View Orientation Matrix Summary

Given:

1. Position of the eye, E
2. Position of the "center of attention", C
3. A vector, **up**, not parallel to $(E - C)$

All measured in model coordinates.

Compute:

The 4x4 matrix, $\mathbf{M}_{mc\text{-}ec}$, that maps coordinates of points in model coordinates to their representation in the eye coordinate system.

Method:

1. Compute: $\hat{\mathbf{w}} = \text{normalize}(E - C)$.
2. Compute: $\hat{\mathbf{v}} = \text{normalize}\left(\mathbf{up}_{\perp,\hat{\mathbf{w}}}\right) = \text{normalize}\left(\mathbf{up} - (\mathbf{up} \cdot \hat{\mathbf{w}})\hat{\mathbf{w}}\right)$.
3. Compute: $\hat{\mathbf{u}} = \hat{\mathbf{v}} \times \hat{\mathbf{w}}$.
4. Construct: $\mathbf{M}_{3x3} = \begin{pmatrix} u_x & u_y & u_z \\ v_x & v_y & v_z \\ w_x & w_y & w_z \end{pmatrix}$
5. Compute: $\mathbf{t} = -\mathbf{M}_{3x3}E$
6. Finally, the 4x4 view orientation matrix is: $\mathbf{M}_{mc-ec} = \begin{pmatrix} & & & t_x \\ & \mathbf{M}_{3x3} & & t_y \\ & & & t_z \\ 0 & 0 & 0 & 1 \end{pmatrix}$

cryph utility:

```
Matrix4x4 Matrix4x4::lookAt(const AffPoint& eye,
    const AffPoint& center, const AffVector& up);
```