



Self Organization in Vowel Systems

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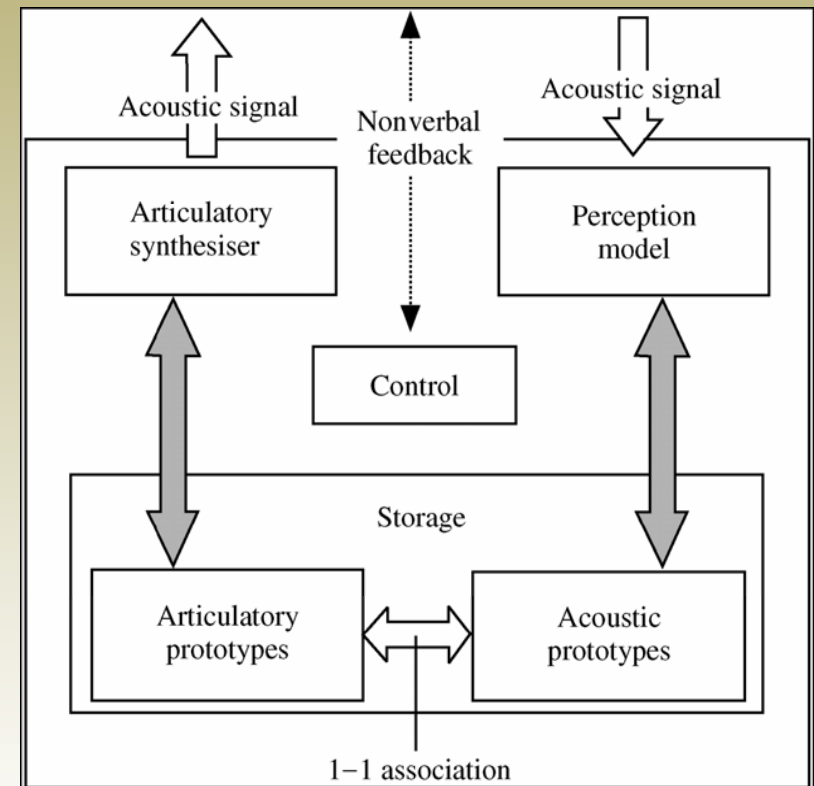


Previous Works

- Glotin: Agent Interaction.
- Berrah's Work: Only Acoustic.
- Problems with the work:
 - Genetic aspect to the simulation.
 - Calculation of the mapping from acoustic differences onto articulatory changes is computationally demanding.

The Simulation

- Self-Organization
- Features of the simulation
 - Population of **interacting agents** : imitation
 - **Game:**
 - Initiator chooses vowel.
 - Noise is added.
 - Imitator hears it and chooses the closest vowel from its repertoire.
 - Noise is added.
 - Initiator hears the spoken vowel and gives feedback..
 - Update.
 - **Darwinian Concept:** Age, preferential selection.
 - **Complex System:** Behavior is indirect, non-hierarchical consequence of interactions.





Experiments

- F₁ vs. F₂' (varying number of games)

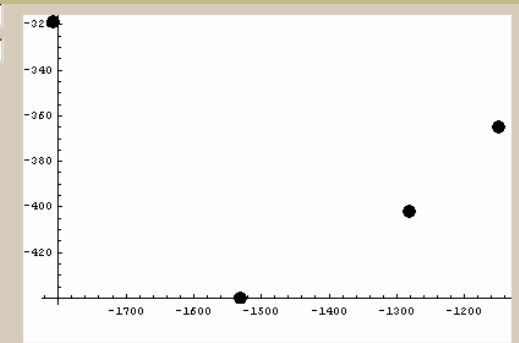
Parameters

Noise Parameter (a)	<input type="text" value="0.3"/>
Distance (c)	<input type="text" value="3.5"/>
Distance (lambda)	<input type="text" value="0.3"/>
Increment	<input type="text" value="0.1"/>
Throwaway threshold	<input type="text" value="0.7"/>
Age to kill	<input type="text" value="25"/>
Shift Threshold	<input type="text" value="0.5"/>
min no. of uses before throw	<input type="text" value="5"/>
articulatory merge threshold	<input type="text" value="0.01"/>
Freq. of adding random vowel	<input type="text" value="50"/>

