

Natural Selection Simulator

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Overview

This activity is the updated version of a Flash based game I programmed back in 2010. This serves as simple simulation of natural selection as happens to a population of playing cards. As you will know, each of the 52 playing cards has three characteristics. A value (Ace through King), a color (Red or Black) and a suit (Hearts, Diamonds, Spades, and Clubs). This simulation looks at the deck of playing cards as a population with 52 variations or genotypes. Each of the three characteristics of a card can be impacted by things that occur in the individual's habitat. Over the course of time, different cards (variations) will be favored by the random environment that the simulation creates.

Each of your students should choose a card from a standard deck of playing cards. If you do not have a deck handy, they may mentally choose a card providing there are no duplicates in the class.

Each time the teacher clicks the Habitat Impact button (MS Excel) or flips the Habitat Impact cards (Paper version) they reveal how the habitat impacts the population of a card or group of cards. Each card begins with a population value of 10. The habitat impact ranges from -10 to 10 and is calculated randomly as is the choice of card(s) affected. As the game progresses, different cards change in their population numbers (aka "fitness" or "success"). The teacher can choose how many time periods to run the simulation for (more is better). When a card value drops below 0 that variation is considered locally extinct and is out of the game.

The highest score at the end of the game is declared the winner – aka the most fit/successful. Playing multiple rounds with students keeping the same card can help show that the "fitness" of a certain card is not innate, but rather is at the mercy of the randomly changing environment of this simulation. The more rounds you play, the more evident this tends to become.

When you are done, there population will have a different frequency of each card than when you started – the basic tenet of natural selection, that evolution is a change in allele frequency.

As you study natural selection it's fun to have students look at this simulation and point out the areas where it oversimplifies things. They may notice that the real-life environments are not truly random like the simulation, the simulation does not have a way for mutations change the 52 cards, the environment may not have any impact on many of the cards if you play for a short period of time. This also gives you a chance to address the nature of using models in science.

In my experience, students like to come up with their own ideas about what "good" or "bad" things are happening to their card. Good things happen like a boom of food or a disease among their predators and bad things happen like drought, disease, or a new predator.

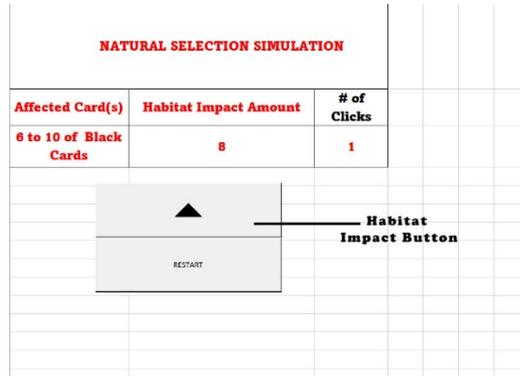
You can tweak things by choosing the diversity of your starting group. A class that is all red cards or all high or low value cards may experience more significant boom/bust issues, which can lead to great

discussions about the impact of losing biodiversity and genetic diversity in real life. I have also had conversations about the value of sexual reproduction vs asexual reproduction from a diversity perspective. Use this simple simulation as a springboard for your own creativity.

As you play this with your students and explore their thoughts about this simulation, I would love to hear about your experiences and class discussions. Please feel free to reach out to me at EvolutionExplorer@gmail.com

Playing The Game - MS Excel Version

The simulation is housed on two sheets of the MS Excel file that is in the same folder as this document. If asked, please allow macros to run - the simulation will not function if you do not have macros enabled. This does not require an active internet connection.



The image above shows the setup - clicking the arrow button triggers the next Habitat Impact choice. It will change the “Affected Card(s)” and the “Habitat impact Amount” and the “# of clicks” will increase by one. Both the affected card(s) and the Habitat Impact amount are chosen by random number generators. The Restart button resets the “# of Clicks” back to 0 and clears the other two fields.

The second sheet of the Excel file has a row for each of the 52 possible cards and a column representing the score for that card after each 10 clicks (up to 200 clicks). Since I do not expect you to have 52 students in your class, you can place an entry in the “Selected” column to allow you to sort the cards that are in use by your students.

