



# Population Individuality & Disease Expansion Mods

Team Ath-bee 1:

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# BASE GAME OVERVIEW

- How ZoF Works:
  - Zombies and flu viruses
  - Goal is to control viruses as best as possible
    - Deployments
  - RNG
  - Best control is represented by the score
    - Fear
    - Number of each category





# Population Individuality Mod

- Personalities
  - Normal
  - Coward
  - Karen
  - Nerd
  - Rebel
  - Lunatic
- Attributes
  - Fear (preexisting)
  - Trust
  - Morale




```
def change_attributes_deployments(self, nbh, dep):
    #makes the relevant attribute changes upon building a deployment happen
    fear_increment = 0
    morale_increment = 0
    trust_increment = 0
    for dep in nbh.deployments:
        if dep is DEPLOYMENTS.QUARANTINE_OPEN:
            fear_increment += 5
        if dep is DEPLOYMENTS.QUARANTINE_FENCED:
            fear_increment += 1
        if dep is DEPLOYMENTS.BITE_CENTER_DISINFECT:
            fear_increment -= 5
            morale_increment += 5
            trust_increment += 2.5
        if dep is DEPLOYMENTS.BITE_CENTER AMPUTATE:
            fear_increment -= 2.5
            morale_increment += 5
            trust_increment += 1.25
        if dep is DEPLOYMENTS.Z_CURE_CENTER_FDA:
            fear_increment -= 10
            morale_increment += 10
            trust_increment += 5
```

```
def update_attributes(self):
    for nbh_index in range(len(self.neighborhoods)):
        nbh = self.neighborhoods[nbh_index]
        fear_increment = 0
        morale_increment = 0
        trust_increment = 0
        #passive increment for every turn
        if(nbh.get_data()["num_zombie"] > nbh.get_data()["num.alive"] / 2): #we can change threshold later
            fear_increment += 10
            morale_increment -= 10
            trust_increment -= 5
        if(nbh.get_data()["num_flu"] > nbh.get_data()["num.alive"] / 2):
            fear_increment += 5
            morale_increment -= 5
            trust_increment -= 2
        if(nbh.get_data()["num_dead"] + nbh.get_data()["num_ashen"] > nbh.get_data()["num.alive"]):
            fear_increment += 10
            morale_increment -= 10
            trust_increment -= 5

        #adds the increments to all the members in a neighborhood
        nbh.raise_total_average_fear(fear_increment)
        nbh.raise_total_average_morale(morale_increment)
        nbh.raise_total_average_trust(trust_increment)
```

# Attributes in-game






```
class Coward(NPC):
    def __init__(self):
        super().__init__()
        self.fear = 60
        self.morale = 50
        self.trust = 50
        self.personality = "coward"
        # self.percent = 0.09 4th largest percent of population

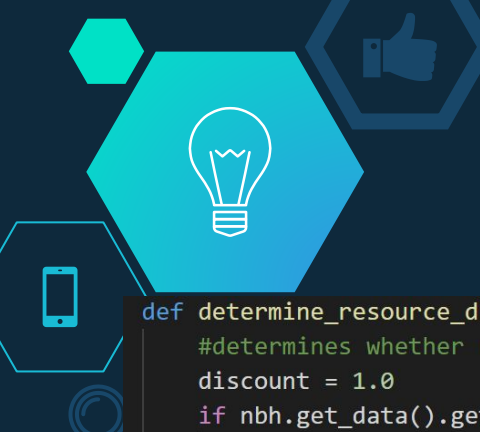
    def increment_fear(self, increment):
        if increment > 0:
            self.fear += (increment * 1.5)
        else:
            super.increment_fear(increment)
    def increment_morale(self, increment):
        if increment > 0:
            self.morale += (increment * 0.75)
        else:
            super.increment_morale(increment)
```

```
class Lunatic(NPC):
    def __init__(self):
        super().__init__()
        self.fear = 20
        self.morale = 80
        self.trust = 40
        self.personality = "lunatic"
        #self.percent = 0.01 #6th largest percent of population

    def increment_fear(self, increment):
        self.fear = 20
    def increment_morale(self, increment):
        if increment > 0:
            self.morale += increment
    def increment_trust(self, increment):
        self.trust = 40
```



