Fallacy of division

- It is the opposite of the fallacy of composition. It occurs when it is automatically presumed that what is true at a larger scale (the global level) is true at some smaller scale (the individual level).

- Emergent properties create this fallacy. A property is emergent when a whole has the property yet none of its components enjoys the property.

- **Examples.** Being alive is an emergent property: cells are made of molecules but molecules are not living beings. Consciousness seems to be an emergent property of the physical brain.

"Because <u>the coordinated macroeconomy is an emergent characteristic of uncoordinated micro behaviour</u>, macro outcomes that are unexpected can emerge (in the sense that the outcomes are not consistent with the objectives of individuals). The most obvious example emphasized by classical and neoclassical economists is that the unconstrained pursuit of maximal profits by individuals operating in a competitive setting ends up reducing their profits to zero. The tragedy of the commons is another example well known to economists."

RG Lipsey, KI Carlaw, CT Bekar (2006): *Economic Transformations: General Purpose Technologies and Long-Term Economic Growth*, Oxford University Press, p. 37.

Simpson's paradox (or reversal paradox)

- Related to the fallacy of division, it occurs when <u>something true for different groups is false for the combined group</u>.

- **Example.** There are three groups, two periods, and the tax rate (taxes paid in relation to income) of each group. The <u>tax rate of each group diminishes</u> from $t = 1$ to $t = 2$, but, <u>in the aggregate, the tax rate increases</u> from $t = 1$ to $t = 2$.

- Emergent properties create this fallacy. <u>A property is emergent when a whole has the property yet none of its components enjoys the property</u>.

	period $t = 1$			period $t = 2$		
	taxes	income	tax rate	taxes	income	tax rate
group 1	5	100	5%	2	50	4%
group 2	150	1,000	15%	63	450	14%
group 3	40	200	20%	255	1,500	17%
all groups	195	1,300	15%	320	2,000	16%

Cum hoc ergo propter hoc fallacy

- The *cum hoc ergo propter hoc* (= "with this, therefore because of this") fallacy consists in inferring causality from the proximity of events.

- One commits this fallacy when the presence of a statistical association between two variables is considered enough to declare a causal connection between them. Statitiscal correlation does not imply (proves) causality.

- **Example.** Having low inflation rates with an independent central bank is not enough to conclude that the bank's independence caused low inflation.

Post hoc ergo propter hoc fallacy

- The *post hoc ergo propter hoc* (= "after this, therefore because of this") fallacy is also known as the false causality fallacy and consists in <u>attributing causality to the order of events</u>.

- This fallacy presumes that, if event A precedes event B, then A causes B. To sustain the causal claim, one needs to explain which is the connection leading from A to B (are you superstitious?).

- **Example.** A fall in unemployment after a change in the law regulating labour contracts does not justify the conclusion that the legal reform caused the fall.

Chicken-egg problems

- It is very likely that, in a developed economy, everything eventually affects everything. This makes it difficult to ascertain what is a cause and what is an effect.

- **Example 1.** Are there more workers hired because firms sell more or firms sell more because more workers have been hired?

- **Example 2.** Are prices going up because consumers spend more now or consumers spend more now because prices are going up (and they expect them to rise further in the future)?

Unintended consequences

- Macroeconomic outcomes are the result of the aggregation of people's decisions. But people may make certain choices aiming at some consequence, result, or outcome and, in the end, the opposite of what was intended may come out.

- This creates a serious problem: <u>how could one explain a result no one intended to achieve</u>?

- From the standpoint of the design of economic policy, how could one prevent the occurrence of unintended events?

Prisoner's dilemma

- The dilemma illustrates the difficulties of trying to reduce macroeconomics to microeconomics and the limits of presuming that all macroeconomic outcomes can be explained in terms of the behaviour of self-interested individuals.

		player 2	
		a	*b*
player 1	*a*	2 2	0 3
	b	3 0	1 1

Only outcome consistent with self-interest

Prisoner's dilemma

- A lesson of the example is that, by trying to get their best result, players end obtaining a bad, unintended result (bad in the sense that there is another result that both players prefer to the bad result).

- The example also represents a serious <u>objection to the claim that the collective outcome of self-interested decisions is collectively desirable</u>. Guided by their self-interest, players generate outcome (1, 1). But from a collective point of view, outcome (2, 2) is more desirable than (1, 1).

