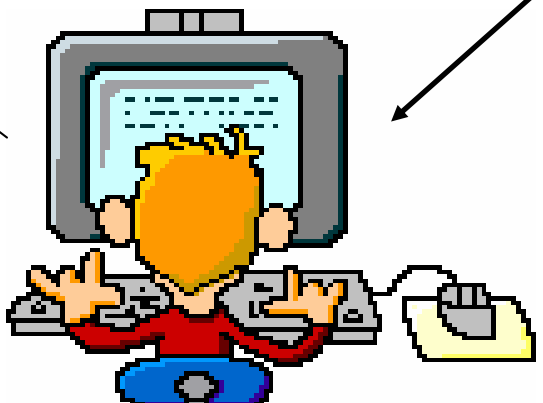
VoiceXML & Finite State Dialogue Processing

	C	S	A
c	C, c	C, c	C, c
u	S, c	A, u	A, u



EUROMASTERS 2004
VoiceXML IPD Tournament

Bonn, July 11-16, 2004

Motivation

You will use VoiceXML technology to solve interesting and important problems in connection to

COOPERATION

and

PREDICTION OF USER BEHAVIOR

which are important tasks in investigation of dialogues.

Your task

is to create a strategy of the dialogue system playing

ITERATED PRISONER'S DILEMMA

Your dialogue system

will be tested in the tournament:

Each of you will play with each DS except for your own

Your results and results of your DS will be summed together and will determine the winner. Minimum wins.

Prisoner's dilemma

- Two robbers have been arrested for robbing and questioned separately. Sheriff's offer is:
- If you confess and your accomplice remains silent – you will testify and be free, your accomplice get 6 years.
- If you remain silent and the accomplice confesses – the accomplice is free, you get 6 years.
- Both of you confess – both of you get 3 years.
- Both of you remain silent – both of you get 1 year.

PRISONER'S DILEMMA

	confess *uncooperate* *defect*	not confess *cooperate*
confess *uncooperate* *defect*	3, 3	0, 6
not confess *cooperate*	6, 0	1, 1

Iterated prisoner's dilemma - IPD

- The game is repeated, the players know the previous behavior of the counterplayer, the results are summed together.
- Example

1. Cooperate, Cooperate
2. Cooperate, Defect
3. Defect, Cooperate
4. Cooperate, Defect

The first player gets 13 "years", the second 7.

Information noise

- IPD (and Iterative Spatial PD) simulate important situation in economy, biology and social sciences. To get realistic results, information noise is often involved. Presence of the noise makes cooperative strategies more successful than uncooperative ones.

Information noise in our tournament

In each move, there will be 10 percent probability that the move of the dialogue system will be misinterpreted. That means, if it plays COOPERATE the real result will be UNCOOPERATE and vice versa. This will make computer automatically – this is intention, not error. The noise be will applied only to computer players, not to human players – for the sake of simplicity.

In our tournament, the number of moves in each game is

15

then the game ends.

Some possible strategies in IPD:

all_c: Always cooperates. (naïve peacemaker)

all_d: Always defects (uncooperates)

tft: tit_for_tat – cooperates or defects, then copies the moves of the couterplayer

tf2t: Tit_for _two_tats - Cooperates except if opponent has defected twice in the two previous moves.

spiteful: It cooperates until the opponent has defected, after that move it always defects.

Pavlov: cooperates if and only if both players opted for the same choice in the previous move.

random : Cooperates with probability 1/2.

Hints:

For IPD tournaments, *all_d* is not a good strategy – you "win" all your plays, but the others will profit from cooperation and in the end get less "years" then you. Also naïve peacemaker is not good. A robust strategy is *tft*, but because of the information noise, more cooperative strategies like *tf2t* are preferable. However, there is a danger that your strategy might be recognized – take this into account and develop your own

WINNING STRATEGY

Good luck!!!

EM 2004 PID Tournament

	1ds	2ds	3ds	4ds	5ds	6ds	7ds	8ds	Σ	Σ_{tota}
1	x	/	/	/	/	/	/	/		
2	/	x	/	/	/	/	/	/		
3	/	/	x	/	/	/	/	/		
4	/	/	/	x	/	/	/	/		
5	/	/	/	/	x	/	/	/		
6	/	/	/	/	/	x	/	/		
7	/	/	/	/	/	/	x	/		
8	/	/	/	/	/	/	/	x		
Σds									x	x
lace									x	x

