istic mechanism. It illustrates beautifully the dependence of space on time in our estimations of visual, tactile, kinesthetic and auditory space. In order to produce the *Tau* effect we may say, in general, vary the time interval in the opposite direction to the space interval and the latter will be distorted accordingly. So easy is it to demonstrate the *Tau* effect that it can be used as a parlor trick or game.

It may be thought that we are here dealing with a lightly dispelled illusion or error in judgment in which the subject unwittingly is judging the time intervals instead of the spatial distance between the spots touched. Nothing could be farther from the truth, for even when the subject knows what the effect consists in and is due to, if we vary our conditions by reversing the spatio-temporal relations, the subject will be wholly lost as to whether or not the spatial intervals are really equal or different and in what sense they differ. We have here, I believe, a *bona fide* example of the interdependence of time and space. They are so intimately related psychologically, as well as physically, that by varying them in opposite sense it is possible to demonstrate directly to an observer the distortions in space which relativists have told us about. It is interesting to note that whereas it is doubtful if the physicist can ever hope to do more than make relativity an intelligible abstraction to the layman, the psychologist by this simple experiment can directly demonstrate what the interdependence of time and space means in direct experience.

Several factors influencing the *Tau* effect which should be noted if one is to get it at its best are the following: (1) care should be taken to touch all the spots equally so that no one stands out more than another; (2) the greater (or less) the spatial distance between the second and third stimuli as compared with the first and second, the less (or greater) must the time interval be between the latter as compared with the former, if the effect is to appear; (3) the optimal effect is limited by the actual spatio-temporal intervals used: we have found that distances as great as 80 mm on the back of the arm and times as long as 1 second may be used. There is practically no lower time limit, although the second temporal interval should not bear a greater ratio to the first than 3 or 4 to 1.

A fuller, quantitative account will appear in one of the psychological journals.

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ON THE AGE OF THE NEW ALBANY SHALE

IN an interesting article on "Petrified Wood in the New Albany Shale," published in SCIENCE for December 13, 1929, Chester A. Arnold described an occurrence of fossil wood in the upper part of the New Albany shale in Scott County, Indiana, which he referred to the genus Callixylon. The concluding paragraph of his contribution is as follows:

> Although the wood is widely scattered, it appears to occur mostly near the top of the New Albany formation. While formerly considered as belonging to the upper Devonian and of the same age as the Genesee shale of New York, the New Albany shale is now viewed by some competent authorities as being, at least in part, of lower Mississippian age. This would place the Indiana wood in the Mississippian, and thus extend the range of Callixylon from the Devonian up into the Carboniferous. However, there is no record of its occurrence any higher than this basal member.

It seems to the present writer that Mr. Arnold is not justified in his conclusion quoted above. The New Albany shale as it occurs in the type locality in the vicinity of New Albany, Indiana, is a definite formation. Other black shales present in eastern Ohio, Kentucky and Tennessee, east of the Cincinnati anticline, were until a few years ago thought to be the equivalent of the New Albany shale at New Albany, Indiana. In recent years a part of the black shale in eastern Ohio, Kentucky and Tennessee has been shown to be of early Mississippian age. However, this does not prove that any part of the New Albany shale at New Albany, Indiana, is younger than the Upper Devonian, but rather that such part of the black shale of eastern Ohio and Kentucky as is now known to be of early Mississippian age is younger than any part of the typical New Albany shale at New Albany, Indiana. So far as known to the present writer, no one has ever shown that any part of the New Albany shale, as it is developed in the type locality near New Albany or farther north in Indiana or south in Kentucky, west of the Cincinnati anticline, is younger than upper Devonian age. Therefore, it seems that the more logical conclusion to be drawn from the occurrence of Callixylon in the upper part of the New Albany shale in Scott County, Indiana, would be that this shale is of upper Devonian age, because the genus of fossil wood that occurs in it has never been found in strata younger than the Devonian.

