# Strengths of Biological Vision Systems

1. Tolerance for significant amounts of camouflage and/or interfering patterns.
2. Tolerance of ambiguity: ability to make alternative interpretations.

   Rubin's chalice.

   E. G. Boring's ambiguous mother-in-law.
3. Wide adaptability:

   multiple positioning mechanisms – body movements, head movements, eye movements (saccades, vergence, focus).

   light-dark adaptation, color adaptation, motion adaptation (as in highway driving).

   use of both actual contours and subjective contours implied by geometric consistencies.
4. Persistence in interpreting visual stimuli.

   Rorschach ink blots. Stellar constellations. UFOs.

# Limits of Biological Vision Systems

1. Physical Limitations: Spatial and Temporal Resolution, Light sensitivity, Color sensitivity, spectral resolution.

   Visual field: approx 200 degrees wide.

   Spatial acuity – roughly a minute of arc in the fovea.

   Flicker fusion rate: around 16 cps.

2. Processing limitations: Finding Waldo in "Where's Waldo" takes a long time.

3. Visual Memory: We can remember hundreds, or even thousands of faces, but not tens of thousands.

4. Susceptibility to Visual Illusions.

# Visual Illusions

1. Judgment about distances and straightness affected by surrounding visual elements. (Mueller-Lyer illusion, Ponzo illusion, Poggendorff illusion, Zoellner illusion).

2. Subjective contours induced by consistent interruptions to figures — apparent occlusions. (Sun illusion, triangular subjective contour illusion).

3. Perceived lightening and darkening in regularly structured grids (Herman grid illusion, the Plateau Spiral, Bridget Riley's *Fall*). Moiré interactions of afterimages with current images caused by eye movements.

4. Apparent motion from sequences of still frames. (Basis of motion pictures).

5. Complementary color afterimages. (Flag illusion).

6. Acceptance of global inconsistency. (Penrose's Triangle, Escher lithographs).

# Potential Advantages of Machine Vision

1. Higher spatial acuity, temporal resolution, light sensitivity, spectral resolution, ability to use infrared or other nonvisible bands or use nonelectromagnetic images (e.g., acoustic).
2. Objective measurement of distances and other geometrical attributes, and luminance or visual density.
3. Possibility of greater speed in perception through fast digital circuitry, parallel processing, etc.
4. Possibility of placing cameras and vision systems in places dangerous for humans — radioactive sites, in satellites, etc.
5. Integration with other information processing subsystems, incorporation in products, etc.
6. Trainable through algorithms, parameter downloads, etc.