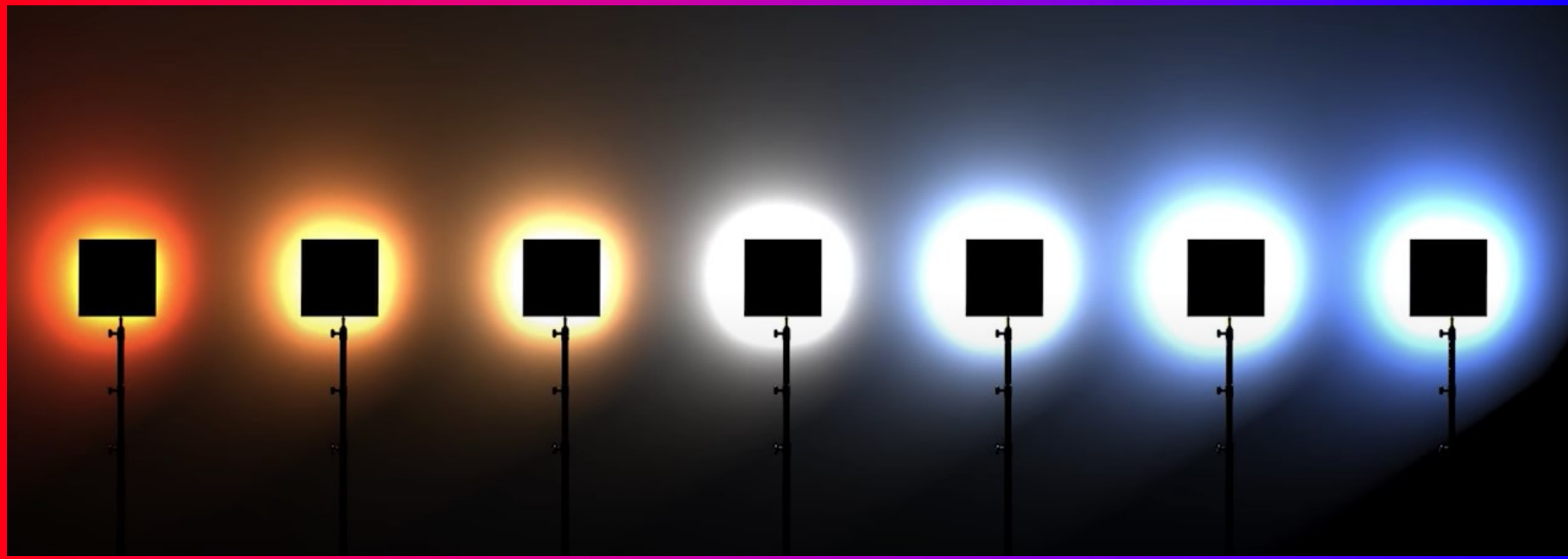
White Balance

in photography



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White Balance - What and Why?

- **White Balance** is a **digital camera setting**
- For some time I have been **frustrated** while taking pictures of **Fall colors** (also sunsets, or any scene with nice warm colors)
- I finally realized that **the problem is the White Balance**.
- By default, cameras use **Automatic White Balance (AWB)**. This setting works well for 90% of the pictures but it can fail in cases where the scene has nice warm colors.

What the camera records (in AWB)

