

# FEEDBACK

## Relativity

In the October issue of *E&WW*, Alan Watson of Mallorca challenges sceptics to provide physical evidence against the second postulate on which Albert Einstein based his relativity doctrine. Perhaps I can help.

The postulate was presented in the second paragraph of Einstein's famous 1905 paper in which he introduced his Special Relativity. He wrote in German. Translated into English, the postulate reads<sup>1</sup>:

"...light is always propagated in empty space with a definite velocity  $c$  which is independent of the state of motion of the emitting body."

Statements about motion and velocity are meaningless unless they specify (or unambiguously imply) a frame of reference. In later years, Einstein and his followers interpreted the postulate to mean: The velocity of light measures as  $c$  under all conditions.

Consider the radar equipment used by traffic police to catch people driving their automobiles too fast. Typical is the case in which a police vehicle sits at the side of a highway, aiming a radar beam at approaching traffic.

One person is driving toward the police vehicle at a speed (a velocity) of 100 km/h (relative to the road surface) in violation of the law. The radar beam bounces off the offending vehicle, bounces back to the police vehicle, and records the illegal land speed in the police radar equipment. The police officer signs a citation, and the offender pays a fine.

How does the radar work? The radar beam emitted by the police vehicle travels at  $c$  (nearly 300,000 km/s) relative to its source. It is reflected back to the waiting police vehicle. How fast does the reflected beam travel? At  $c$ , relative to the vehicle from which it is reflected.

So far, Einsteinians and anti-Einsteinians agree. But then we ask the critical question: What is the velocity of the incoming reflected beam relative to the police vehicle? It is only  $c$ , the Einsteinians reply. But the anti-Einsteinians say no, insisting that the returning beam comes in at a velocity of  $c+100\text{km/}$

$h=c+0.02777\dots\text{km/s}$ .

The radar equipment in the police vehicle shows the Doppler effect, a slight shift in the frequency of the incoming beam, and calculates the oncoming vehicle's illegal land speed of 100 km/h, which is equal to 0.02777...km/s. If the incoming beam's velocity were only  $c$  (as Einsteinians contend), there would be no shift in frequency. But there is a shift, and Einstein was mistaken.

Now a bit of direct evidence.

*Scientific American*, in its issue of November 1961, published an article describing the two-mile linear accelerator to be built at Stanford University in California (it was built a few years later, and has been in operation for many years). On page 50, the article said the velocity of particles would be 0.9999999997 $c$  relative to the accelerator. Then, a few words later, on the same page, came this:

"...the accelerating (electromagnetic) field must travel at a velocity close to that of the particles. Some slippage between the two is allowable, so long as the particles stay near the wave crests (the points of maximum accelerating force). To bring the wave velocity close enough to that of the particles, the inside of the pipe is designed with a series of ridges. These have the effect of slowing the electromagnetic waves travelling through the pipe. If the pipe were perfectly smooth, the waves would travel faster than  $c$  and would be unable to transfer energy to the particles... A proper choice of the dimensions of the ridged structure slows the wave to the desired velocity."

### Reference

1. A Einstein, "On the Electrodynamics of Moving Bodies," in *The Principle of Relativity*, translators (1923) W. Perrett, G.B. Jeffery (Dover, New York, 1952), p.38. (Also, General Publishing, Toronto, and Constable & Co., London.)  
Lee Coe, Berkeley, California.

I was very interested in H. Aspden's letter concerning relatively and the Sagnac effect.

STC in London are developing a optical-fibre gyroscope which depends upon this effect for its operation. However, what is detected is a rotation of an optical-fibre coil, not linear motion, thus the general theory and not the special theory is involved. In E.W. Silvertooth's experiment as described, surely what is being detected is a rotational effect as the earth rotates around the sun. D. Marquis, Westerham Hill, Kent.

