Motion Perception

AIBO

Applications, suggestions and influences.

511 words

This essay examines applications that take advantage of artifacts in motion perception. The first two applications deal with moving patterns and how they can be used in deceiving the perception of motion. The third section discusses *motion camouflage* as observed in nature and its applications.

Progress Bars

Fooling users into optimism

Progress bars are a common visualization metaphor for showing the progression of an extended operation [2]. To improve user satisfaction, UI designers often resort to various tricks to make progress bars appear to move faster than they actually do. One of them is pulsating progress bars[1]. Frequency variations in periodic stimuli have been shown to affect users' perception of time [1]. Pulsating (in lightness values) bars with increasing frequency (increasing with progress) were shown to be perceptually faster [3].

A second trick that is now commonly being used is rippled progress bars[2], like the one shown in Figure 1. This takes advantage of the fact that humans perceive motion relative to the surrounding visual context [4]. These progress bars feature an animated ripple which moves from right to left (while the progress bar grows to the right). Studies have shown that such a design can fool users into overestimating the speed of progress by over 11% [3].

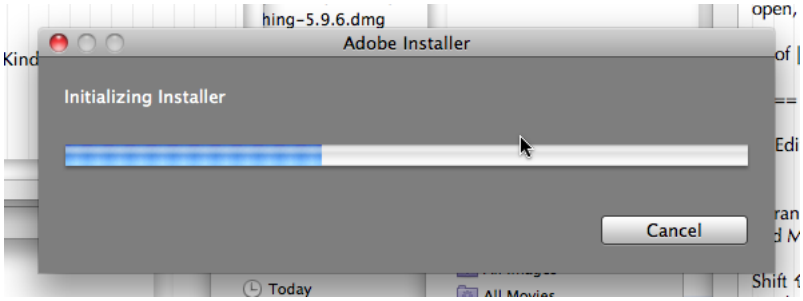

Figure 1: A rippled progress bar in OS X.

Movement and Protective Coloration

Flicker-fusion and motion perception used for camouflage

Movement is one of the most important cues used in detection. *Cryptic camouflage*[3] is more susceptible to detection if the object moves in its surrounding. Some animals, like snakes, are covered with banded patterns. These may be aposematic (serve as a warning) when motionless, but become cryptic if they move faster than a predator's flicker-fusion frequency

[1] Used in Microsoft Windows Vista, for example.

[2] Used in Mac OS X since it's earliest releases.

[3] Attempting to blend into an environment and become effectively imperceptible.

[5, 6]. The resulting monochrome color is often designed to match the general background of the surroundings [7].

The repeating patterns, particularly zigzag markings found on snakes, serve another important purpose – to disrupt accurate motion perception. The patterns make it difficult for a predator (or prey) to detect motion and determine how fast and in which direction the animal is moving. The speed of the animal's movement should correlate with the pattern's spatial frequency, where a slower animal would require a higher spatial frequency for the effect to work [7, 8]. Such patterns can be used in developing disruptive camouflaging for military vehicles.

Predator Stalking Patterns and Optical Flow

They never see it coming

Even perfect cryptic camouflage is betrayed by movement. *Motion camouflage* as a technique was first discovered when studying mating behavior in hoverflies [10]. It has since been extensively observed in dragonflies and in certain predators [11]. Motion camouflage works by minimizing optical flow of the predator in the prey's perceived environment[4]. The pursuer tries to maintain its position on a constraint line linking the moving target and a distant point (see Figure 2). When approaching along this trajectory, the pursuer appears to remain perfectly stationary from the point of view of the target. The pursuer can use this effect to rush right up to the target before it is perceived as a threat.

It has been shown that humans too are deceived by this stealth strategy [12]. This technique finds potential in missile trajectory planning for avoiding detection[5] [9].

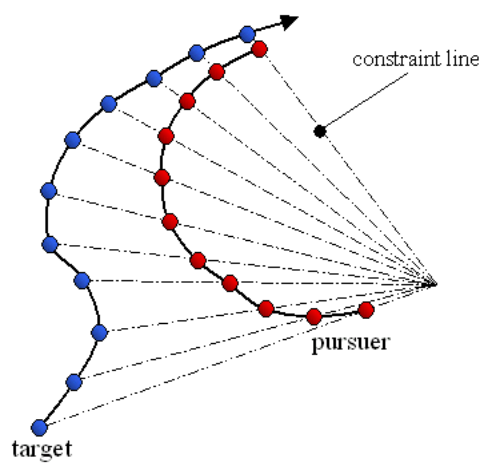

Figure 2: The pursuer is using motion camouflage to mimic a stationary object.
(Image courtesy: [12])

[4]Motion camouflage works particularly well on dragonflies because they possess a fairly well-developed perception of optical flow, but not of depth.

[5]The primary method of detection is through motion on the optical image in detectors. Depth measurements are usually done only on objects that are perceived as threats.

References

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