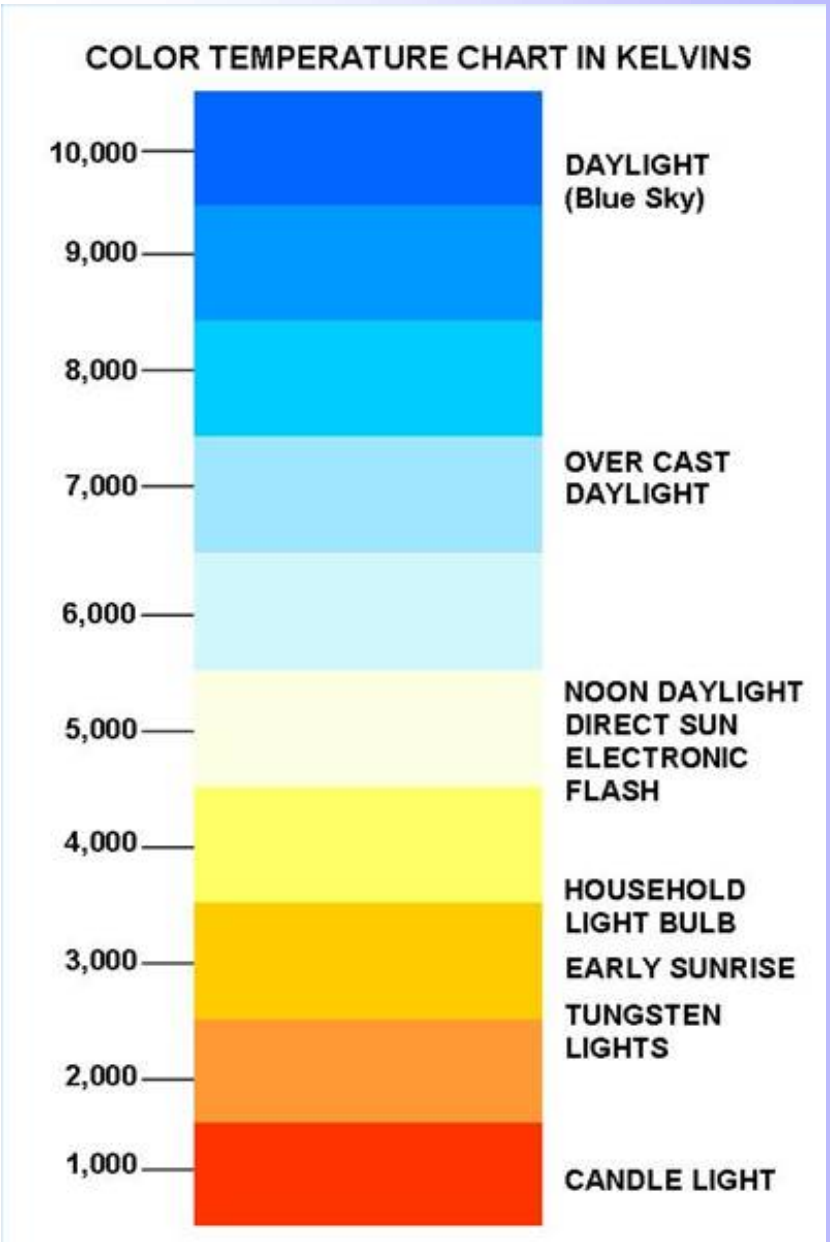
What my eyes see

What is White Balance?

To understand “White Balance” you need to understand the concept of **Color Light Temperature**

Sunlight looks white for most of the day (except for sunset/sunrise when it is clearly yellow/red). But there is some variation from red to blue during the day. This can be measured using a temperature scale.

Color Light Temperature



- The color of the light, is measured in **degrees Kelvin** (a temperature scale)
- **Typical range** is from **1,000K** to **10,000K**
- **Daylight** is defined at the color of the sunlight around noon and it is **~5,500K**

Color temperature is important in several different areas:

- Photography and art
- Desktop publishing
- Agriculture
- Science / Astronomy
- Interior lighting
  - ◊ Warm white 3000K (Bedrooms, living rooms)
  - ◊ Natural white 4000K (bathrooms, entryways)
  - ◊ Cool white 5000K (basement, garage)

