***Visible Light World, 400-750 nm**. F/6.3, 1/2500 sec, ISO 200, 35 mm Nikkor glass lens. Modified Nikon D90 with IR/UV filters removed. Kolari Vision Hot Mirror UV/IR Cut filter.*

People often ask, why do I do invisible photography? Infrared, ultraviolet, thermal? What is there that you can't appreciate with common visible light?

So, I made a demo with 15 different objects. Each of them changes in some respect if you look at them with the light humans can't see. They are numbered as following:

1. A UV-A lamp.

2. A silver bar in a plastic bag.

3. US one cent copper coin.

4. A ring made with Rhodium.

5. A shot glass with white wine in it.

6. Plastic cutting board, probably made of PVC.

7. Some green grass in the background.

8. A shot glass with red wine in it.

9. A piece of black plastic trash bag.

10. A piece of paper with a stripe of sunscreen applied to it.

11. A diode flashlight.

12. A wooden pencil.

13. An 0.8 mm thick Silicon plate.

14. A burning candle.

15. A heart-shaped piece of foggy quartz or possibly selenite.

Ready? Let's go.

__Ultraviolet World, 350-400 nm__. F/6.3, 1/5 sec, ISO 3200, 35 mm glass lens. Modified Nikon D90 with IR/UV filters removed. Kolari Vision UV Ultraviolet Bandpass Transmission filter.

1. UV lamp is very bright. No surprise: we **are** filming in UV now.

2. Virtually no change to the **silver bar**. I was hoping to observe darkening known below ~350 nm, but apparently my filters did not let that through.

3. But **copper coin** did darken. It is known that copper is a poor reflector of near UV.

5. White wine… isn't white anymore! It is almost black and non-transparent! This works with grape – but not with peach wine.

6. The **cutting board** changed color dramatically. And all cuts and scratches became prominent. So, you can use UV photography to distinguish a freshly used board from the one that's been sitting idle for a while :) © Eugene Bobukh

7. The grass is also dark in UV. The effect extends to nearly all foliage and was a trouble to early photographers who worked with old orthochromatic black and whit film.

10. Sunscreen stripe stands out very well. That's a practical application of UV photos: finding spots of missing sunscreen before going out under tropical sun.

11. What happened to the **diode light**? It is not anymore… No, I did not switch it off. It just emits nearly no UV light. Which is good for museums seeking to protect painted art from destructive effects of UV.

12. The **pencil** is also darker, though that could be just its yellow paint effect.

14. Candle flame turned nearly invisible. This is expected. It takes quite a high temperature to start shining in UV.

15. Finally**, the heart**. It is opaque now because of the effects of Rayleigh scattering.

***Near Infrared World, 750-900 nm**. F/6.3, 1/2500 sec, ISO 1600, 35 mm glass lens. Modified Nikon D90 with IR/UV filters removed. B+W #093 (87C) filter.*

1. Now the **UV lamp** is completely screened by the filter.

2. The **silver bar** became darker, though we know that silver reflect IR very well. Why? Because it is reflecting mostly the blue light off the sky. And as we cut off that blue together with most of the visible light, the sky turned dark, and so did the reflection.

3. Still, the relative brightness of **Rhodium** is lesser than that of shiny **Silver** or **Copper**. That, actually, is expected (see Figure 5).

5. **White wine** is transparent now. And so is the **red wine** (#8), too! Both look just like water.

7. The **grass** is much brighter than the asphalt in IR, which is common to most foliage in that range.

11. No visible IR emission from the diode **flashlight** either.

13. But the **candle's flame** is prominent, which is expected since this is a rather low-temperature thermal emission.

14. And the **smoky heart stone**, what happened to it? It is completely transparent now, appearing just like some ordinary glass.

Near Infrared 1000-1050 nm. *F/6.3, 1/4 sec, ISO 3200, 35 mm glass lens. Modified Nikon D90 with IR/UV filters removed. 2.4mm Silicon plate filter ©.*

The changes mostly continue the trend set by the previous IR picture… but there are some peculiar details.

