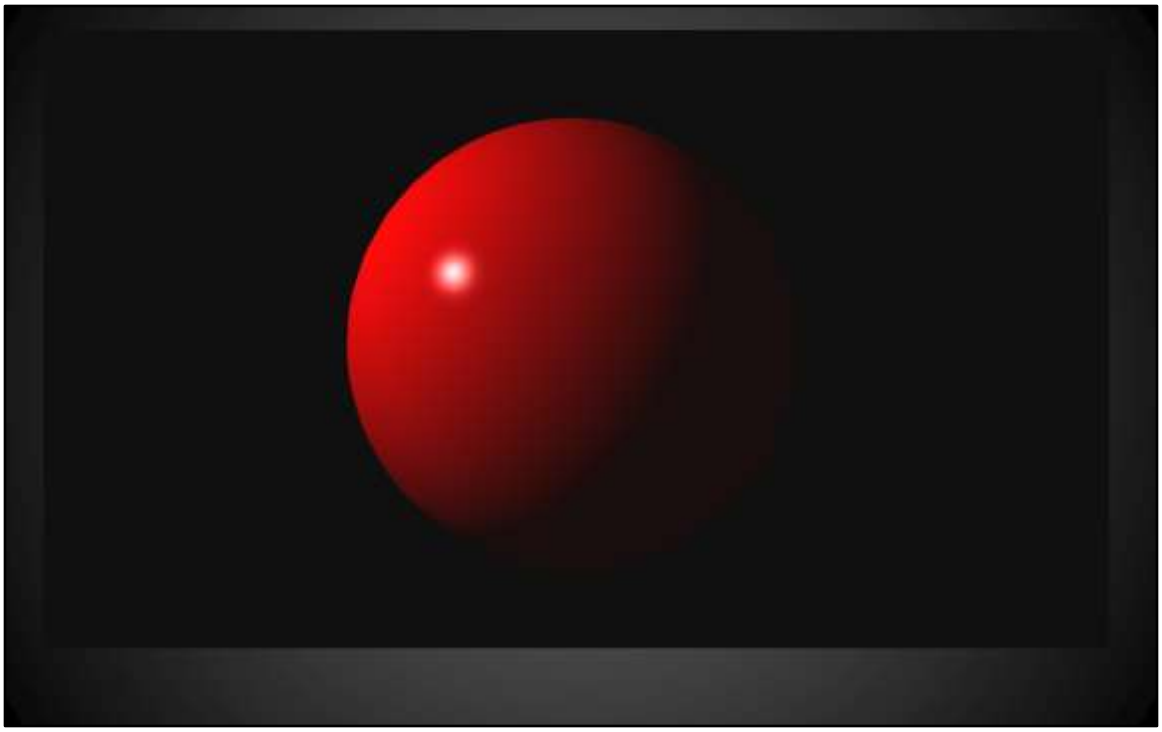
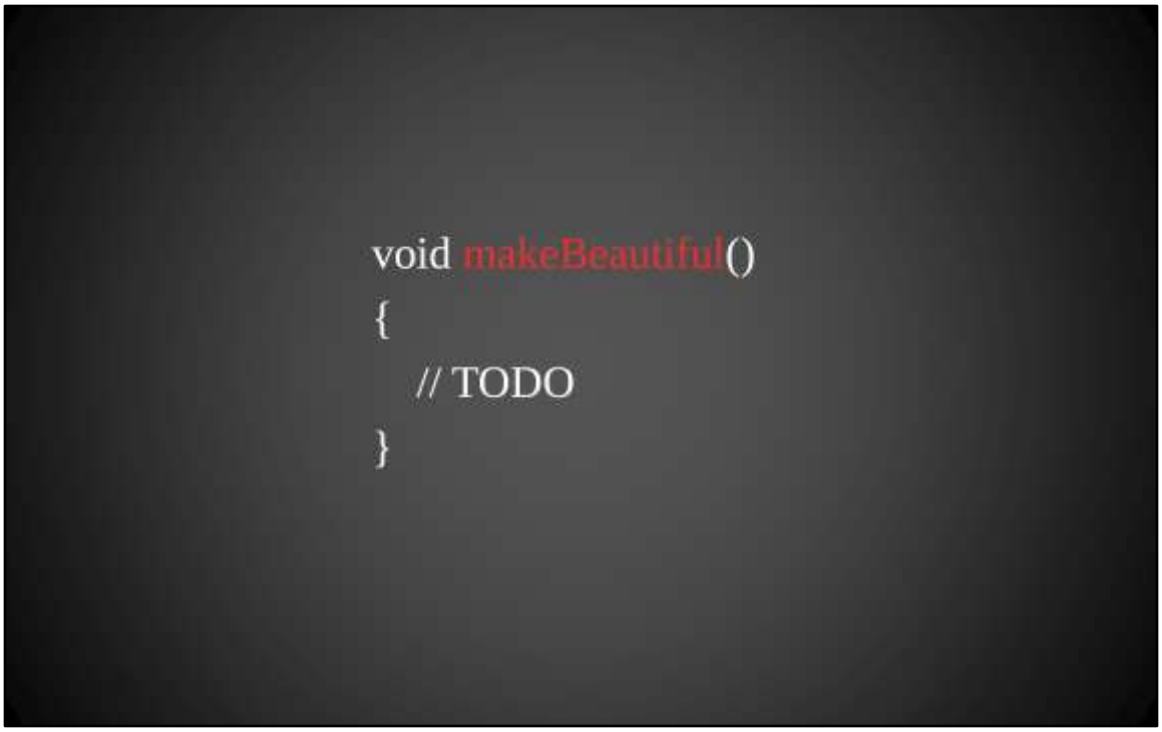
Abstract:
In demos, light is too often only added as an afterthought, without any clear purpose. It is a powerful tool though, that can be used to support and strengthen the concept of any piece of art. It is also difficult to implement, especially in real-time, as a broad range of techniques exist. As demomakers, what choices do we have before us, and how could we better use light to bring our productions to the next level?

This is how my first OpenGL program looked like.
(So did our first demo, B – Incubation, which won a 64k competition and was nominated to a Scene.org Award; we didn't get it though, I suppose one doesn't get an award for making a demo about the spinning cube.)



This is how it probably looked when I later first tried to use light.
It looked terribly ugly. So did my next couple of attempts.

Why was that?