Initial number of Agents

Number of games

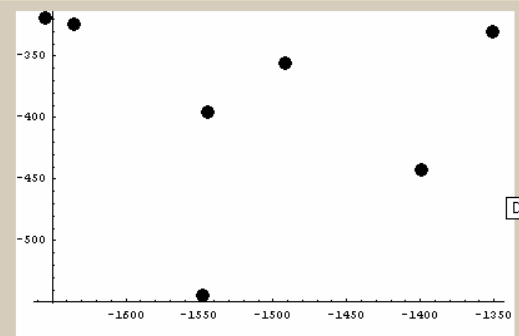
Controls



Initial number of Agents

Number of games

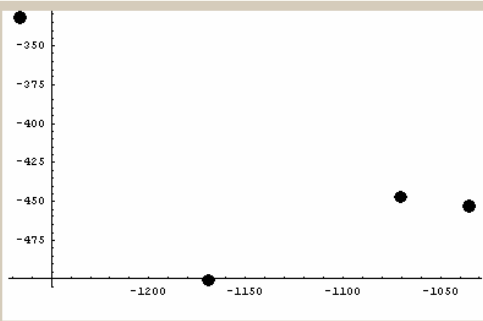
Controls



Initial number of Agents

Number of games

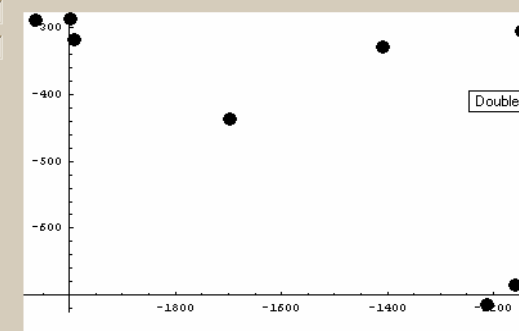
Controls



Initial number of Agents

Number of games

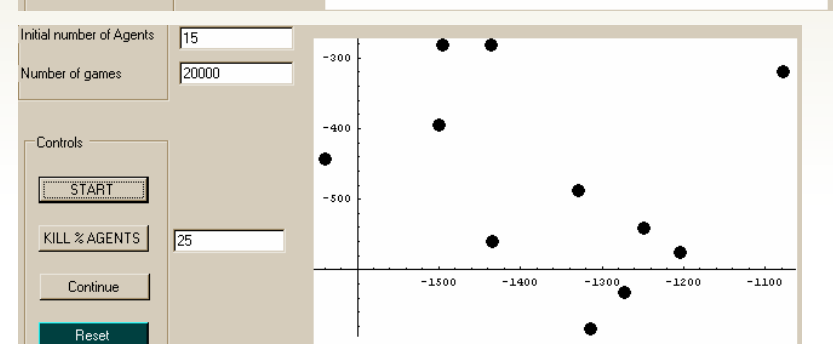
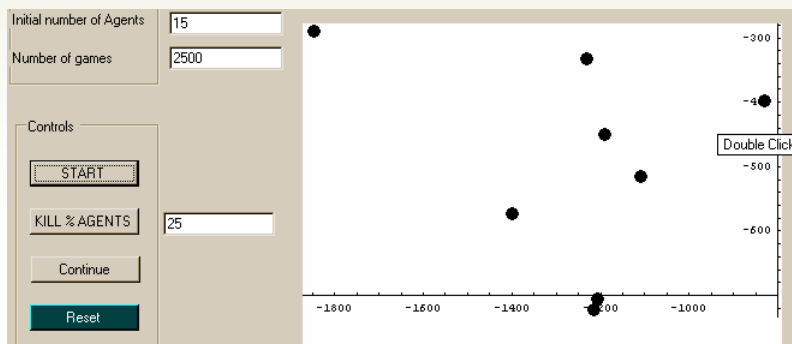
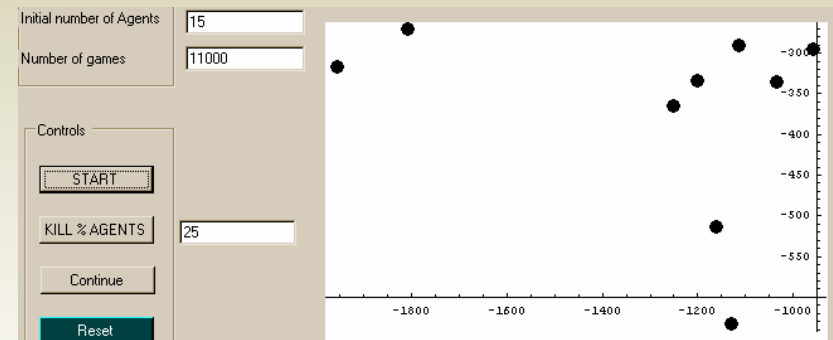
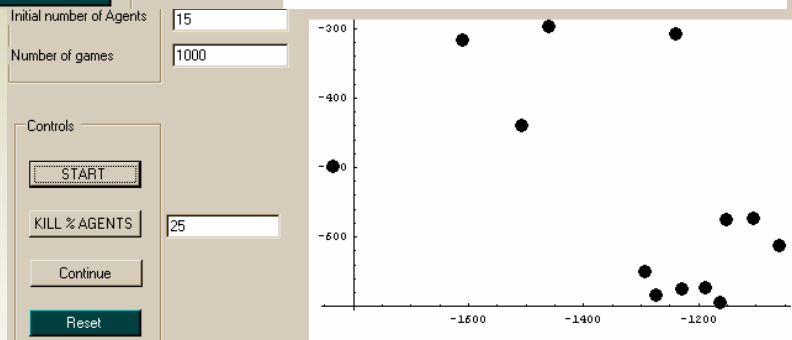
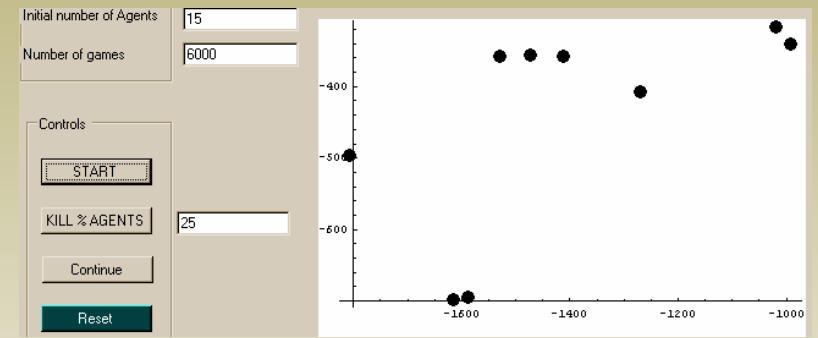
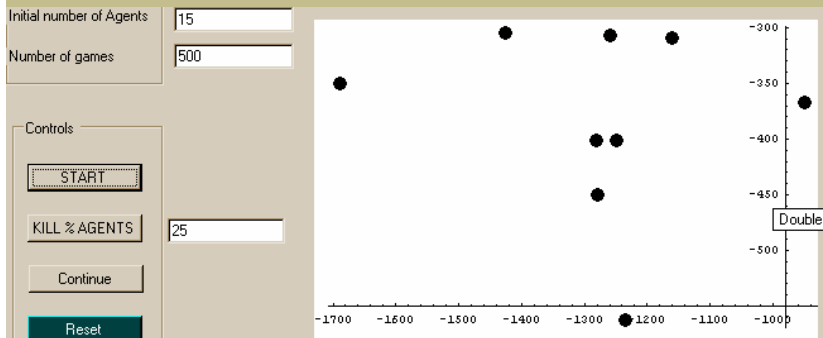
Controls





