Errata for Watt

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Errata 1 (p. 7) *Incorrect transformation matrices*

The transformation matrices shown do not agree with what is shown in Figure
1.3; the correct matrix order would be as follows:

$$
\mathbf{T_2RT_1} =
\begin{bmatrix}
1 & 0 & 0 & T_x \\
0 & 1 & 0 & T_y \\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
\cos\theta & -\sin\theta & 0 & 0 \\
\sin\theta & \cos\theta & 0 & 0 \\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
1 & 0 & 0 & -T_x \\
0 & 1 & 0 & -T_y \\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1
\end{bmatrix}
$$

$$
=
\begin{bmatrix}
\cos\theta & -\sin\theta & 0 & (-T_x\cos\theta + T_y\sin\theta + T_x) \\
\sin\theta & \cos\theta & 0 & (-T_x\sin\theta - T_y\cos\theta + T_y) \\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1
\end{bmatrix}
$$

Errata 2 (p. 23) *Intersections with quadrics – (Already corrected in the Spring'04 handout)*

There is an error in the b coefficient for intersections with quartics in §1.4.5. It
currently reads:

$$b = d(Ax_1x_d + \dots)$$

It should be:

$$b = 2(Ax_1x_d + \dots)$$

The complete formulae appear below:

$$
\begin{aligned}
a &= Ax_d^2 + Ey_d^2 + Hz_d^2 + 2Bx_dy_d + 2Cx_dz_d + 2Fy_dz_d \\
b &= 2(Ax_1x_d + B(x_1y_d + x_dy_1) + C(x_1z_d + x_dz_1) + \\
&\quad Dx_d + Ey_1y_d + F(y_1z_d + y_dz_1) + Gy_d + Hz_1z_d + Iz_d \\
c &= Ax_1^2 + Ey^2 + Hz_1^2 + 2Bx_1y_1 + 2Cx_1z_1 + 2Dx_1 + 2Fy_1z_1 + \\
&\quad 2Gy_1 + 2Iz_1 + J
\end{aligned}
$$

Errata 3 (p. 24) *Equation for refraction – (Already corrected in the Spring'04 handout)*

Watt confuses the notation in the derivation of the formula for calculating the cosine of the index of refraction. He uses μ in the equations in the text, but η in figure 1.16; these are the same. The angle of incidence is ϕ and the angle of refraction is θ.

There is also an error in the formula for computing $\cos\theta$; the last equation on p. 24 should read:

$$\cos\theta = \sqrt{1 - \mu^2(1 - \cos^2\phi)}$$

There is also an error in the computed transmission direction $\mathbf{T}$. The equation in the text is incorrect, while the one in figure 1.16 is correct. However, the opposite is true for the reflection direction $\mathbf{R}$. In this case, the equation in text is *correct*, while the one in figure 1.16 is *incorrect*. (Sheesh!)

For convenience, the entire list of correct equations is repeated below:

$$
\begin{aligned}
\mathbf{I} &= -\mathbf{L} \\
\mathbf{R} &= 2(\mathbf{N}\cdot\mathbf{L})\mathbf{N} - \mathbf{L} \\
&= 2\mathbf{N}\cos(\phi) - \mathbf{L} \\
&= \mathbf{I} + 2\mathbf{N}\cos(\phi) \\
\mathbf{T} &= \mu\mathbf{I} - (\cos\theta - \mu\cos\phi)\mathbf{N} \\
\mu &= \frac{\mu_1}{\mu_2} \\
\cos\theta &= \sqrt{1 - \mu^2(1 - \cos^2\phi)}
\end{aligned}
$$

Errata 4 (p. 427) *YIQ – RGB conversion matrix*

The YIQ matrix on page 427 (§15.2.3) should read:

$$
\begin{bmatrix} Y \\ I \\ Q \end{bmatrix} =
\begin{bmatrix}
0.299 & 0.587 & 0.114 \\
0.596 & -0.275 & -0.321 \\
0.212 & -0.523 & 0.311
\end{bmatrix}
\begin{bmatrix} R \\ G \\ B \end{bmatrix}
$$