

Pygame game explanation



```
import pygame, random, sys
pygame.init()

# Window setup
WIDTH, HEIGHT = 600, 450
win = pygame.display.set_mode((WIDTH, HEIGHT))
pygame.display.set_caption("HCI Gaming App - Avoid the Falling Blocks")

# Colors
BLACK = (0, 0, 0)
WHITE = (255, 255, 255)
RED = (200, 0, 0)
BLUE = (0, 100, 255)
LIGHT_BLUE = (100, 149, 237)
DARK_BLUE = (10, 25, 70)
GRAY = (180, 180, 180)

# Clock and font
clock = pygame.time.Clock()
font = pygame.font.Font(None, 36)
arrow_font = pygame.font.Font(None, 60)

# Player setup
player = pygame.Rect(WIDTH // 2 - 25, HEIGHT - 60, 50, 50)
player_speed = 7

# Obstacle setup
obstacle = pygame.Rect(random.randint(0, WIDTH - 50), -50, 50, 50)
obstacle_speed = 5

# Buttons for HCI controls
btn_size = 65
left_btn = pygame.Rect(70, HEIGHT - 90, btn_size, btn_size)
right_btn = pygame.Rect(180, HEIGHT - 90, btn_size, btn_size)

# Score
score = 0
game_over = False

def draw_game():
    win.fill(DARK_BLUE)

    # Draw player and obstacle
    pygame.draw.rect(win, RED, player)
    pygame.draw.rect(win, BLUE, obstacle)
```

```
# Draw HCI buttons
pygame.draw.rect(win, LIGHT_BLUE, left_btn, border_radius=10)
pygame.draw.rect(win, LIGHT_BLUE, right_btn, border_radius=10)

# Draw arrow symbols on buttons
left_arrow = arrow_font.render("←", True, WHITE)
right_arrow = arrow_font.render("→", True, WHITE)
win.blit(left_arrow, (left_btn.x + 15, left_btn.y + 5))
win.blit(right_arrow, (right_btn.x + 15, right_btn.y + 5))

# Score display
score_text = font.render(f"Score: {score}", True, WHITE)
win.blit(score_text, (20, 20))

pygame.display.update()

def show_game_over():
    win.fill(BLACK)
    over_text = font.render("GAME OVER!", True, RED)
    score_text = font.render(f"Final Score: {score}", True, WHITE)
    restart_text = font.render("Press R to Restart or Q to Quit", True, GRAY)
    win.blit(over_text, (WIDTH // 2 - 100, HEIGHT // 2 - 60))
    win.blit(score_text, (WIDTH // 2 - 120, HEIGHT // 2))
    win.blit(restart_text, (WIDTH // 2 - 180, HEIGHT // 2 + 50))
    pygame.display.update()

# Main game loop
while True:
    clock.tick(30)
    if not game_over:
        for event in pygame.event.get():
            if event.type == pygame.QUIT:
                pygame.quit()
                sys.exit()
            # Mouse (HCI) Controls
            if event.type == pygame.MOUSEBUTTONDOWN:
                if left_btn.collidepoint(event.pos):
                    player.x -= player_speed
                if right_btn.collidepoint(event.pos):
                    player.x += player_speed

            # Keyboard Controls
            keys = pygame.key.get_pressed()
            if keys[pygame.K_LEFT]:
                player.x -= player_speed
            if keys[pygame.K_RIGHT]:
                player.x += player_speed

            # Obstacle movement
            obstacle.y += obstacle_speed
```

```

if obstacle.y > HEIGHT:
    obstacle.y = -50
    obstacle.x = random.randint(0, WIDTH - 50)
    score += 1 # Increase score for surviving

# Collision detection
if player.colliderect(obstacle):
    game_over = True

# Boundary check
if player.x < 0: player.x = 0
if player.x > WIDTH - 50: player.x = WIDTH - 50

draw_game()

else:
    show_game_over()
    for event in pygame.event.get():
        if event.type == pygame.QUIT:
            pygame.quit()
            sys.exit()
        if event.type == pygame.KEYDOWN:
            if event.key == pygame.K_r:
                # Restart game
                player.x, player.y = WIDTH // 2 - 25, HEIGHT - 60
                obstacle.y = -50
                score = 0
                game_over = False
            elif event.key == pygame.K_q:
                pygame.quit()
                sys.exit()

```

explain me this code in detail

Nice little Pygame project — thanks for sharing! I'll walk through the code step-by-step, explain what every part does, point out subtle behaviors and potential bugs, and finish with practical improvement ideas and small code tweaks you can use.