Eye vs. Camera

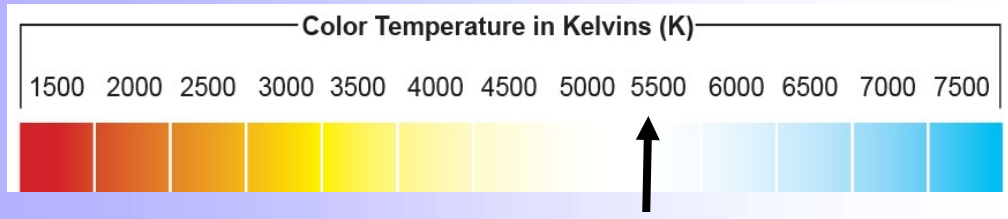
There are differences in the way that the eye ***sees*** colors vs. the way the camera ***records*** colors:

- The eye **does not see colors well in low light**
- The eye tends to **see any bright light source as white**, especially in the absence of a comparison
- The eye **adapts** and tends to see any predominant light color as white
- If we know that something is white **we tend to see it as white**, even under very different light color light
- The camera does something similar in the AWB setting. But **with the white balance fixed, the camera records colors accurately**.

White Balance Camera Adjustment

- **A digital camera needs to be told what white is**. This is called "setting the white balance"

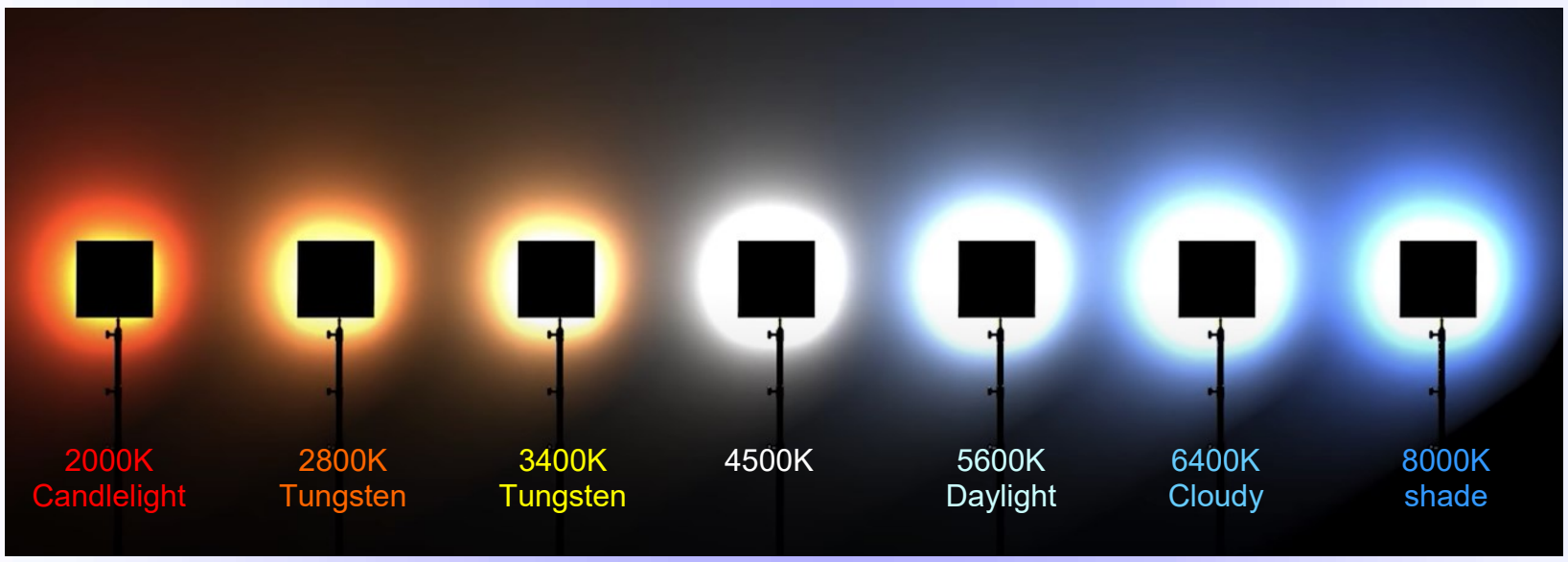
- The simplest way would be to **specify the temperature of what the camera should consider white**, in degrees K



For example, we can set the white balance at **5,500K**. Everything "colder" than that (higher temperature) will appear blue. Anything "warmer" than that will appear orange.

