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Implementation and mind control

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Nash implementation

- **Uninformed principal (planner) delegates decision to informed agents.**
- **Adverse Selection, Mechanism design, unique NE**

Standard approach

- **Agent's incentive is based on material interest**

  cf. Glazer and Rosenthal (92):   Salience
- **Mechanism design: Punish and Reward**

  Maskin (77/99), Abreu + Matsushima (92)

A behavioral approach

- **Agents' incentive is based, not only on material interest, but also, on social psychology (obedience, conformity)**

  Ash (55), Milgram (74), Zimbardo (77)

- **psychological cost of lying**

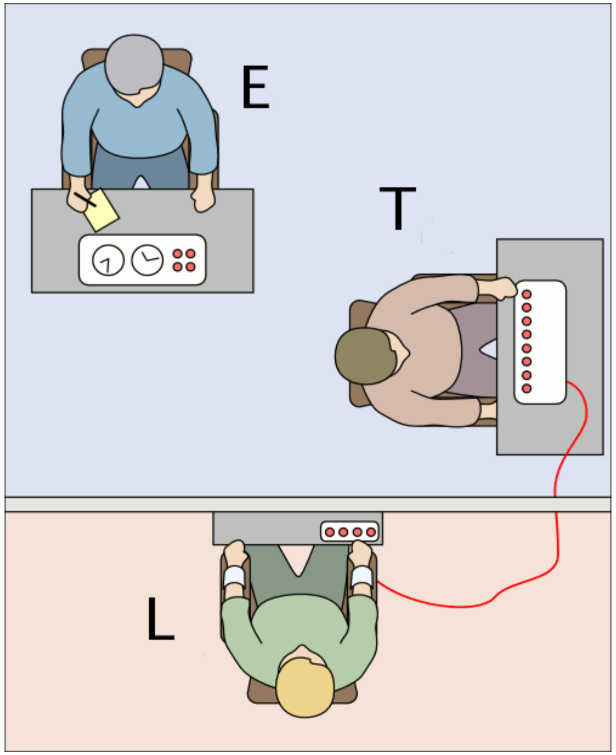
  $W_i(s_i) = 0$ **if strategy** s_i **implies honest**

  $W_i(s_i) > 0$ **otherwise**

- **Tiny cost functions in implementation**

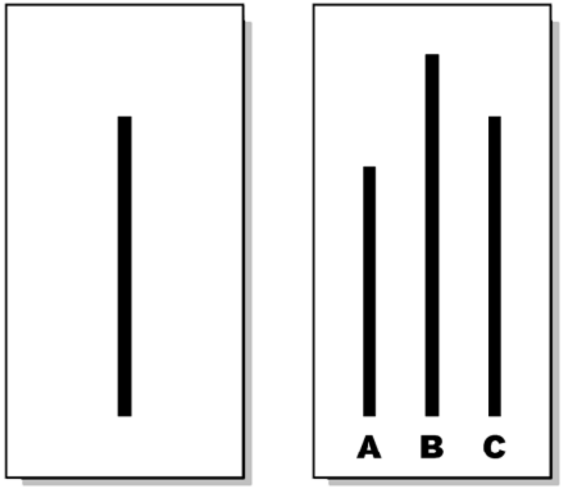
  Matsushima (02, 08a, 08b), Dutta + Sen (09), Kartik + Tercieux (09)

Eichmann test



Prison experiments

Ash experiment



Present paper

- **Psychological cost depend on ‘expectation’**

  ex. Psychological game Geanakoplos et al (89)

  Charness et al (06)

$$W_i(s_i, s_{-i})$$

S_i **Agent i’s strategy**

S_{-i} **Agent i’s expectation on others’ strategies**

- **Expectation-based obedience (EBO)**

  Psychological cost is greater if he expects others have kept honest.

  Psychological cost is smaller if he expects others have lied.