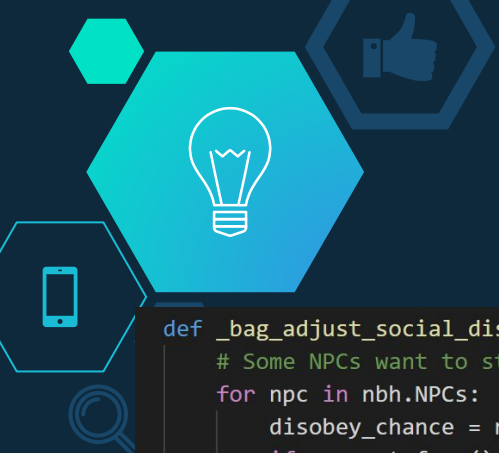
## Personality implementation comparison



```
def determine_resource_discount(self, nbh, og_cost):
    #determines whether resource cost for the turn is increased/decreased based on morale and high fear if applicable
    discount = 1.0
    if nbh.get_data().get('fear') > 80:
        discount *= 1.5
    elif nbh.get_data().get('fear') > 60:
        discount *= 1.25
    if nbh.get_data().get('morale') > 80:
        discount *= 0.5
    elif nbh.get_data().get('morale') > 60:
        discount *= 0.75
    elif nbh.get_data().get('morale') < 20:
        discount *= 1.5
    elif nbh.get_data().get('morale') < 40:
        discount *= 1.25
    return discount
```

Attributes in-game (cont.)






```
def _bag_adjust_social_distancing_signs(self, nbh):  
    # Some NPCs want to stay here to keep from spreading the disease  
    for npc in nbh.NPCs:  
        disobey_chance = npc.get_trust() / 100  
        if npc.get_fear() > 60:  
            disobey_chance -= npc.get_fear() / 200  
        chance = random.random()  
        if (npc.get_personality() != 'karen' or npc.get_personality() != 'rebel' or npc.get_personality() != 'lunatic') \\\n            or chance < disobey_chance:  
            # People who are sickly and active want to stay in place  
            if npc.sickly or npc.active:  
                for _ in range(2):  
                    npc.add_to_bag(NPC_ACTIONS.STAY)
```

Disobeying





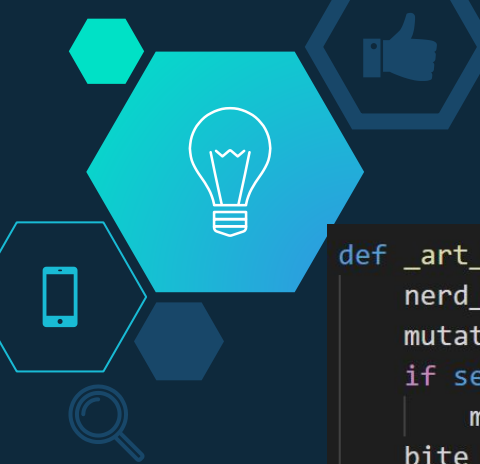
```
def update_riot_status(self):
    self.riot_status = False
    riot_chance = 0.1
    chance = random.randrange(0, 1)
    if self.trust < 20.0 and chance < riot_chance:
        for npc in self.NPCs:
            if self.breakdown.get('rebel') > 0:
                self.riot_status = True
                break
```

```
def _add_buildings_to_locations(self, nbh_1_index, dep_1, nbh_2_index, dep_2):
    # Update the list of deployments at that location
    if self.neighborhoods[nbh_1_index].get_riot_status() == False:
        self.neighborhoods[nbh_1_index].add_deployment(dep_1)
        self.change_attributes_deployments(self.neighborhoods[nbh_1_index], dep_1)
    else:
        print('neighborhood 1 has an ongoing riot! action failed')
    if self.neighborhoods[nbh_2_index].get_riot_status() == False:
        self.neighborhoods[nbh_2_index].add_deployment(dep_2)
        self.change_attributes_deployments(self.neighborhoods[nbh_2_index])
    else:
        print('neighborhood 2 has an ongoing riot! action failed')
```