We can set any temperature to be white, the camera does not really care.

Here we have 7 lights, all at different light temperatures. The white balance for the camera that took this picture is set at 4500K, which appears white. Anything lower appears orange/red, anything higher appears bluish. If we change the camera white balance to 2000K, then the candlelight will appear white, everything else will appear increasingly blue. If we set the white balance to 8000K, then the right light will appear white, everything else will appear increasingly red. **The camera is fine will any temperature being white, but are we??**



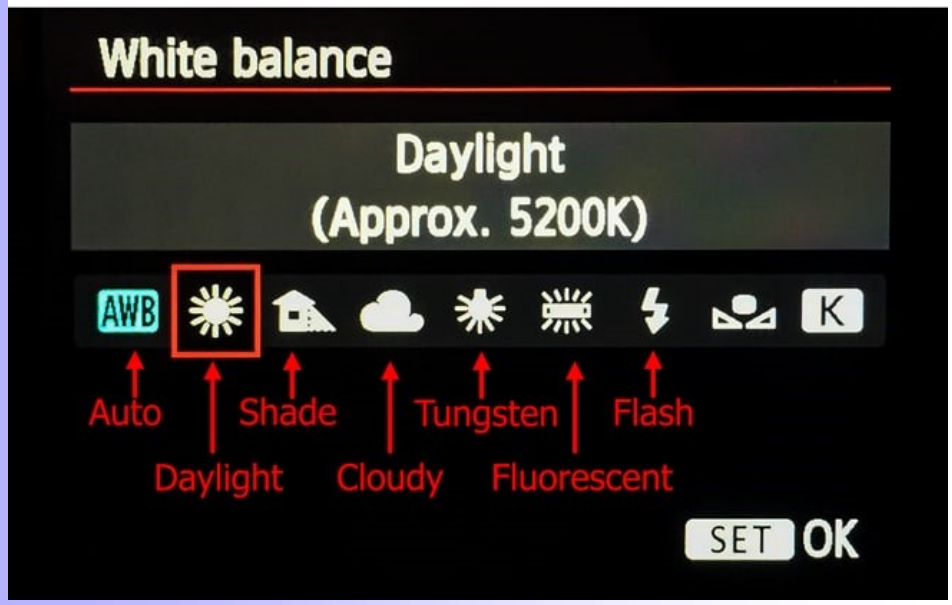
https://www.youtube.com/watch?v=48c02L_nHZc

White Balance Camera Adjustment

- In addition to entering the white balance in degrees K, cameras offer certain **presets**, depending on the light conditions.
- **Each preset corresponds to a certain temperature**, the exact value of which depends on the camera. Typical presets are shown here.
- There is also the **Auto White Balance (AWB)** usually the first choice and the default setting. In this case, the camera analyzes the scene and sets its own white balance, depending on this analysis.
- Finally, there is usually a "**Custom**" white balance setting. The user points the camera to a white surface and presses a button. The camera measures the color temperature of the surface and sets this value as the white balance.

Important: In certain camera modes there **is no option to change the white balance from AWB**. This is usually the case in auto-everything modes.