Experiments

- F_1 vs. F_2 ' (varying number of games) contd..





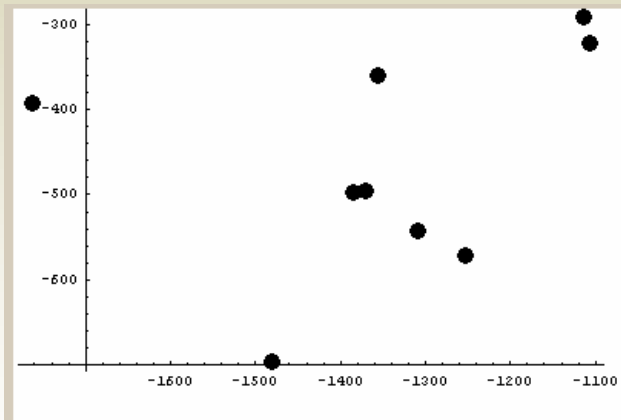
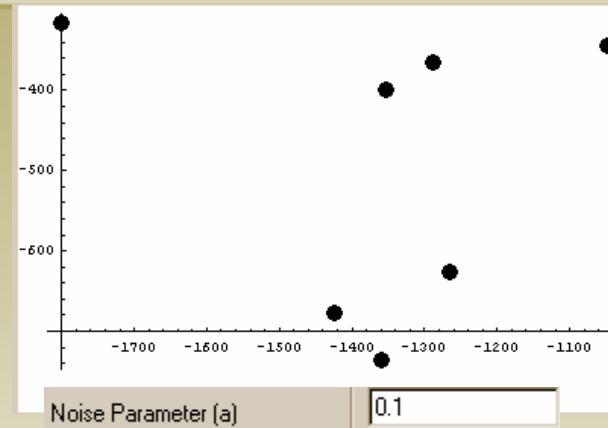
Experiments

- F1 vs. F2' (varying noise)

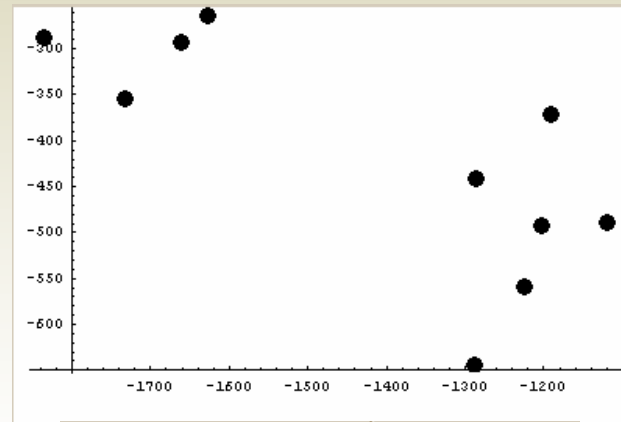
Start Values

Initial number of Agents

Number of games



Noise Parameter (a)

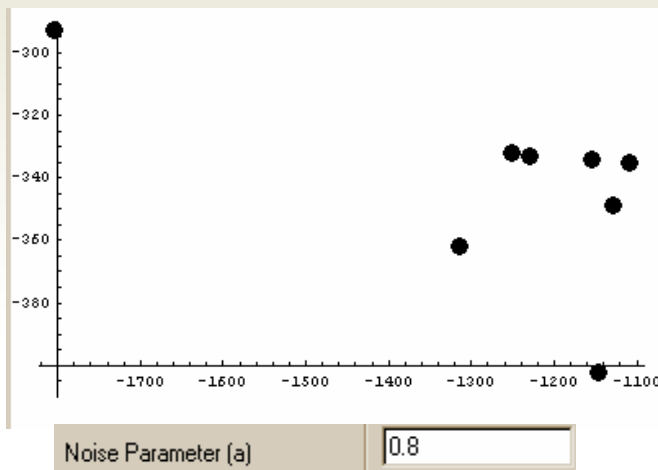
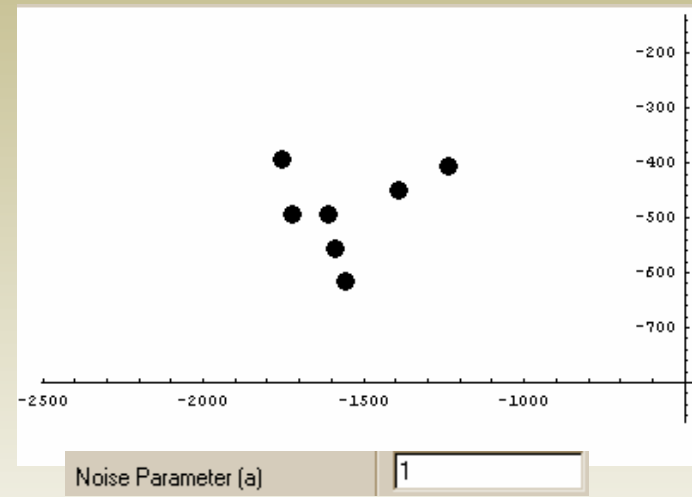
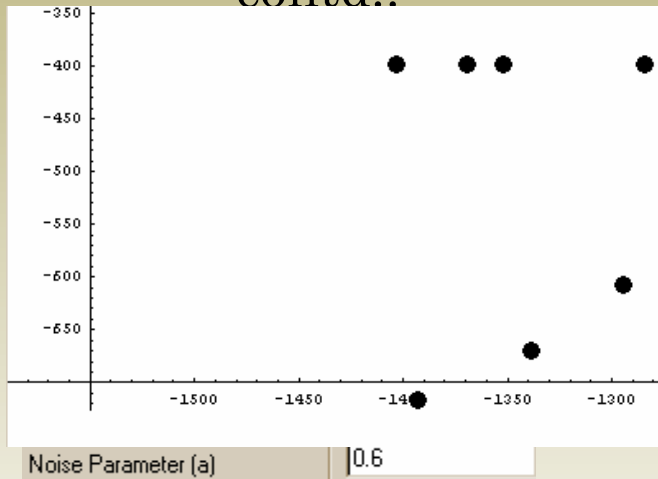