Rioting








```
def _art_trans_z_cure_center_fda(self, nbh_index):
    nerd_benefit = self.neighborhoods[nbh.index].get_data('nerd') * 0.05
    mutation_reduction = 1.0
    if self.mutation_status['hinder cure']:
        mutation_reduction = 0.5
    bite_cure_prob = (0.25 + nerd_benefit) * mutation_reduction
    zombie_cure_prob = (0.05 + nerd_benefit) * mutation_reduction
    nbh = self.neighborhoods[nbh_index]
    for npc in nbh.NPCs:
        if npc.state_zombie is NPC_STATES_ZOMBIE.ZOMBIE_BITTEN:
            if random.random() <= bite_cure_prob:
                npc.change_zombie_state(NPC_STATES_ZOMBIE.HUMAN)
        if npc.state_zombie is NPC_STATES_ZOMBIE.ZOMBIE:
            if random.random() <= zombie_cure_prob:
                npc.change_zombie_state(NPC_STATES_ZOMBIE.ZOMBIE_BITTEN)
```

Nerd's benefit on deployments





# Disease Expansion Mod

- Mutations (many different types):
  - Faster/slower spread
  - More/less lethal
  - Hindering flu vaccine/zombie virus cure
  - Rendering immunity useless
- Quiet cases






```
if npc.state_flu is NPC_STATES_FLU.IMMUNE:
    if self.mutation_status['reverse immunity']:
        npc.change_flu_state(NPC_STATES_FLU.HEALTHY)
```

```
def _art_trans_flu_vaccine(self, nbh_index):
    nbh = self.neighborhoods[nbh_index]
    nerd_benefit = nbh.get_data('nerd') * 0.05
    mutation_reduction = 1.0
    if self.mutation_status['hinder vaccine']:
        mutation_reduction = 0.5
    vaccine_success = (0.25 + nerd_benefit) * mutation_reduction
    for npc in nbh.NPCs:
        if (npc.state_flu is not NPC_STATES_FLU.IMMUNE) and (npc.state_zombie is not NPC_STATES_ZOMBIE.ZOMBIE):
            if random.random() <= vaccine_success:
                npc.change_flu_state(NPC_STATES_FLU.IMMUNE)
```

```
#update based on mutations
if self.mutation_status['faster']:
    fumes_prob *= 1.5
    cough_prob *= 1.5
elif self.mutation_status['slower']:
    fumes_prob *= 0.5
    cough_prob *= 0.5
if self.mutation_status['lethality up']:
    recover_prob *= 0.5
    pneumonia_prob *= 1.25
    incubate_prob *= 1.5
elif self.mutation_status['lethality down']:
    recover_prob *= 1.25
    pneumonia_prob *= 0.75
    incubate_prob *= 0.5
```




## Mutations



```
if(rand2 > 0.05):
    flu_loc_index = random.choice(range(len(self.neighborhoods)))
    flu_loc = self.neighborhoods[flu_loc_index]
    self.flu_quiet = True
    flu_npcs = []
    num = random.randint(1, 5)
    for _ in range(num):
        flu_npc = NPC()
        flu_npc.change_flu_state(NPC_STATES_FLU.FLU)
        flu_npcs.append(flu_npc)
    flu_loc.add_NPCs(flu_npcs)
    self.flu_quiet = False
else:
    self.flu_quiet = True
```

```
#randomly rolls chance to not have flu or zombies
rand1 = random.random()
rand2 = random.random()

if(rand1 > 0.05):
    zombie_loc_index = random.choice(range(len(self.neighborhoods)))
    zombie_loc = self.neighborhoods[zombie_loc_index]
    #generate a random number of dead people
    num = random.randint(1, 10)
    for _ in range(num):
        dead_npc = NPC()
        dead_npc.change_dead_state(NPC_STATES_DEAD.DEAD)
        dead_npcs.append(dead_npc)
        dead_loc.add_NPCs(dead_npcs)
        dead_loc.orig_dead += num
    zombie_npcs = []
    num = random.randint(1, 5)
    for _ in range(num):
        zombie_npc = NPC()
        zombie_npc.change_zombie_state(NPC_STATES_ZOMBIE.ZOMBIE)
        zombie_npcs.append(zombie_npc)
    zombie_loc.add_NPCs(zombie_npcs)
    self.zombie_quiet = False
else:
    self.zombie_quiet = True
```