White Balance Camera Presets



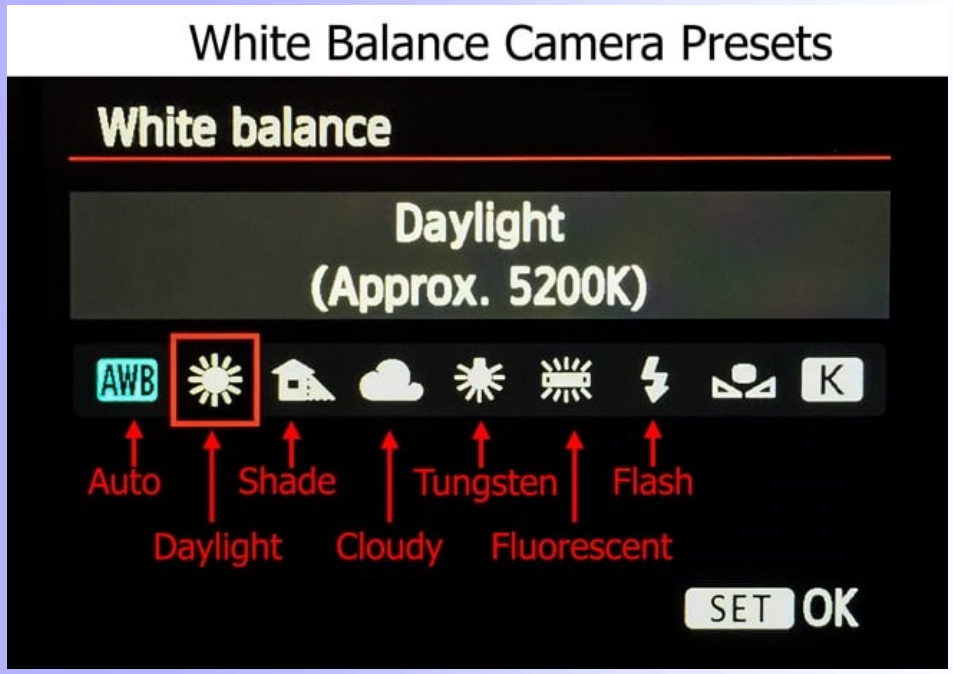
AWB	*Auto WB setting*
	7000 K *shade*
	6000 K *cloudy*
	6000 K *strobe/flash*
	5200 K *daylight*
	4000 K *fluorescent*
	3200 K *tungsten*
	Custom WB setting

FILM: Daylight or Tungsten

- Two types of film:
  - **Daylight** (~5,000K)
  - **Tungsten** (~3,200K)
- Cannot switch white balance mid-film
- Use **filters** to change the color balance (e.g. blue filters indoors or warming filters outdoors)

DIGITAL:

Many more options!



White Balance Questions

So far we have:

- Explained **color temperature** of light
- Showed different ways to **set the white balance** in a camera

Questions:

1. What is the **best setting** for white balance in a camera?
2. How about **other colors** (Green)?
3. Can Color be adjusted in **post processing**?

Best Camera Setting for White Balance

Outdoors:

- **Daylight** (25 years shooting daylight balance film without problems)
- **Cloudy** (or shade for warm colors)
- Avoid AWB for scenes with warm colors (Fall colors, fire, sunsets, etc.)

Indoors / Mixed lights:

- **AWB** does a good job in removing unwanted color casts

Commercial / Product photography:

- **Custom** setting to match the light source

For my ebay photography I use two good quality LED lights with Daylight balance and set my camera to daylight. Using AWB would distort the colors when the product has a dominant color.

AWB setting

Cloudy setting

Best Camera Setting for FUJI W3

WHITE BALANCE is available for all modes except AUTO

I normally use **P** (Program Mode) with **–2/3 exposure compensation** & **AUTO (400) ISO**

I use **daylight** or **shade** settings for outdoor photography

AUTO for indoors or any tricky light situation

Option	Description
AUTO	White balance adjusted automatically.
☀	For subjects in direct sunlight.
☁	For subjects in the shade.
1	Use under "daylight" fluorescent lights.
2	Use under "warm white" fluorescent lights.
3	Use under "cool white" fluorescent lights.
💡	Use under incandescent lighting.
🐟	For underwater subjects in an aquarium.

Panasonic 3D camera

Unfortunately, **white balance is not an option** because in 3D mode the mode is set by default in AUTO and white balance is not an option.

This, and also the inability to control the shutter speed (for fast moving objects) are for me the two most important limitations of this camera.

How about other colors?

- Color temperature is the range from red to blue, but how about other colors, like **green**?

