

This is a draft—a set of notes really—that may ultimately end up as part of a larger work. It addresses a perceptual constraint in cinematic design that helps to explain the power of filmic editing.

Exploring the Reluctance to Cut

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Some of my students are reluctant to cut; fortunately, I don't teach surgery. I, along with Professor of Medicine Charles Lumsden, teach a cinematic design course as part of the Master's program in Biomedical Communication here at the University of Toronto.

We help students in Biomedical Communication's Visualization Design field take complex scientific stories and ideas, and represent them as dynamic visual representations, as *film*. The course has a pre-production focus, and we explore the history and techniques of film design. As part of the film design process, students create a series of documents (treatment, script, etc.) and film plans (storyboards, animatic) that will ultimately serve as detailed proposal for the production of a complete animated film. The film topics usually involve complex scenarios in cellular and molecular science.

The cut some students are reluctant to make is the editorial cut: the most frequently used (and universally understood) cinematic editing technique. A cut occurs whenever two shots are juxtaposed in time, with no transition.

It seems that whenever our students start to design their films, they tend to imagine a continuous, swooping camera. They plan very long shots, with dramatic dollies in and out (sometimes from cellular to molecular landscapes) to reframe the action as it unfolds. It is as if they are shooting a

real-time *cinema verité* documentary, and have shrunk themselves to micron size to steadicam their way through a cytoplasmic landscape. It often takes some time to get them to entertain the notion that redesigning their work as a sequence of coordinated, but *discrete*, shots, could make their work more intelligible, not less. In this, they are reluctant to embrace one of the core aspects of the “magic of cinema”: the invention of continuity editing ninety years ago in the work of Edwin S. Porter, D. W. Griffith, and Lev Kuleshov. These cinematic pioneers discovered that, when properly deployed, cuts from one shot to another didn't disorient their viewers (as earlier film pioneers had worried), rather they allowed filmmakers to reshape time, focus attention, and enhance the narrative impact of films.

So, whence comes this reluctance to cut? I am sure there is no simple answer to that question, but I think one aspect of the problem is that many people imagine their own subjective experience to consist of “one long shot”; with the exception of blinking, our waking hours seem to consist of a more-or-less uninterrupted “camera move”. The camera is our eyes, locked into the tripod of our head. We move through the world, with a contiguous, unending stream of visual stimulus washing into us.

This subjective impression is understandable, but close examination proves it to be, if not unfounded, at least rather more complicated than it at first appears. Further, the phenomena I'll describe below may help to explain why the editorial cut works in the first place. It all has to do with how our eyes move, and with the subtle and unconscious creativity of visual perception.

Human visual acuity is highest in the fovea, the small depression at the back of our eyes, in the centre of our retinas. As you move outward along the retina from the fovea, receptor density, and therefore perceived detail, decreases rapidly. In order to build up a detailed view of the world around us, our eyes rarely sit still for long. Approximately three times per second, our eyes jump from one fixation point to another, in movements known as *saccades*.

These rapid eye movements project areas of interest on to the receptor-dense fovea at the back of our eyes.

If you took a video camera and pivoted it about, with small pauses, in imitation of the movements of our eyes, the resulting video would contain brief episodes of stability, interspersed with uncomfortably blurry pans. In between fixations, the video would streak and blur as the camera moved, even if you were able to move it as quickly as your eyes. Strangely, we don't perceive such blurring in our own vision as our eyes dart about. Why not?

The answer lies in a somewhat mysterious phenomena known as *saccadic suppression* or *saccadic masking* (Burr, 2004). Psychologists and neuroscientists have found that visual perception is actively and selectively suppressed during saccades. The startling implication is that we don't see what happens when our eyes move¹. Our perceptual apparatus pastes over the gaps in our vision so that we feel that we are seeing continuously, even if a significant, though very brief, cut has been made in our stream of vision. There is a quick and convincing home experiment that will demonstrate this effect: regard your own face in the mirror, and fixate on (look at) one of your eyes. Now look at the other eye; did you see your eyes move? A normal glance from one eye to the other causes a saccade (this won't work if you deliberately move your eyes slowly) and results in no visual perception of your reflected eyes' movement.

Researchers are still trying to understand at what level this effect is regulated. Some evidence indicates that amacrine nerve cells in the retina act in an inhibitory fashion on retinal ganglion cells when they detect global changes in retinal activation. However, saccadic suppression must occur at “higher” levels of visual perception as well, since the effect results only from viewer-induced saccades, and not from passively observed motion². For instance, people do perceive fast, blurred action on a movie screen (especially as a result of overly rapid panning of the camera), and may feel disoriented or uncomfortable as a result.

In any case, the effect is real, and powerful. It results, without our really perceiving

¹ Or, more accurately, we don't see during rapid, saccadic eye movement; vision is not suppressed during other eye movements such as “smooth pursuit”

² Since the effect initiates before eye movement occurs, input from brain regions controlling eye movement is likely.

it, in a subjective experience studded with discontinuities; the perceptual equivalent of the editorial cut. The “panning” of the eye, and the resulting streaking of the retinal image, is effectively deleted from our conscious perception. In effect, every time our eyes hop from fixation to fixation, our brains construct a jump cut. Sometime the magnitude of these jumps is small, such as when scanning a page of text in the act of reading. But sometimes the magnitude is large, such as when we glance from our desks to the world outside our windows.

Each saccade takes around fifty milliseconds (Diamond et al, 2000), and the period of perceptual suppression lasts from about ten milliseconds before the saccade until about twenty milliseconds afterwards (this range varies with stimulus luminance). What happens to the approximately eighty milliseconds that is “lost”? Why don’t we notice a “blink” when it occurs? That we tend not to perceive these discontinuities is a testament to the capability of our minds to “fill-in” the holes in our subjective experience. How this happens is still under investigation, but it is yet another example of the mutability of visual perception, and the fact that the world that we perceive does not reflect a 1:1 relationship with the external world.

The lesson for our student filmmakers is clear: embrace the cut; there is nothing unnatural about it. This lesson is not lost on practitioners of the “Hollywood style” of narrative film-making (Smith, 2006). Since its invention in the early years of the last century, the “Hollywood style” has long embraced the power of the editorial cut to control cinematic narrative. We should not hesitate to use it to tell scientific stories as well. After all, it is very much like the way we see the world, whether we realize it or not.

References

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