

Behavioral Game Theory

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Outline

(September 3, 2007)

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- Introduction

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- Examples of laboratory experiments

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 - ① “Beauty contest”, iterated elimination of dominated strategies, depth of reasoning

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 - ④ Ultimatum game

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 - ② Coordination and convention
 - ③ Testing mixed strategies
 - ④ Ultimatum game
- Experimental protocol

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Recent branch of game theory using an *experimental approach*

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- Evaluate new policies or institutions before implementing them in the field
- Teaching tool of game theory and market mechanisms

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- ② Easy to replicate

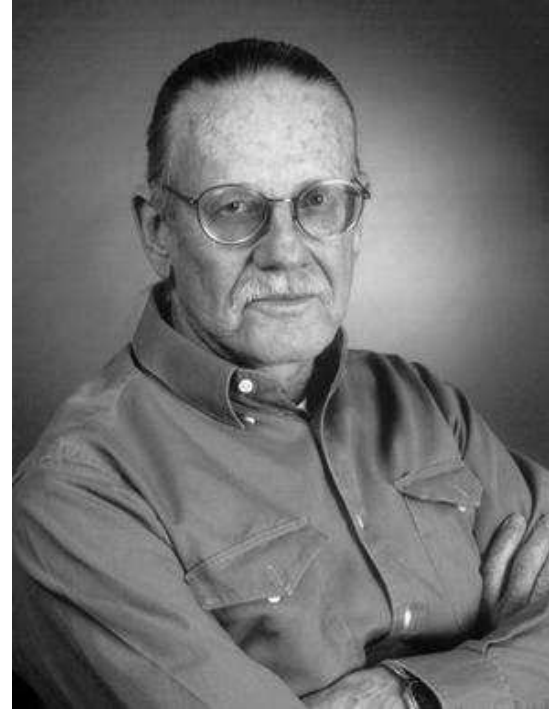
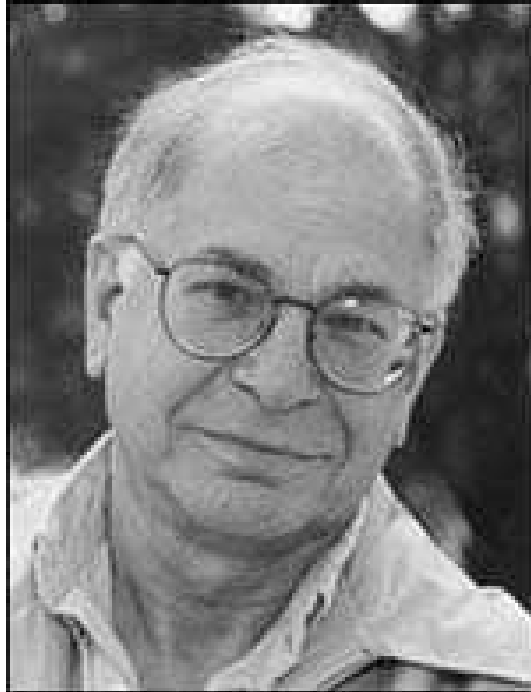


Figure 1: Daniel Kahneman (1934–) and Vernon L. Smith (1927–), Nobel Prize in Economics in 2002

“Beauty contest” and Depth of Reasoning

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“Professional investment may be likened to those newspaper competitions in which the competitors have to pick out the six prettiest faces from a hundred photographs, the prize being awarded to the competitor whose choice most nearly corresponds to the average preferences of the competitors as a whole; so that each competitor has to pick, not those faces which he himself finds prettiest, but those which he thinks likeliest to catch the fancy of the other competitors, all of whom are looking at the problem from the same point of view. It is not a case of choosing those which, to the best of one’s judgment, are really the prettiest, nor even those which the average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligence to anticipating what the average opinion expects the average opinion to be . And there are some, I believe, who practice the fourth, fifth and higher degrees.” (Keynes, 1936, Chapter 12).

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Iterated elimination of dominated strategies:

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- With this reasoning, every player's announcement is in $[0, 70]$, so 70% of the average is not larger than 49
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- then 25, 18, ...