- Normally, **not a problem with daylight**, but a problem with artificial light (that's where AWB works well)

- Some cameras have controls to adjust the **tint** (green-pink) to remove green cast, etc., as part of the White Balance setting

Color adjustment in post processing

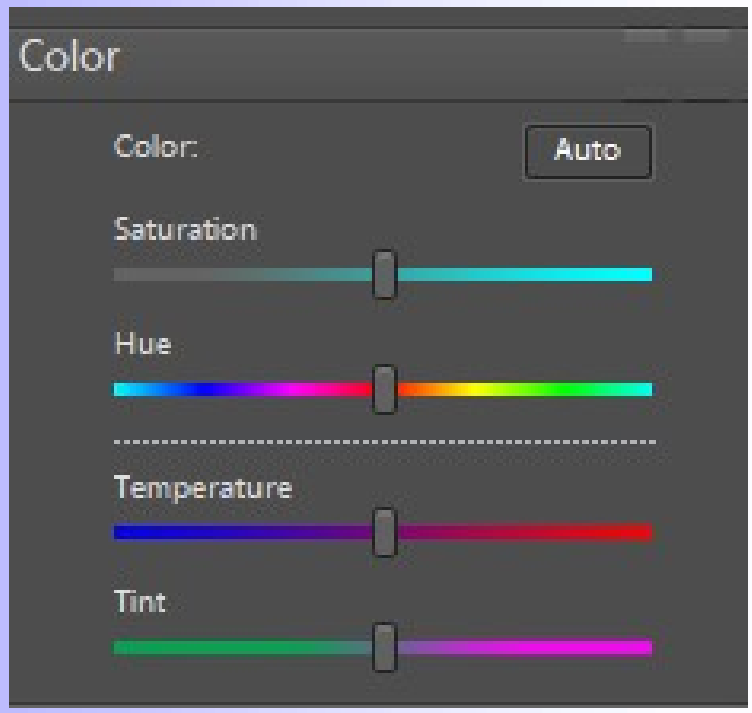
It is a good idea to **get the colors accurate during shooting** when shooting **JPEG images**. Off-color balance problems can be (to some degree) corrected in post processing.

Shooting **RAW images** has the **advantage** of setting the white balance in post-processing, so the camera's white balance is not important

