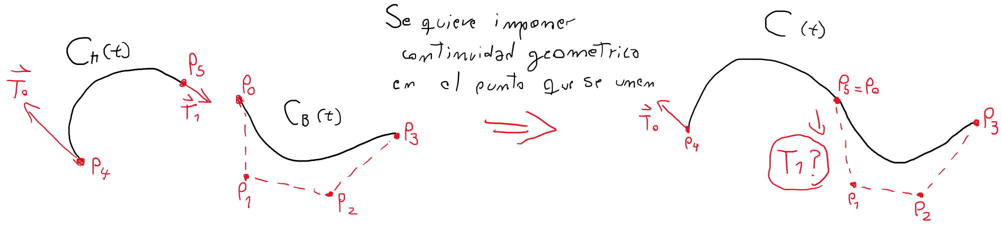
P1 i) Sean las curvas:



Describimos las curvas y sus matrices:

$$M_H = \begin{bmatrix} 1 & 0 & -3 & 2 \\ 0 & 0 & 3 & -2 \\ 0 & 1 & -2 & 1 \\ 0 & 0 & -1 & 1 \end{bmatrix}, \quad M_C = \begin{bmatrix} 1 & -3 & 3 & -1 \\ 0 & 3 & -6 & 3 \\ 0 & 0 & 3 & -3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$C_B(t) = [P_0\ P_1\ P_2\ P_3]\, M_B\, T(t),$$

$$C_H(t) = [P_4\ P_5\ T_0\ T_1]\, M_H\, T(t)$$

vector Tiempo $T(t) = \begin{bmatrix} 1 \\ t \\ t^2 \\ t^3 \end{bmatrix}$

su derivada $\dfrac{dT(t)}{dt} = \begin{bmatrix} 0 \\ 1 \\ 2t \\ 3t^2 \end{bmatrix}$

$\Rightarrow$ Describimos la union de ambas curvas como:

$$C(t) = \begin{cases} C_H(t) & t \in [0,1) \\ C_B(t-1) & t = [1,2) \end{cases}$$

Ajuste ya que cada curva tiene dominio $[0,1]$

$\Rightarrow$ Imponemos la condicion para continuidad geometrica, las tangentes de las curvas tienen que ser iguales en $t=1$ ($t=0$ para C_B)

$$\Rightarrow \left.\frac{dC_H(t)}{dt}\right|_{t=1} = \alpha \cdot \left.\frac{dC_B(t)}{dt}\right|_{t=0}$$

Factor para controlar la magnitud

$$[P_4\ P_5\ T_0\ T_1] \begin{bmatrix} 1 & 0 & -3 & 2 \\ 0 & 0 & 3 & -2 \\ 0 & 1 & -2 & 1 \\ 0 & 0 & -1 & 1 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \\ 2 \\ 3 \end{bmatrix} = \alpha\, [P_0\, P_1\, P_2\, P_3] \begin{bmatrix} 1 & -3 & 3 & -1 \\ 0 & 3 & -6 & 3 \\ 0 & 0 & 3 & -3 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

$$[P_4\, P_5\, T_0\, T_1] \begin{bmatrix} -3\cdot 2 + 2\cdot 3 \\ 3\cdot 2 + -2\cdot 3 \\ 1 + -2\cdot 2 + 1\cdot 3 \\ -1\cdot 2 + 1\cdot 3 \end{bmatrix} = \alpha\, [P_0\, P_1\, P_2\, P_3] \begin{bmatrix} -3 \\ 3 \\ 0 \\ 0 \end{bmatrix}$$

$$[P_4\, P_5\, T_0\, T_1] \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix} = \alpha\, [P_0\, P_1\, P_2\, P_3] \begin{bmatrix} -3 \\ 3 \\ 0 \\ 0 \end{bmatrix}$$

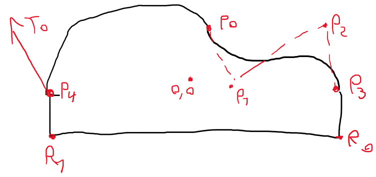
$$T_1 = \alpha(-3P_0 + 3P_1)$$

$$\boxed{T_1 = 3\alpha(P_1 - P_0)}$$

ii) Los puntos encontrados:

$$\underbrace{\begin{aligned} P_0 &= (0.01, 0.14) \\ P_1 &= (0.27, -0.04) \\ P_2 &= (0.42, 0.06) \\ P_3 &= (0.5, -0.06) \end{aligned}}_{\text{Bezier}} \qquad \underbrace{\begin{aligned} P_4 &= (-0.5, -0.06) \\ T_0 &= (-0.13, 0.36) \\ T_1 &= 3\,(P_1 - P_0) \end{aligned}}_{\text{Hermite}} \qquad \underbrace{\begin{aligned} R_0 &= (0.5, -0.2) \\ R_1 &= (-0.5, -0.2) \end{aligned}}_{\text{Rectas}}$$

