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```
%{
SCENE 1 - Jake Kaplan
%}

%function [out_flag, ns1mtx, characterCenter1] = Scene1_2_final(~)
```

Play background music throughout all scenes.

```
[y,Fs] = audioread('ninja_music.wav');
player = audioplayer(y,Fs);
play(player)   % Start the music
```

Create background image

```
clf %This clears the figure, so remove this line if you want to
 preserve a plot you have already made
% This creates the 'background' axes
ha = axes('units','normalized', 'position',[0 0 1 1]);
% Move the background axes to the bottom
uistack(ha,'bottom');
% Load in a background image and display it using the correct colors
% The image used below, is just a Roadrunner scene I downloaded.
I=imread('NinjaHome.jpg');
hi = imagesc(I);
colormap gray;
% Turn the handlevisibility off so that we don't inadvertently plot
 into the axes again
% Also, make the axes invisible
set(ha,'handlevisibility','off', 'visible','off')
% Now we can use the figure, as required.
% For example, we can put a plot in an axes
%axes('position',[0.3,0.35,0.4,0.4])
```

```
filename = 'NinjaSword1.jpg';
ninjaColor =[0, 0, 1];
thresh = 219;
ninjasword1 = imread(filename);
ns1mtx = fJpeg2pointsConverter(ninjasword1, thresh);
[m,n]=size(ns1mtx);
fprintf("%s size (thresh=%i) , [%i,%i]",filename,thresh,m,n);
disp(m);  disp(n);
ns1mtx = [ns1mtx;ones(1,n)]; %Make the matrix 3x3 by adding a row of
 1s
S = [0.02 0 0; 0 0.02 0; 0 0 1];  %This is my rescaling matrix to
 shrink the character to fit the background
ns1mtx = S*ns1mtx;
ns1mtx_orig = ns1mtx;


% import the throwing star sprite
throwingStar = fJpeg2pointsConverter(imread("throwing-star.jpg"),
 thresh);

% get the size and convert the matrix to a set of homogenous
 coordinates
[m,n]=size(throwingStar);
throwingStar = [throwingStar;ones(1,n)];

% rescale the throwing star to the character
throwingStar = S*throwingStar;



axesVisible = 'off';
axesXpos = 0;
axesYpos = 0;
axesXdim = 1.2;
axesYdim = 1;
```

```
NinjaSword1.jpg size (thresh=219) , [2,12878]     2

       12878
```

Run towards the edge of the building (using shear)

```
ns1mtx = ShearHScene(ns1mtx,0.5);
hb = axes('units','normalized', 'position',[-0.2 .0625 axesXdim 1]);
r = 1/5;
numItr = 17.5;
for i=1:0.5:numItr
    %hb = axes('position',[axesXpos axesYpos axesXdim axesYdim]);
    h_rr = plot(hb,ns1mtx(1,:), ns1mtx(2,:),   '.', 'color',
 ninjaColor, 'MarkerSize', 1);
    axis([0 70 0 70]) %This let me set the scale I wanted in the
 inserted axes

 set(gca,'color','none','handlevisibility',axesVisible,'visible',axesVisible)

    Shift = [1 0 1; 0 1 0; 0 0 1];
    ns1mtx = Shift*ns1mtx;
    ns1mtx = RotationScene(ns1mtx,r);
    r = -1*r;

    pause(0.1)
    set(h_rr,'Visible','off')  % This line erases the image of the
 Road Runner and Wile E. Coyote
```

```
    axis([0 70 0 70]) % This let me set the scale I wanted in the
 inserted axes
    set( gca, 'color','none','handlevisibility','off','visible','off')
end
ns1mtx = RotationScene(ns1mtx,r);
```

Reflect character and jump to left

```
ns1mtx = ShearHScene(ns1mtx,-0.5);
ns1mtx = ReflHScene(ns1mtx);
hb = axes('units','normalized', 'position',[-0.2 .0625 axesXdim 1]);
numItr = 12;
for i=1:numItr
    %hb = axes('position',[axesXpos axesYpos axesXdim axesYdim]);
    h_rr = plot(hb,ns1mtx(1,:), ns1mtx(2,:),   '.', 'color',
 ninjaColor, 'MarkerSize', 1);
    axis([0 70 0 70]) %This let me set the scale I wanted in the
 inserted axes

 set(gca,'color','none','handlevisibility',axesVisible,'visible',axesVisible)

