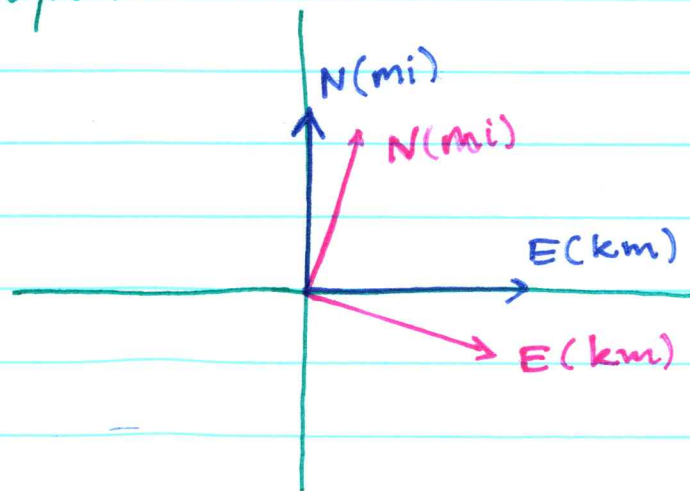


The Surveyor's Parable

4/3/19

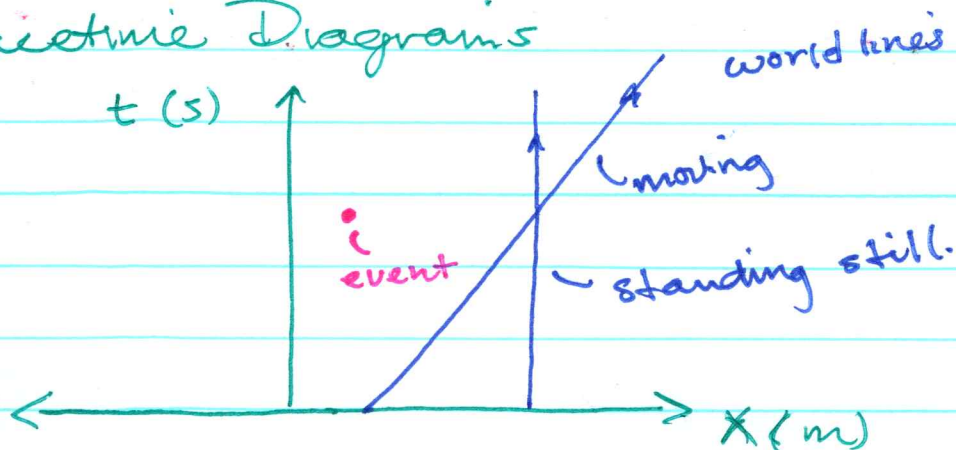
we have two groups of surveyors
One measures north and east relative to sun and other measures north and east by compass



Conclusions:

- (1) use the same units (km or mi)
- (2) distances are invariant
- (3) convert between surveyors using rotations

