

```

; ***** INCLUDED FILES *****

__includes [
    "citizens.nls"
    "cops.nls"
    "vid.nls" ; contains the code for the recorder. You also need to activate the vid-extension and the
command at the end of setup
]
; *****end included files *****

; ***** EXTENSIONS *****

extensions [
    vid bitmap; used for recording of the simulation
]
; *****end extensions *****

;***** INITIAL AND DEFINITIONS PART *****
;
;---- Breeds of agents
breed [citizens citizen] ;
breed [cops cop] ;

globals [
    ;
    max-jailterm
    hunger_rate
]

;---- General agent variables
turtles-own [
    ;speed

```

]

;---- Specific, local variables of patches

patches-own [

neighborhood ; surrounding patches within the vision radius

region ; used for identification of different regions

]

;---- Specific, local variables of citizen-agents

citizens-own [

;citizen-vision is set by ruler 'citizen-vision'

inPrison?

jailtime

jailsentence

state

vision

walking-speed

]

;---- Specific, local variables of cop-agents

cops-own [

;cop-vision is set by slider

cop-speed

hunger

inRestaurant?

restauranttime

]

```

; ***** SETUP PART *****

; setup of the environment, and the different agents

to setup

  clear-all

  ; define global variables that are not set as sliders

  set max-jailterm 50

  set hunger_rate 0.1


  ; setup of the environment:

  ; setup of all patches

  ask patches [

    ; make background a certain color or leave it black

    ;set pcolor white - 1

    ; cache patch neighborhoods

    set neighborhood patches in-radius citizen-vision

  ]

  ; setup prison

  let prisonpatches patches with [ pxcor >= -5 and pxcor <= 20 and pycor >= -5 and pycor <= 15 ]

  ask prisonpatches [

    set pcolor gray

    set region "prison"

  ]

  ask one-of prisonpatches [set plabel "PRISON"]


;setup restaurant

let restaurantpatches patches with [pxcor >= 40 and pxcor <= 50 and pycor >= 20 and pycor <= 25]

ask restaurantpatches [

  set pcolor red

  set region "restaurant"

]

ask one-of restaurantpatches [set plabel "RESTAURANT"]

```

```
; setup citizen-agents
create-citizens num-citizens [
  set label who
  set shape "person"
  set size 1.5
  set color green
  setxy random-xcor random-ycor
  ; make sure the agents are not placed in prison already during setup:
  move-to one-of patches with [ not any? turtles-here and region != "prison"]
  ; setting specific variables for citizen
  set inPrison? false
  set jailtime 0
  set jailsentence 0
  ;set speed random 5 + 1 ; make sure it cannot be 0

  set state "moving around freely"
  set vision random-float 10
  set walking-speed 1 + random-float 1
  set jailtime 0
  set jailsentence random max-jailterm
  set inPrison? false
]
```

```
;---- setup cops
create-cops num-cops [
  set label who
  set shape "person police"
  set size 2
  set color blue
  set cop-speed random 3 + 1 ; make sure it cannot be 0
```

```

    move-to one-of patches with [ not any? turtles-here and region != "prison"]
    move-to one-of patches with [ not any? turtles-here and region != "restaurant"]
    set inRestaurant? false
    set cop-speed random 3 + 1
    set hunger random 50 + 1
    set restauranttime 0

]

```

```

; must be last in the setup-part:

```

```

reset-ticks

```

```

;recorder

```

```

if vid:recorder-status = "recording" [

```

```

    if Source = "Only View" [vid:record-view] ; records the plane

```

```

    if Source = "With Interface" [vid:record-interface] ; records the interface

```

```

]

```

```

end

```

```

; *****end setup part *****

```

```

; ***** TO GO/ STARTING PART *****

```

```

;;

```

```

to go

```

```

;---- Basic functions, like setting the time

```

```

;

```

```

tick ; - update time

```

```

;---- Agents to-go part -----
; Cyclic execution of what the agents are supposed to do
;
ask turtles [
  ; Reactive part based on the type of agent
  if (breed = citizens) [
    citizen_behavior ; code as defined in the include-file "citizens.nls"
  ]
  if (breed = cops) [
    cop_behavior ; code as defined in the include-file "cops.nls"
  ]
]

;recorder
if vid:recorder-status = "recording" [
  if Source = "Only View" [vid:record-view] ; records the plane
  if Source = "With Interface" [vid:record-interface] ; records the interface
]

end ; - to go part

