?
  - Good question
  - Needs much more elaboration and thinking
  - Should be done (but anyway also in other fields)
- What next?



- Emotions are the way to go
- Any new model should work out how it can be tested against other predictions

Thank you !