As every schoolboy surely has been taught, it is perfectly possible to "prove" (mathematically, of course) that  $2=1$ . Permit a reminder:

Let  $a=b$  and multiply both sides by  $a$ , so  $a^2=ab$ .

Subtract  $b^2$  from both sides—  
 $a^2-b^2=ab-b^2$

Factorize  
 $(a+b)(a-b)=b(a-b)$

Cancel  
 $(a+b)=b$   
But  $a=b$   
Therefore  $2b=b$   
 $2=1$

It is quite like removing every vestige of energy from a system so that a transform may work in the static state of mathematics, simultaneity having broken down, so that the assumption may be made that the speed of light is infinite to correct the situation, so that the interval in space-time between two events on the world line of a photon may be made zero, in order that the said transform may work as intended! Of course, it is just another Ezekiel's wheel revolving round an axle of presumption.

One is then left with the infinite speed of light when the system is devoid of energy: very neat! This is further explained by the strange statement that mass and energy are the same thing, whence energy must have inertial mass because it is non-existent.

Unfortunately for the mathematicians, both these are interrupted by catastrophe which makes both the numbers and their symbols totally valueless.

What this demonstrates is the lack of value of mathematics unless they are fully backed by an active dynamic logic which may

be expressed in words: that is to say, the mathematics must be done without first freezing the system solid by removing every vestige of energy, and existing thought is sheer poppycock. Sorry Mr Coleman, but at least Mr Snoswell should be pleased, along with Mr Aspden and Mr Abdullahi when they get down to it, all in November Feedback.

Incidentally, Mr Editor, and presumably for the benefit of your (what used to be called) "comps", the word is "couch" as recorded in the Book of Job: to "couch" implies servility but "couch" implies a sleepy state of static boredom!

James A. MacHarg,  
Wooler,  
Northumberland.

I was interested in the comment in the letter from M.D. Abdullahi of Zaria, Nigeria in your issue of November, where he obtained the energy of a charge as  $(mc^2/2)$ , rather than  $mc^2$ .

$mc^2/2$  is the finite limiting value of the translational kinetic energy of the electron, and we can obtain this as equal in magnitude to the finite limiting value of the spin angular kinetic energy of the electron as the translational velocity approaches zero, which is the rest energy.

As the translational velocity of the electron approaches its finite limiting value, the fluctuations in the magnitude of the spin angular velocity increase indefinitely, and the electron liberates an infinite sequence of photons of indefinitely increasing energy. Thus the electron can take as much energy from the accelerating field as the field can give it; and most of this energy is radiated as an infinite sequence of photons of indefinitely increasing energy.

During the fluctuations in the spin angular velocity of the electron, the resultant angular momentum is conserved by fluctuations in the lateral component of the translational velocity of the centre of mass, this representing the commutation relations of translational and angular velocity of quantum mechanics. At the minima of the total kinetic energy as the translational velocity approaches its finite limiting value, the magnitude of the spin angular velocity

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low thermal resistance of typical audio output transistors. Such transistors must have a metal tab to screw to a heat sink, constant  $H_{fe}$  over a wide current range (e.g.  $10\mu A$  to  $100mA$ ), Minimum  $H_{fe}$  guaranteed not less than 50 or 100 over this current range,  $V_{be}$  close to  $600mV$  at  $1mA$  collector current and a thermal resistance from junction to case of  $3$  to  $5^{\circ}C/watt$ . Such transistors would need to be available in n-p-n and p-n-p configurations, with dual matched pairs available and high-voltage versions also available with some relaxation of the above specs.

If Mr Pritchard can help, I would be delighted to hear from him.

Graham Nalty  
Audiokits  
Borrowash  
Derby

## Relativity

I have always found the experience of reading James MacHarg's letters rather like reading a novel by James Joyce, and the feeling was intensified when I saw his letter in the January issue. The letter includes a 'mathematical proof' that 2 equals 1. If every schoolboy had been taught that dividing both sides of an equation by a factor whose value is zero is a legitimate mathematical operation British technology would be in a poor way. In Victorian times continental mathematicians accused their English colleagues of lack of rigour and of excessive formalism. It seems old habits die hard.