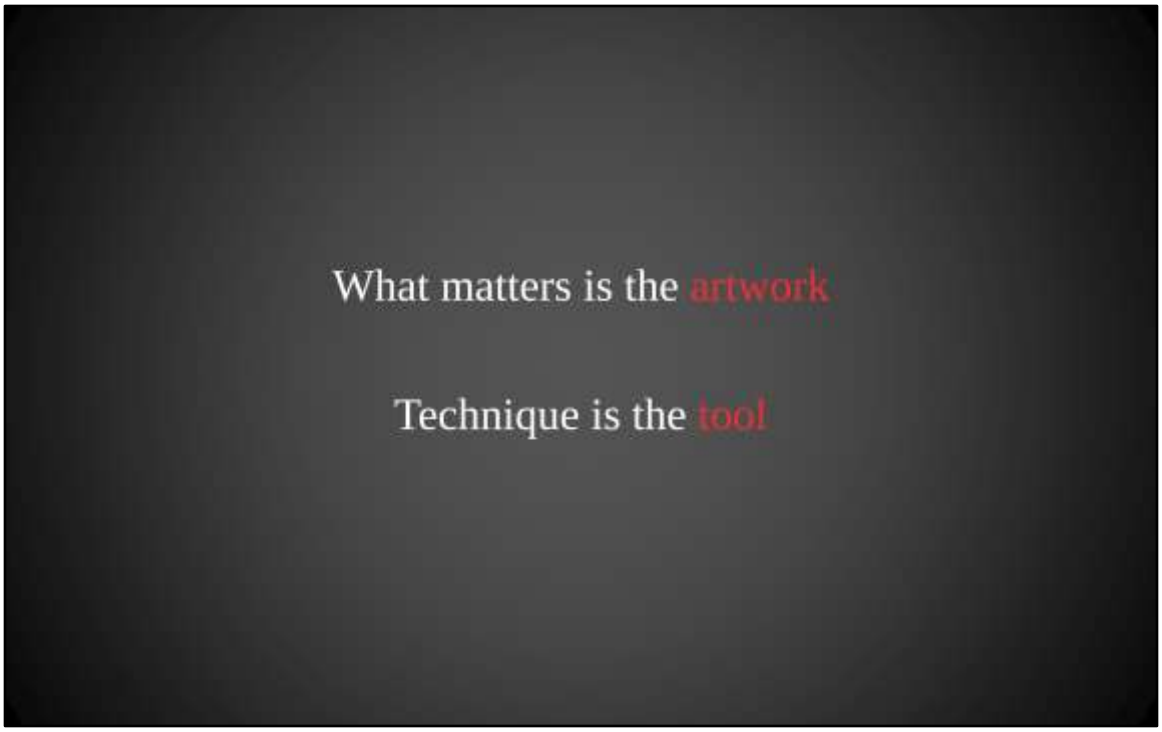


There are two reasons it looked bad:

- Lack of understanding of the lighting model used by OpenGL. I did not understand what all the parameters meant, and I didn't know what values I should give them to make it look good.
- Lack of a clear goal. Instead of thinking in terms of "I want this kind of light/look" I was just thinking "Lets add light so it looks better", which is a mistake.

Facing a situation where you have something and you want it to look better, you may think "I am going to use this fancy technique everybody is talking about". Then you have a new problem, because that technique requires learning and fine tuning. Meanwhile your work doesn't look better, it may even be the opposite. Worse, you might not even notice because it looks cool and you don't realize it also looks ugly.

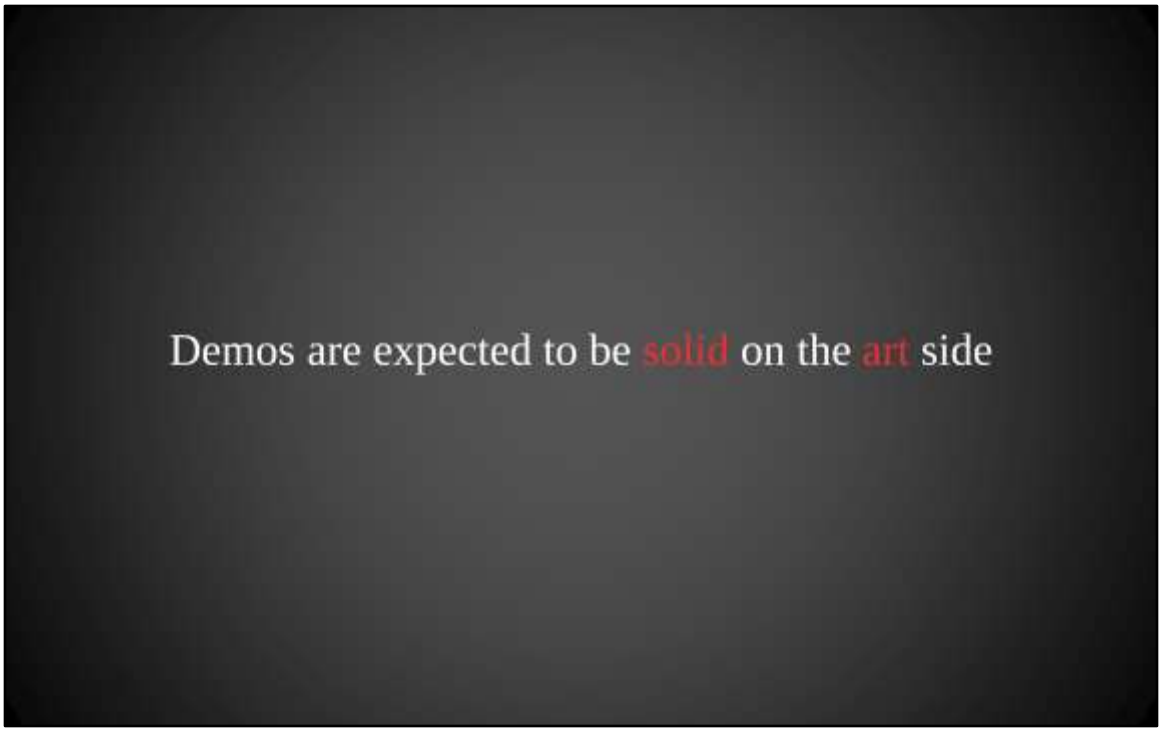
Bottom line: throwing a new technique at whatever you're doing is not going to make it better, it's only going to change what you can achieve.



There are two sides of image creation: the technical one, and the artistic one. Different techniques allow to do different things. The more techniques you know and the more you master those techniques, the better you understand what you can and cannot do with them, and how to do it.

Technique is a tool that changes how you can express yourself. This is true for other media too: photo, filmmaking, painting… You could argue it applies to most art forms.

But it's only a tool; what matters is what you are trying to create from it, the artwork.



I don’t mean to belittle technique, especially given how we care about it in the scene. Technique is cool, testing new techniques is fun.

But nowadays demos are expected to be solid on the art side. And we should expect even more from them. Even if you’re doing a tech demo, you should choose an artwork that not only fits the technical showcase, but really profits from it.