Spacetime Diagrams



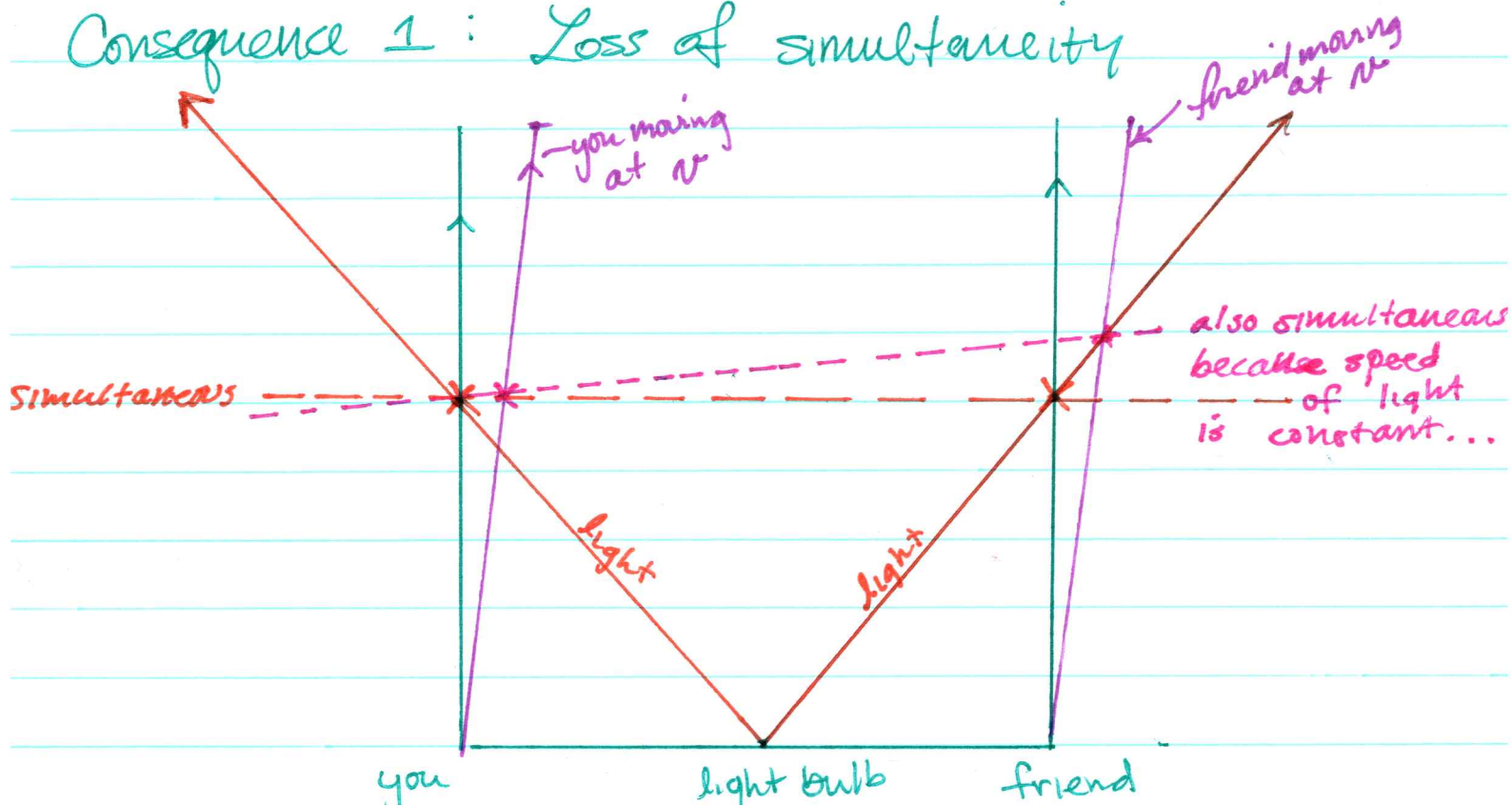
dilemma: we need to choose
common units in order
for "distance" to make
sense.

Standard fix: $t \rightarrow ct$ (meters)
"measure time as a distance"

$$c = 3.0 \times 10^{10} \text{ cm/s} \rightsquigarrow \text{speed of light}$$

Postulate: It is an observational fact that
the speed of light is the same
in all inertial reference frames.

Consequence 1: Loss of simultaneity



2. Inner products in M^2

metric: $ds^2 = -dt^2 + dx^2 + dy^2 + dz^2$

$$\longrightarrow \hat{t} \cdot \hat{t} = -1, \quad \hat{x} \cdot \hat{x} = 1, \dots$$

Terminology

Let $\vec{u}, \vec{v} \in M^2$, then

$$\vec{u} \cdot \vec{u} > 0 \iff \text{spacelike}$$

$$\vec{u} \cdot \vec{u} < 0 \iff \text{timelike}$$

$$\vec{u} \cdot \vec{u} = 0 \iff \text{light like (null) assuming } \vec{u} \neq \vec{0}.$$