- **Principal designs mechanism that makes it easy to control agents' mind.**

  $\Rightarrow$ **Agents expect others to keep honest for a short while.**

  $\Rightarrow$ **They want to keep honest longer.**

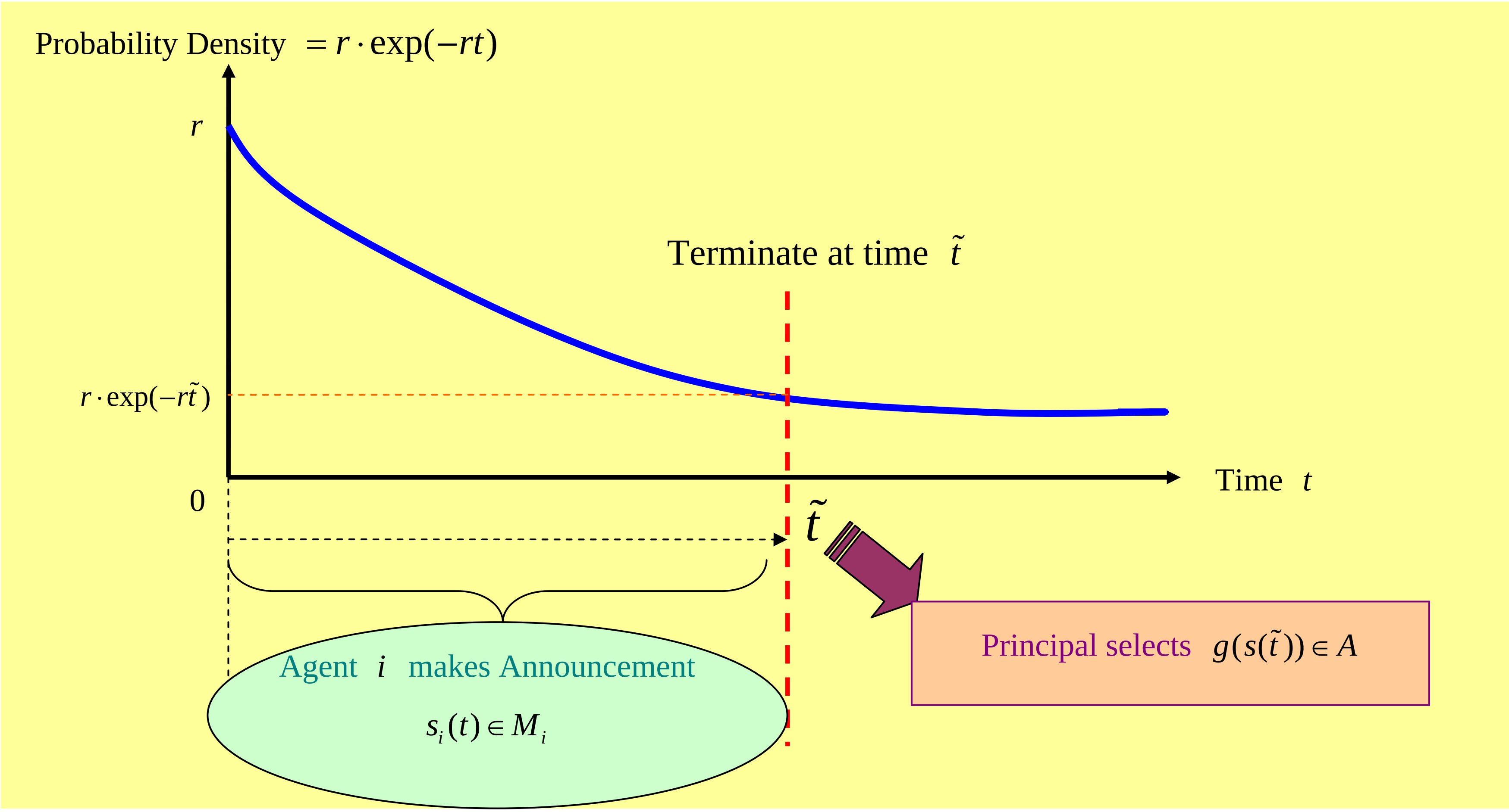
  $\Rightarrow$ **They expect others to keep honest longer.**

  $\Rightarrow$ **・・・** $\Rightarrow$ **'Honest ever' becomes unique NE**

How to design mechanism?

$$A,\ (M,g,r),\ M \equiv \underset{i \in N}{\times} M_i,\ g : M \to A,\ r \in [0,1),\ s_i : [0,\infty) \to M$$

- **Continuous time horizon** $[0,\infty)$
- **Agents make announcements at initial time 0,** $s_i(0) \in M_i$**.**
- **Agents can change announcements any time, many times.**
- **Principal determines terminal time** $\tilde{t}$ **randomly with hazard rate** r**.**
- **Principal follows final announcements.**
- **Principal prohibits mutual monitoring and communication.**
- **No 'punish and reward' scheme is used.**