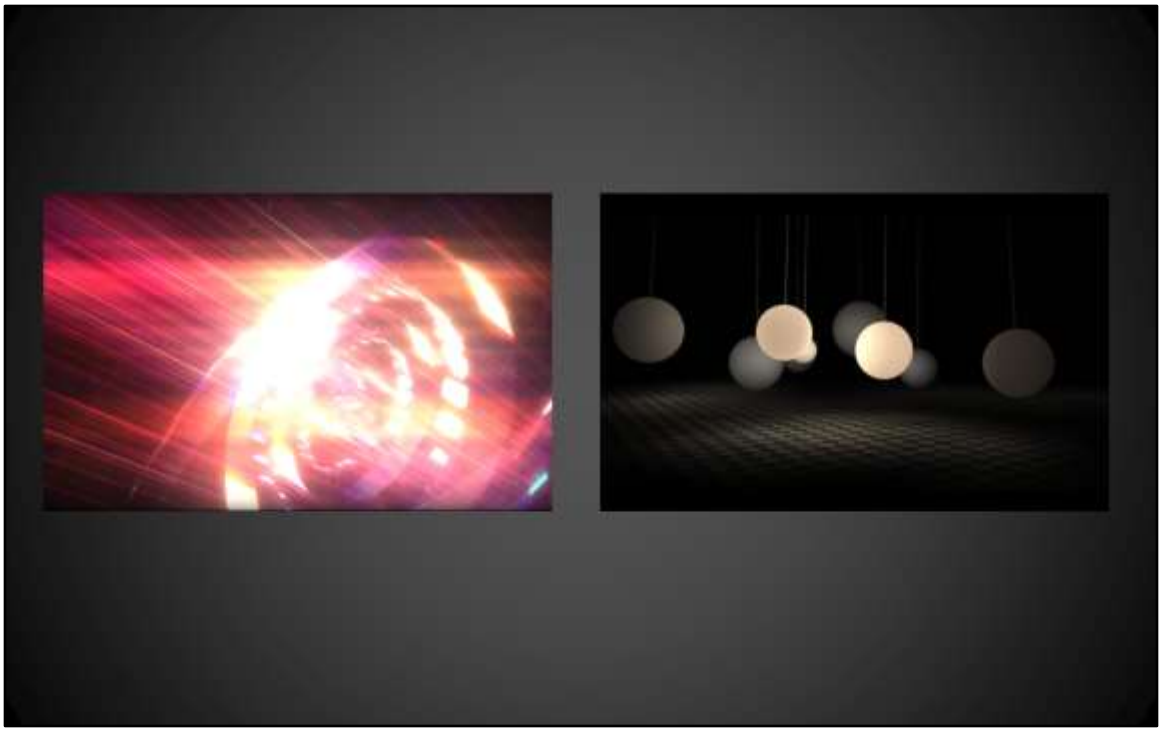
So the question becomes:
- What do we want to do on the artistic side?
- What can we do on the technical side?

(and find a compromise between the two)

On the technical side there is a broad range of tools and models you can choose from. They vary in terms of quality, performances, conditions for them to work, difficulty of use and difficulty of implementation. Listing or comparing some of them is outside the scope of this talk.

Let’s focus instead what we can do with light.
Light is an extremely powerful tool, as we shall see.

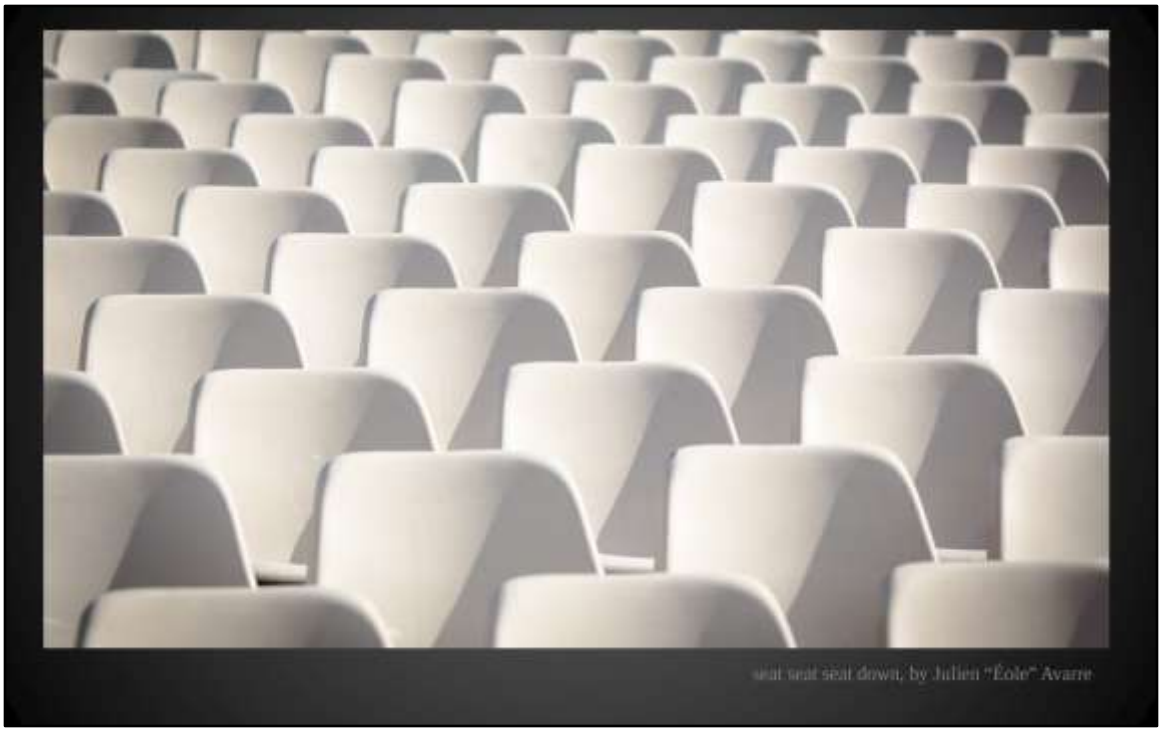
So what can we do with it?



You may use light for its aesthetics.
Maybe the most classic use of light in demos is the hypno-glow.

Another very typical use of light in demos is as a bound between sound and image.

You may use the light to get a dramatic effect, or a soothing one on the contrary. Light can be used to set the mood and evoke emotions.



You may use light to give information: textures, volumes, distances, depth, time, location, weather, temperature…

You may use light to remove information on the opposite, so you can concentrate on something specific.

You may use light to isolate an element, or draw attention.

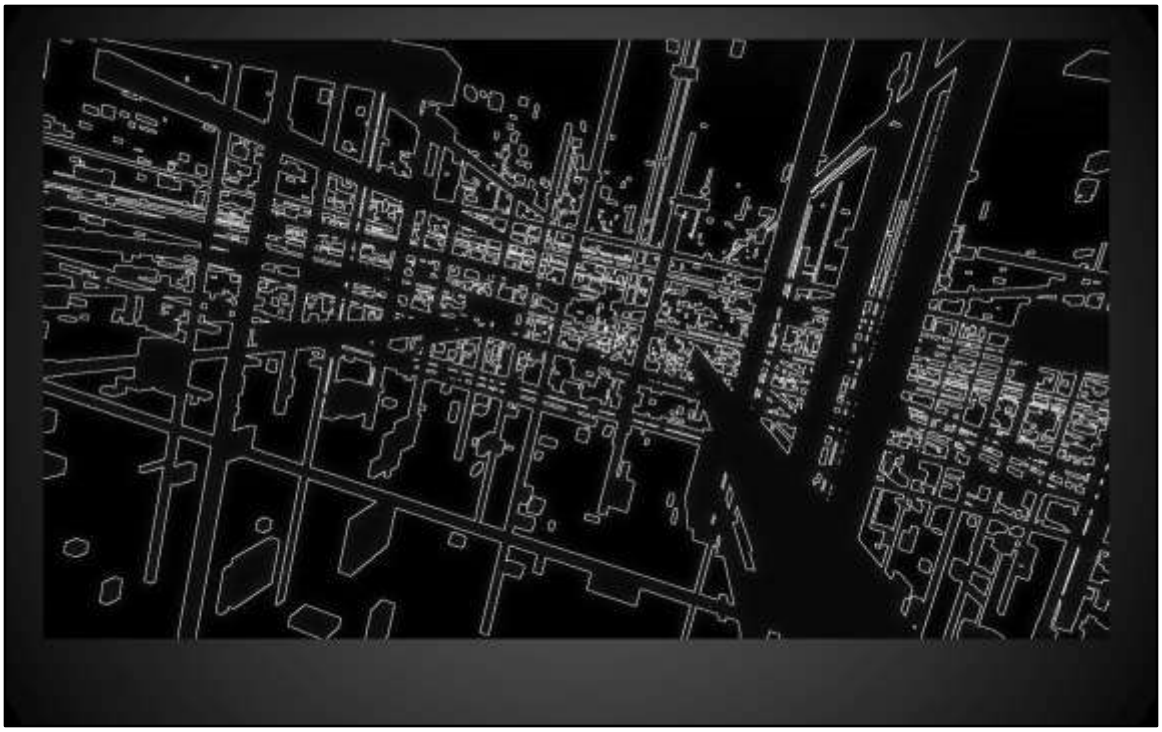
This sort of use makes the image easier to grasp for the viewer. Naturally you could do the opposite and use light to make the image more difficult to understand or more confusing.