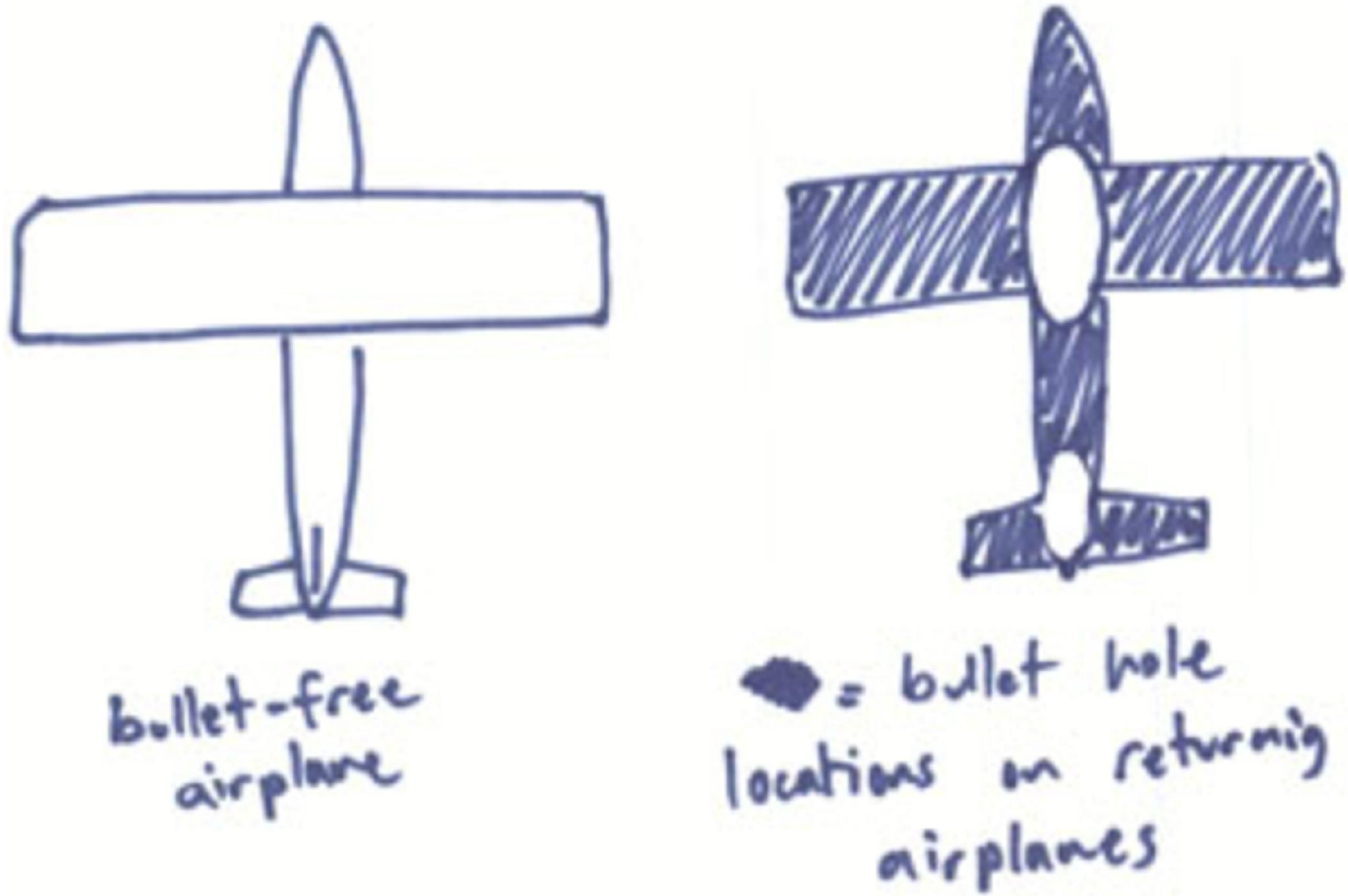
Silent evidence: an example

- During WWII, the British Air Ministry faced the problem of improving the protection of bombers by adding armor to the planes' structure.

- Data showed the greatest damage on the aircraft extremities. The natural suggestion was to add armor to the extremities. The mathematician Abraham Wald suggested <u>putting more armor on the places with the fewest holes</u>: the main wing and tail spars, engines, and core fuselage areas.

- The explanation was "survivorship bias": data did not include the lost planes.

http://digitalroam.typepad.com/digital_roam/2006/03/the_hole_story_.html



- No damage was recorded in engines and core areas most likely because those planes crashed and thus did not appear in the database. Corollary: the information that is not there may be as relevant as the information that is collected.