Probability Density $= r \cdot \exp(-rt)$
r
$r \cdot \exp(-r\tilde{t})$
0
Terminate at time $\tilde{t}$
Time t
$\tilde{t}$
Agent i makes Announcement
$s_i(t) \in M_i$
Principal selects $g(s(\tilde{t})) \in A$

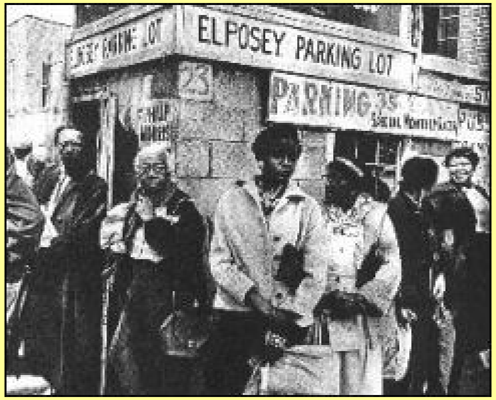
Principal prohibits mutual monitoring and communication

$\Rightarrow$ **Strategy is path-independent,** $s_i : [0, \infty) \to M_i$

cf. Montgomery Bus Boycott in 1955

$\Rightarrow$

$\Rightarrow$



Utility (expectation-based)

$$U_i(s) = \boxed{\begin{array}{c}\textbf{Material Payoff}\\ V_i(s)\end{array}} - \boxed{\begin{array}{c}\textbf{Psychological Cost}\\ W_i(s)\end{array}}$$