You may use light to separate elements, create opposition or emphasize difference.

You may have your entire composition relying on light.

You may use light to suggest an idea.
In this shot light is used to create a shadow that makes a reference to a famous tale, thus giving its meaning to the image. Without the shadow this picture would lose its meaning.

There can be many other uses of light. Be creative, try to surprise the audience.



You can decide not to use light at all.

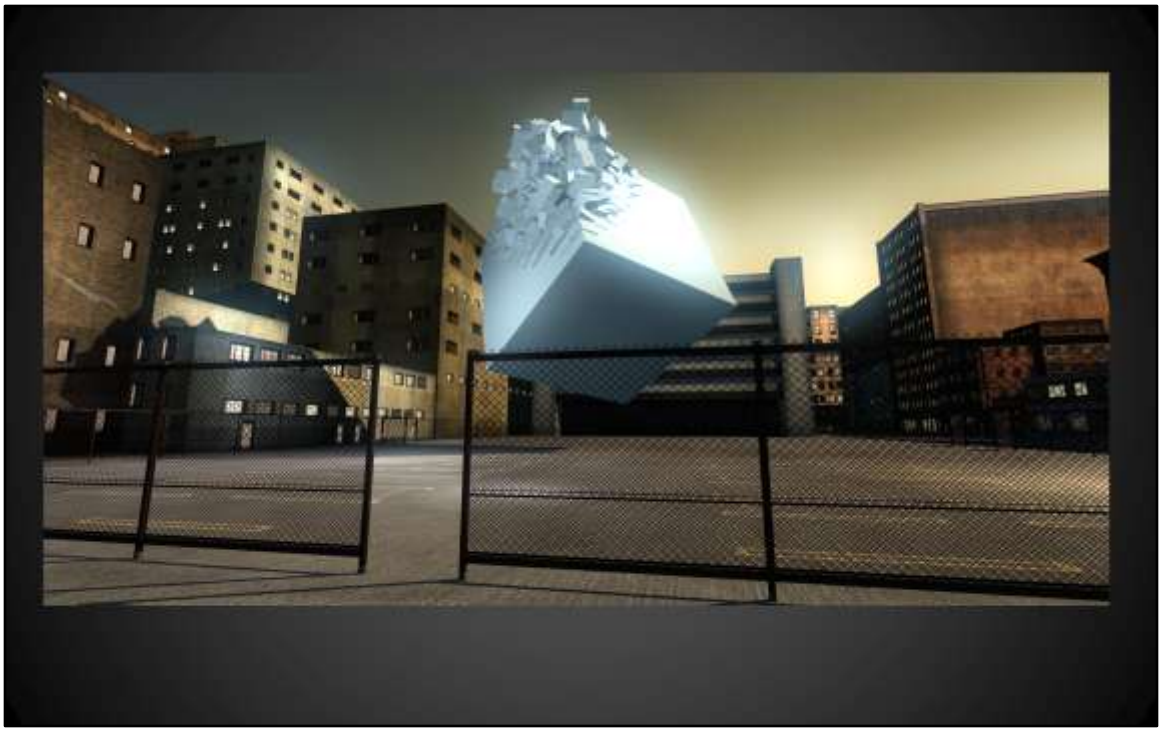
This capture is from Chromosphere, which doesn’t use any light or face shading. The lack of light completely supports the story, an allegory of how images are created inside the eye. The information brought by light just doesn’t exist yet.

Or maybe they just thought this rendering was cool. But the result is consistent with the story nevertheless.

You could also choose to have a scene without light to represent the loss of something, and have light again when that thing is found back, or a different light if something new comes to replace the lost one.

An interesting use of light in demo for example is fr-041 – Debris, by Farbrausch.

Debris uses stencil shadows, a technique that was already considered obsolete went it was released, in 2007.
One of the limitations of stencil shadows it the inability to have soft shadows. But Debris uses this limitation as a strength.



At the beginning, the tension is very low. The lighting is soft, the contrast is moderate.

By disabling shadow casting, we see the contrast was very low.

During the climax, the light is very different. The bright highlights contrast with the dark shadows.
The debris cast sharp shadows with aggressive lines that significantly contribute to the intensity to the picture.

If we launch the demo without shadow casting, the pictures loses a lot of its intensity and the scene feels less ominous.

In this shot where the viaduct first appears, we cannot help but look at it.
Several elements in the picture are responsible for that: the perspective, the rule of third, and the light.

The source of light is right behind the viaduct, making a brighter zone that calls the attention. Moreover, the shadows casted on the ground make lines that point toward it.

On the next scenes the origin of the viaduct is noticeably brighter than the rest of the picture, ensuring we look there first.

So light in Debris is essentially used for two purposes: drawing the attention, and give intensity to the picture.