    Shift = [1 0 -(6/numItr); 0 1 (6/numItr); 0 0 1];
    ns1mtx = Shift*ns1mtx;

    pause(0.001)
    set(h_rr,'Visible','off')  % This line erases the image of the
 Road Runner and Wile E. Coyote
    axis([0 70 0 70]) % This let me set the scale I wanted in the
 inserted axes
    set( gca, 'color','none','handlevisibility','off','visible','off')
end
```

Character scales the building

```
hb = axes('units','normalized', 'position',[-0.2 .0625 axesXdim 1]);
r = 1/9;
for i=1:9
    %hb = axes('position',[axesXpos axesYpos axesXdim axesYdim]);
    h_rr = plot(hb,ns1mtx(1,:), ns1mtx(2,:),   '.', 'color',
 ninjaColor, 'MarkerSize', 1);
    axis([0 70 0 70]) %This let me set the scale I wanted in the
 inserted axes

 set(gca,'color','none','handlevisibility',axesVisible,'visible',axesVisible)

    Shift = [1 0 0; 0 1 1; 0 0 1];
    ns1mtx = Shift*ns1mtx;
    ns1mtx = RotationScene(ns1mtx,r);
    r = -1*r;

    pause(0.2)
    set(h_rr,'Visible','off')  % This line erases the image of the
 Road Runner and Wile E. Coyote
    axis([0 70 0 70]) % This let me set the scale I wanted in the
 inserted axes
    set( gca, 'color','none','handlevisibility','off','visible','off')
end
ns1mtx = RotationScene(ns1mtx,r);
```

Reflect character and jump to right (to reach roof)

```
ns1mtx = ReflHScene(ns1mtx);
hb = axes('units','normalized', 'position',[-0.2 .0625 axesXdim 1]);
for i=1:numItr
    %hb = axes('position',[axesXpos axesYpos axesXdim axesYdim]);
    h_rr = plot(hb,ns1mtx(1,:), ns1mtx(2,:),   '.', 'color',
 ninjaColor, 'MarkerSize', 1);
    axis([0 70 0 70]) %This let me set the scale I wanted in the
 inserted axes

 set(gca,'color','none','handlevisibility',axesVisible,'visible',axesVisible)

    Shift = [1 0 (5/numItr); 0 1 (5/numItr); 0 0 1];
    ns1mtx = Shift*ns1mtx;
    pause(0.001);
    set(h_rr,'Visible','off');  % This line erases the image of the
 Road Runner and Wile E. Coyote
    axis([0 70 0 70]) ;% This let me set the scale I wanted in the
 inserted axes

 set( gca, 'color','none','handlevisibility','off','visible','off');;
end

characterCenter1 = centerPivot(ns1mtx);

x_final = characterCenter1(1,1);
y_final = characterCenter1(2,1);
fprintf("x_final = %f", x_final);
fprintf("y_final = %f", y_final);
```

```
x_final = 35.192720y_final = 22.381160
```

```
%{
SCENE 2 - Stephen Horn
%}

%ns1mtx = teleportTo(ns1mtx,35,25);
```

Lands on to roof

```
for i=1:5
    hb = axes('units','normalized', 'position',[-0.2 .0625 1.2 1]);
    h_rr = plot(hb,ns1mtx(1,:), ns1mtx(2,:),   '.', 'color',
 ninjaColor, 'MarkerSize', 1);
    axis([0 70 0 70]) ;

 set(gca,'color','none','handlevisibility',axesVisible,'visible',axesVisible)

    nS = [1 0 0.5 ; 0 1 -0.1; 0 0 1 ];
    ns1mtx = nS*ns1mtx;

    pause(0.05);
    set(h_rr,'Visible','off');
    axis([0 70 0 70]) ;

 set( gca, 'color','none','handlevisibility','off','visible','off');
end
```

sneaks...