Noise Parameter (a)



Experiments

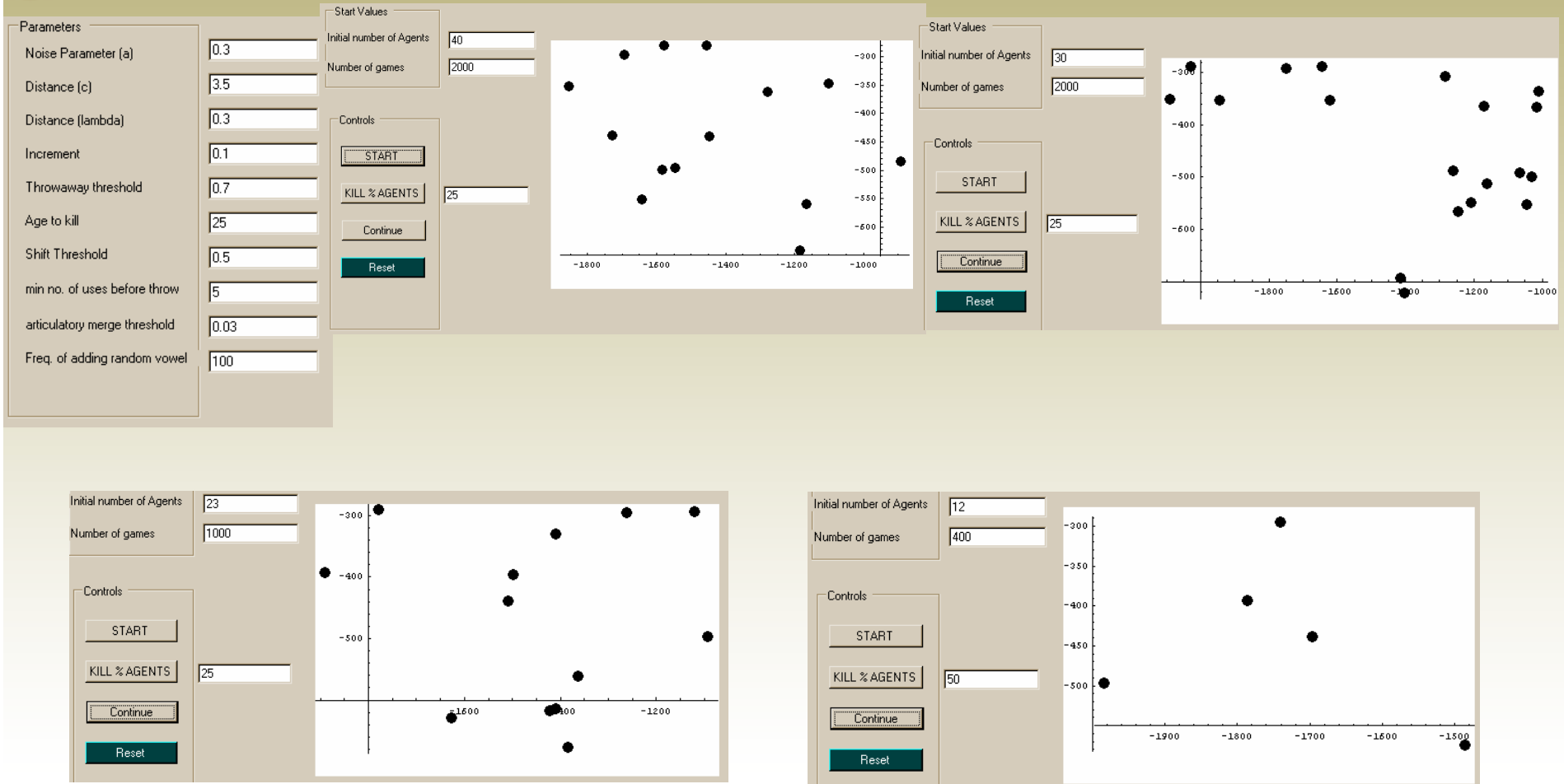
- F1 vs. F2' (varying noise)
contd..