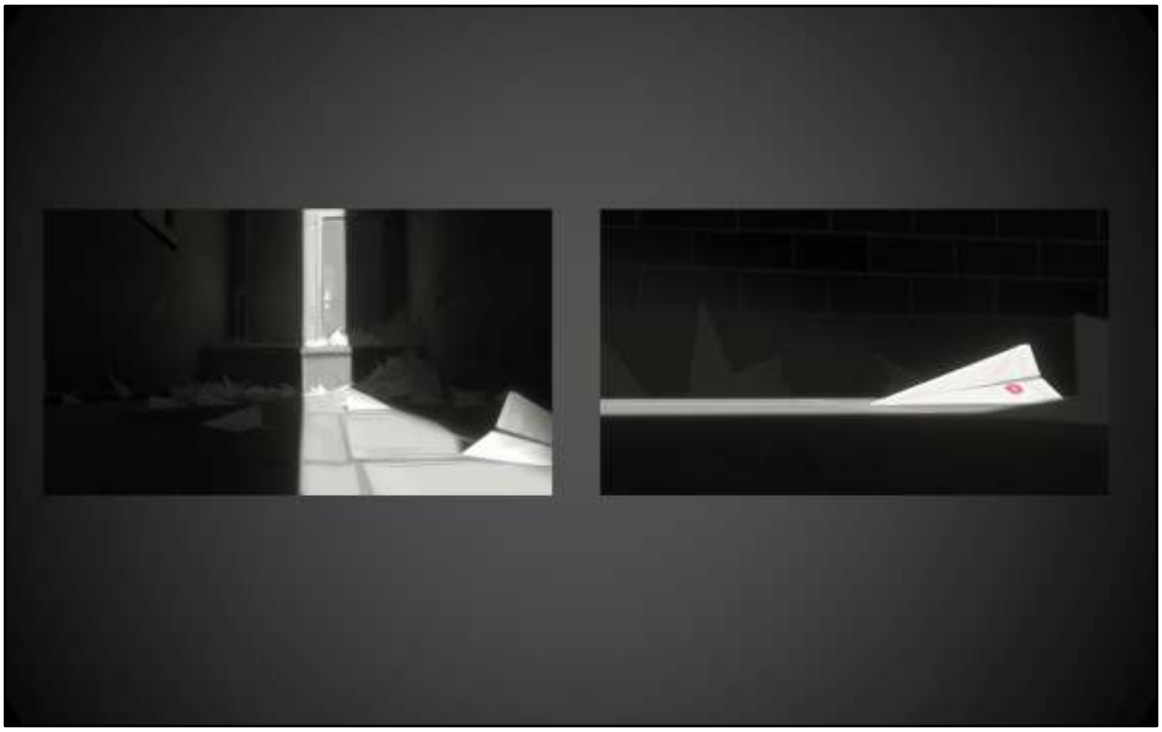
Now lets take a different example and see how the big guys use light.

In Summer 2012, Walt Disney Animation Studios presented their last short film, Paperman.
It was later released to the public in December, and won the Oscar for Animated Short Film in February, 2013.

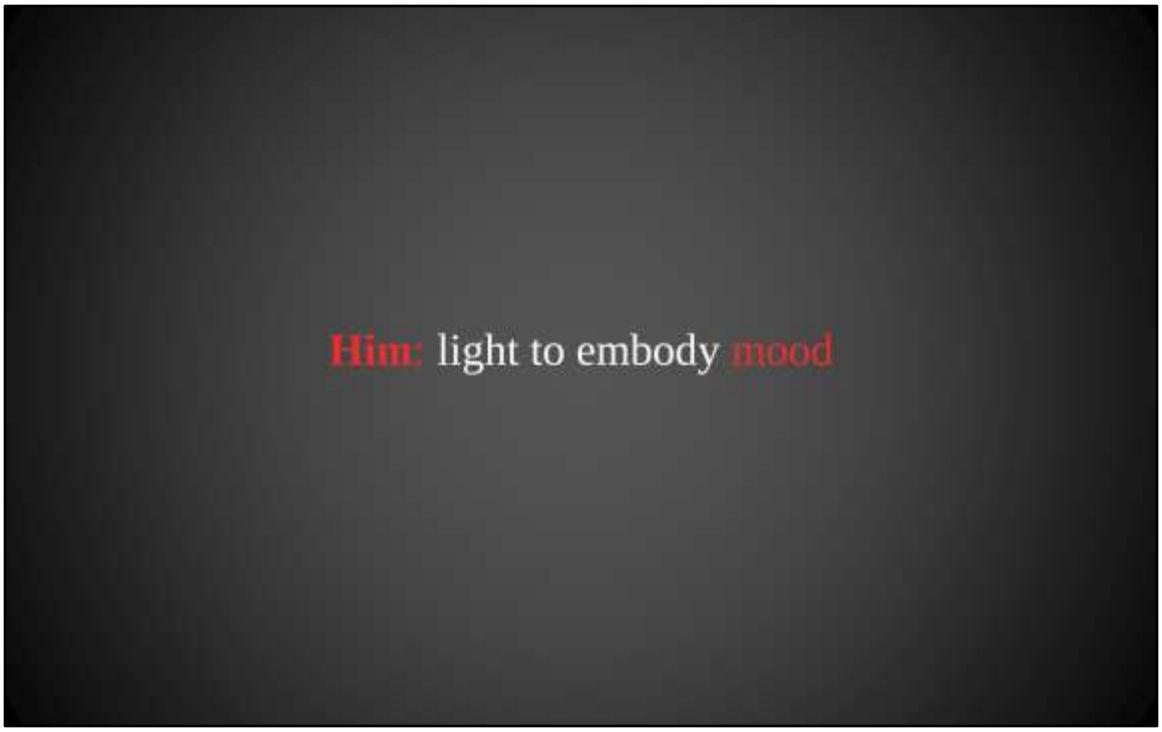
The story is about how a guy and a girl in New York in the 40s, who try to meet again after a first chance encounter.


Light to draw attention

When the guy notices the girl through the window, the building is bright and all windows reflect light, so the room where the girl is appears much darker.
Our attention is immediately pointed to that window so we see the girl, even though she has little contrast and is very small compared to the size of the picture.



In these shots, the shaft of light is used to draw our attention on a single paper plane out of dozens. Light is used to make the picture simpler, removing the superfluous so we can see what the author wants us to see.



The male character is lit according to his mood and to the intensity of the events happening to him.
When nothing happens or when his mood is low, the light is soft and dull.
When the events are intense, light gets strong and harsh.

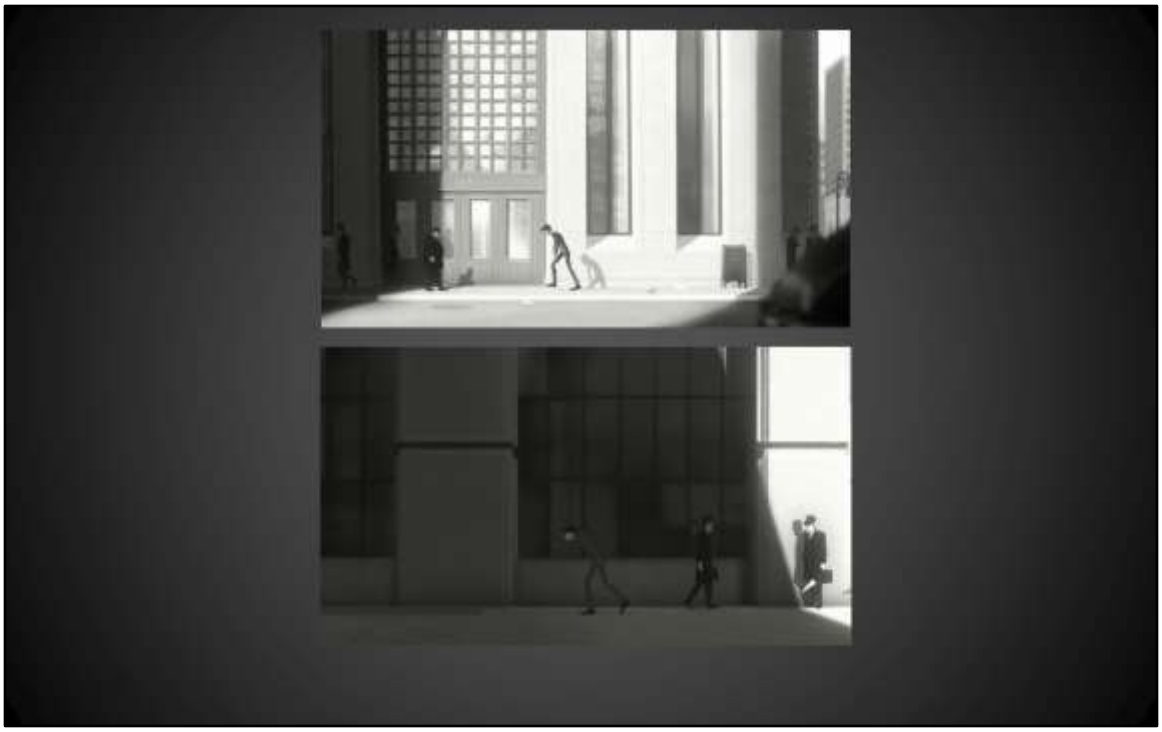
At work, the light is soft, dim, and dull.
It represents his boredom and sadness.