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FIREFLIES FLASHING IN UNISON

SEVERAL times in recent years correspondents of SCIENCE have directed attention to the synchronous flashing of a swarm of fireflies or other insects, as at page 132 in the issue for January 31, 1930.

A theory to explain this behavior of the insects is as follows. Doubtless each individual insect has a normal tendency to flash at approximately equal intervals, these intervals being nearly the same for many different individuals of the swarm. Suppose that in each insect there is an equipment that functions thus: when the normal time to flash is nearly attained, incident light on the insect hastens the occurrence of the event. In other words, if one of the insects is almost ready to flash and sees other insects flash, then it flashes sooner than otherwise. On the foregoing hypothesis, it follows that there may be a tendency for the insects to fall in step and flash synchronously.

Everybody knows the flashing electric glow lamps for advertising and for warning signals. Some of these of longer period (five or ten seconds) have apparatus in which a condition (like the heat expansion of a core by an electric heating coil) builds up with time until it causes a flash which wipes out that condition, which then begins and builds up anew, and so on. Let us have a number of such lamps on a bench with their periods nearly, but not exactly, the same. Suppose that with each lamp there is a respective photoelectric cell connected to intensify the said condition (as by increasing the electric current in the heating coil) when light falls on the cell. First, screen the lamps from each other; there will be no sustained synchronism. Next, remove the screen; with suitable adjustment of the apparatus, the lamps will fall in step and flash in synchronism.

Consider two flashing lamps (or insects) A and B of periods slightly different, A having the shorter period. Eventually there will come a time when B's normal flash will be promptly after A's flash. Thereafter, were it not for the photoelectric cell (or in the case of the insect, the special equipment assumed by the present theory), B would flash later and later compared with A. But because of the cell (or equipment), B is accelerated each time enough to keep it in step with A. Further development of the principle here involved could be reached by extending the discussion to cases of three or more units.

An individual flashing firefly should be confined and its approximate period ascertained by observation, then a light should be flashed in its presence at a period slightly less; would the firefly fall into step? Various intensities and kinds of light should be tried.

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PRESSURE IN A FLUID

W. H. PIELEMEIER proposes in the issue of SCIENCE for April 25 that the concept of pressure potential be introduced, in the treatment of hydrodynamics. It seems to me that he has misconceived the nature of pressure. He states that according to the defining equation, $p = F \div A$, pressure is a vector quantity. This is not the case. In the equation F is a vector normal to the surface, and A is a vector in the same direction. The quotient is a scalar quantity. p is therefore a scalar. Inasmuch as we have already the potential function represented by the product of pressure and the specific volume of the fluid, it seems unnecessary to introduce another potential function so closely related to the one already in use.

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LAWS OF ORBITAL MOTION

RECENT correspondence has directed my attention to a law of planetary distances given in SCIENCE for April 5, 1929, by Professor Caswell, who states that so far as he is aware the relation has not hitherto been reported.

As a matter of fact, the law was enunciated by me ten years ago, in *The Observatory*, No. 545, November, 1919, and was shown to apply not only to the Sun and planets but also to systems of satellites.

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SPECIAL CORRESPONDENCE

BARRO COLORADO ISLAND BIOLOGICAL STATION

DR. THOMAS BARBOUR, chairman of the executive committee of the Barro Colorado Island Biological Station in the Panama Canal Zone, has submitted to the division of biology and agriculture of the National Research Council the sixth annual report of the station, covering the period from March 1, 1928, to February 28, 1929.

Dr. Barbour reports that the following institutions have continued their annual $300 table subscriptions: American Museum of Natural History, Harvard University, Missouri Botanical Garden, Smithsonian Institution, Johns Hopkins University and the University of Michigan. He is also glad to be able to announce that the Carnegie Institution and the Field Museum of Natural History have joined the institutions that help support the station through table subscriptions. There should be more.

The total expenses for the year were $6,052.80, and the total income received was $6,489.45. This total was made up by table subscriptions, personal donations (among which Dr. Barbour's account for two