The Future of Super-Fast Lenses

At the birth of cinema, film emulsions were slow. Very slow. In fact, so slow they served as a catalyst for the development and advancement of fast aperture lenses. Together with film emulsions, the two technologies have advanced together, offering the modern day cinematographer the ability to capture more on film with less light. With the exception of rare/specialty lenses and film stocks, the motion picture 35mm format lens has settled around T/1.3 or T/1.4 as the standard super-fast lens range, while 500iso/asa has settled as the commonly used fast film stock, despite faster options existing. Although light-years better than what existed in the early days of cinema, the demand for increased light sensitivity has not relented. In that quest for light sensitivity, it appears cinema lenses have hit a glass ceiling.

Building a professional quality S35mm cinema lens at a T/1 is almost unfathomable in design and manufacturing difficulty. The resulting cost of such a lens would likely be unprecedented. Photography lenses with an F-stop under F/1 have been manufactured, most notably Kubrick's F/.7 lens borrowed from NASA for Barry Lyndon. But perhaps more importantly, the demand for such a lens is hard to grasp. In motion picture 35mm and S35mm formats, shooting at T/1 would produce a depth of field considerably shallower to the already super-thin depth of field T/1.4 can provide. Very few cinematographers would desire the aesthetic look such narrow depth of field offers. Additionally, cinematographers would not want to put their 1st camera assistant through incredible strain while constantly putting the shot and performance at increased risk of focus error. T/1 is simply too expensive and shallow for mainstream use.

Which T-stop is ideal? It is a safe generalization to state most cinematographers cautiously avoid the use of T/stops *wider* than T/4 or T/2.8. These two stops offer shallow depth of field qualities, but allow more reasonable depth of field for the subject. Stops wider exhibit more extreme shallow depth of field that may not satisfy the desired look of the picture. As mentioned, wider stops tax the focus puller and increase the potential risk for error and reshoots. Therefore, unless extremely shallow depth of field is the intended look for the picture, the only reason to desire a super fast aperture lens is if the cinematographer knows or fears not having sufficient lighting to properly expose.

Thus, if one eliminates the need of super-fast lenses for aesthetic use, the only remaining factor is one of exposure. If the cinematographer simply does not have the natural or artificial means of lighting to proper exposure, faster lenses are the answer. Camera technology, however, is relentlessly irradiating this need as this article is being printed. With the arrival of the newest generation of digital cinema cameras, the progression of camera sensitivity has taken giant leaps forward. In fact, digital camera sensitivity is advancing at such a rate; it is argued that T/2.8 is the new T/1.4.

The following are manufacturer issued or commonly rated ISO/ASA ratings for recent (2009/2010) professional digital cinema camera models:

Make/Model	ISO/ASA ratings
Silicon Imaging SI-2K	200 – 400

Arri D-21	200 – 400
RedOne Mysterium	320
Phantom 35/HD	320
Sony Cinealta F900	320
Panavision Genesis	400

Available in 2010- 2011, the following cameras or upgrades represent a hint of what is to come. As of this writing, common ratings or preferences are:

Make/Model	ISO/ASA rating
Arri Alexa	800
RedOne Mysterium X	400 – 800
Phantom Flex	1000
Sony F-35	650-1000

Notice Arri, RedOne, Phantom, and Sony have at least ***doubled*** in sensitivity between camera models or upgrades. Sensitivity coupled with cleaner signals, allows the possibility of stretching these numbers further.

Why T/2.8 On the New Cooke Panchro/i's Work.

Cooke's goal when designing the new Panchro/i line was to create a smaller, lighter, and more affordable lens set, yet retain the optical quality of the established Cooke S4 series. The result was a color-matched prime lens set less than half the price and only one–stop slower. The cost differential is a direct result of the stop-loss. In conversation with Les Zellan, Chairman of Cooke Optics Ltd., the difficulty manufacturing a lens of such caliber multiplies by a factor of 8x for each stop reduction in maximum aperture.

All facts considered, it becomes increasingly difficult to understand why anyone who could achieve a desired shooting stop of at least T/2.8, would justify spending more money for a set of equal quality super-fast lenses. This especially rings true when budgeting lenses for the 2nd unit or multiple camera production. If a stop under T/2.8 is not needed, renting multiple sets of more expensive lenses adds up quickly. Thus, the question remains; " *does one need a T-stop wider than T/2.8?*" The answer is increasingly 'no'.

The newest wave of digital cinema cameras boast sensitivities of one or two stops *more* than their previous generations or models. Of course, most cinematographers are well versed in shooting digital cinema cameras around 320-400iso/asa, at reasonable T-stops; as that has been the ballpark sensitivity for almost all professional digital cinema cameras in past years. However, there are productions that shoot in extremely low light and otherwise *need* to shoot wide open at T/1.4 for exposure. Previously marooned at T/1.4 wide-open, these same filmmakers, with the same light levels, may now achieve similar exposure but with a T/2 or T/2.8 lens using one of the many higher sensitive cinema cameras now available.

Perhaps the only other reason to desire a super-fast lens is a direct result of another historical precedence regarding optics. It is the classic trick of the knowledgeable cinematographer wishing to stop the lens down a couple of stops from wide-open in order to 'center the lens', a term for finding the sweet spot on a lens where the image is at optimal performance in relation to sharpness. Historically, this isn't a false practice. Many super-fast lenses from yesteryear, sacrificed a degree of sharpness when wide open. If using an older T/1.3 lens, stopping down to a T/2.8 or T/4 would typically exhibit optimal sharpness which was lost when wide open. This practice still holds true regarding older primes and zoom lenses. However, modern cinema primes, including the new Panchro/i's are designed and built to work at optimal sharpness from wide-open and down the aperture. They do not need to be stopped down in order to find the 'sweet spot'.

What does the future hold?

Since cinematographers typically desire a decent stop around T/2.8 –T/4, the increasing technology of camera chip sensitivity are making that goal increasingly accessible. These cameras allow those who previously worked at such stops more room for experimentation, while those who were forced to shoot at open stops for the sake of expose, an opportunity to shoot at their desired stop. With camera sensitivity currently in an arms race with no end in sight, the need of super fast prime lenses, which cost more to produce and rent, will dwindle to that of specialty lenses for productions who need the super-shallow look for a specific visual aesthetic.

The future of super-fast lenses appears to be slowing.

-Ryan Patrick O'Hara, cinematographer

(All numbers assigned as ISO/ASA are either found by the author from experience, as a realistic base sensitivity or are number taken from a manufacturer recommendation. Test cameras and find what works.)