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It is also easy to verify that announcing 0 is the unique Nash equilibrium

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Further readings: Camerer (2003, chap. 5), Nagel (1995) and Ho et al. (1998)

Coordination and Convention

Coordination and Convention

	Median choice													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	45	49	52	55	56	55	46	-59	-88	-105	-117	-127	-135	-142
2	48	53	58	62	65	66	61	-27	-52	-67	-77	-86	-92	-98
3	48	54	60	66	70	74	72	1	-20	-32	-41	-48	-53	-58
4	43	51	58	65	71	77	80	26	8	-2	-9	-14	-19	-22
5	35	44	52	60	69	77	83	46	32	25	19	15	12	10
6	23	33	42	52	62	72	82	62	53	47	43	41	39	38
7	7	18	28	40	51	64	78	75	69	66	64	63	62	62
8	-13	-1	11	23	37	51	69	83	81	80	80	80	81	82
9	-37	-24	-11	3	18	35	57	88	89	91	92	94	96	98
10	-65	-51	-37	-21	-4	15	40	89	94	98	101	104	107	110
11	-97	-82	-66	-49	-31	-9	20	85	94	100	105	110	114	119
12	-133	-117	-100	-82	-61	-37	-5	78	91	99	106	112	118	123
13	-173	-156	-137	-118	-96	-69	-33	67	83	94	103	110	117	123
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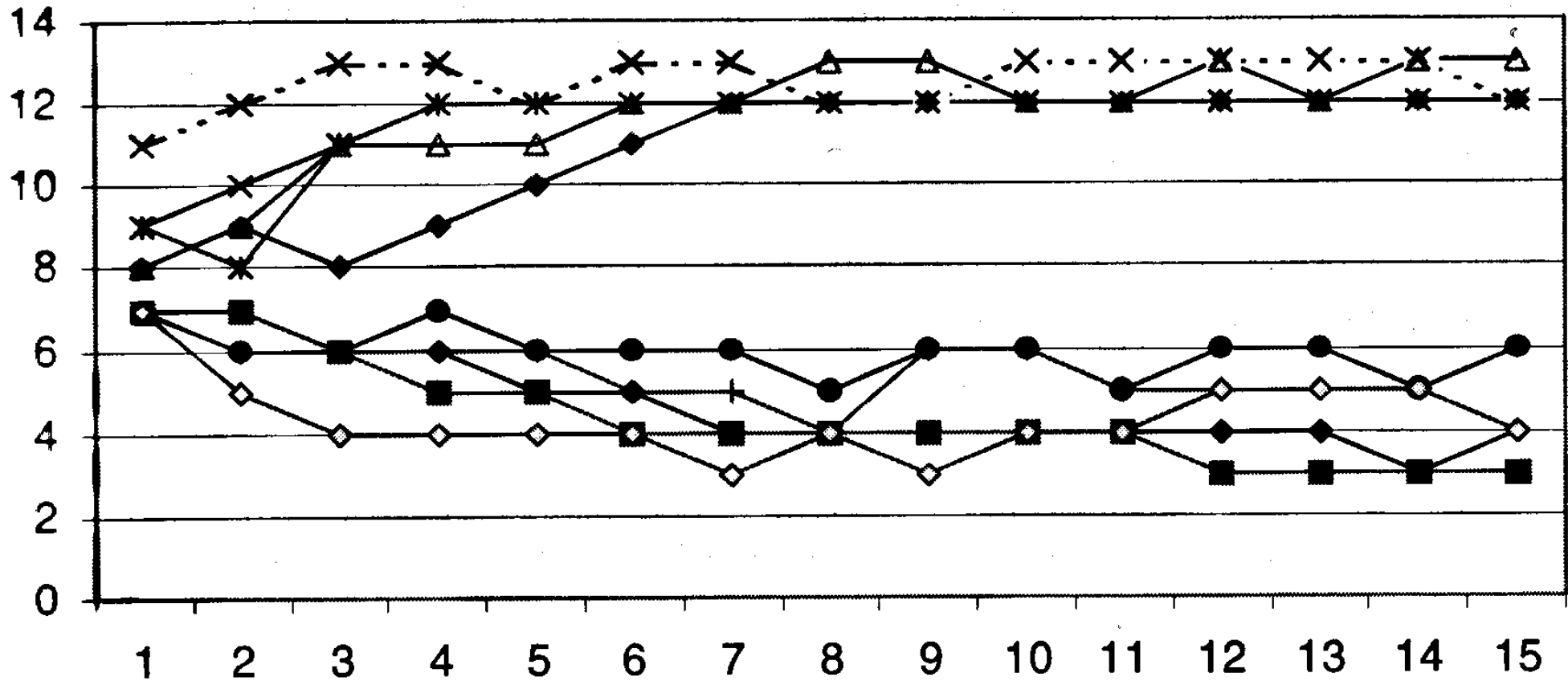
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- Biases of human perception of probabilities, and difficulty to make independent choices

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- Non-independent choices is consistent with an **equilibrium in beliefs** (Brandenburger, 1992; Aumann and Brandenburger, 1995)
- No assumption on risk attitude is required if there is only two possible payoffs in the game (cardinality of VNM utility functions)

