



---

# On Shot Lengths and Film Acts: A Revised View

**James E. Cutting, Kaitlin L. Brunick, and Jordan DeLong**

In a recent issue of *Projections*, Cutting, Brunick, and DeLong (2011b) reported that the structure of film acts—the four relatively equal-length stretches of film determined by the progression of the narrative—influenced shot lengths and shot transitions. We compared 143 films released from 1935 to 2005. To do so we first needed to normalize each film to the same time scale. That is, because films in our sample ranged from just over 200 to just over 3,000 shots, and their average shot length varied from just over 25 seconds to just under 2.5 seconds, statistical transformations were necessary. Using a resampling method we stretched or compressed the waveform of the shot pattern for each film to fit into 1,000 bins, what we called 1,000 “adjusted shot lengths.”

Of our major reported findings, one was that shot lengths within an act were scalloped in shape. That is, each act began and ended with slightly longer shots than those toward the middle. We reported the peak-to-trough magnitude of this effect to be about 1.1 seconds for the films that we investigated, which had a mean shot length of 7.7 seconds.

Barry Salt was intrigued by our finding and, to his credit, tried to replicate it in his data and in ours, which are available on the cinematics website ([www.cinematics.lv](http://www.cinematics.lv)). Salt found several patterns that matched ours, but others that did not—particularly the longer shots that we found at one-quarter, one-half, and three-quarters of the way through films. In our correspondence, Salt suggested a possible artifact created by the method we used. When dividing the stream of shots of each film into temporal quarters as we did, we created regions near the ends of these quarters (particularly near and around bins 250, 500, and 750) where the alignment of shot lengths coincided across films, whereas they did not coincide away from these boundaries. This alignment alone, he argued, would cause averages at those locations to be inflated. He suggested a simple way to test for this: divide each film into thirds and see if peaks occurred at these new boundaries, or at bins at and around 333 and 667.

We reanalyzed our data with our original interpolation technique and with two others that were similar but computationally different. Indeed, Salt is correct. With all three methods, when films were divided into quarters there

were internal peaks at and around bins of 250, 500, and 750; but when divided into thirds, new internal peaks occurred at and around bins 333 and 667, and not at the previous bins.

Meanwhile Salt had performed a different kind of analysis on the shots, one that did not divide the film into quarters or thirds at all. That analysis divides each film into equal temporal bins. As before, we chose 1,000 bins. Because an average film has about 165,000 frames (115 minutes in length), each bin for that film would be 165 frames long; for a shorter film of 115,000 frames (80 minutes) each bin would be 115 frames; and so forth. Next, we looked at the likelihood of a cut (or the center of a fade, dissolve, or wipe) within each bin for each film, and then averaged these likelihoods across all films. The outcome is shown in Figure 1.

The abscissa (horizontal or x-axis) plots the bin results from 1 to 1,000; the ordinate (vertical or y-axis) plots the density. The graph is inverted from the usual form because we wanted the shape of the results to map onto shot lengths. Higher values (less density) correspond to longer shot lengths; lower values (greater density) correspond to shorter shot lengths. Also, the values are presented as the proportion of shots within each film. Thus, notice that most values lie near .0010 (or 1/1,000). This suggests that the values of all 1,000 bins will add to 1.0.

Two features remain from what we showed before (Cutting, Brunick, and DeLong 2011b: figure 3, p. 8). First, shot lengths are generally longer at the

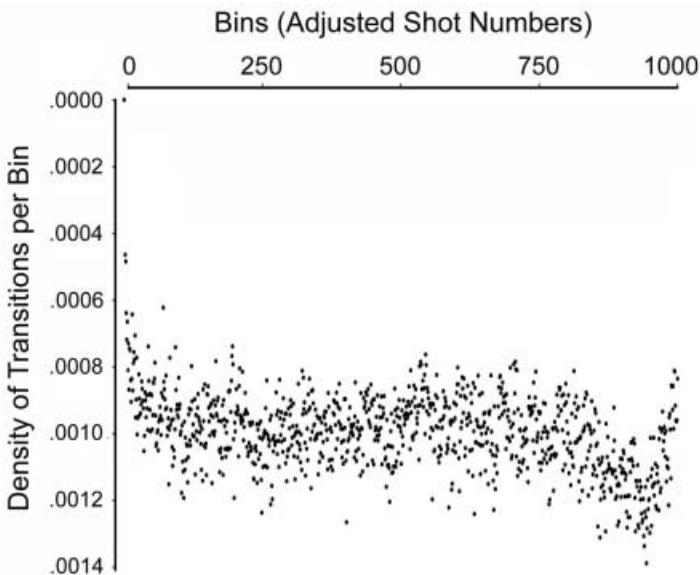


Figure 1. A density analysis of transitions (cuts, fades, dissolves, wipes, etc.) and their relative locations in 143 films. Each film was divided into 1,000 temporal bins and the average proportion of transitions within each bin was recorded. (This figure supersedes Figure 3 of Cutting, Brunick, and DeLong [2011b].)

beginning of films. Second, there is a scallop that occurs during the climax (act 4) of films, where shot lengths get shorter and then increase at the end, likely during the epilog. Absent, however, are any internal peaks near and around bins 250, 500, and 750. Thus, there is no data in the shot lengths that supports the notion that the complication and development sections (acts 2 and 3) shape shot lengths.

The rest of our article remains undisturbed by this analysis, and figure 5 of Cutting, Brunick, and DeLong (2011b, p. 12) accurately represents the number of noncut transitions—dissolves, fades, wipes—within 20 temporal bins of each film. Again, noncuts are frequent at the very beginnings of film, during the development section (act 3), and during the epilogs of act 4, but they are rare during the first part of the climax (act 4). We also found that montage sequences, which we defined as strings of shots knit together with at least three consecutive dissolves (Cutting, Brunick, and DeLong 2011a), are most prevalent during the development section (act 3, 39%), common in the setup (act 1, 28%, and with half of these occurring within the first five minutes of the film), but less common in the complication (act 2, 19%), and relatively rare in the climax and epilog (act 4, 14%). Again, the frequency of these sequences in the setup, which often induce a mood for the beginning of a film, and in the development, which often collapse time to accelerate the film toward the climax, seem to be a function of the narrative.

### **Acknowledgment**

We thank Barry Salt for pointing out our error in Cutting, Brunick, and DeLong (2011b).

---

**James E. Cutting** is Professor of Psychology at Cornell University where he has taught courses on perception for over 30 years. He has written two books, *Perception with an Eye for Motion* (1986) and *Impressionism and its Canon* (2006), and published more than 100 scientific articles on form, motion, depth, and related areas of perception.

**Kaitlin L. Brunick** is a graduate student in Psychology at Cornell University. She received her B.A. degrees in Psychology and Linguistics from the College of William and Mary and is interested in film, TV, and children's cognitive development.

**Jordan E. DeLong** is a graduate student in Psychology at Cornell University. He received his B.S. degrees in Psychology and in Cognitive Science from Indiana University and is interested in film, faces, fingerprints, and the visual system.

---

## References

- Cutting, James E., Kaitlin L. Brunick, and Jordan E. DeLong, 2011a. "The Changing Poetics of the Dissolve in Hollywood Film." *Empirical Studies of the Arts* 29(2): 149–169.
- . "How Act Structure Sculptures Shot Lengths and Shot Transitions in Hollywood Film." *Projections* 5(1): 1–16.
-