The spatio-temporal contrast sensitivity function:
Spatial contrast sensitivity depends on temporal frequency

Robson, 1966
Smoothly moving grating
Sampled moving grating (60Hz)
Counterphase grating
Smoothly moving bar
Sampled moving bar
Difference between smooth and sampled moving bar

[Graph with axes labeled as follows: Time (msec) on the y-axis, Space (deg) on the x-axis, Temporal Frequency (Hz) on the right y-axis, and Spatial Frequency (c/deg) on the bottom x-axis. The graph shows a pattern that deteriorates with time, indicating a decrease in smoothness as more time passes.]
Sampled sinusoidally moving edge (10 Hz)
Sampled rightward noise (25 Hz)
rightward ‘reverse phi’
Sampled rightward square wave
Sampled rightward ‘fluted’ square wave
'First order' motion
‘Second order’ motion
Four separable linear filters
Cross-sections in space and time
Four space-time oriented filters generated by adding and subtracting the separable linear filters
Four space-time oriented filters generated by adding and subtracting the separable linear filters.
Space-time oriented filters in the space and Fourier domain
Response of ‘Energy mechanisms’ to a moving sinusoidal edge

![Graphs showing response of 'Energy mechanisms' to a moving sinusoidal edge.](image)
Response of ‘Energy mechanisms’ to a sampled moving sinusoidal edge
Response of ‘Energy mechanisms’ to a moving grating

![Graphs showing response of 'Energy mechanisms' to a moving grating]
Response of ‘Energy mechanisms’ to a moving grating
Response of ‘Energy mechanisms’ to a sampled moving grating

![Graph showing response of energy mechanisms to a sampled moving grating.](image)
Response of ‘Energy mechanisms’ to a sampled moving grating
Response of ‘Energy mechanisms’ to counterphase grating

![Graphs showing response of energy mechanisms to counterphase grating.](image-url)
Response of ‘Energy mechanisms’ to counterphase grating
Response of ‘Energy mechanisms’ to a smoothly moving bar
Response of ‘Energy mechanisms’ to a smoothly moving bar
Response of ‘Energy mechanisms’ to a sampled moving bar
Response of ‘Energy mechanisms’ to a sampled moving bar
Response of ‘Energy mechanisms’ to rightward moving noise
Response of ‘Energy mechanisms’ to rightward moving noise
Response of ‘Energy mechanisms’ to a rightward reverse phi stimulus
Response of ‘Energy mechanisms’ to a rightward reverse phi stimulus
Response of ‘Energy mechanisms’ to a sampled rightward moving square wave

![Graphs showing response of energy mechanisms to a rightward moving square wave]
Response of ‘Energy mechanisms’ to a sampled rightward moving square wave
Response of ‘Energy mechanisms’ to a ‘fluted’ square wave
Response of ‘Energy mechanisms’ to a ‘fluted’ square wave
Response of ‘Energy mechanisms’ to rightward first order motion

The graphs illustrate the response of energy mechanisms to rightward motion. The top row shows the response in space and time for left and right movements, with the right-left difference also depicted. The bottom row presents the response in the center over time, highlighting the temporal dynamics.
Response of ‘Energy mechanisms’ to rightward first order motion
Response of ‘Energy mechanisms’ to rightward second order motion

![Graphs showing response of 'Energy mechanisms' to rightward second order motion.](image)
Response of ‘Energy mechanisms’ to rightward second order motion
The box interrupts the apparent motion.
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Rules of apparent motion:

Objects should not change shape when they move.

Rather than a box turning into a circle (shortest path), we see the box disappearing and the circle moving diagonally.
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