```
ns1mtx = squatScene(ns1mtx,1.8,0.6);
r=-1;
for i=1:28
```

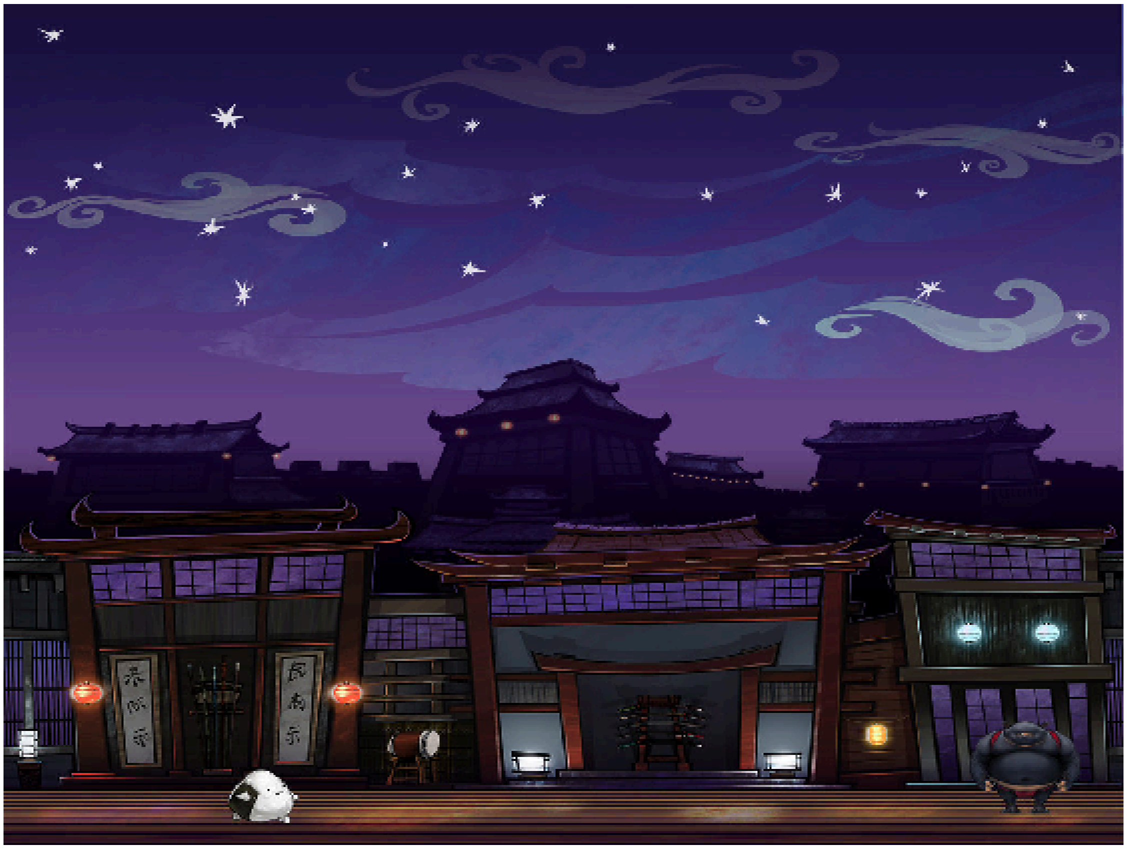
```
    hb = axes('units','normalized', 'position',[-0.2 .0625 1.2 1]);
    h_rr = plot(hb,ns1mtx(1,:), ns1mtx(2,:),   '.', 'color',
 ninjaColor, 'MarkerSize', 1);
    axis([0 70 0 70]) ;

 set(gca,'color','none','handlevisibility',axesVisible,'visible',axesVisible)

    nS = [1 0 0.5 ; 0 1 0; 0 0 1 ];
    ns1mtx = nS*ns1mtx;
    ns1mtx = squatScene(ns1mtx, 1.0 + (0.2*r) , 1.0);
    r=-1*r;

    pause(0.05);
    set(h_rr,'Visible','off');
    axis([0 70 0 70]) ;

 set( gca, 'color','none','handlevisibility','off','visible','off');
end
```



Character stands up from sneak position

```
algn = alignWith(ns1mtx, ns1mtx_orig);
ns1mtx = algn;

for i=1:4
    hb = axes('units','normalized', 'position',[-0.2 .0625 1.2 1]);
    h_rr = plot(hb,ns1mtx(1,:), ns1mtx(2,:),   '.', 'color',
 ninjaColor, 'MarkerSize', 1);
    axis([0 70 0 70]) ;

 set(gca,'color','none','handlevisibility',axesVisible,'visible',axesVisible)

    % sv + c
    nS = [1 0 0.5 ; 0 1 0; 0 0 1 ];
    ns1mtx = nS*ns1mtx;

    pause(0.05);
    set(h_rr,'Visible','off');
    axis([0 70 0 70]) ;

 set( gca, 'color','none','handlevisibility','off','visible','off');
end

nt4mtx = loadNinjaTool4('NinjaTool4.jpg');
Z = (-1)*centerPivot(nt4mtx);
nt4mtx = ShiftScene(nt4mtx, Z(1),Z(2));
nt4mtx = [-1 0 0; 0 -1 0; 0 0 1]*nt4mtx;
algn = alignWith(ns1mtx , nt4mtx);
nt4mtx = algn;
```