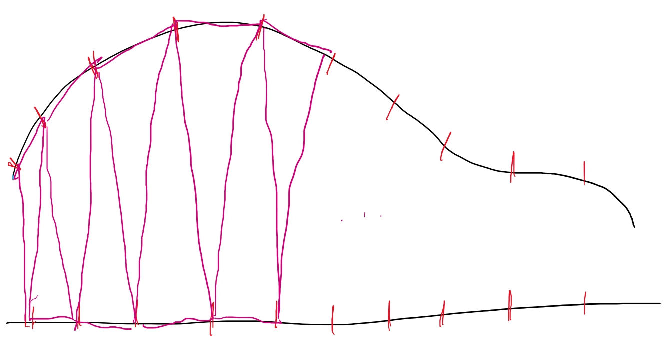
Que genera una figura como esta:



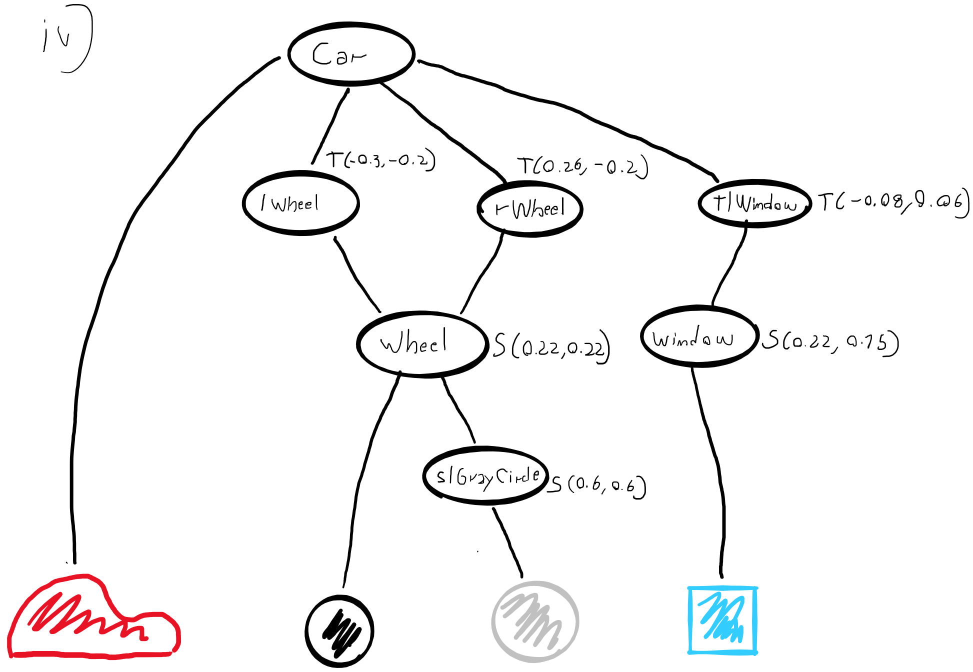
$\Rightarrow$ Descripcion formal de la curva:

$$C_{car}(t) \quad t \in [0,5] \begin{cases} [P_4\ P_0,\ T_0,\ 3(P_0 - P_1)]\, M_H\, T(t) & t \in [0,1] \\ [P_0\ P_1\ P_2\ P_3]\, M_B \cdot T(2-t) & t \in [1,2] \\ P_3(3-t) + R_0(t-2) & t \in [2,3] \\ R_0(4-t) + R_1(t-3) & t \in [3,4] \\ R_1(5-t) + P_4(t-4) & t \in [4,5] \end{cases}$$