Teams

- 1……
- 2 ……
- 3 ……
- 4 ……
- 5 ……
- 6 ……
- 7 ……
- 8 ……

Mealy-type automaton

$\boldsymbol{A} = (A, X, Y, \lambda, \delta)$

A, X, Y are finite non-empty sets,

$\delta: A \times X \to A$ - transition function

$\lambda: A \times X \to Y$ - output function

A - set of *states*

X, Y sets of input and output symbols

Some reasons for using FSA models

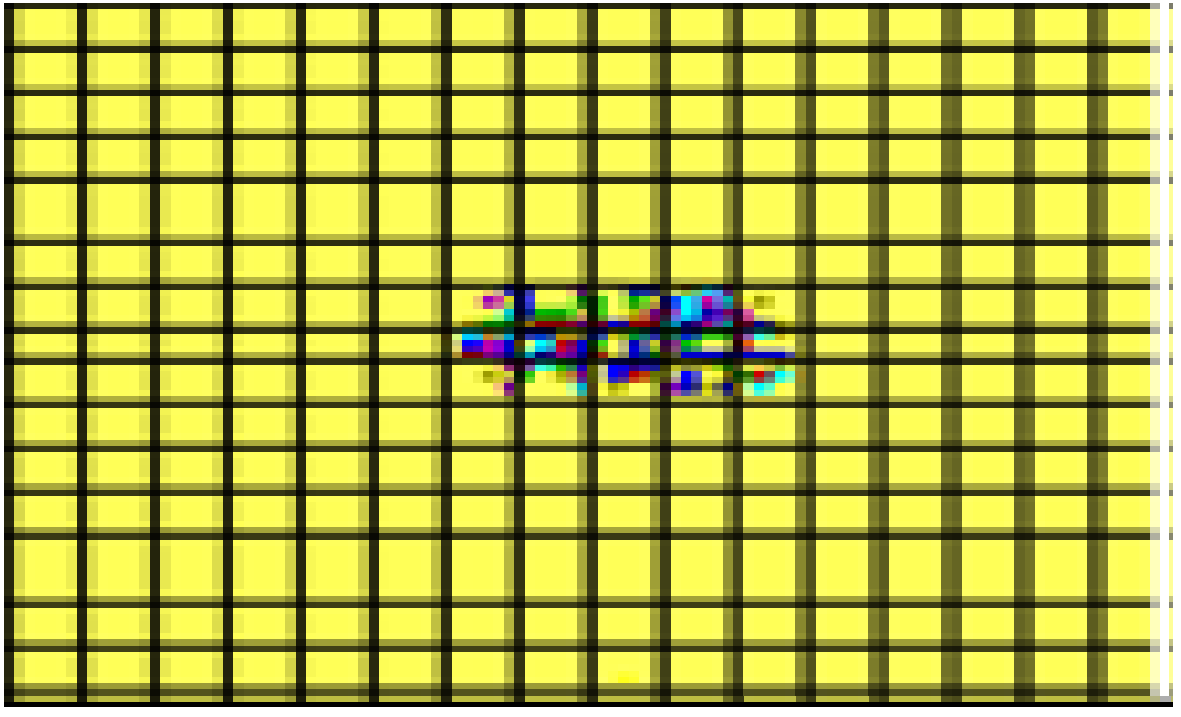
- FSA model is the most general model of a communicating object
- FSA have a simple structure
- FSA theory involves many important applicable results
- FSA are well supported by programming technology (LEX, BISON, YACC)