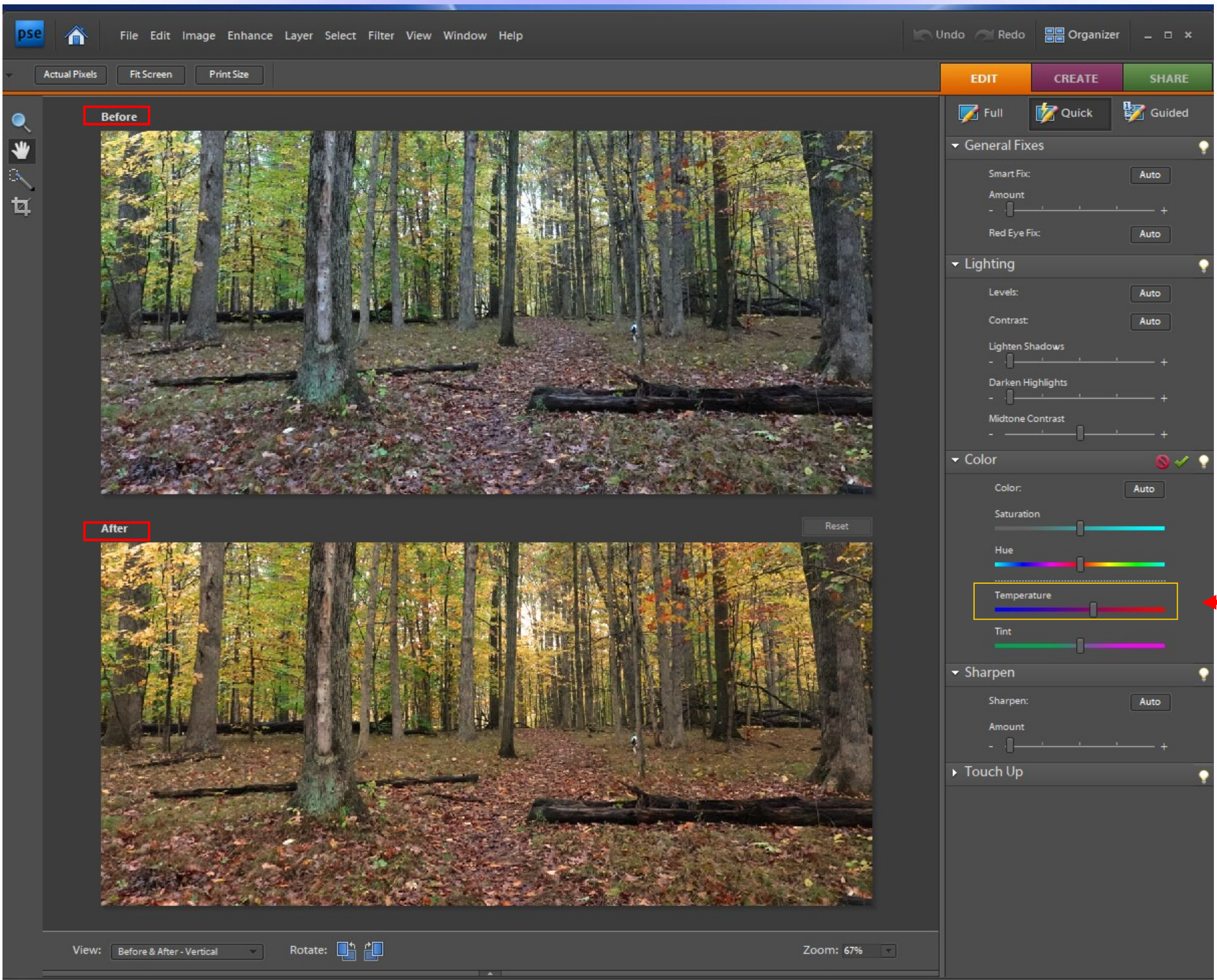
Various ways to color-correct images using photo editing software:

- **Auto color balance**
- **Remove color cast**
- Individual Color Adjustment
  - **Saturation**
  - **Hue**
  - **Temperature**
  - **Tint**