O'Neill (1987) Experiment

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	a	b	c	J	Nash equilibrium	Empirical frequencies
a	-5	5	5	-5	0.20	0.221
b	5	-5	5	-5	0.20	0.215
c	5	5	-5	-5	0.20	0.203
J	-5	-5	-5	5	0.40	0.362
Nash equilibrium	0.20	0.20	0.20	0.40		
Empirical frequencies	0.226	0.179	0.169	0.426		

(105 rounds with 25 pairs of subjects)

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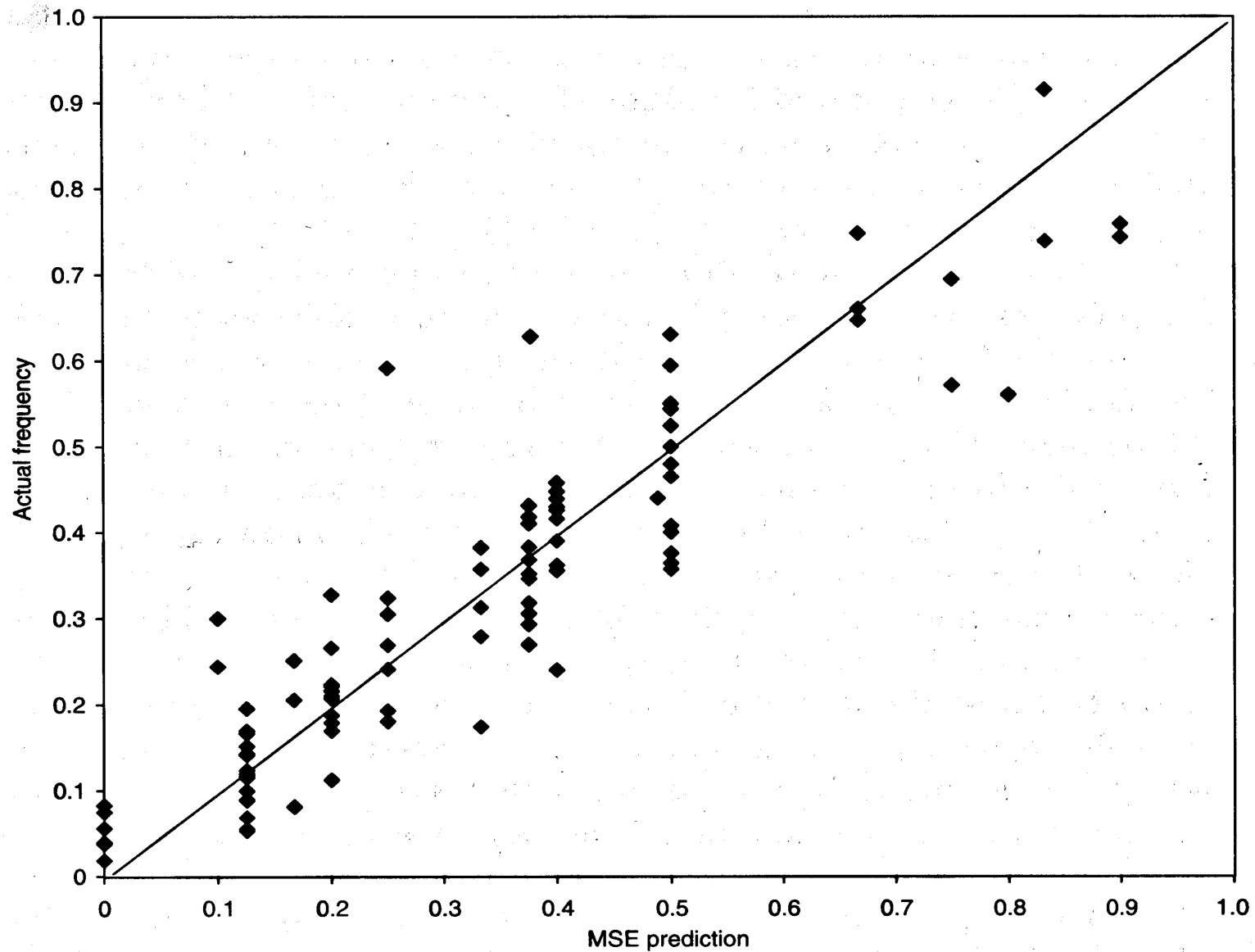
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➡ Aggregate behavior remarkably close to equilibrium predictions

Camerer (2003, Figure 3.1, page 121) : General idea of the predictive power of mixed strategy Nash equilibrium in various experiments with a unique Nash equilibrium