Experiments

- Killing of agents: Language is a complex system

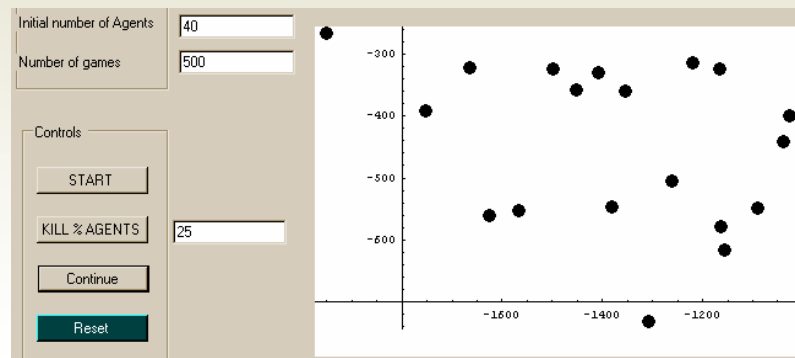
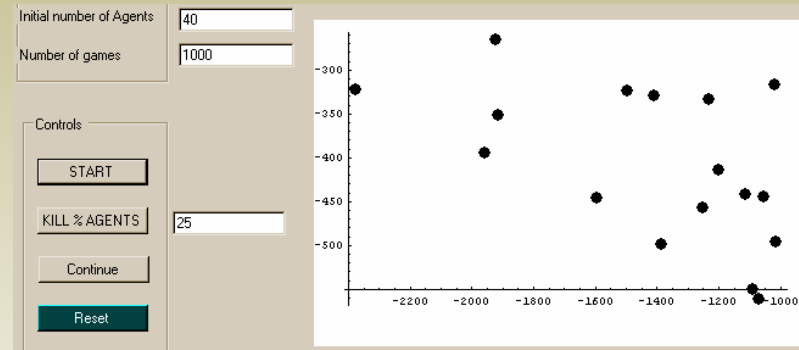
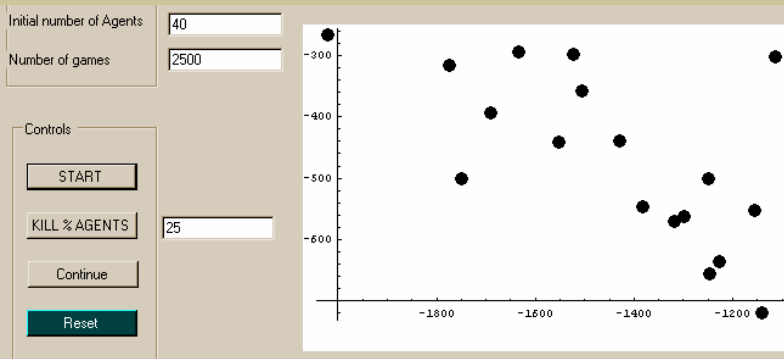


When agents are killed – appreciable change in vowel space



Experiments

- Killing of agents: Language is a complex system



When agents are not killed – almost constant shape of the vowel space



Experiments

- F_1 vs. F_2 ' (varying the age to kill)

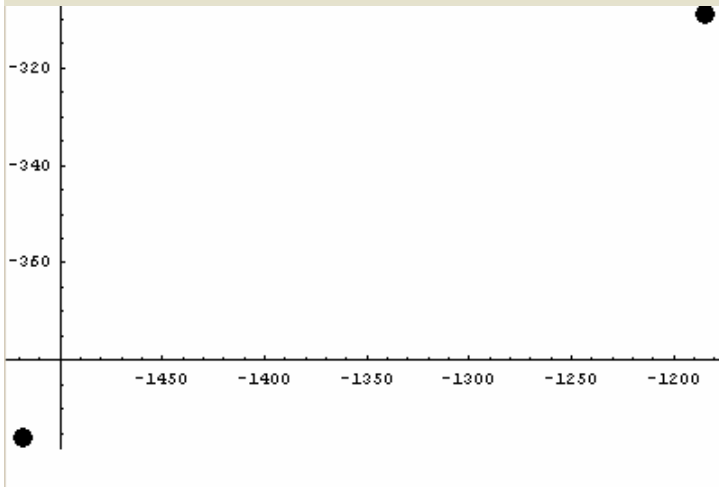
Start Values

Initial number of Agents

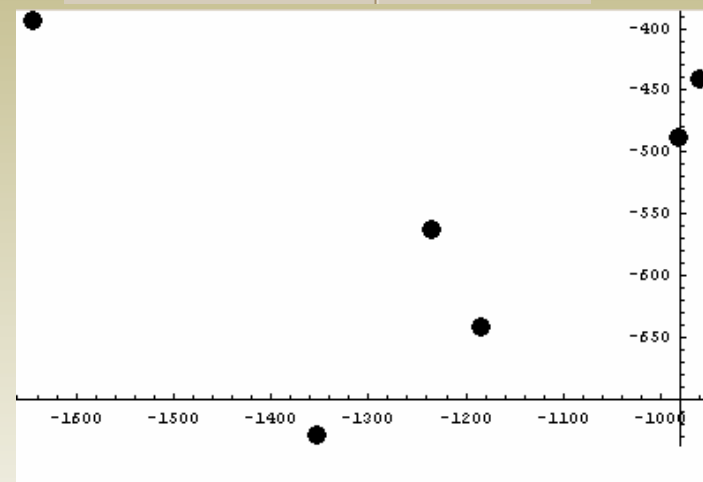
Number of games

Noise Parameter (α)