High-level overview

This is a simple “avoid the falling blocks” game built with Pygame.

- You control a red square at the bottom of the screen.
- Blue square(s) fall from the top.
- If a falling block passes the bottom you score a point.
- If a block collides with the player, the game ends and you can restart (R) or quit (Q).

- On-screen clickable HCI buttons (left/right) let you move the player with mouse clicks as well as keyboard arrows.

File setup & initialization

```
py

import pygame, random, sys
pygame.init()
```

- Imports Pygame, random, and sys.
- `pygame.init()` initializes all the Pygame modules (display, font, audio etc.). Must be called before using Pygame features.

Window and display

```
py

WIDTH, HEIGHT = 600, 450
win = pygame.display.set_mode((WIDTH, HEIGHT))
pygame.display.set_caption("HCI Gaming App - Avoid the Falling Blocks")
```

- Creates the game window sized 600×450 pixels.
- Sets the window title.

Colors & constants

```
py

BLACK = (0, 0, 0)
WHITE = (255, 255, 255)
RED = (200, 0, 0)
BLUE = (0, 100, 255)
LIGHT_BLUE = (100, 149, 237)
DARK_BLUE = (10, 25, 70)
GRAY = (180, 180, 180)
```

- RGB tuples for colors used in the UI (player, obstacle, background, buttons, text).

Clock and fonts

```
py

clock = pygame.time.Clock()
font = pygame.font.Font(None, 36)
arrow_font = pygame.font.Font(None, 60)
```

- `clock()` manages FPS (frames per second).
- `font` and `arrow_font` create font objects for drawing text. `None` uses Pygame's default font; numbers are sizes.

Player setup

```
py

player = pygame.Rect(WIDTH // 2 - 25, HEIGHT - 60, 50, 50)
player_speed = 7
```

- `player` is a `pygame.Rect(x, y, width, height)` centered horizontally near the bottom.
- `player_speed` controls how many pixels the player moves per frame when an input is active.

Obstacle setup

```
py

obstacle = pygame.Rect(random.randint(0, WIDTH - 50), -50, 50, 50)
obstacle_speed = 5
```

- Single falling block (`obstacle`) starts off-screen above top (`y = -50`) at a random `x`.
- `obstacle_speed` is vertical speed in pixels per frame.

HCI buttons (on-screen clickable controls)

```
py

btn_size = 65
left_btn = pygame.Rect(70, HEIGHT - 90, btn_size, btn_size)
right_btn = pygame.Rect(180, HEIGHT - 90, btn_size, btn_size)
```

- Two square buttons near the bottom-left. These are drawn and can be clicked to move the player left or right.

Score and game state

```
py

score = 0
game_over = False
```

- `score` increments when a falling block passes the bottom.
- `game_over` toggles whether main gameplay is active or end-screen is displayed.

draw_game() — rendering function

py

```
def draw_game():
    win.fill(DARK_BLUE)
    pygame.draw.rect(win, RED, player)
    pygame.draw.rect(win, BLUE, obstacle)
    pygame.draw.rect(win, LIGHT_BLUE, left_btn, border_radius=10)
    pygame.draw.rect(win, LIGHT_BLUE, right_btn, border_radius=10)
    left_arrow = arrow_font.render("←", True, WHITE)
    right_arrow = arrow_font.render("→", True, WHITE)
    win.blit(left_arrow, (left_btn.x + 15, left_btn.y + 5))
    win.blit(right_arrow, (right_btn.x + 15, right_btn.y + 5))
    score_text = font.render(f"Score: {score}", True, WHITE)
    win.blit(score_text, (20, 20))
    pygame.display.update()
```

- Clears screen with `DARK_BLUE`.
- Draws player & obstacle rectangles.
- Draws rounded HCI buttons (light blue) and arrow glyphs on them using `arrow_font`.
- Draws score text on top-left. `pygame.display.update()` pushes the frame to the screen.