El Farol bar problem

- 100 individuals plan, simultaneously and independently, to go to a bar. If more than 60 persons come to the bar, the experience is not enjoyable: to have fun requires than at most 60 persons attend. Each individual would like to stay away if the bar is overcrowed (more than 60 persons attend) and would like to go to the bar otherwise.

- The paradox is that <u>if everyone chooses the same strategy, the strategy fails</u> in the sense that everyone would prefer to have selected the other strategy.

El Farol bar problem

- If all individuals decide to go, the bar is overcrowded and, hence, they would have been preferable not to come. If all individuals decide not to come, the bar is empty, so each individual would have liked to go.

- <u>If there is a "natural" way of predicting what an individual will do, the prediction is self-defeating</u>: if the prediction is that few will attend, then all will attend; if it is that all will attend, then no individual will attend.

El Farol bar problem

- This illustrates the limitations of a common strategy in macroeconomic analysis: the use of representative agents models in which the behaviour of a collective (all consumers, all firms) is studied presuming that one can replace the collective by one agent (the representative consumer or firm).
- In El Farol bar problem this strategy is not appropriate, because the analysis demands the existence of heterogeneity: based on private information (their social context) some individuals will choose to go and others to stay away.

Truth decision criteria: the lottery paradox

LOTTERY PARADOX, THE. First adduced by Henry Kyburg, this paradox puts the confidence-threshold theory of acceptance in question. **Formulation.** Let us agree to accept any proposition whose degree of confirmation is greater than 0.9. We are given, *ex hypothese* (hence with degree of confidence = 1) that there is a fair lottery with 1000 tickets in which one, and only one, ticket will win. Let P_i, for *i* from one to 1000, be the proposition that the *i*th ticket will lose. Hence, the degree of confidence for each P_i is 0.999, which is greater than 0.9. Therefore, we accept each P_i and, in consequence, we accept that no ticket will win, which contradicts our acceptance of the proposition that one ticket will win.

Glenn W Erickson and John A Fossa (1998): Dictionary of paradox, p. 115

More on what is right or wrong to do

Suppose you're on a game show and you're given the choice of three doors. Behind one door is a car; behind the others, goats. The car and the goats were placed randomly behind the doors before the show. The rules of the game show are as follows: After you have chosen a door, the door remains closed for the time being. The game show host, Monty Hall, who knows what is behind the doors, now has to open one of the two remaining doors, and he will open a door with a goat behind it. After Monty opens a door with a goat, he always offers you a chance to switch to the last, remaining door. Imagine that you chose Door 1 and the host opens Door 3, which has a goat. He then asks you "Do you want to switch to Door Number 2?" Is it to your advantage to change your choice?

The Monty Hall dilemma/paradox

Mark Chang (2012): Paradoxes in scientific inference, p. 67

Michael Clark (2012): Paradoxes from A to Z, p. 133

The trolley problem

A trolley's brakes have failed and it is careering towards five workmen on the track ahead; a bystander can avert their death by pulling a lever and diverting the trolley to a spur that forks off to the right, though only at the expense of killing a workman on the spur. Should he turn the trolley?

While it may be permissible, even mandatory, to divert the trolley, it is not in general right to sacrifice one to save many. For example, five patients dying from organ failure can be saved from death only by transplanting organs from a sixth, healthy individual. Should he be sacrificed to save the other five? Surely not. But why not?

Michael Clark (2012): Paradoxes from A to Z, p. 248

Regression to mean

The phenomenon of regression to the mean holds for almost all scientific observations. Thus, many phenomena tend to be attributed to the wrong causes when regression to the mean is not taken into account. What follows are some real-life examples.

The calculation and interpretation of "improvement scores" on standardized educational tests in Massachusetts probably provides an example of the regression fallacy. In 1999, schools were given improvement goals. For each school the Department of Education tabulated the difference in the average score achieved by students in 1999 and in 2000. It was quickly noted that most of the worst-performing schools had met their goals, which the Department of Education took as confirmation of the soundness of their policies. However, it was also noted that many of the supposedly best schools in the Commonwealth, such as Brookline High School (with 18 National Merit Scholarship finalists), were declared to have failed.

Mark Chang (2012): Paradoxes in scientific inference, p. 132

On generalizing from micro analysis

- Consider the following extremely simple economy. There are two individuals, A and B. Individual A has exclusive access to a valuable resource X. Individual B has exclusive access to a valuable resource Y. Individual A would like to obtain Y from B, and B would like to obtain X from A.