```

---

```

; File with the "to-go"- functionality of citizen-agents

```

```

; FILE HISTORY:

```

```
; 2024-01-29 Initial template, gks  
;  
;  
;-----
```

```
to citizen_behavior
```

```
if state = "moving around freely" [
```

```
    rt random 360
```

```
    fd walking-speed
```

```
    if (pcolor = gray) [
```

```
        bk walking-speed
```

```
    ]
```

```
    let nearby-police other cops in-radius vision
```

```
    if any? nearby-police [
```

```
        set state "running away from cops"
```

```
    ]
```

```
]
```

```
if state = "running away from cops" [
```

```
    let nearest-cop min-one-of (other cops in-radius vision) [distance myself]
```

```
    if nearest-cop != nobody [
```

```
let escape-heading towards nearest-cop + 180
```

```
set heading escape-heading
```

```
let escape-speed walking-speed * 1.5 ; Increase the speed by 50%
```

```
fd escape-speed
```

```
if (pcolor = gray) [
```

```
  bk escape-speed
```

```
]
```

```
]
```

```
if not any? (other cops in-radius vision) [
```

```
  set state "moving around freely"
```

```
  set walking-speed 1 + random-float 1
```

```
]
```

```
]
```

```
if state = "being arrested and put to prison" [
```

```
  set color red
```

```
  set walking-speed 0
```

```
  move-to one-of patches with [pcolor = gray and not any? turtles-here]
```

```
  set state "in prison"
```

```
]
```

```
if state = "in prison" [
```

```
  set inprison? true
```

```
  set jailtime jailtime + 1
```

```
  set walking-speed 0
```



```

if jailtime >= jailsentence [

    set jailtime 0
    set state "just released"
]

]

if state = "just released" [

    move-to one-of patches with [not any? turtles-here and pcolor != gray]
    set color green
    set inprison? false
    set walking-speed 1 + random-float 1
    set state "moving around freely"
]

end

```

---

```

; File with the "to-go"- functionality of cops-agents

```

```

; FILE HISTORY:

```

```

; 2022-04-10 Initial template, gks

```

```

;

```

```

;

```

```

;

```

```

;

```

```

;-----

```

```

to cop_behavior

```

```
; check if citizen is nearby to arrest
```

```
let suspect one-of citizens-here with [inPrison? = false] ; need to make sure the citizen is not in jail,  
otherwise can the cop be trapped besides
```

```
ifelse suspect != nobody [
```

```
  ; move the citizen to prison and mark them as arrested
```

```
  print (word " cop-agent: " who " puts suspect: " suspect " to prison!")
```

```
  ask suspect [
```

```
    set jailsentence random max-jailterm
```

```
    set state "being arrested and put to prison"
```

```
  ]
```

```
]
```

```
[; else look for citizens and move towards them
```

```
;set suspect one-of other citizens with [inPrison? = false] in-radius cop-vision
```

```
set suspect one-of other citizens with [inPrison? = false] in-cone vision-radius vision-angle
```

```
if suspect != nobody [
```

```
  print (word " cop-agent: " who " sees suspect: " suspect)
```

```
  face suspect
```

```
]
```

```
forward cop-speed ; move forward towards suspect
```

```
set hunger hunger - hunger_rate
```

```
if hunger <= 0 and inRestaurant? = false[
```

```
  print(word "cop-agent:" who "is hungry and is heading to restaurant")
```

```
  ask self[
```

```
    gotorestaurant
```

```
  ]
```

```
]
```

```
if inRestaurant? = true[
```

```
  set restauranttime restauranttime + 1
```

```

set cop-speed 0
print( word "Cop" who "is in restaurant since" restauranttime)
if restauranttime >= 50[
  set restauranttime 0
  set hunger 50
  set cop-speed random 3 + 1
  set color pink
  print( word "Cop" who "is back from eating donuts")
  set inRestaurant? false

]

]

if inRestaurant? = false[
  move-to one-of patches with [not any? turtles-here and region != "restaurant"]
]

]
end
; if asked to go to restaurant
to gotorestaurant
; set flag

move-to one-of patches with [not any? turtles-here and region = "restaurant"]
set inRestaurant? true

end

```