Note: arrow placement (`left_btn.x + 15`, `left_btn.y + 5`) works visually but could be made more centered by measuring the surface size and centering the rendered text.

show_game_over() — end-screen

py

```
def show_game_over():
    win.fill(BLACK)
    over_text = font.render("GAME OVER!", True, RED)
    score_text = font.render(f"Final Score: {score}", True, WHITE)
    restart_text = font.render("Press R to Restart or Q to Quit", True, GRAY)
    win.blit(over_text, (WIDTH // 2 - 100, HEIGHT // 2 - 60))
    win.blit(score_text, (WIDTH // 2 - 120, HEIGHT // 2))
    win.blit(restart_text, (WIDTH // 2 - 180, HEIGHT // 2 + 50))
    pygame.display.update()
```

- Clears to black and draws three lines: game over, final score, and restart/quit instructions.

Note: center positions are approximated using offsets; `get_rect(center=(...))` would center text precisely.

Main game loop

py

```
while True:
    clock.tick(30)
    if not game_over:
        for event in pygame.event.get():
            if event.type == pygame.QUIT: ...
            if event.type == pygame.MOUSEBUTTONDOWN:
```

```

        if left_btn.collidepoint(event.pos):
            player.x -= player_speed
        if right_btn.collidepoint(event.pos):
            player.x += player_speed
    keys = pygame.key.get_pressed()
    if keys[pygame.K_LEFT]:
        player.x -= player_speed
    if keys[pygame.K_RIGHT]:
        player.x += player_speed
    obstacle.y += obstacle_speed
    if obstacle.y > HEIGHT:
        obstacle.y = -50
        obstacle.x = random.randint(0, WIDTH - 50)
        score += 1
    if player.colliderect(obstacle):
        game_over = True
    if player.x < 0: player.x = 0
    if player.x > WIDTH - 50: player.x = WIDTH - 50
    draw_game()
else:
    show_game_over()
    for event in pygame.event.get():
        if event.type == pygame.QUIT: ...
        if event.type == pygame.KEYDOWN:
            if event.key == pygame.K_r: ...
            elif event.key == pygame.K_q: ...

```

Walkthrough of main loop details:

- `clock.tick(30)` limits the loop to ~30 FPS. This keeps motion consistent across machines.
- **Event handling:**
 - Handles `QUIT` to exit cleanly.
 - On `MOUSEBUTTONDOWN` it checks whether the click was inside the left or right button, and moves the player by `player_speed` once for that click.
- **Keyboard:**
 - `pygame.key.get_pressed()` gives continuous state; holding left/right moves the player continuously.
- **Obstacle movement:**
 - Each frame, `obstacle.y += obstacle_speed`.
 - If `obstacle.y > HEIGHT` (it passed the bottom), it's reset above the screen and x randomized. `score` increments by 1.
- **Collision detection:**
 - Uses `player.colliderect(obstacle)` — a built-in Rect collision test. If collision, `game_over = True`.
- **Boundary checks:**
 - Prevents player from moving off-screen by clamping `player.x`.
- **Game-over handling:**
 - On game over, `show_game_over()` is drawn and keyboard events for `R` (restart) or `Q` (quit) are handled. Restart resets `player` position, `obstacle.y`, `score`, and toggles `game_over = False`.

Subtle behaviors & potential bugs

1. Mouse buttons only move on click (not hold):

Clicking left/right moves the player by `player_speed` one time. Holding mouse down does nothing (no `MOUSEBUTTONDOWN` or continuous check). For touch interfaces you'd likely want to move while the mouse is down or track `MOUSEMOTION` while a button is held.

2. Single obstacle only:

Game has only one falling block. Game difficulty is limited.

3. No difficulty scaling:

`obstacle_speed` is constant. You might want to increase it as score increases.

4. No delta-time usage:

Movement is frame-dependent (pixels per frame). `clock.tick(30)` regularizes frames but using delta-time makes motion robust to varying FPS.