```
NinjaTool4.jpg size (thresh=219) , [2,14085]     2

       14085
```

Frontflip

```
v=1;
for i=1:19
    hb = axes('units','normalized', 'position',[-0.2 .0625 1.2 1]);
    h_rr = plot(hb,nt4mtx(1,:), nt4mtx(2,:),    '.', 'color',
 ninjaColor, 'MarkerSize', 1);
    axis([0 70 0 70]) ;

 set(gca,'color','none','handlevisibility',axesVisible,'visible',axesVisible)

    % sv + c
    nS = [1 0 0.4 ; 0 1 (-0.28)*v+3; 0 0 1 ];
    nt4mtx = nS*nt4mtx;
    nt4mtx = RotationScene(nt4mtx, -0.66 );
    v=v+1;

    pause(0.05);
    set(h_rr,'Visible','off');
    axis([0 70 0 70]) ;

 set( gca, 'color','none','handlevisibility','off','visible','off');
end
```

Lands and walks on roof

```
algn = alignWith(nt4mtx , ns1mtx);
ns1mtx = algn;
for i=1:6
    hb = axes('units','normalized', 'position',[-0.2 .0625 1.2 1]);
    h_rr = plot(hb,ns1mtx(1,:), ns1mtx(2,:),   '.', 'color',
 ninjaColor, 'MarkerSize', 1);
    axis([0 70 0 70]) ;

 set(gca,'color','none','handlevisibility',axesVisible,'visible',axesVisible)

    nS = [1 0 0.5; 0 1 0; 0 0 1];
    ns1mtx = nS*ns1mtx;

    pause(0.05);
    set(h_rr,'Visible','off');
    axis([0 70 0 70]) ;

 set( gca, 'color','none','handlevisibility','off','visible','off');
end
```

Jumps off roof to the edge of the screen

```
for i=1:5
    hb = axes('units','normalized', 'position',[-0.2 .0625 1.2 1]);
    h_rr = plot(hb,ns1mtx(1,:), ns1mtx(2,:),   '.', 'color',
 ninjaColor, 'MarkerSize', 1);
    axis([0 70 0 70]) ;

 set(gca,'color','none','handlevisibility',axesVisible,'visible',axesVisible)

    nS = [1 0 1.5 ; 0 1 1; 0 0 1 ];
    ns1mtx = nS*ns1mtx;

    pause(0.05);
    set(h_rr,'Visible','off');
    axis([0 70 0 70]) ;

 set( gca, 'color','none','handlevisibility','off','visible','off');
end

characterCenter2 = centerPivot(ns1mtx);

x_final = characterCenter2(1,1);
y_final = characterCenter2(2,1);
fprintf("x_final = %f", x_final);
fprintf("y_final = %f", y_final);
```

```
x_final = 71.810776y_final = 30.271048
```

```
%{
SCENE 3 - Andrew Brown
%}

% Call scene three function
failureFlag = false;
[failureFlag, ns1mtx, characterCenter, throwingStar1, throwingStar2] =
 third_scene(ns1mtx, [x_final, y_final], throwingStar, throwingStar,
 ninjaColor, axesVisible);
x_final = characterCenter(1,:);
y_final = characterCenter(2,:);
```

```
%{
SCENE 4 - Giovanni
%}

stop(player)   % Stop the music after the animation is complete.
disp('script completed');

%{
----------------------------------------------------------
Functions below
%}

function PPt = teleportTo(PP,tx,ty)
    nc = centerPivot(PP);
    nP = [1 0 -1*nc(1) ; 0 1 -1*nc(2); 0 0 1 ];
    zPP = nP*PP;
    nS = [1 0 tx ; 0 1 ty; 0 0 1 ];
    PPt = nS*zPP;
end


function PPal = alignWith(PPprevmtx , newmtx )
    [Mrows Ncols] = size(PPprevmtx);
    center = feetPivot(newmtx);
    newzzero = ShiftScene(newmtx, -1.0*center(1,1), -1.0*center(2,1));
    prevc = feetPivot(PPprevmtx);
    if Mrows == 3,PPal = newzzero + prevc;
    else, PPal = newzzero + prevc(1:2 , :);
    end
end