Adobe Photoshop Elements

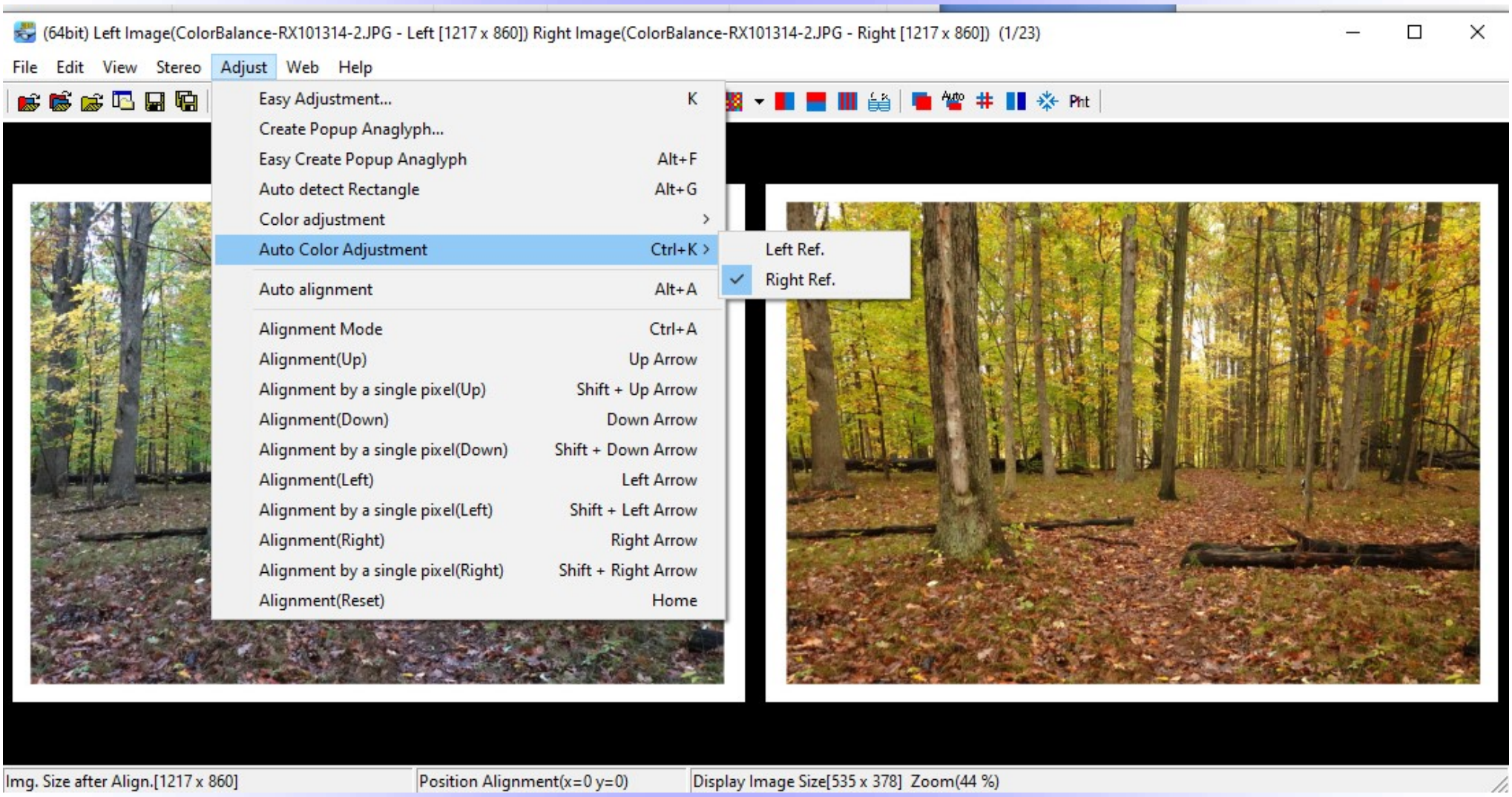


I adjusted the colors of the “bad” Falls picture with Photoshop Elements by sliding the color temperature a bit to the right (warm)



SPM Auto Color Adjustment

- There is often a small color/exposure difference between the R/L images of a 3D picture taken with twin cameras (my Fuji also shows a color difference). This can be corrected using the **SPM Auto Color Adjustment**
- Using this adjustment, I was able to match the color balance of the two images recorded with AWB and Cloudy camera settings.



Original pair, left camera AWB, right camera “Shade”

After SPM color correction (R used as reference)

Bracket White Balance?

- We are used to bracketing exposure in photography (also stereo base for 3D photography)
- Modern cameras (my Sony RX100 M6 fore example) allow you to bracket all kinds of things, like ISO, and white balance!
- The camera produces 3 pictures, one at your chosen white balance, one at higher temperature, one at lower
- Interesting twist: You only press the shutter once and the camera generates 3 versions of this one picture

This amplifies the point that white balance is not set when recording the picture, but when the JPEG file is created, either in the camera or later at home, if you are shooting RAW

Summary

- **Light** has **temperature**
- The eye **adapts** and cannot easily differentiate color temperatures, but the camera can record them **accurately**
- The camera needs to be told which color temperature is white, which is part of **setting the white balance**
- Most cameras (in non Auto mode) have presets (sunny, cloudy, etc.) and also an **Auto White Balance (AWB)** mode, which is the default setting.
- AWB works well in many situations, especially indoors and with mixed lights, but **fails to record pleasing warm colors** (Fall colors, sunset, etc.) In these situations it is better to use the Daylight or a similar preset.
- It is a good idea to get the color balance correct in JPEG images, but **color adjustment** is an option in **post processing**.