5. Instant restart uses same obstacle x position?

On restart you set `obstacle.y = -50` but not `obstacle.x`, so the obstacle will resume at the same `x` where it was at game over. That's okay but worth noting.

6. Text centering uses approximate offsets:

Might not be perfectly centered for all text lengths or fonts.

7. No sound or visual feedback for collision:

Could enhance UX.

8. No cleanup on quit:

You call `pygame.quit()` which is fine, but if using more resources or files, ensure proper cleanup.

Simple improvements & code snippets

1) Keep moving while mouse button is held

Replace the mouse click handling with a flag to track mouse button down:

```
py

mouse_left_down = False
mouse_right_down = False

# in event loop:
if event.type == pygame.MOUSEBUTTONDOWN:
    if left_btn.collidepoint(event.pos): mouse_left_down = True
    if right_btn.collidepoint(event.pos): mouse_right_down = True
if event.type == pygame.MOUSEBUTTONUP:
    mouse_left_down = mouse_right_down = False

# then after keys checking:
if mouse_left_down:
    player.x -= player_speed
if mouse_right_down:
    player.x += player_speed
```

2) Add difficulty scaling

Increase obstacle speed every few points:

```
py

if obstacle.y > HEIGHT:
    obstacle.y = -50
    obstacle.x = random.randint(0, WIDTH - 50)
    score += 1
    if score % 5 == 0:
        obstacle_speed += 1    # make it harder every 5 points
```

3) Center text precisely

```
py

over_surf = font.render("GAME OVER!", True, RED)
over_rect = over_surf.get_rect(center=(WIDTH//2, HEIGHT//2 - 60))
win.blit(over_surf, over_rect)
```

4) Add multiple obstacles

Create a list of obstacles:

```
py

obstacles = [pygame.Rect(random.randint(0, WIDTH-50), random.randint(-300, -50), 50,50) for _ in
range(3)]
# each loop:
for ob in obstacles:
    ob.y += obstacle_speed
    if ob.y > HEIGHT:
        ob.y = -50
        ob.x = random.randint(0, WIDTH-50)
        score += 1
    if player.colliderect(ob):
        game_over = True
```

5) Use delta time (recommended for smoother motion)

```
py

dt = clock.tick(60) / 1000.0 # seconds passed
move_amount = player_speed * dt * 60 # keep similar feeling
player.x += move_amount # or player.x -= move_amount
```

(Requires making `player_speed` a float, and adjusting other movement calculations similarly.)

UX / HCI suggestions

- Make on-screen controls larger and placed more ergonomically for touch screens.
- Add visual feedback on button press (e.g., change button color while pressed).
- Add a pause option (P).
- Add audio cues for collision and scoring.
- Show difficulty level or progress bar.

- Provide an instruction screen before gameplay.

Summary (quick)

- The code sets up a Pygame window and runs a 30 FPS game loop.
- Player is a `Rect` controlled by keyboard or click buttons.
- Single falling obstacle moves down each frame; score increments when it passes bottom.
- Collision ends game; player can restart or quit.
- Several practical improvements: continuous mouse hold movement, variable difficulty, multiple obstacles, delta-time for frame-independent motion, and improved centering and UI feedback.

If you want, I can:

- update your script to add any specific improvement (e.g., continuous button hold, difficulty scaling, multiple obstacles), and paste the full modified code — ready to copy/paste; OR
- explain how to package the game into an executable for distribution.

Which improvement should I implement for you right now?



also give me 25 question of viva on this

Perfect 👍 — since this project is your **HCI (Human-Computer Interaction) Gaming App – “Avoid the Falling Blocks”** made with **Python and Pygame**, here are **25 well-structured viva questions** along with **their answers**, covering concepts from:

- Pygame basics
- event handling
- HCI design principles
- game logic
- and Python coding concepts.

Viva Questions and Answers

1. What is the main purpose of this game?

Ans: The purpose is to control a player block and avoid falling obstacles using both keyboard and on-screen buttons, demonstrating Human-Computer Interaction concepts.