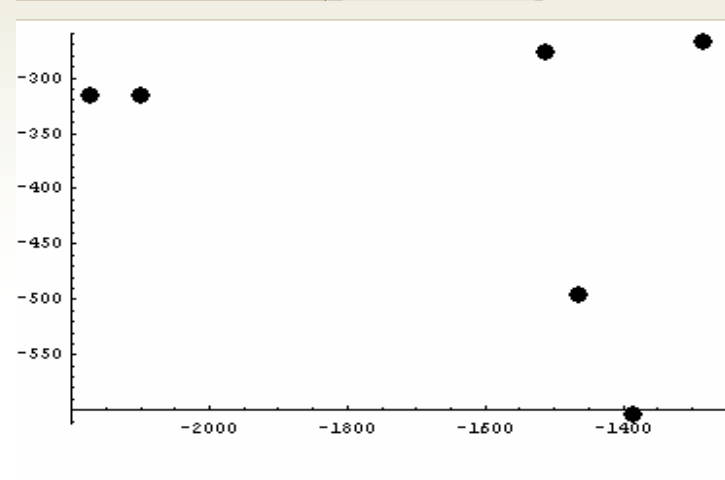
Age to kill



Age to kill



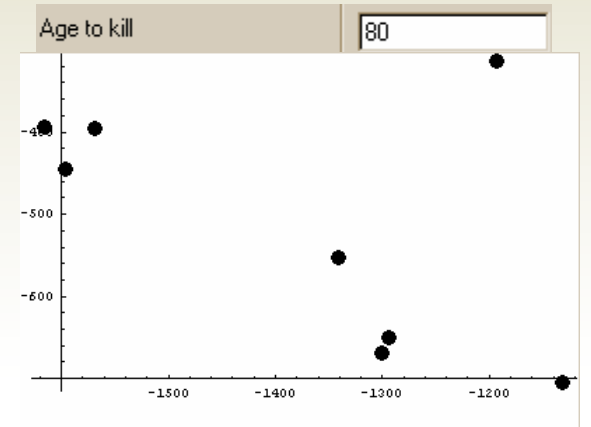
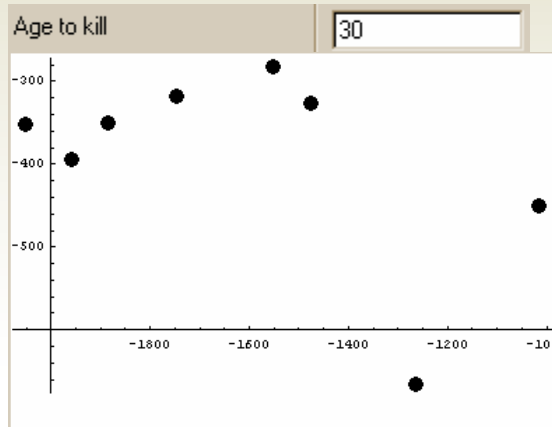
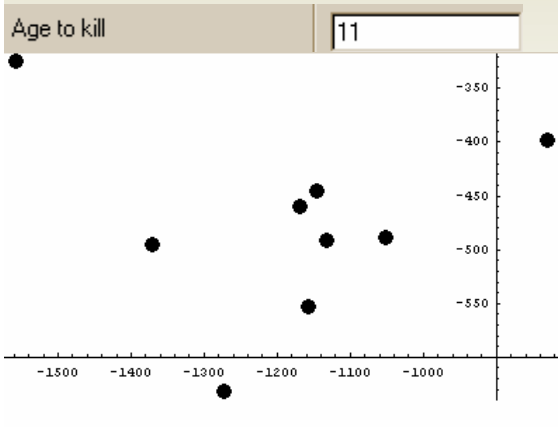
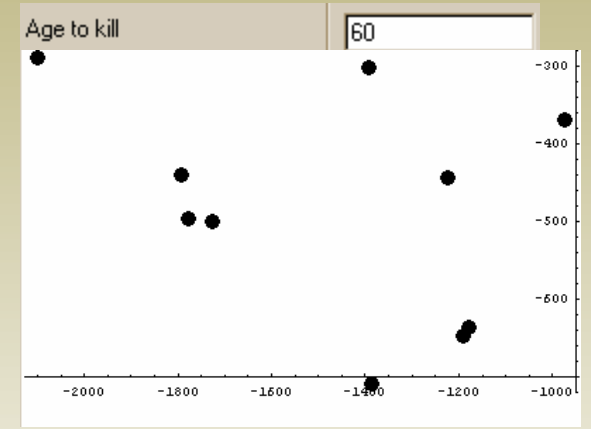
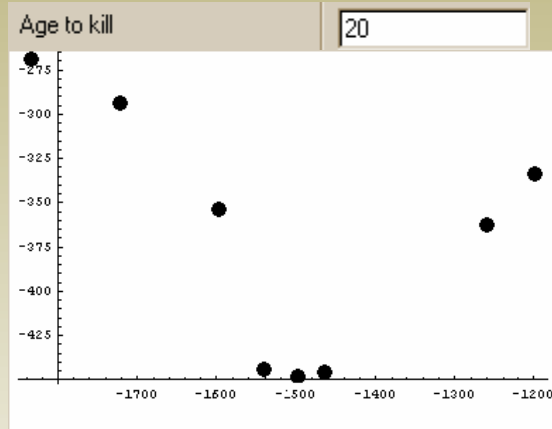
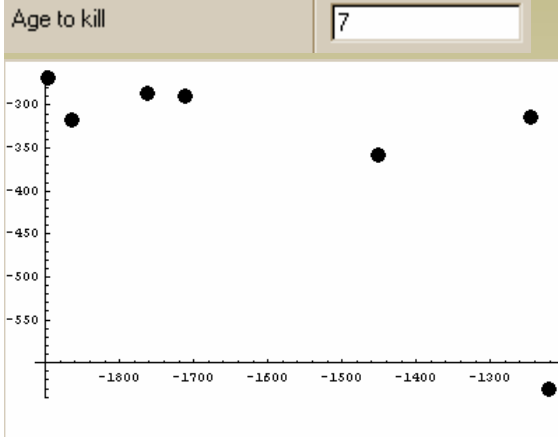
Age to kill