Later on, while he is sitting at the same place, although the light conditions haven’t changed, the falloff on is face is much stronger.
Why is that?

The reason is because he has made a decision.
He is about to do something bold, and the light emphasizes it.

Likewise, in the same scene, at the same moment, the light is very soft and dull on George, but harsh and strong on his boss. This represents the latent conflict in the boss – employee relationship.

In this scene where he is rushing through traffic, the light is of course very strong, with very sharp falloffs. This creates a lot of contrast, matching the intensity of the moment.



When he is giving up, we see him walking from light into the shadow.
By walking away from hope, he is walking away from light.

When the magic of Disney happens he gets literally pulled out of the shadow, back into the light.

The lighting used for the female character is even more interesting.
As the guy is chasing after her, she is lit according to how distant she is.
The farther away she is, the less light she receives. The closer she gets, the more light she receives.

When the guy notices the girl in the building, she seems far away and unreachable. Therefore she is in the shadow, although the building is in plain sunlight.

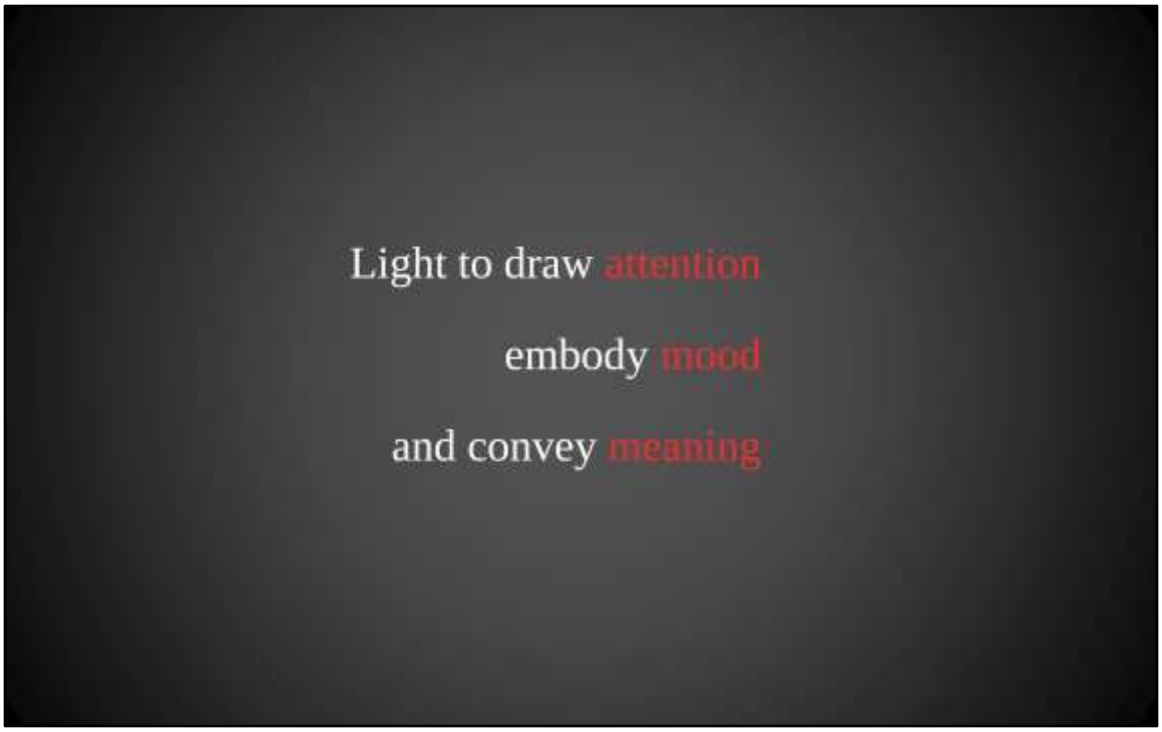
As he figures there might be a way to get her attention, she has a hint of light indicating there is a chance of reaching her.

When she leaves the room, she becomes unreachable again, so she gets back in the shadow.

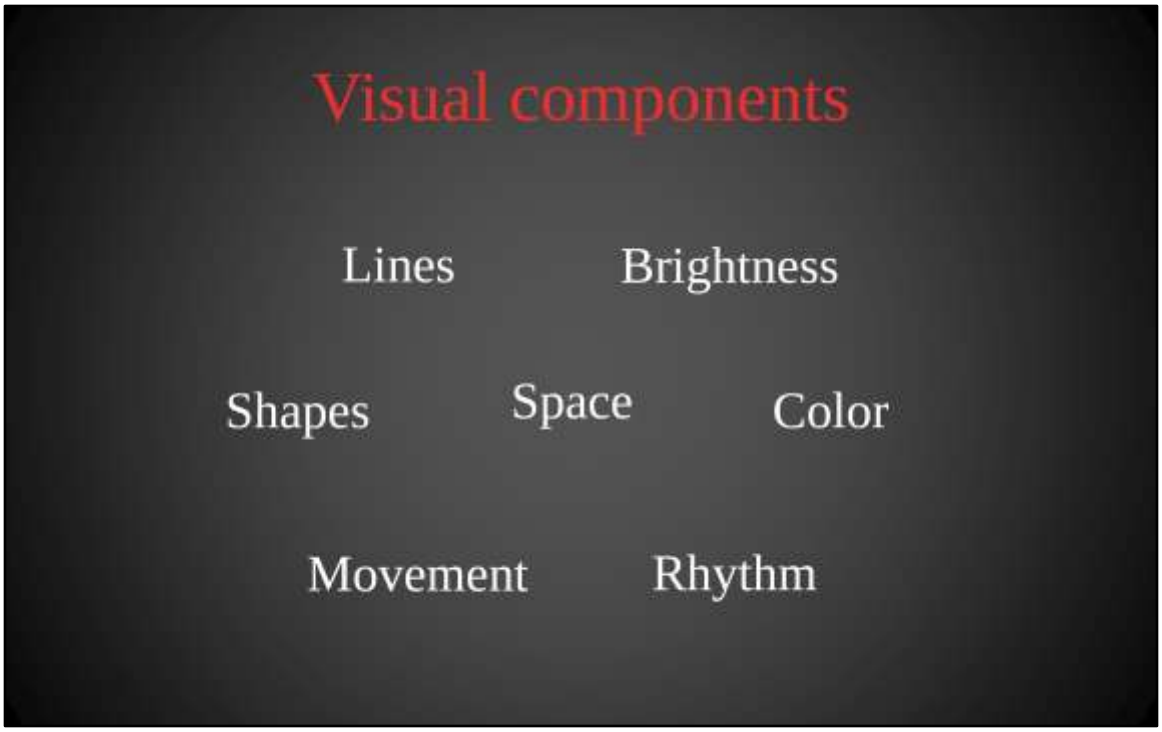
When she decides to look after him, she is under a strong sunlight.