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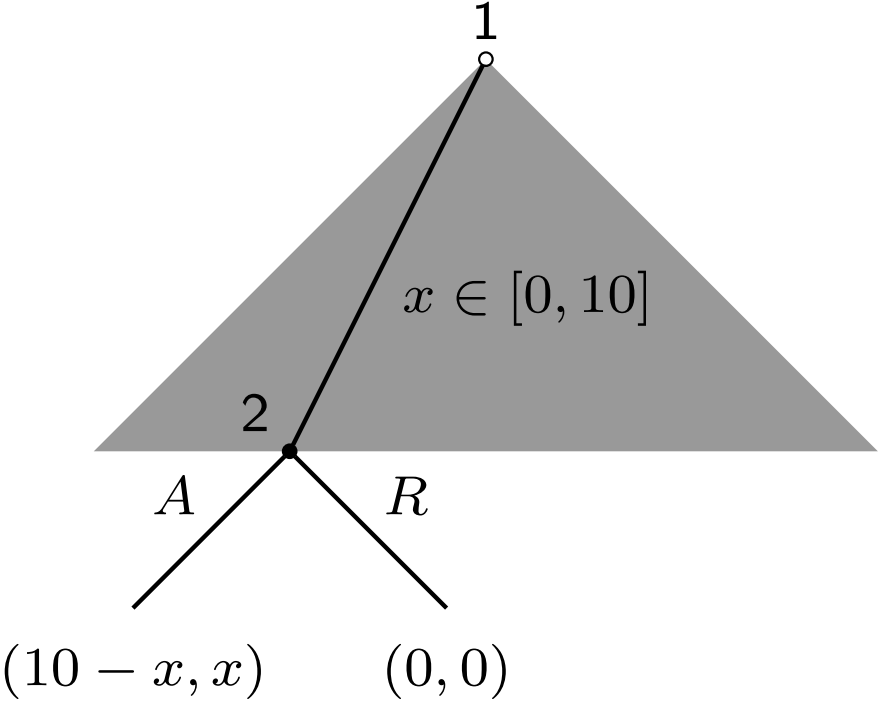
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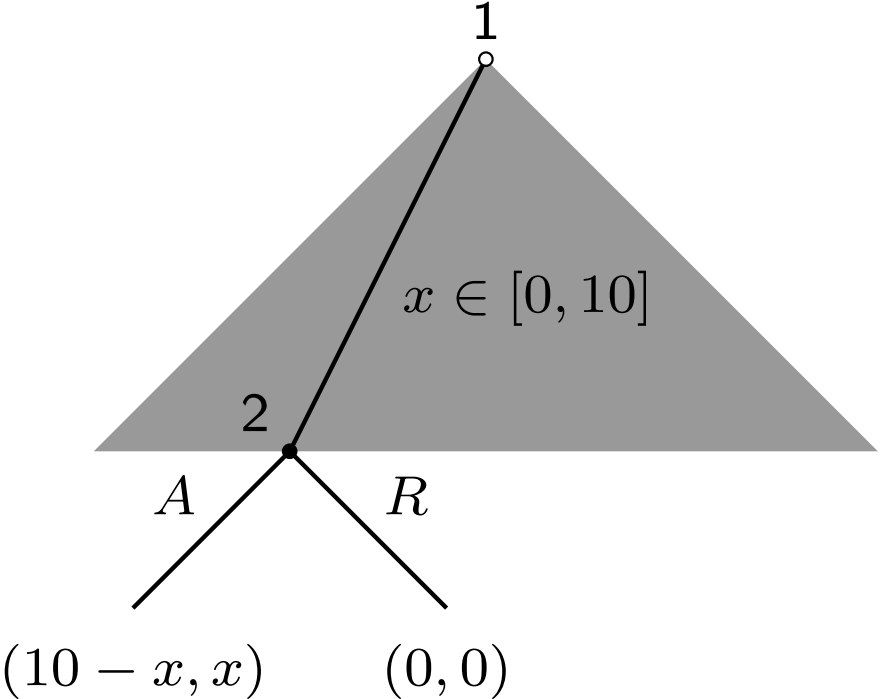
- ↳ Last step of a more complicated negotiation problem

Game tree:

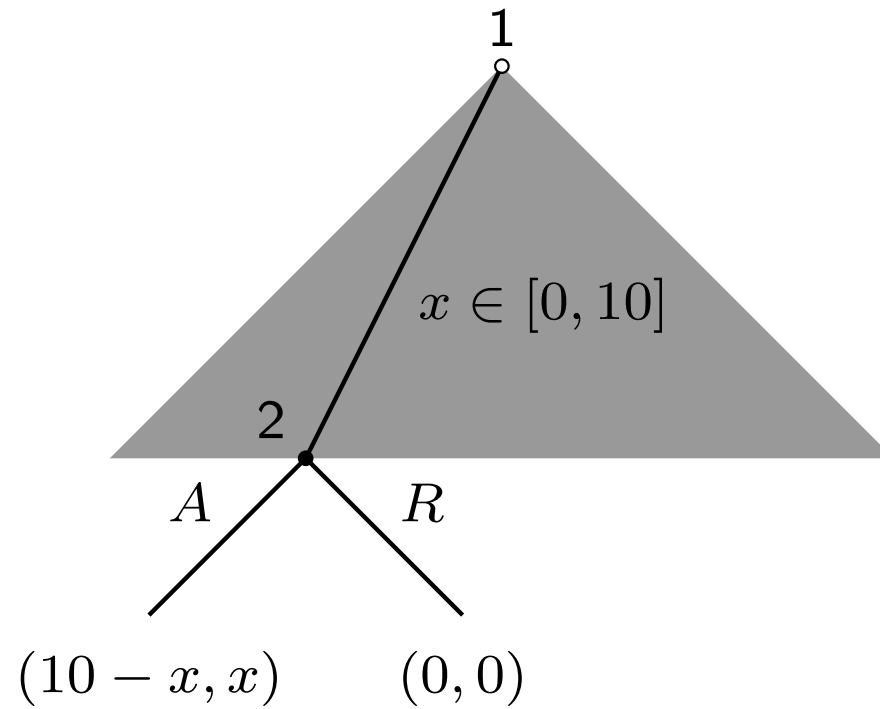
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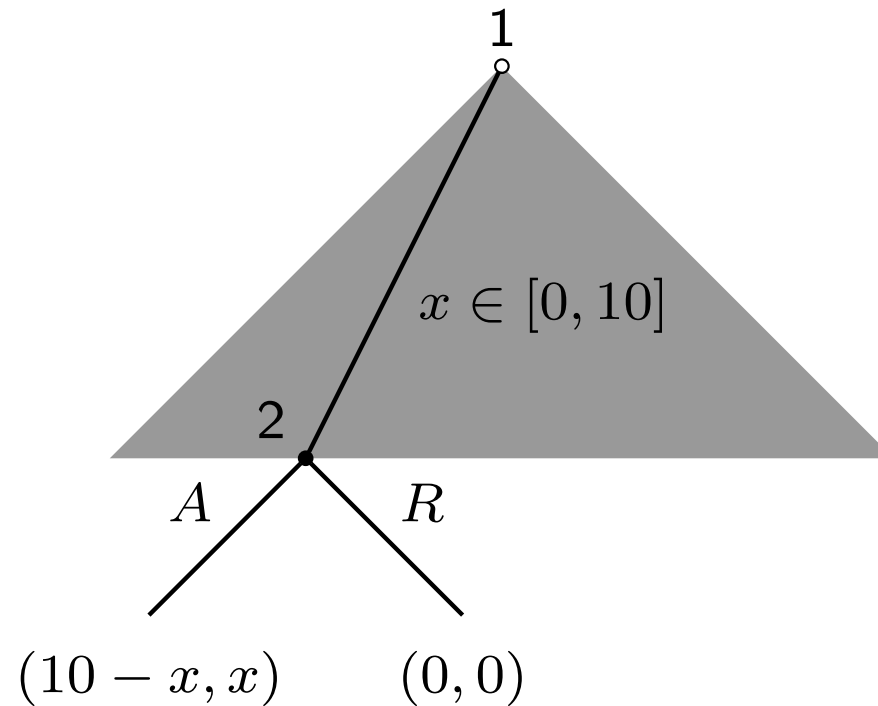
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Game tree:

**Backward Induction:**

The second player accepts every positive offer

\Rightarrow The first player keeps 10 euros (or 9.99 euros): $x \simeq 0$

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Remark. This explanation is NOT inconsistent with standard game theoretical models and expected utility theory

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- In general, all information that is available to the game theorist should be made available to the subjects (\neq experiments in psychology)

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Anonymity.

- Subjects should not be able to identify the other participants
- No communication is allowed, except if communication is explicitly specified into the rules of the game (e.g., experiments on “*cheap talk games*”)

Matching and Reputation.

- Repetition of the game should not interfere with the original rules of the game (supergame effects: reputation, threat, punishment)

Incentives.

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Ordering Effect.

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Ordering Effect.

- Several games can be implemented in the same experiment but all subjects should not play them in the same order because the order may significantly influence their behavior (learning, framing, . . .)

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