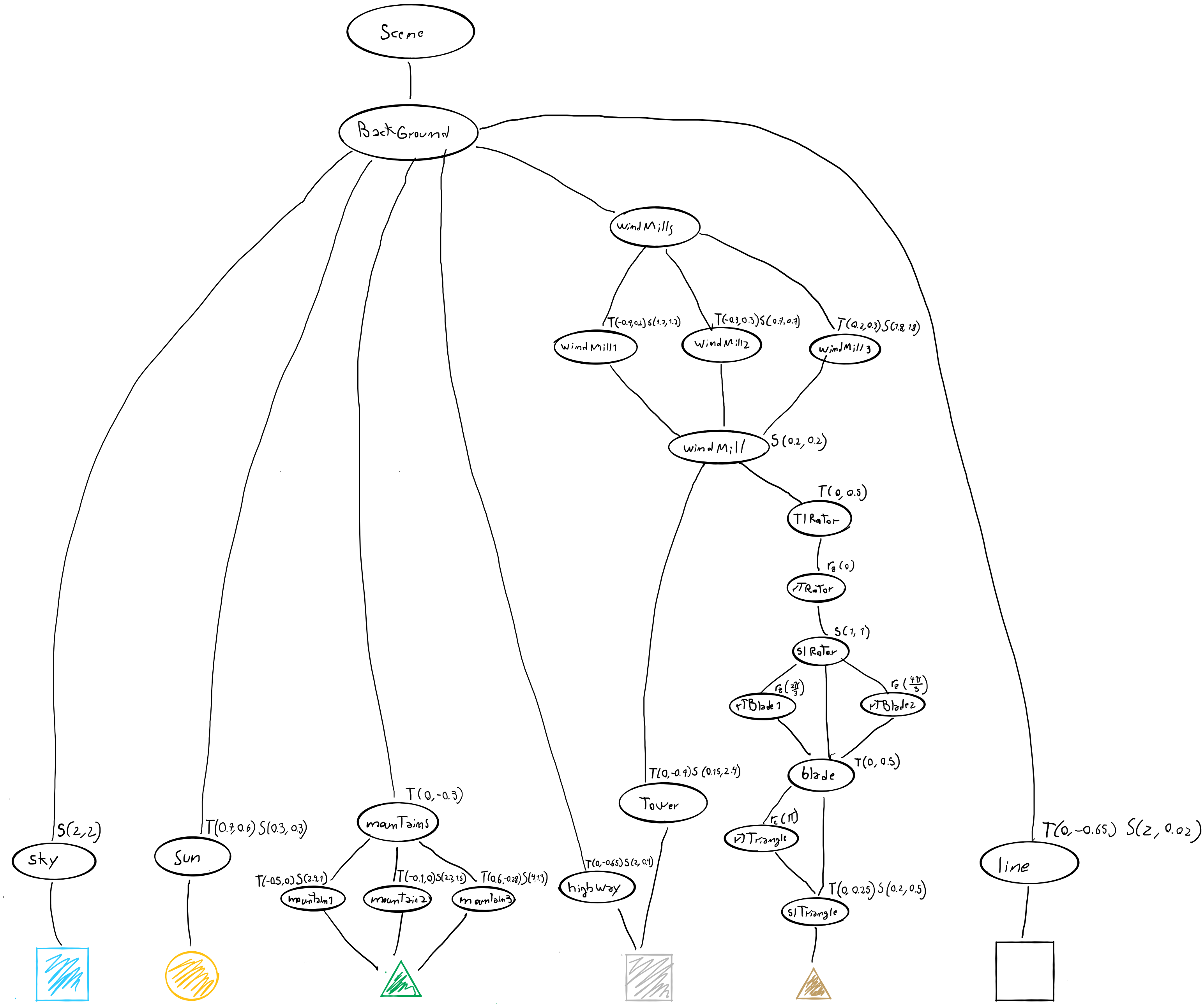
iii) Se crearon los triangulos de la sgte manera:



iv)



P2


Scene
BackGround
windMills
T(-0.9,0.2) S(1.2,1.2)
T(-0.3,0.3) S(0.7,0.7)
T(0.2,0.3) S(1.8,1.8)
windMill1
windMill2
windMill3
windMill
S(0.2, 0.2)
T(0, 0.5)
T1Rotor
rz(0)
rTRotor
S(1, 1)
S1Rotor
rTBlade1
rTBlade2
blade
T(0, 0.5)
rz(π)
rTTriangle
T(0, 0.25) S(0.2, 0.5)
s1Triangle
T(0,-0.7) S(0.15,2.4)
Tower
T(0,-0.3)
mountains
T(-0.5,0) S(2.4,1)
T(-0.1,0) S(2.3,1.5)
T(0.6,-0.28) S(4,3)
mountain1
mountain2
mountain3
S(2,2)
sky
T(0.7,0.6) S(0.3,0.3)
Sun
T(0,-0.65) S(2,0.4)
highway
T(0,-0.65) S(2, 0.02)
line