The moment she finally meets him, she receives more light than ever.
At this point you don’t need to see the next scene to understand: the light is already telling you they have found each other.

Obviously as they are finally together, they are both lit by a strong light.



So we have seen three different uses of light in this short.
Light as a tool to draw attention and represent intensity is probably the most obvious.
But light as a metaphor is a much more clever use.



What else can be done?
The Visual Story breaks down the image of a motion picture into the basic visual components: space, line and shape, brightness, color, movement, and rhythm. Carefully choosing them and using appropriate contrast allows to create images that support the story in a motion picture, in the very same way the music does.

Have you noticed for example how in animation films, good guys are usually curvy, while bad guys are straight and spiky?
In the case of Aladdin, also notice how the good guys are blue and white, when the bad one is red and black.

All these visual components are going to evolve over the film, according to the story.

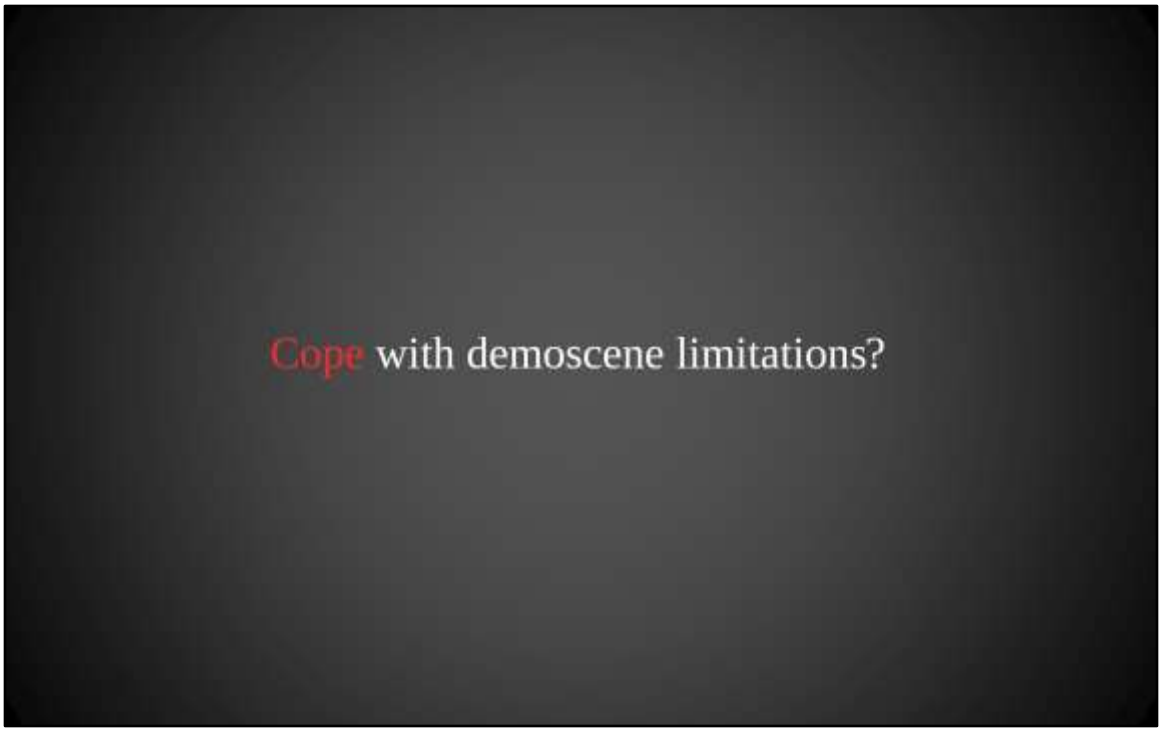
Color palette is probably the most noticeable: films often picture characters being happy on sunny days, having romance on sunsets, going through sad events on rainy days, fighting under a raging storm…

These evolutions in the color palette are very noticeable when you look at the film as a whole. Here is an image made of the pictures from Jaws: one capture per second, 60 of them per line.
Can you guess when the shark attacks?

There are many ways to control these components: location, furniture, clothes... Light can be used to affect all of them at once and become a key component.

- Light color and intensity are going to change the tones, brightness and contrast of the image.
- Lights and shadows are going to give texture and depth cues, create lines and shapes, and add rhythm.
- Lighting an element, keeping it in the darkness, casting long shadows, are ways to control the attention of the viewer.
- Moving light sources will create movement, and driving the attention to different points will create movement too.

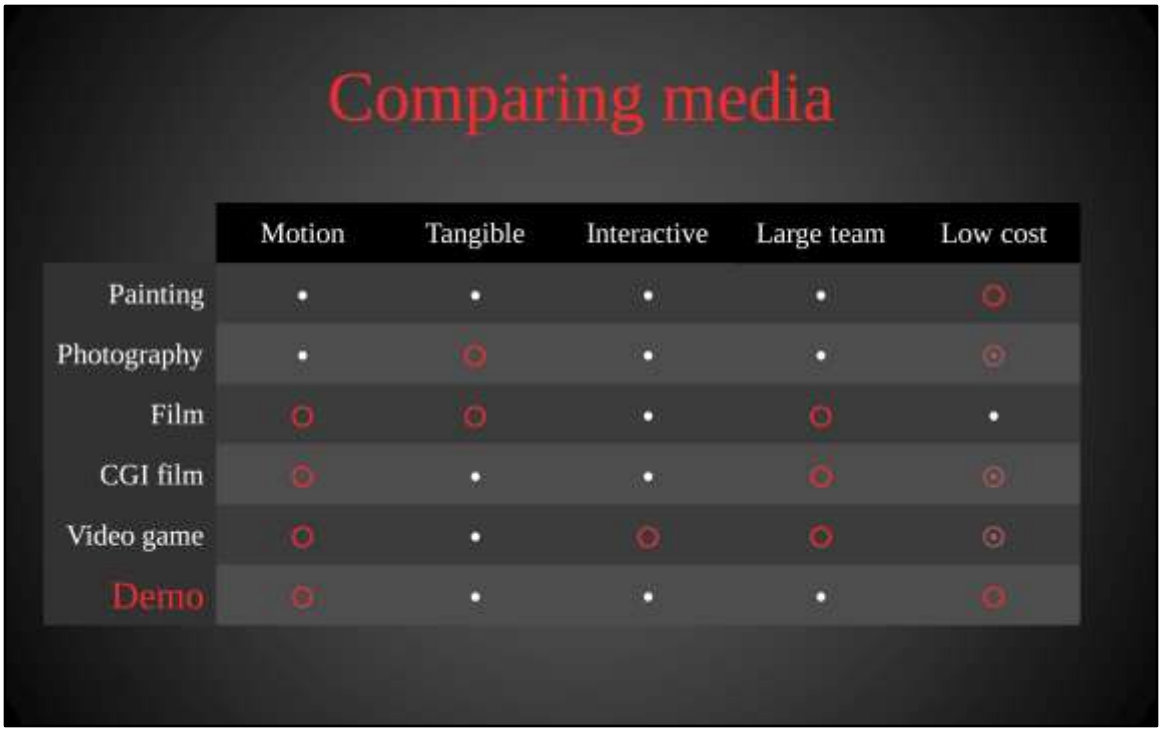
In this example see the role played by light in portraying what is obviously the bad guy. Colors are washed out, shadows are strong and red, setting a mood both depressing and intense. All the elements that make the scene dreadful could be dramatically changed simply by using a different lighting.