	Selected	START	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
1																							
2		Ace of Hearts	10																				
3		2 of Hearts	10																				
4		3 of Hearts	10																				
5		4 of Hearts	10																				
6		5 of Hearts	10																				
7		6 of Hearts	10																				
8		7 of Hearts	10																				
9		8 of Hearts	10																				
10		9 of Hearts	10																				
11		10 of Hearts	10																				
12		Jack of Hearts	10																				
13		Queen of Hearts	10																				
14		King of Hearts	10																				
15		Ace of Diamonds	10																				
16		2 of Diamonds	10																				
17		3 of Diamonds	10																				
18		4 of Diamonds	10																				
19		5 of Diamonds	10																				
20		6 of Diamonds	10																				
21		7 of Diamonds	10																				
22		8 of Diamonds	10																				
23		9 of Diamonds	10																				
24		10 of Diamonds	10																				
25		Jack of Diamonds	10																				
26		Queen of Diamonds	10																				
27		King of Diamonds	10																				
28		Ace of Spades	10																				
29		2 of Spades	10																				

The final sheet of the Excel file is a scoresheet you can print out for your students to keep track of each click that impacts their specific card (up to 100 clicks).

	A	B	C	D	E	F	G	H
1	NAME:				My Card:			
2	Click Number:	Habitat Impact	Score		Click Number:	Habitat Impact	Score	
3	0	-	10		26			
4	1				27			
5	2				28			
6	3				29			
7	4				30			
8	5				31			
9	6				32			
10	7				33			
11	8				34			
12	9				35			
13	10				36			
14	11				37			
15	12				38			
16	13				39			

Every time you click the Habitat Impact button, have your students add or subtract the amount that impacts their specific card. After every ten clicks they can report their population number (score) to you to place in the class data sheet you see above. You can go for as many clicks as you want and then the data can be looked at by you & your students. Because it's in Excel, you can sort & graph the data to see how the environment impacted different groups of cards. I have found that doing 100 clicks works well. It can also work well to run it as a short class starter over multiple days where you do 10 or 20 clicks to drag out the drama & anticipation.

Playing The Game – The Paper Version

This version works the same as the Excel version except that in place of the Habitat impact button choosing the card(s) and the effect of the environment each turn, the teacher or selected students flips cards from 3 stacks that include the card value stack, the card suit/color stack and the habitat impact value stack. You can print these on card stock and shuffle them. Choosing one card from each stack will give you a card(s) and the habitat impact value for that turn. Each time you select a card from each stack it's the same as if you clicked the Habitat Impact button in the Excel version. Your students can then record the impact on their card and once you have 10 turns the whole class can report their scores. As with the Excel version you can choose how many turns to run.

The next three pages have the card decks to print out.

Card Value Deck: Print these out on card stock and shuffle them.

2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
Jack	Jack	Jack	Jack
Queen	Queen	Queen	Queen
King	King	King	King
Ace	Ace	Ace	Ace
Ace to 5	Ace to 5	Ace to 5	Ace to 5
6 to 10	6 to 10	6 to 10	6 to 10
Face Cards	Face Cards	Face Cards	Face Cards
All Cards	All Cards	All Cards	All Cards

Card Suit/Color Deck: Print these out on card stock and shuffle them.

Hearts	Hearts	Hearts	Hearts
Diamonds	Diamonds	Diamonds	Diamonds
Spades	Spades	Spades	Spades
Clubs	Clubs	Clubs	Clubs
Red Cards	Red Cards	Red Cards	Red Cards
Black Cards	Black Cards	Black Cards	Black Cards
All Suits	All Suits	All Suits	All Suits
Red Cards	Red Cards	Red Cards	Red Cards
Black Cards	Black Cards	Black Cards	Black Cards
All Suits	All Suits	All Suits	All Suits

Habitat Impact Value Cards: Print these out on card stock and shuffle them.

-10	-10	-10	-10	-10
-9	-9	-9	-9	-9
-8	-8	-8	-8	-8
-7	-7	-7	-7	-7
-6	-6	-6	-6	-6
-5	-5	-5	-5	-5
-4	-4	-4	-4	-4
-3	-3	-3	-3	-3
-2	-2	-2	-2	-2
-1	-1	-1	-1	-1
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9
10	10	10	10	10