Experiments

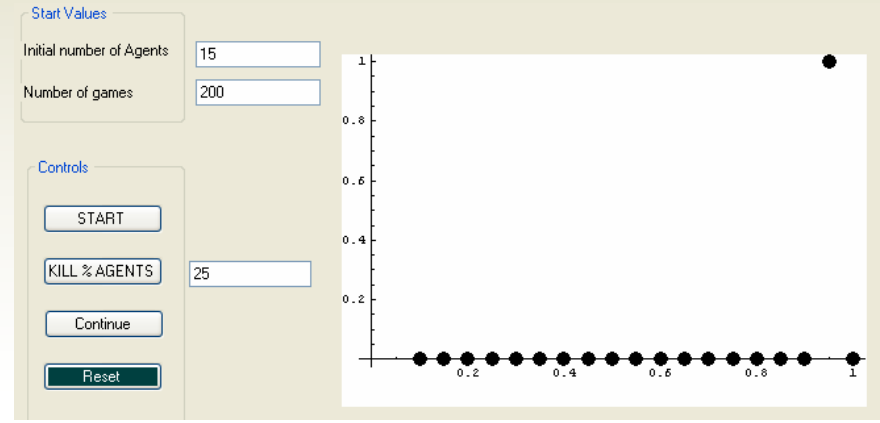
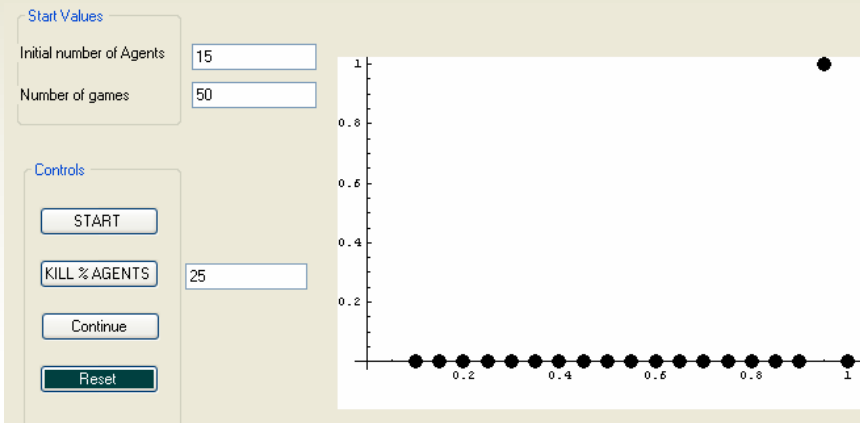
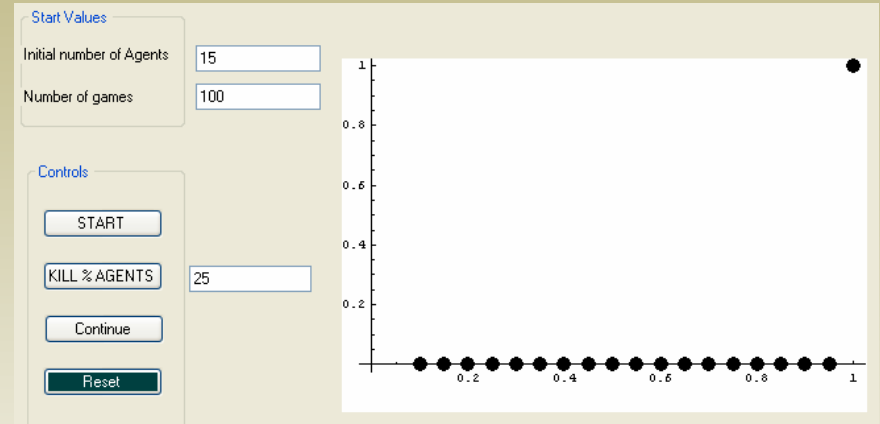
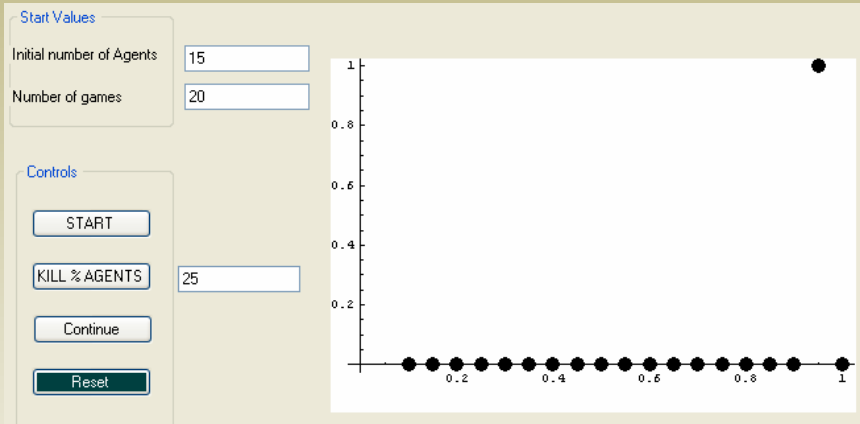
- F_1 vs. F_2' (varying the age to kill) contd ...





