

## Explaining Spacetime Fabric for the Layman

*"A man's ethical behavior should be based effectually on sympathy, education, and social ties; no religious basis is necessary. Man would indeed be in a poor way if he had to be restrained by fear of punishment and hope of reward after death" - Albert Einstein ( 1879 - 1955 )*

*"My religion consists of a humble admiration of the illimitable superior spirit who reveals himself in the slight details we are able to perceive with our frail and feeble mind" - Albert Einstein ( 1879 - 1955 )*

### In The Case Where Gravity Is Taken Into Account

Any clock or watch is immediately and directly effected by the gravity field. If however there is no gravity, then no matter where a clock or watch is placed in space, the clock or watch runs at a constant speed. So if we have multiple watches or clocks placed here and there with different space coordinates, then all these watches or timepieces will run at the same pace, especially if they all are coordinated at the outset before being dispersed throughout a volume of space with different spacial coordinates such as x, y and z.

So, because gravity effects a clock or timepiece and because of varying intensities of a gravity field, different clocks dispersed throughout a varying gravity field will each run at a different rate of progression.

Therefore what is the *real time* in a gravity field? Well, it depends directly upon a clock's position in a gravity field.

Conclusion: time and position in the space of a gravity field are therefore intimately connected.

Hence, 'space - time' or simply 'spacetime'.

And never mind that thing 'bout the "fabric of spacetime". Saying 'fabric' is just a shorthand word for varying gravity conditions throughout different positions in space.

### Now Let's Take The Case Where There Is Absolutely No Gravity

And, in fact, the entire idea of gravity is totally omitted from any consideration. This is the situation in Special Relativity. Ok, so there's two parts to this:

- a). No velocity of the clocks / watches. They are simply stationary relative to each other. But for this "mind experiment", they are all set to the same exact time beginning from a same exact position. Ok? Ok!

Now let's move several of these watches / timepieces. Move them without acceleration ( if possible, ha! )!! Because acceleration and gravity are the same. Identical in the mathematical physics of relativity. So in our mind experiment for these several clocks, just disperse them with linear distances separating them. Like, for example, watch 1 on your wrist, timepiece 2 at 3 feet from you, clock 3 at 12 feet from you, watch 4 at 1000 feet from you. Oh, well, let's get wild: put clock #5 at a distance of 1 lightyear from your eyes.

Remember, each of these clocks were simultaneously coordinated at the moment just before they were separated from your eye's view.

One other condition is that there is no velocity(ies) of the clocks relative to your eye's view. The clocks are stationary relative to you and relative to each other. Period!!

Question: when now looking at the second, minute, hour, ( day, year? ), etc. hands of each of these clocks, including the one on your wrist, will they each run exactly at the same rate?

Answer: no.

Why?

Because of the constant speed ( not velocity! ) of light coming off the faces of each of these timepieces.

Actually a sphere of light coming off the faces of each of these timepieces.

That is, your wristwatch will be running faster than any of the other clock pieces. Especially compared to clock #5 at a distance of 1 light-year from your eyes. Because it takes "extra" time ( not to use a pun ... ha! ) for the distant light to reach your eyeballs.

Conclusion: time is therefore intimately associated with **position. IN SPACE!**

Hence, 'space - time' or simply 'spacetime'.

- b). But case a). above involved no relative velocity(ies) either between the clocks themselves or relative to your eye view.

Now let's make each of the clocks have velocity(ies) relative to each other but in particular relative to your eye's view. Ah, ha! Now we have both position in space and velocity!

So, of course, case **a**). applies insofar as differing positions in space will determine differing time - rates or progression of clocks.

But now the relative velocity(ies) must also be taken into account.

How?

By understanding "Doppler" or "Doppler Effect".

How so?

The best ( visual - hearing ) example for 'doppler' is an approaching train whistle. As the train approaches, the whistle pitch or frequency will increase, then noticeably decrease as the physical train departs your standing / stationary position in space. Remember, frequency ( of sound or light ) is a "time thing". No joke. That's why oscillating cesium atoms are among the best timepieces in the cosmos.