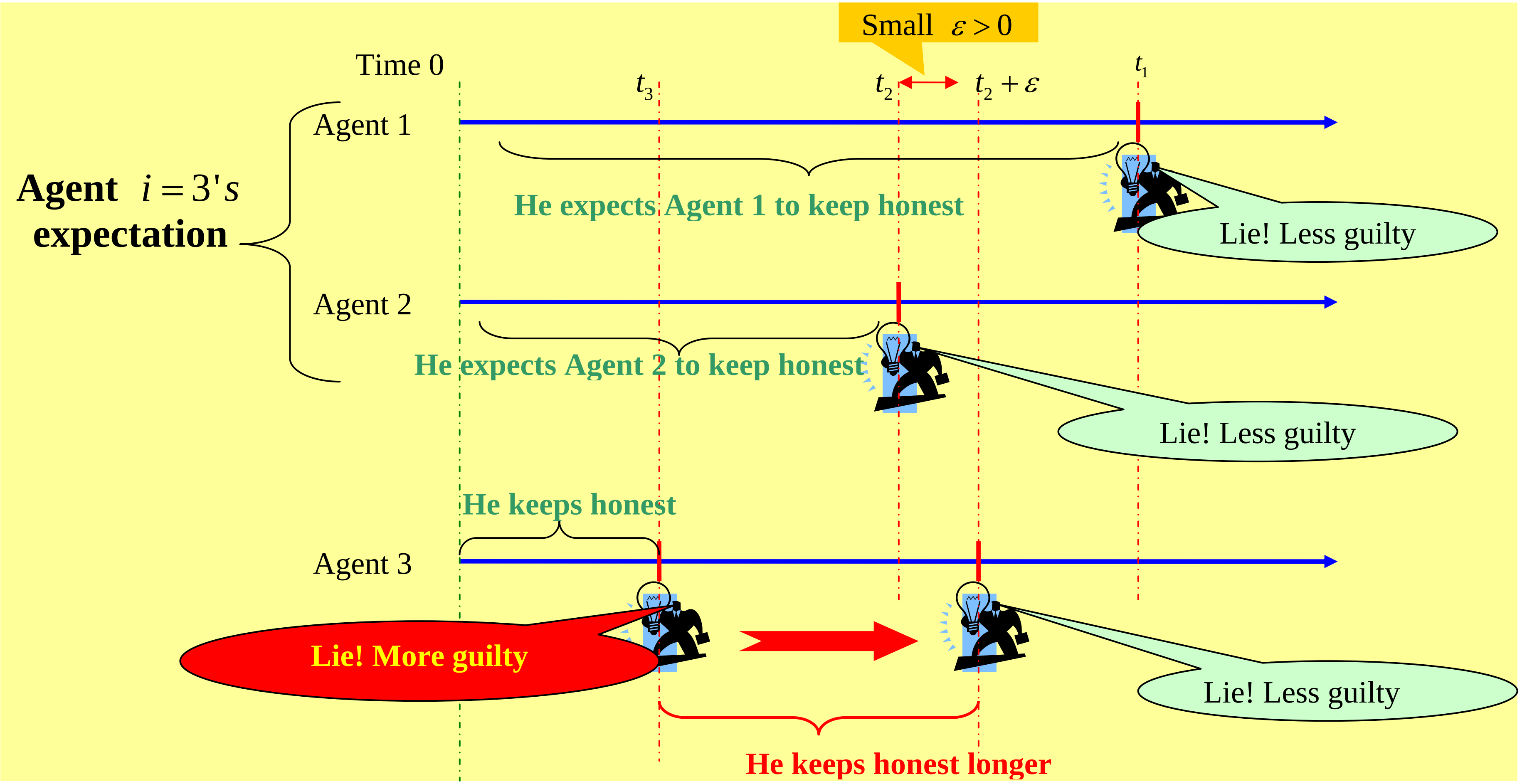
$s_i \in S_i$ **His strategy**

$s_{-i} \in S_{-i}$ **His expectation on other's strategies**

Material Payoff: **Expected value of his intrinsic utility** $v_i(a)$

$$V_i(s) \equiv \int_0^{\infty} v_i(g(s(t)))d[1-\exp(-rt)]$$

Utility satisfies EBO!



Expectation-based obedience (EBO): Definition

$m_i^* \in M_i, \;\; m^* = (m_i^*)_{i=1}^n$ Truthful message

$s_i^* \in S_i$ Truthful strategy, $s_i^*(t) = m_i^*$ for all $t \geq 0$

$t_i(s_i) \in [0, \infty)$ First time for agent i to tell a lie

$$s_i(t_i(s_i)) \neq m_i^*, \;\; s_i(\tilde{t}) = m_i^* \;\; \textbf{for all} \;\; \tilde{t} < t_i(s_i)$$

$s_{i,t} \in S_i$ Agent i keeps honest before t, follows s_i afterwards

$$s_{i,t}(\tilde{t}) = m_i^* \;\; \textbf{for all} \;\; \tilde{t} \in [0, t)$$

$$s_{i,t}(\tilde{t}) = s_i(\tilde{t}) \;\; \textbf{for all} \;\; \tilde{t} \geq t$$

Utility Function satisfies EBO if

For every $i \in N$, $j \in N \setminus \{i\}$, and $s \in S \setminus \{s^*\}$,

$$[t_i(s_i) \le t_j(s_j) \le t_h(s_h) \text{ for all } h \in N \setminus \{i, j\}]$$

$$\downarrow$$

$$[\lim_{\varepsilon \downarrow 0} \frac{W_i(s) - W_i(s / s_{i, t_j(s_j)+\varepsilon})}{\varepsilon} > r \max_{(a,a') \in A^2} |v_i(a) - v_i(a')| \exp(-rt_j(s_j))]$$

- **Lie after someone else has lied saves psychological cost.**
- **Marginal decrease in psychological cost is greater than marginal decrease in intrinsic (material) utility.**

Incentive compatibility in terms of intrinsic utility (IC)