Experiments

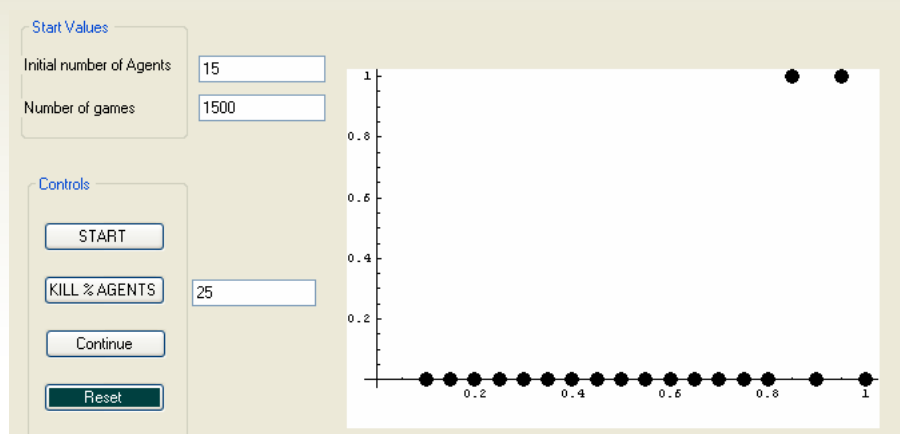
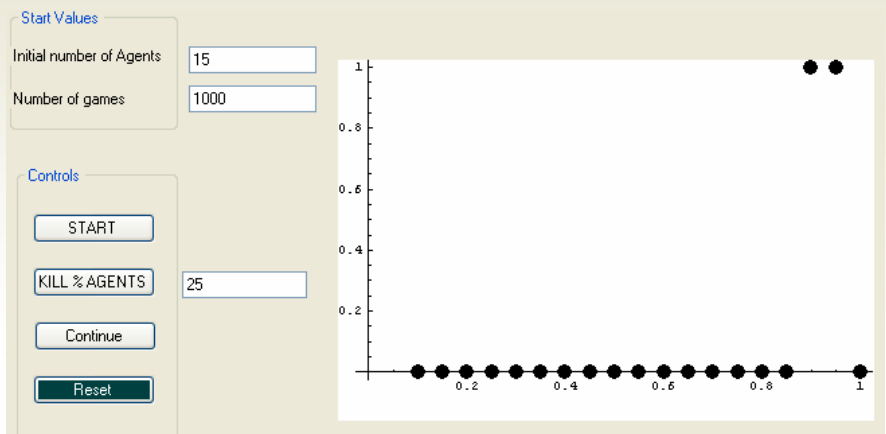
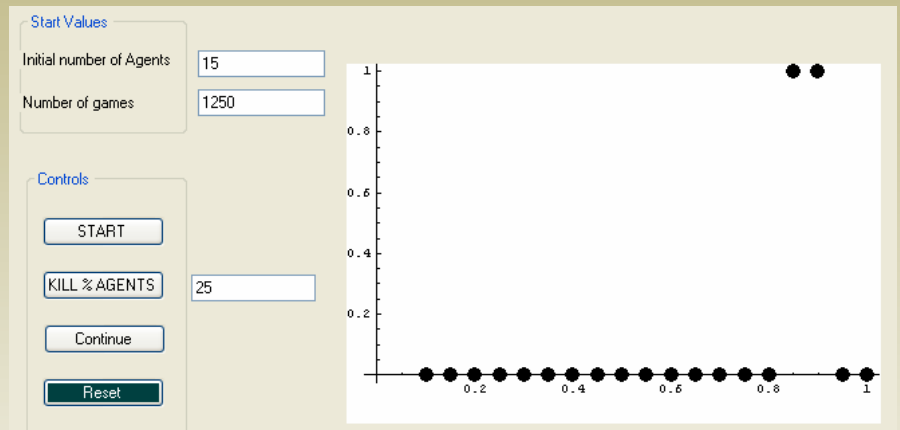
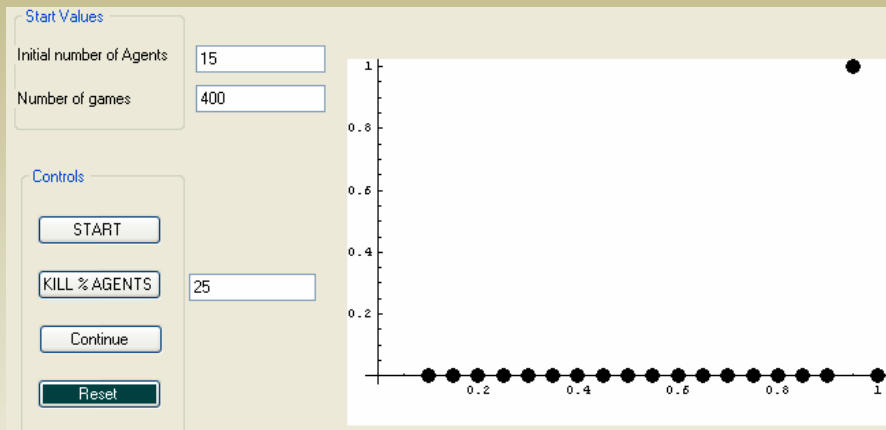
- Success Ratio(with varying no. of games)





Experiments

- Success Ratio(varying no. of games) contd....





Questions and comments invited

THANK YOU