- Each individual sets the price of the respective resource in terms of some unit of account. Let p_x designate the price for X set by A and by p_y the price for Y set by B. Suppose A demands Y_A units of Y and B demands X_B units of X.

On generalizing from micro analysis

- It is assumed that what each individual spends in buying the resource to which the individual has no access coincides with the income the individual obtains from selling the resource the individual owns. Formally,

$$\underbrace{\overbrace{p_x \cdot X_B}^{A'\text{s income}}}_{B'\text{s expenditure}} = \underbrace{\overbrace{p_y \cdot Y_A}^{A'\text{s expenditure}}}_{B'\text{s income}} .$$

On generalizing from micro analysis

- **Assumption 1.** Income $p_x \cdot X_B$ moves in the same direction as p_x (a conventional justification could be that the demand for X is inelastic). That is,

$$\uparrow p_x \;\Rightarrow\; \uparrow (p_x \cdot X_B)$$

- **Assumption 2.** The demand for each resource increases with income (they are normal goods).

$$\uparrow (p_x \cdot X_B) \;\Rightarrow\; \uparrow Y_A$$

$$\uparrow \left(p_y \cdot Y_A\right) \;\Rightarrow\; \uparrow X_B$$

On generalizing from micro analysis

- **Assumption 3.** The price p_y of Y is not lowered when the price p_x of X is increased.

$$\uparrow p_x \not\Rightarrow \downarrow p_y$$

- **Result.** The demand for X is upward sloping: <u>an increase in the price p_x of X leads to an increase in the demand for X</u>.

$$\uparrow p_x \Rightarrow^{A1} \uparrow (p_x \cdot X_B) \Rightarrow^{A2} \uparrow Y_A \Rightarrow^{A3}$$
$$\Rightarrow \uparrow p_y \cdot Y_A \Rightarrow^{A2} \uparrow X_B$$

Newcomb's problem

- There are two boxes, A and B. Your decision is between taking both boxes or taking only box B. Box A contains 1,000 EUR. Box B may contain 1,000,000 EUR or nothing.
- What B contains depends on the decision of an individual who has predicted correctly what thousands of people confronted with that dilemma have chosen in the past. The individual has put 1,000,000 EUR in box B if he has predicted that you will take only box B. He has put nothing in box B if he has predicted that you will take both boxes. Knowing all this, what choice would you make?

Gideon's problem

- You must choose box A, containing €1,000, or box B, containg €1. Someone promises to pay you €1,000,000 if you choose irrationally. Which box would you choose?

- If choosing B is irrational, you get €1,000,001. That makes A the rational choice, so you would receive only €1,000. Hence B is not the irrational choice.

- If choosing A is irrational, you get €1,001,000. That makes B the rational choice, so you would receive only €1. Therefore A is not the irrational choice.

Paradox of the court

- A contract between A and B establishes that (i) A gives legal instruction to B and (ii) B pays for the instruction only after B wins his first case. When B's instruction has been complete, A asked B to pay for his instruction. B refuses to pay and you must solve the dispute. Must B pay to A?

- If A wins the case, he should be paid because he has won. If A does not win, then B wins his first case and, by the agreement with A, B should pay.

- If B wins the case, he should not pay because of your verdict. If B does not win, by virtue of the contract, B need not yet make any payment to A.

The dogmatism paradox

- Suppose you know some sentence **s** is true. This makes any evidence against **s** misleading, since it would be evidence against a true sentence.
- If one does not accept misleading evidence, the conclusion is that once something is accepted as true, there is a strong incentive to disregard any subsequent evidence against it.
- By ignoring evidence to what one holds as true, one becomes dogmatic, which does not seem a desirable trait of truth searchers.

The indoctrination paradox

- It seems that in a democratic society students should develop rationally grounded beliefs that are open to change.
- But this goal seems to demand acceptance by students of the belief in rational methods of forming beliefs.
- The paradox is that such a belief must be immune to challenges: to prevent indoctrination students must be indoctrinated.

The framing effect

- The framing effect occurs when conclusions depend on the way information is presented. For instance, options described in terms of outcomes viewed as positive tend to be preferred to equivalent options described in terms of outcomes viewed as negative.