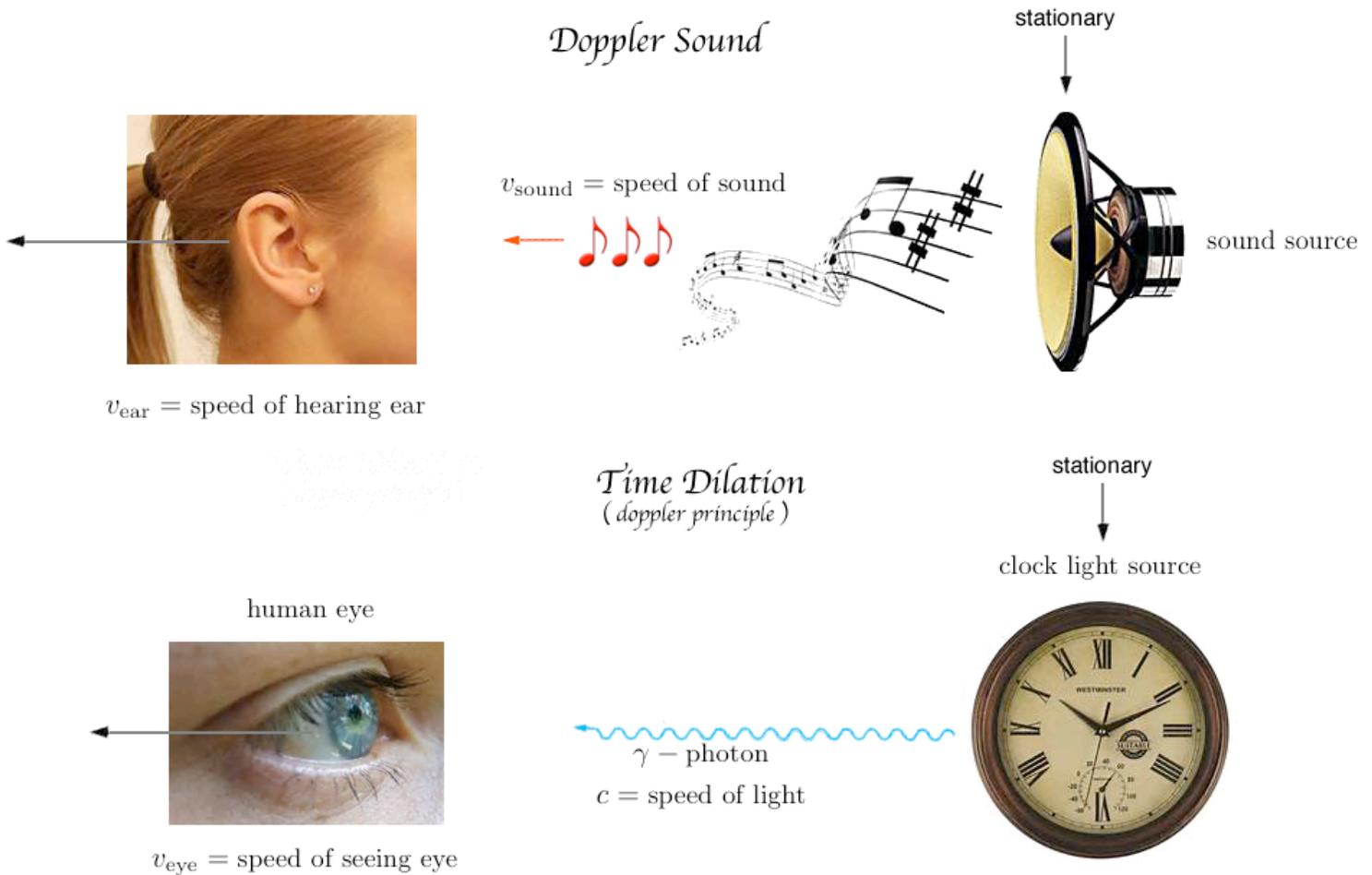
Oh, and different people in different positions in space along and to the side of the train tracks listening to the train's whistle will each hear a different frequency / pitch from the oncoming and departing whistle sound. Hence, according to differing "whistles" for different positions in space, different frequencies or "time beats" will be recorded.

Hence, 'space - time' or simply 'spacetime'.

But!

A much, much better visual explanation for the 'Doppler Effect' in Special Relativity ( no gravity! ) is given in Relativity Science Calculator at the following chapter: "Doppler - Sound and Time Dilation"

for which



The only actual "cloth" is the invisible veil of gravity and/or the *cloth of position in space* in the case of Special ( no gravity! ) Relativity.

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So, spacetime in General Relativity is conceptually easier to understand.

But spacetime in Special Relativity ( absolutely no gravity! ) is a bit more difficult to understand.

And forget 'bout 'fabric of spacetime'. It's just a crutch in understanding. There is no such actual cloth or fabric thing! Ha!

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Finally a practical example in the use of both Special and General Relativity is GPS satellite location for ground position. However a bit too hard to explain right now in words.

Have a nice Spacetime Fabric Day!

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