## Quiet Cases



```
Starting new game with human play!

=====
ZGonne Status
=====

##### GLOBAL STATUS #####
Turn: 0 of 14          Turn Score: 8.0 (Total Score: 0)
Fear: 5              Living at Start: 110
Resources: 10         Dead at Start: 10
=====

##### CITY STATUS #####
== Active: FEW      (NW) == Active: FEW      (N) == Active: FEW      (NE) ==
== Sickly: NONE     == Sickly: NONE     == Sickly: NONE     ==
== Zombies: NONE    == Zombies: NONE    == Zombies: NONE    ==
== Dead: NONE       == Dead: NONE       == Dead: NONE       ==
== Living at Start: 10 == Living at Start: 12 == Living at Start: 11 ==
== Dead at Start: 0  == Dead at Start: 0  == Dead at Start: 0  ==
=====

== Active: FEW      (W) == Active: FEW      (C) == Active: FEW      (E) ==
== Sickly: NONE     == Sickly: NONE     == Sickly: NONE     ==
== Zombies: NONE    == Zombies: NONE    == Zombies: NONE    ==
== Dead: FEW        == Dead: NONE       == Dead: NONE       ==
== Living at Start: 10 == Living at Start: 10 == Living at Start: 10 ==
== Dead at Start: 10 == Dead at Start: 0  == Dead at Start: 0  ==
=====

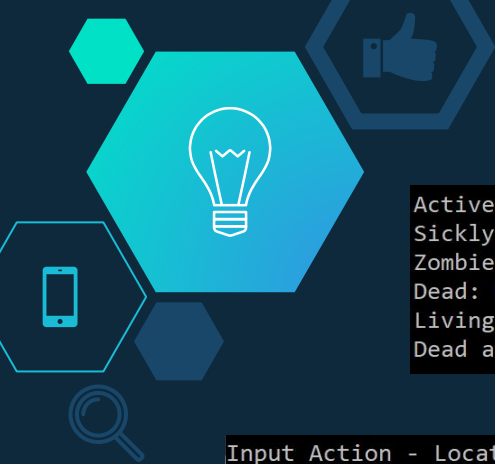
== Active: FEW      (SW) == Active: FEW      (S) == Active: FEW      (SE) ==
== Sickly: NONE     == Sickly: NONE     == Sickly: NONE     ==
== Zombies: NONE    == Zombies: NONE    == Zombies: NONE    ==
== Dead: NONE       == Dead: NONE       == Dead: NONE       ==
== Living at Start: 11 == Living at Start: 13 == Living at Start: 13 ==
== Dead at Start: 0  == Dead at Start: 0  == Dead at Start: 0  ==
=====

=====
LOCATIONS  DEPLOYMENTS
=====
** 0 - CENTER 0 - NONE 13 - SNIPER_TOWER_CONFIRM **
** 1 - N 1 - QUARANTINE_OPEN 14 - SNIPER_TOWER_FREE **
** 2 - S 2 - QUARANTINE_FENCED 15 - PHEROMONES_BRAINS **
** 3 - E 3 - BITE_CENTER_DISINFECT 16 - PHEROMONES_MEAT **
** 4 - W 4 - BITE_CENTER_AMPUTATE 17 - BSL4LAB_SAFETY_ON **
** 5 - NE 5 - Z_CURE_CENTER_FDA 18 - BSL4LAB_SAFETY_OFF **
** 6 - NW 6 - Z_CURE_CENTER_EXP 19 - RALLY_POINT_OPT **
** 7 - SE 7 - FLU_VACCINE_OPT 20 - RALLY_POINT_FULL **
** 8 - SW 8 - FLU_VACCINE_MAN 21 - FIREBOMB_PRIMED **
** -- -- 9 - KILN_OVERSIGHT 22 - FIREBOMB_BARRAGE **
** -- -- 10 - KILN_NO_QUESTIONS 23 - SOCIAL_DISTANCING_SIGNS **
** -- -- 11 - BROADCAST_DONT_PANIC 24 - SOCIAL_DISTANCING_CELBRITY **
** -- -- 12 - BROADCAST_CALL_TO_ARMS -- -- **
=====

Input Action - Location 1:
```