2. Which Python library is used in this project and why?

Ans: The `pygame` library is used to create graphical interfaces, handle events, draw shapes, and control the game loop.

3. What does `pygame.init()` do?

Ans: It initializes all the imported Pygame modules, such as display, fonts, sound, and input systems, to prepare them for use.

4. Explain the role of `pygame.display.set_mode()` function.

Ans: It creates the main window surface where all game graphics are drawn.

5. What is a `pygame.Rect` object used for?

Ans: It defines a rectangular area with properties (x, y, width, height). Here, it's used for player, obstacle, and button boundaries.

6. How is the player controlled in this game?

Ans: The player can be moved using **keyboard arrow keys** or **mouse clicks** on on-screen left and right buttons (HCI feature).

7. What happens when the obstacle moves beyond the bottom of the screen?

Ans: The obstacle is reset to the top at a random x-position, and the score increases by 1.

8. What is the purpose of the variable `score`?

Ans: It keeps track of how many obstacles the player successfully avoids.

9. How is collision between the player and obstacle detected?

Ans: Using `player.colliderect(obstacle)`, which returns `True` if the two rectangles overlap.

10. What happens when a collision is detected?

Ans: The `game_over` flag is set to `True`, stopping gameplay and showing the Game Over screen.

11. What is the role of `clock.tick(30)` in the loop?

Ans: It limits the game loop to run at 30 frames per second, ensuring consistent gameplay speed.

12. Explain the purpose of the `draw_game()` function.

Ans: It draws all visual elements (player, obstacle, score, and HCI buttons) on the game window.

13. What is the difference between `pygame.event.get()` and `pygame.key.get_pressed()`?

Ans:

- `pygame.event.get()` fetches discrete events (like key down, mouse click).
 - `pygame.key.get_pressed()` returns the current state of all keys (used for continuous movement).
-

14. What are HCI buttons in this project?

Ans: On-screen blue rectangles with arrow symbols (\leftarrow , \rightarrow) that can be clicked to move the player, simulating touch input.

15. Why is HCI important in game design?

Ans: HCI focuses on how users interact with software. In games, it ensures ease of control, accessibility, and good user experience.

16. What is the role of `pygame.display.update()`?

Ans: It updates the display surface to show all recent drawing changes to the screen.

17. What are the color constants (like RED, BLUE) used for?

Ans: They define RGB values for colors used to visually distinguish player, obstacles, background, and UI elements.

18. How is the "Game Over" screen implemented?

Ans: When `game_over` is `True`, the `show_game_over()` function is called to draw a black screen with text for final score and restart/quit options.

19. How can the player restart the game after losing?

Ans: By pressing the 'R' key, which resets `player` position, `obstacle` position, and the score.

20. What happens when the player presses the 'Q' key on the Game Over screen?

Ans: The program exits gracefully by calling `pygame.quit()` and `sys.exit()`.

21. How does randomization enhance the game experience?

Ans: The obstacle's x-position is randomized each time, making the game unpredictable and more engaging.

22. What is the purpose of border checks for the player?

Ans: They prevent the player's rectangle from moving outside the window boundaries.

23. What is the significance of using `border_radius` while drawing buttons?

Ans: It gives the button rectangles rounded corners, improving aesthetic appeal and HCI usability.

24. Suggest one improvement to make the game more challenging.

Ans: Increase obstacle speed as score increases, or add multiple obstacles falling simultaneously.

25. How does this project relate to Human-Computer Interaction concepts?

Ans: It demonstrates HCI principles through intuitive control mechanisms (keyboard + clickable UI), color contrast, real-time feedback, and simple visual cues enhancing usability and engagement.



Bonus Discussion Points (for extra marks)

- **Accessibility:** Using large buttons makes it easier for users on touchscreens.
 - **Feedback:** Visual score updates give immediate performance feedback.
 - **Simplicity:** Minimalistic UI reduces cognitive load, improving user focus.
 - **Learnability:** Simple controls allow users to learn gameplay instantly.
-

Would you like me to also give you a **"viva sheet" PDF** version (formatted, printable for submission)?
I can generate that directly for you — just say *"Yes, make it a PDF viva sheet."*