Our poor sense of video speed

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We live almost literally immersed in an artificial visual world, especially motion pictures. Yet, there are several perceptual, motor and cognitive reasons to suspect that the best speed for reproducing a video may not be the original, shooting speed. By using adjustment, staircase, constant-stimuli and free viewing methods, in four experiments we examined kinematic biases and speed change (un)awareness during real-life videoclip viewing, and tested the robustness of natural speed tuning by manipulating visual and acoustic factors. In no single case the subjectively estimated video speed corresponded to the original video speed, thus revealing the importance of internal models for complex dynamic visual perception. With the tested stimuli (short, self-made clips of human motion, physical motion, mixed human-physical motion, ego-motion, and a recorded soccer match) there was a general tendency to speed underestimation (grand-average, 9%), possibly resulting from the so-called slow-motion bias which in turn would reflect the statistics of natural vision. Speed constant errors largely depended on the clip content, and ranged from 1% (ego-motion) to 23% (physical motion), which suggests a tighter visual tuning for human actions. Neither display size nor soundtrack manipulations modified the speed bias. Speed estimation errors were not correlated with duration estimation errors, thus pointing to a specific rate control mechanism for events that unfold in time. Remarkably, observers did not spontaneously notice speed modifications as high as ±1.12x applied to a 10-min soccer match videoclip. Even when tested with a constant-stimuli 2afc discrimination task they still made large errors, though in this condition of focused attention sensitivity to the original video speed rose considerably. These findings thus document a flexible and biased sense of visual *tempo* when viewing real-life scenes, even familiar ones. This approach may integrate retrospective time estimation methods, also in clinical and developmental contexts. From a technological perspective, proper psychophysical quantification of kinematic tolerance may validate "natural" video compression techniques based on sub-threshold temporal squeezing. Furthermore, a user-friendly device for continuous speed control would favor individually-tailored optimal viewing experience.