13. The **Silicon plate** is completely transparent now – you can see through it.

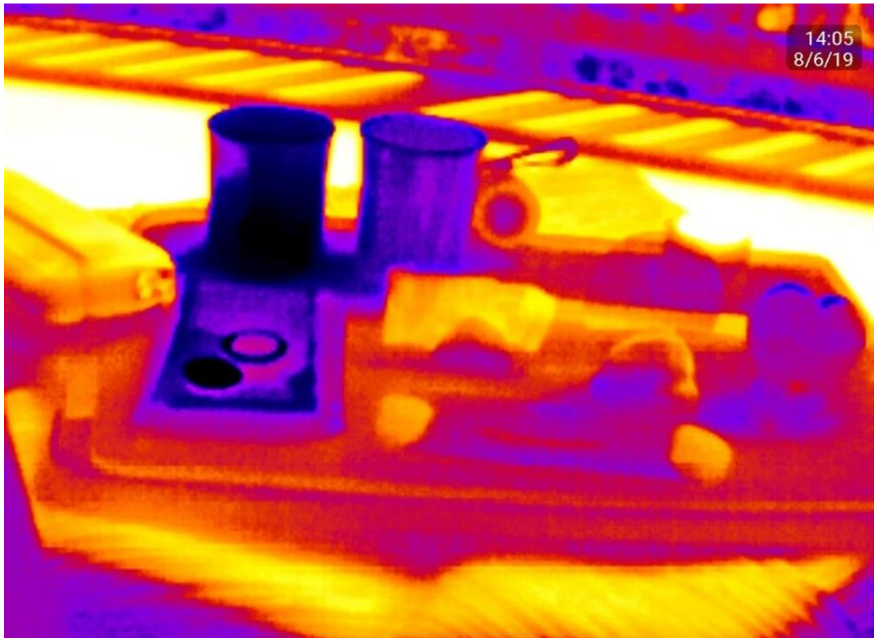
13. The candle's flame is even brighter, as we are moving closer to the thermal range.

And no, the white wine did not get darker. This is rather a vignette effect produced by an imperfect IR filter.

In case you are wondering, here is what the filter looks like, as well as a Si plate alone seen through it. Yes, thin Silicon is transparent to digital cameras near 1000 nm.

Thermal Infrared, 6-14 mkm. *SeekThermal CompactPRO camera.*

The next photos are truly thermal infrared. They "see" the heat, even as modest one as the heat of a human body. As the shots were made from two slightly different vantage points, I'm presenting two views of slightly differing compositions to illustrate all the effects.



5. The **shot glasses** are opaque, and clearly their content is cold.

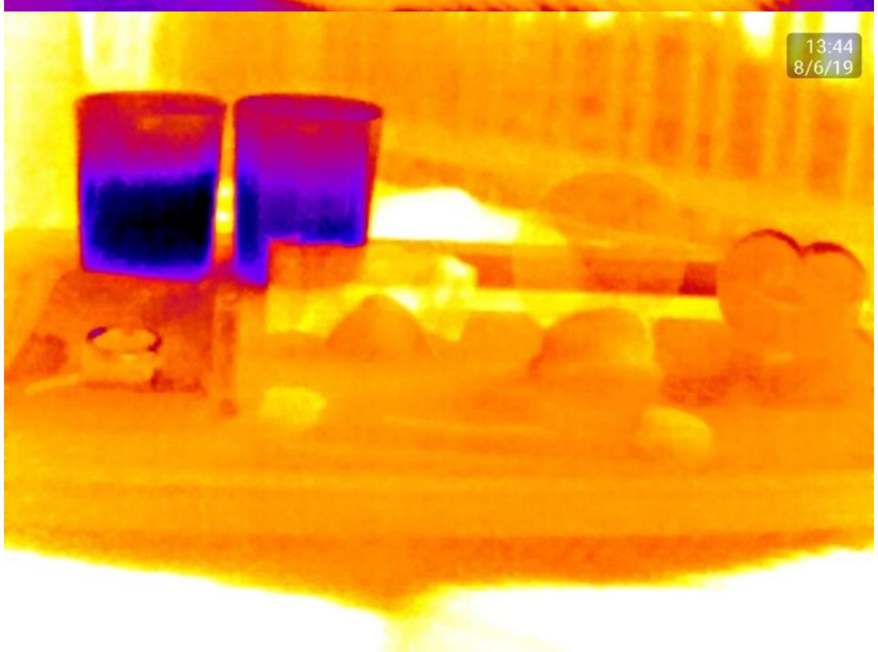
9. But you can see through a piece of **black plastic** now. It is better observed on the lower picture, where the bottom of the shot glass and the pencil clearly stand out though the plastic.