function PPq = squatScene(PP, xq, yq )
    [Mrows Ncols] = size(PP);
    if Mrows == 2, SH = [xq 0 ; 0 yq];
    else , SH = [xq 0 0; 0 yq 0; 0 0 1];
    end
    center = feetPivot(PP);
    PPz = ShiftScene(PP, -1.0*center(1,1), -1.0*center(2,1));
    if Mrows == 3,PPq = (SH*PPz) + center;
    else, PPq = (SH*PPz) + center(1:2 , :);
    end
end


function nt4mtx = loadNinjaTool4(filename)
    thresh = 219;
    ninjatool4 = imread(filename);
    nt4mtx = fJpeg2pointsConverter(ninjatool4, thresh);
    [m,n]=size(nt4mtx);
    fprintf("%s size (thresh=%i) , [%i,%i]",filename,thresh,m,n);
    disp(m);  disp(n);
    nt4mtx = [nt4mtx;ones(1,n)];
    %This is my rescaling matrix to shrink the character to fit the
 background
    S = [0.025 0 0; 0 0.025 0; 0 0 1];
    nt4mtx = S*nt4mtx;
end


function fpiv = feetPivot(PP)
    % Get a pivot point at the feet of the character.
    uX = max(PP(1,:));
    lX = min(PP(1,:));
    %uY = max(PP(2,:));
    lY = min(PP(2,:));
    fpiv = [ mean([uX,lX])  ; lY ; 0];
end


function PPshh = ShearHScene(PP,k)
    [Mrows Ncols] = size(PP);
    if Mrows == 2,
        SH = [1 k ; 0 1];
    else ,
        SH = [1 k 0; 0 1 0; 0 0 1];
    end
    center = feetPivot(PP);
    PPz = ShiftScene(PP, -1.0*center(1,1), -1.0*center(2,1));
    if Mrows == 3,
        PPshh = (SH*PPz) + center;
    else ,
        PPshh = (SH*PPz) + center(1:2 , :);
    end
end


function cent = centerPivot(PP)
    % Assume these points are moved into a scene frame.
    uX = max(PP(1,:));
    lX = min(PP(1,:));
    uY = max(PP(2,:));
    lY = min(PP(2,:));
    cent = [ mean([uX,lX])  ; mean([uY,lY]) ; 0];
end


function PPrs = RotationScene(PP,radAngle)
    th=radAngle;
    [Mrows Ncols] = size(PP);
    if Mrows == 2 ,
        R = [cos(th) -sin(th); sin(th) cos(th)];
    else ,
        R = [cos(th) -sin(th) 0; sin(th) cos(th) 0 ; 0 0 1];
    end
    center = centerPivot(PP);
    PPz = ShiftScene(PP, -1.0*center(1,1), -1.0*center(2,1));
    Prot = R*PPz;
    PPrs = Prot + center;
end


function PPshsc = ShiftScene(PP,xD,yD)
    Shift = [1 0 xD; 0 1 yD; 0 0 1];
    [Mrows Ncols] = size(PP);
    if Mrows == 2,
        N1 = [PP(1,:) ; PP(2,:)  ;  ones(1,Ncols)];
    else ,
        N1 = PP;
    end
    shN1 = Shift*N1;
    if Mrows == 2,
        PPshsc = [shN1(1,:)  ; shN1(2,:)];
    else ,
        PPshsc = shN1;
    end
end


function PPrefl = ReflHScene(PP)
    [Mrows Ncols] = size(PP);
    if Mrows == 2,
        RE = [-1 0 ; 0 1];
    else ,
        RE = [-1 0 0; 0 1 0; 0 0 1];
    end
    center = feetPivot(PP);
    PPz = ShiftScene(PP, -1.0*center(1,1), -1.0*center(2,1));
    if Mrows == 3,
        PPrefl = (RE*PPz) + center;
    else ,
        PPrefl = (RE*PPz) + center(1:2 , :);
    end
end


function PPout = fJpeg2pointsConverter(BB,THRESHOLD)
    BB1=BB(:,:,1);
    [M, N]= size(BB1);
    BB1=double(BB1);
    BB2 = 255-BB1;
    BB3 = (BB2 > THRESHOLD);
    PP=zeros(2,M*N);
    cnt=0;
    for ii=1:M,
        for jj=1:N,
            if (BB3(ii,jj)>0.5),
                PP(:,cnt+1)=[jj;N-ii];
                cnt=cnt+1;
            end,
        end,
    end
    PPout = PP(:,1:cnt);
end
```

```
script completed
```

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