Some reasons for using FSA models

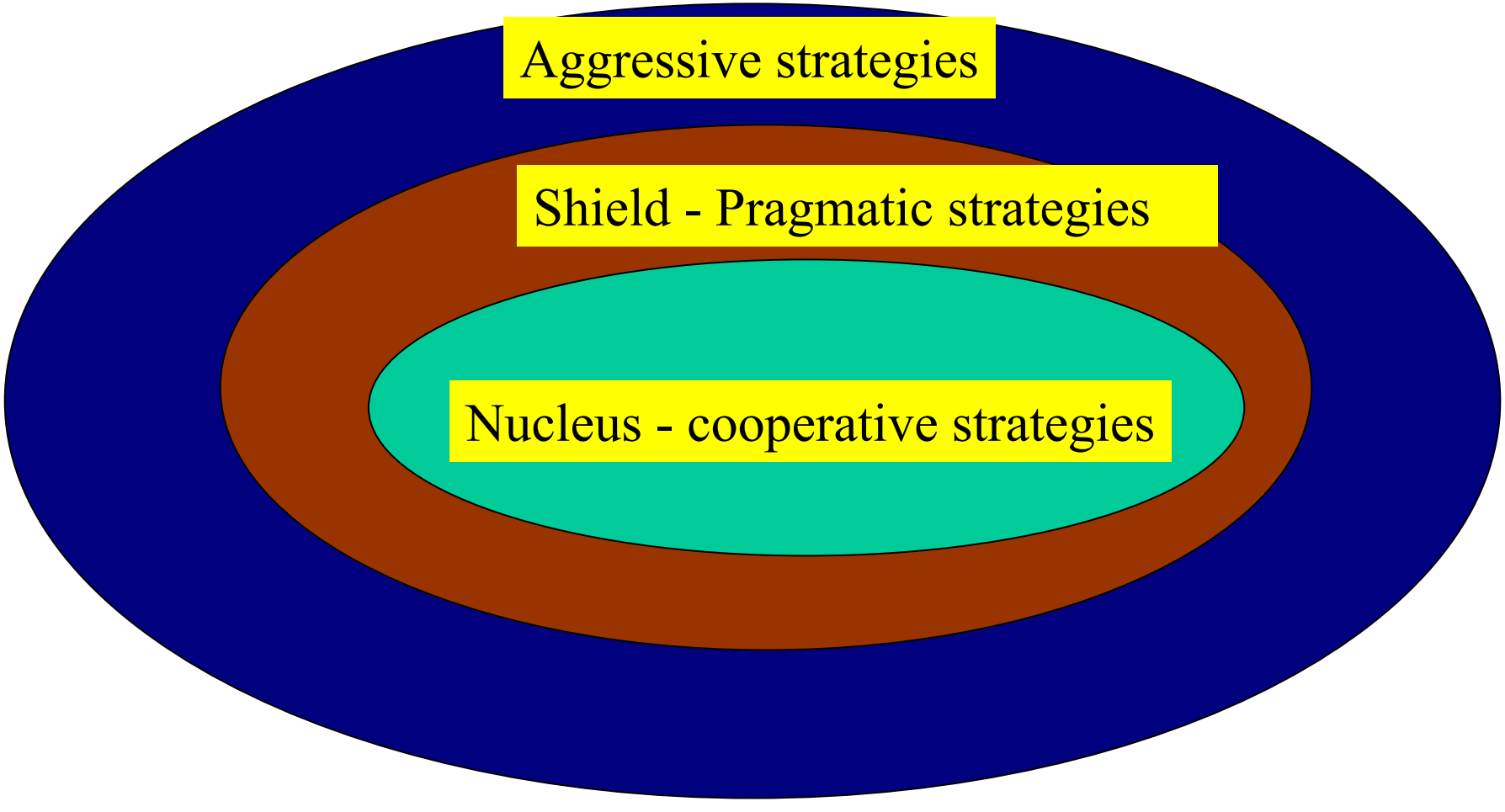
- VoiceXML – technological standard for developing DS. VoiceXML program can has the structure of FSA
- FSA stucture can be efficiently checked and veryfied by MODEL CHECKING
- FS analysis is involved in many important theories, like **game theory, cooperation theory** etc.

Iterated spacial PD

- Undecidable problem (P. Grim 1994)



Nucleus and Shield



B.Lomborg *(1996),* D. Haynes(1988), Ch. Elston (2000).

Aplications

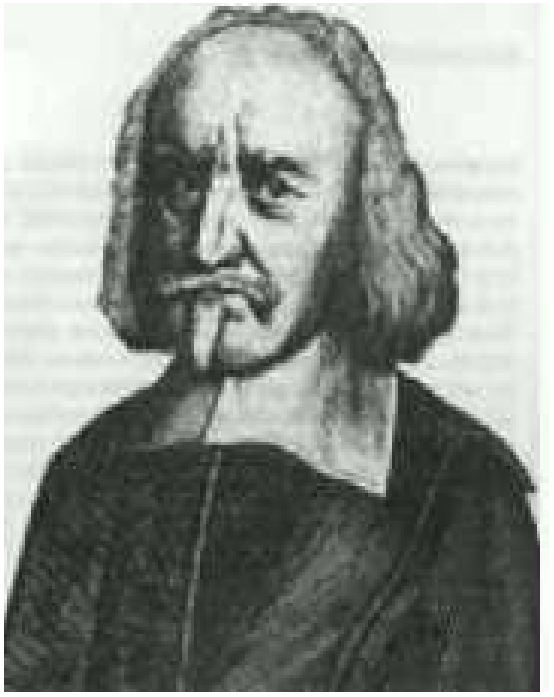
- Economy
- Sociology
- Psychology
- Politology
- Public choice theory
- Ecology
- …

Robert Axelrod

University of Michigan

National Academy of Sciences Award for Behavioral Research Relevant to the Prevention of Nuclear War.

Thomas Hobbes (1588-1679)



- the causes of quarrel,
- the natural condition of war
- the motivations for peace.

"any account of human action, including morality, must be consistent with the fact that we are all self-serving".

- fundamental Law of Nature: To seek peace and follow it;

Tit-for-two-tats strategy

	C	S	N
c	(C, c)	(C, c)	(C, c)
n	(S, c)	(N, n)	(N, n)

Tit-for-tat strategy

	S
c	(S, c)
n	(S, n)

Testing and predicting

	T	S1	S21	S22
c	(S21, c)	(S1, c)	(S22, c)	(S21, c)
n	(S1, c)	(S1, n)	(S22, n)	(S21, n)

Have a fun,
good luck in IPD
championship