$$v_i(g(m^*)) \geq v_i(g(m^* / m_i))$$

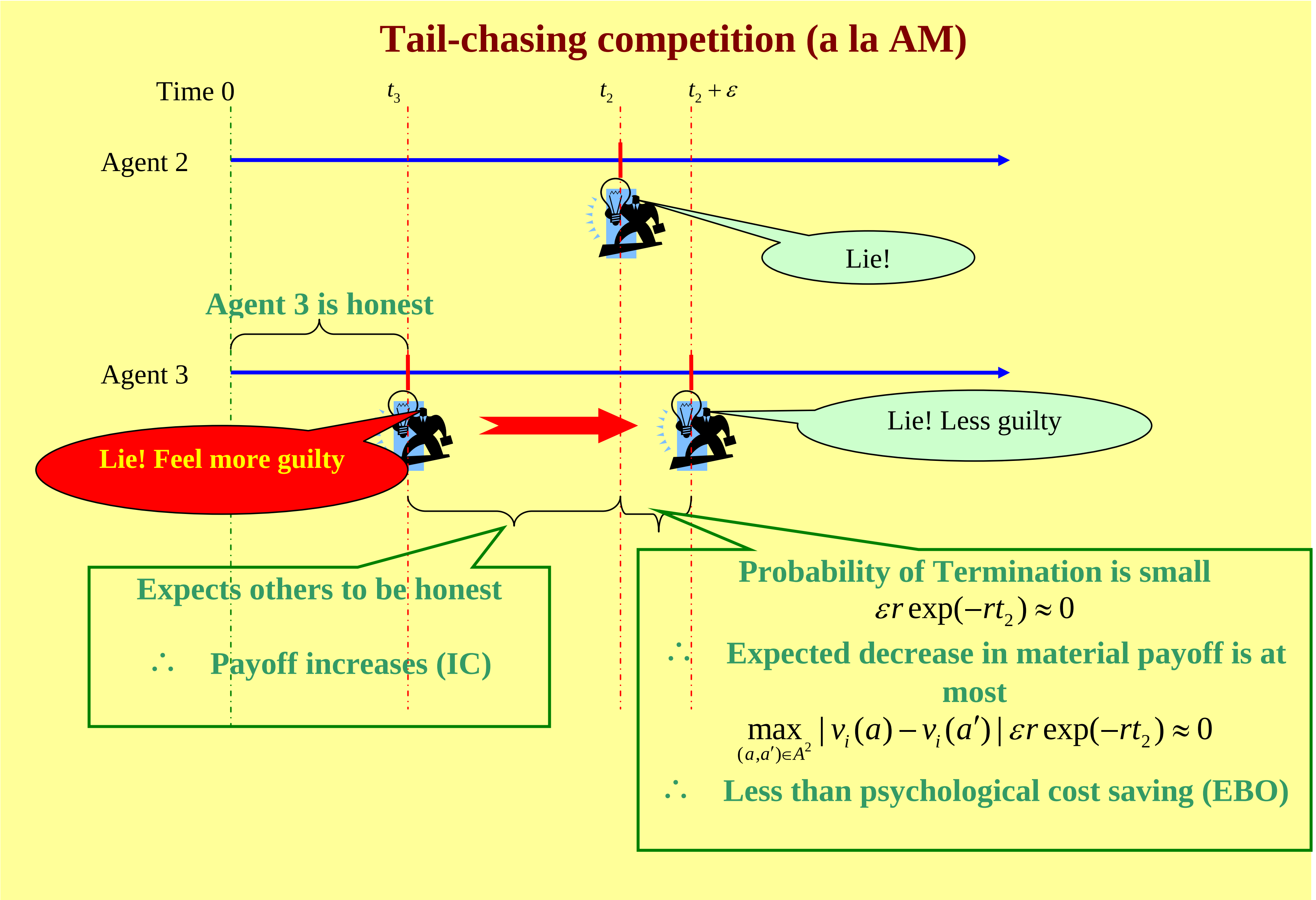
for all $i \in N$ **and all** $m_i \in M_i$

Main Theorem

With $n \geq 3$**, EBO, and IC,**

truthful strategy profile s^* **is**

unique Nash equilibrium


Tail-chasing competition (a la AM)
Time 0
t_3
t_2
$t_2+\varepsilon$
Agent 2
Lie!
Agent 3 is honest
Agent 3
Lie! Feel more guilty
Lie! Less guilty
Expects others to be honest
∴ Payoff increases (IC)
Probability of Termination is small
$\varepsilon r \exp(-rt_2) \approx 0$
∴ Expected decrease in material payoff is at most
$\max_{(a,a')\in A^2} |v_i(a) - v_i(a')| \varepsilon r \exp(-rt_2) \approx 0$
∴ Less than psychological cost saving (EBO)

Tail-chasing competition: difference from AM

AM mechanism controls material interest by fining first deviant explicitly.

Mechanism in present paper control mind to dislike being first deviant.

Psychological cost can be negligible compared to material payoff

$$\max_{(s,s')\in S^2} |W_i(s) - W_i(s')| \approx 0 \text{ for all } i \in N$$