## UI Comparison (OLD UI)





Active: FEW (C)  
Sickly: NONE  
Zombies: NONE  
Dead: NONE  
Living at Start: 9  
Dead at Start: 0

Input Action - Location 1:  
2  
Input Action - Deployment 1:  
OWO  
Please input an integer between 0 - 24  
Input Action - Deployment 1:

locations history in input 1: C  
deployments history in action 1: 2  
locations history in input 2: E  
deployments history in action 2: 2

```
===== GLOBAL STATUS =====
Turn: 0 of 14                               Turn Score: 9.0 (Total Score: 0)
Fear: 5                                     Living at Start: 116
Resources: 10                               Dead at Start: 10
=====
Input a location you would like to deploy an action in, then input the deployment.
Battle against mutating flu and zombie infestation!
Careful on reaching high fear levels! There is a chance of riots...

===== CITY STATUS =====
== Active: FEW (NW) == Active: FEW (N) == Active: FEW (NE) ==
== Sickly: NONE == Sickly: NONE == Sickly: NONE ==
== Zombies: NONE == Zombies: NONE == Zombies: NONE ==
== Dead: NONE == Dead: NONE == Dead: NONE ==
== Living at Start: 14 == Living at Start: 9 == Living at Start: 10 ==
== Dead at Start: 0 == Dead at Start: 0 == Dead at Start: 0 ==
=====
== Active: FEW (W) == Active: FEW (C) == Active: FEW (E) ==
== Sickly: NONE == Sickly: NONE == Sickly: NONE ==
== Zombies: NONE == Zombies: NONE == Zombies: NONE ==
== Dead: FEW == Dead: NONE == Dead: NONE ==
== Living at Start: 11 == Living at Start: 12 == Living at Start: 12 ==
== Dead at Start: 0 == Dead at Start: 0 == Dead at Start: 0 ==
=====
== Active: FEW (SW) == Active: FEW (S) == Active: FEW (SE) ==
== Sickly: NONE == Sickly: NONE == Sickly: NONE ==
== Zombies: NONE == Zombies: NONE == Zombies: NONE ==
== Dead: NONE == Dead: NONE == Dead: NONE ==
== Living at Start: 13 == Living at Start: 12 == Living at Start: 13 ==
== Dead at Start: 0 == Dead at Start: 0 == Dead at Start: 0 ==
=====
Personalities:
normal - does this need a description?
coward - gets scared easily
nerd - loves to analyze diseases, hard to scare
lunatic - crazy, dedicated to serving the virus.
karen - does not like it when they have to do things
rebel - does not like authority in general, likes to stir up trouble
=====
===== DEPLOYMENTS =====
**|| LOCATIONS || DEPLOYMENTS ||**
**|| 0 - CENTER || 0 - NONE || 13 - SNIPER_TOWER_CONFIRM ||**
**|| 1 - N || 1 - QUARANTINE_OPEN || 14 - SNIPER_TOWER_FREE ||**
**|| 2 - S || 2 - QUARANTINE_FENCED || 15 - PHEROMONES_BRAINS ||**
**|| 3 - E || 3 - BITE_CENTER_DISINFECT || 16 - PHEROMONES_MEAT ||**
**|| 4 - W || 4 - BITE_CENTER_AMPUTATE || 17 - BSL4LAB_SAFETY_ON ||**
**|| 5 - NE || 5 - Z_CURE_CENTER_FDA || 18 - BSL4LAB_SAFETY_OFF ||**
**|| 6 - NW || 6 - Z_CURE_CENTER_EXP || 19 - RALLY_POINT_OPT ||**
**|| 7 - SE || 7 - FLU_VACCINE_OPT || 20 - RALLY_POINT_FULL ||**
**|| 8 - SW || 8 - FLU_VACCINE_MAN || 21 - FIREBOMB_PRIMED ||**
**|| -- -- || 9 - KILN_OVERSIGHT || 22 - FIREBOMB_BARRAGE ||**
**|| -- -- || 10 - KILN_NO_QUESTIONS || 23 - SOCIAL_DISTANCING_SIGNS ||**
**|| -- -- || 11 - BROADCAST_DONT_PANIC || 24 - SOCIAL_DISTANCING_CEBELITY ||**
**|| -- -- || 12 - BROADCAST_CALL_TO_ARMS || -- -- ||**
=====
Input Action - Location 1:
```