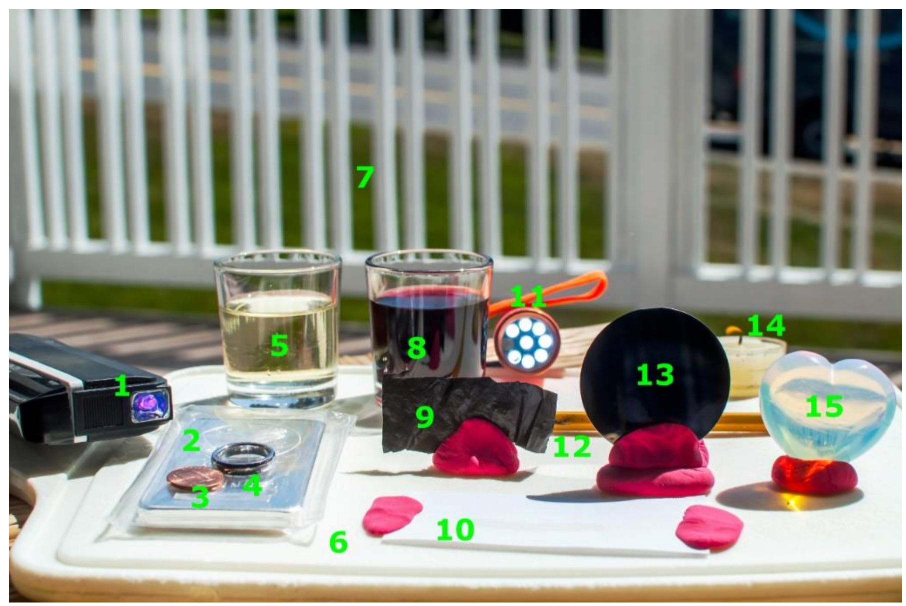
10. Funny enough, the **sunscreen** is a bit hotter than the paper it is on. That's probably because it absorbed enough of UV light (compared to paper) to release it back as a heat now.

11. The **flashlight** makes no heat, as diodes are quite efficient light sources.

13. The **Silicon plate** is still transparent!

14. The candle is very bright, though because of unlucky camera positioning it's rather hard to notice (and there is no candle on the lower picture).





Combined

Per great suggestion of my friend Andrey Lelikov, I also combined the UV and two IR photos into a color map.

In this picture, blue was assigned to UV channel, green to near infrared 750-900 nm, and red to IR of 1000-1050 nm. Now some of the differences clearly stand out!

- Red objects are those transparent or reflecting only in further ranges of IR
- Yellow and green are good near IR but poor near UV reflectors/transmitters.
- Same for green (the edges of the photo are greener due to vignetting from Si filger)
- Blue are UV bright things.

Thank you for your interest!

This demo was prepared by Eugene V. Bobukh. It is available for download as PDF (mirror) and as Web page on Medium and Habr (in Russian). If you feel like donating, the instructions are here (mirror). In case those sites are offline, use these addresses: Crypto: BTC: 1DAptzi8J5qCaM45DueYXmAuiyGPG3pLbT; ETH: 0xbDf6F8969674D05cb46ec75397a4F3B8581d8491; LTC: LKtdnrau7Eb8wbRERasvJst6qGvTDPbHcN; XRP: ranvPv13zqmUsQPgazwKkWCEaYecjYxN7z. Paypal: e u g e n e b o (at) h o t m a i l (dot) c o m

Or just email the address above for more options