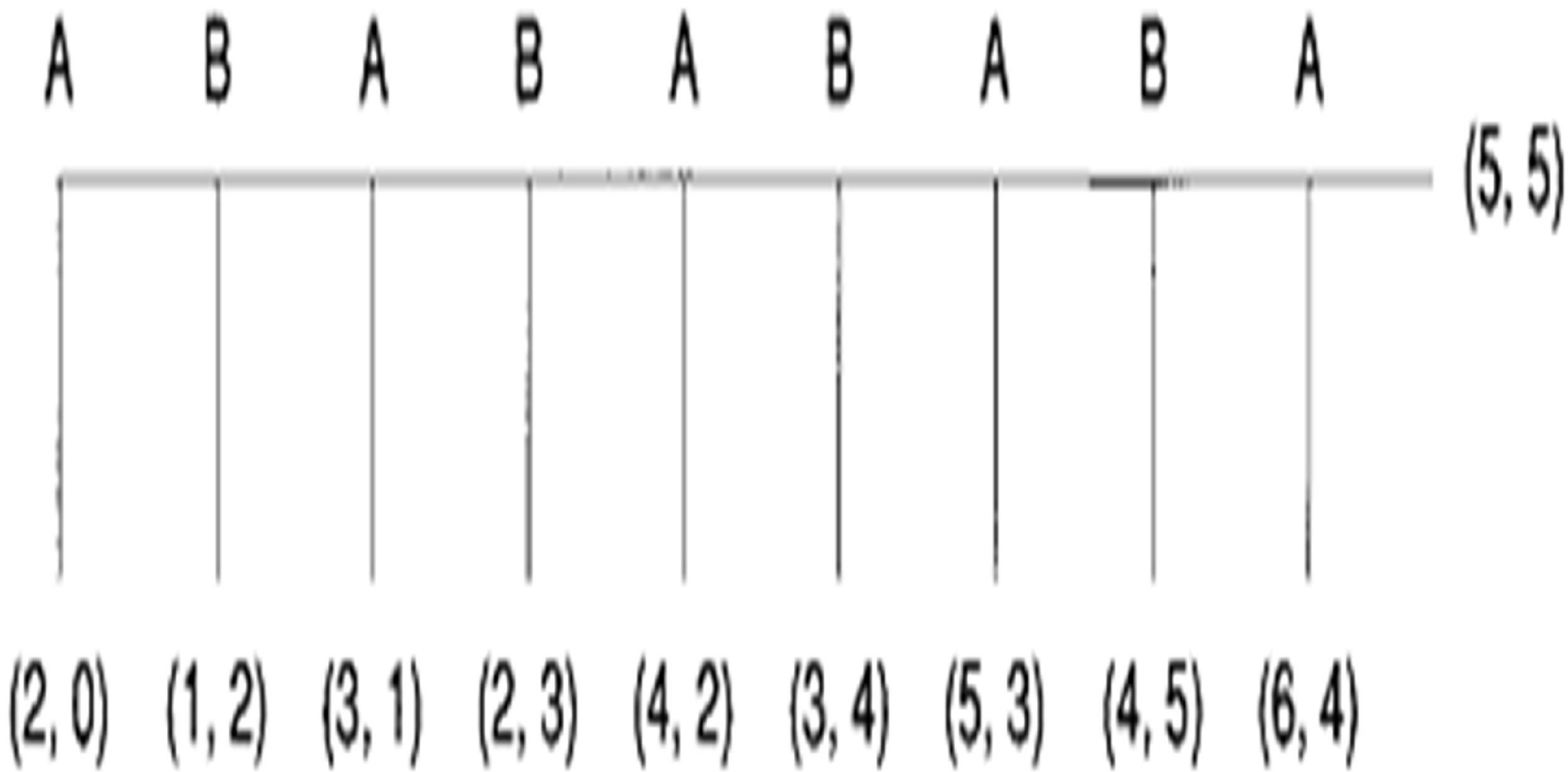
- For instance, an economic policy expressed in terms of employment is more likely to be supported by people than the corresponding policy expressed in unemployment terms.

- There are 100 people, 80 of them unemployed and the remaining 20 employed. What do you prefer?

- **Policy A**: a measure that increases employment by 10 persons
- **Policy B**: a measure that reduces the unemploy-ment rate by 10 percent points

- Policy C: a measure that reduces employment by 10 persons
- Policy D: a measure that increases the employment rate by 50%

- **Policy E**: a measure that reduces the unemploy-ment rate by 10 percent points
- **Policy F**: a measure that increases the employment rate by 10 percent points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(5, 5)
(2, 0) (1, 2) (3, 1) (2, 3) (4, 2) (3, 4) (5, 3) (4, 5) (6, 4)