## UI Comparison (NEW UI)



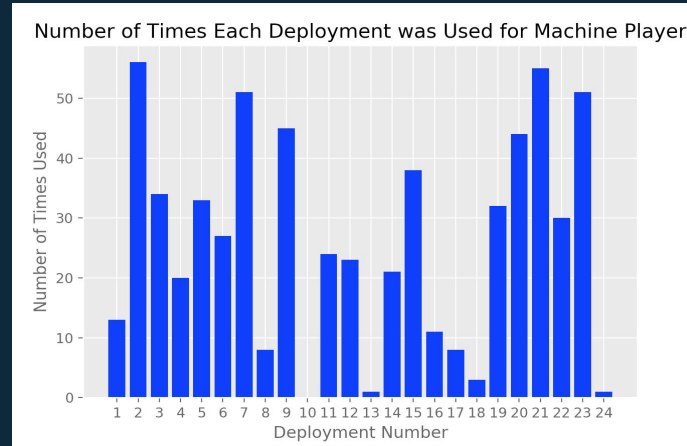
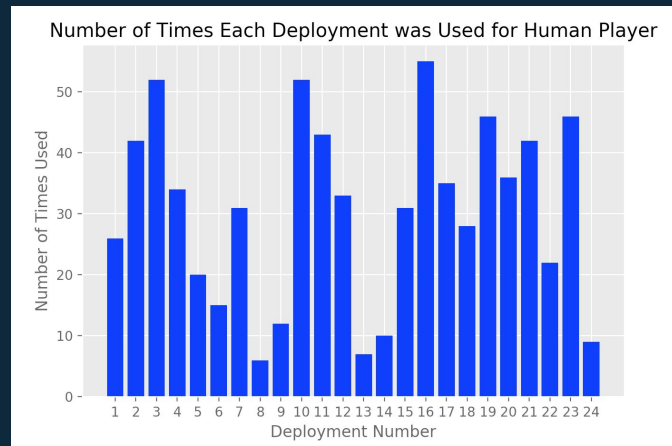
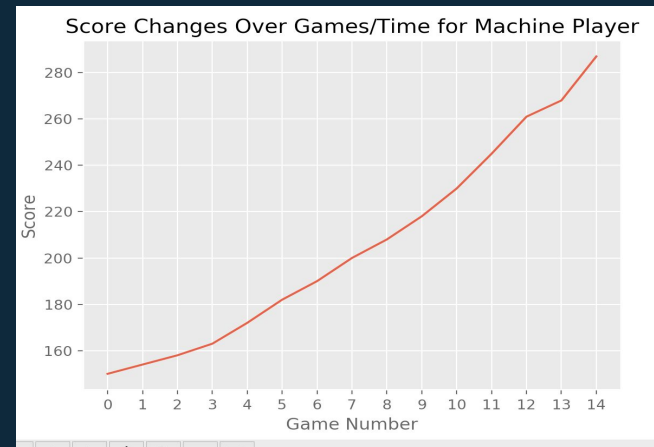
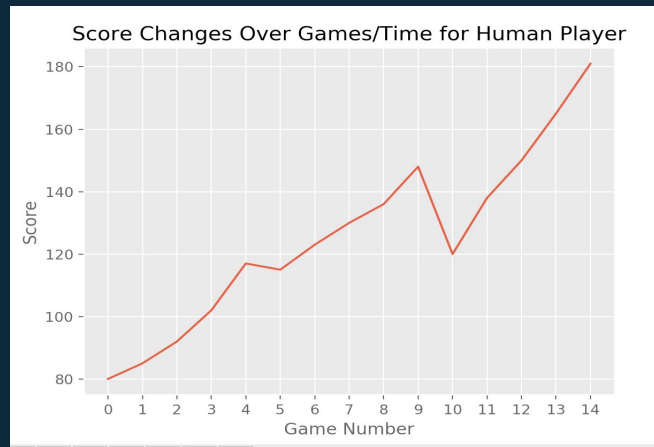


# RL/AI Changes

- New scoring system
  - More specific factors in the game were included
  - Adjusted weights for factors
- Accommodated for new factors added







(Hypothesized) Sample Graphs of Our Data







thank you!