All this is cool, but that's the film industry; we are the demoscene, and demoscene has limitations:

- Small team, limited free time, which means limited manpower.
- Necessity to build things, the engine, the tools, and the constant choice between writing tools and producing content.
- The real-time aspect, which means limited computing budget.

These limitations make such craftwork impossible. Or do they?
When you talk with people working on these media, you realize they face their own limitations too.



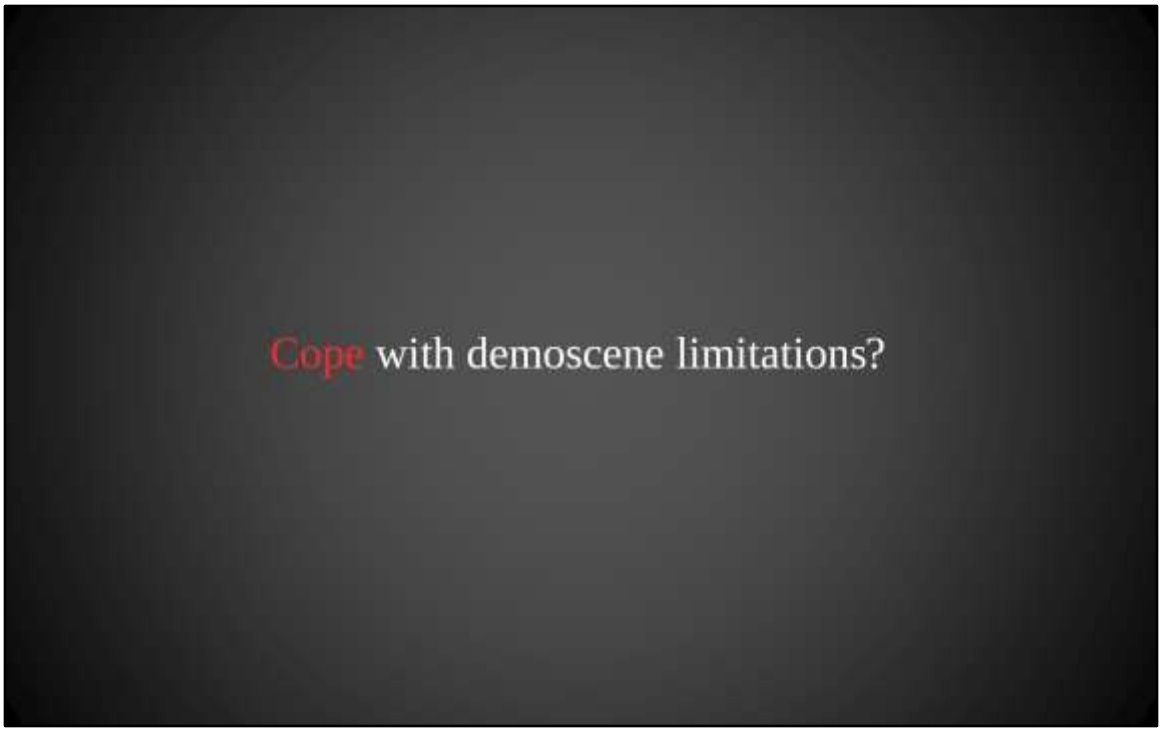
A few things to notice:

- Photography is affordable, but still comes with a cost: equipment is not cheap enough to ignore. This makes it more difficult to experiment. If you want to do artificial light photo, you need lighting equipment.
- While in photography you have a lot of freedom regarding exposure, when filming you can't afford more than 1/25th of a second of exposure.
- For a photo or a film, it is harder to create the image you want than in CGI, because you are bound to the reality. For example some lighting setup is going to prove difficult create, require expensive equipment, or will be simply impossible.
- In CGI you have to build everything from scratch, which makes it more difficult to work on the big picture.
- In FPS video games you don't control where the player looks so your scene has to be very consistent and your lighting has to be very robust.
- In a film you can have a different lighting from one shot to another, but it's much more difficult to do this in an interactive media.
- Both film and video game industries usually have large teams, which brings all sort of problems: communication problems, consistency problems, etc.

So where does this leaves demos?

Strengths of the demoscene

- Motion picture: take advantage of motion
- Virtual: not bound to reality, be creative
- Non-interactive: staging, hacking, faking
- Small team: greater consistency
- Low cost: try, hack, experiment
- Short length: make an impact
- Community: share



To get the best out of your media, you need to be aware of its limitations and strengths. Taking a look at other medias may help: see there limitations and realize which ones you are free of. Then take advantage of them.

This is the final word and conclusion.

Thank you!

Blog: Light is beautiful
lousodrome.net/blog/light

Twitter: @zavie

Resources

The Visual Story, by Bruce Block, ISBN-13 978-0240807799

Painting with Light, by John Alton, ISBN-13 978-0520089495

Film Art: an introduction, by D. Bordwell & K. Thompson, ISBN-13 978-0077689063

Cinema Redux, by Brendan Dawes

Spotmaps, by Andy Willis

Graphics vs. Aesthetics, by Penny Arcade

http://brendandawes.com/projects/cinemaredux
http://spotmaps.jit.su/about
http://www.penny-arcade.com/patv/episode/graphics-vs.-aesthetics

Illustrations: demos

Chaos Constructions 2011 invitation, by Quite

Chromosphere, by SQNY

fr-041 - Debris, by Farbrausch

Frameranger, by CNCD, Fairlight and Orange

Into The Pink, by Plastic

Spheres on a plane, by dead roman

Illustrations: photos

seat seat seat down, by Julien “Éole” Avarre
Bioluminescence, by Laurent Filoche
The night of the hunter, by Laurent Filoche
Untitled photo, by Laurent Filoche
Hiroshima my love, by Laurent Filoche
Linda – Peter Pan, by Jon Senior

http://www.flickr.com/photos/eole/
http://www.flickr.com/photos/bonze/
http://www.flickr.com/photos/jon_senior/

Illustrations: films

Aladdin, by Walt Disney Pictures
Kung Fu Panda 2, by DreamWorks Animation
Paperman, by Walt Disney Animation Studios

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