Lee Coe in a letter in the same issue used the phrase 'wave velocity' for what is evidently the phase velocity for the wave pattern within a pulse travelling down a wave guide. Information is propagated, not at the phase velocity, but at the group velocity, so that Special Relativity does allow phase velocities in excess of the velocity of light. For a normal waveguide the product of the phase and group velocities is  $c^2$ . It is easier to avoid exciting unwanted modes at drive frequencies near cut-off, but at those frequencies the group velocity falls well below the velocity of light and the phase velocity therefore rises well above it. Loading the guide in the way described in the *Scientific Amer-*

*ican* article reduces the product of the phase and group velocities. The guide can then be driven at near its cut-off frequency to minimise the rise of mixed-mode excitation, yet will still allow a pulse to propagate for which the phase velocity is less than the velocity of light, so that it is suitable for accelerating elec-

trons. Thus the design of the Stanford Electron Linac does not provide evidence against Special Relativity. How could it, seeing that the Lorentz Transformations were first introduced as transformations which when made left the form of Maxwell's equations unaltered?

Alex Jones' letter in the Janu-

## Mathematics

In the January 1987 issue of *E&WW*, Mr James MacHarg of Northumberland has tried to demonstrate "the lack of value of mathematics, unless backed by an active dynamic logic which may be expressed in words" In this he has totally failed.

By its very nature, as any mathematician will tell you, the science of mathematics is an active dynamic logic and may be expressed in plain English if so required.

I hope not all schoolboys have been shown his 'proof' that  $2 = 1$ , for in his attempt to create a mathematical catastrophe, he has made a number of fundamental errors, as I will now show.

MacHarg	Remarks
Let $a = b$	
Multiply both sides by $a$	
$a^2 = ab$	
Subtract $b^2$ from both sides	As $a = b$ , so $a^2 = b^2$ , therefore
$a^2 - b^2 = ab - b^2$	$a^2 - b^2 = 0$
	and
	$(ab) - b^2 = b^2 - b^2 = 0$
	very neat, we have just proved that zero equals zero.
Let us continue	
Factorize	
$(a + b)(a - b) = b(a - b)$	
Cancel	
$\frac{(a + b)(a - b)}{(a - b)} = \frac{b(a - b)}{(a - b)}$	Dividing by $(a - b)$
	At the beginning, we set $a = b$ i.e. $(a - b) = 0$
	Dividing by zero is an invalid operation as it is not defined.
	So, this reduces to
	$\frac{(a + b) \times 0}{0} = \frac{b \times 0}{0}$
	What is zero divided by zero?
	It certainly isn't unity as Mr MacHarg is suggesting.
$(a + b) = b$	Perfectly OK so long as
but $a = b$	$a = 0$ , but as $a = b$ (our definition) $b$ must also be zero.
$2b = b$	Correct if $b = 0$
$2 = 1$	Nonsense.

I'm sorry, Mr MacHarg, but one should be sure of one's methods before attempting to discredit anything, especially by reductio ad absurdum.

John R. Ridley

Ruwi

Sultanate of Oman

ary issue includes a photograph of an interesting demonstration devised by the arch-engineer, inventor, and showman Professor Eric Laithwaite. However, the account he gives is wrong. The downward force on the finger is almost exactly 24 pounds, as anyone can verify who cares to weigh a toy gyroscope and its tower first stationary, and secondly after the gyroscope has been brought up to speed, and then set with its axis horizontal and supported at one end on the top of the tower. There is nothing out of the way about supporting a 24 pound weight from a little finger if it is suspended directly below; what is surprising is that with the weight over a foot off to one side the finger isn't twisted out of its socket. In fact the twist exerted is almost nil.

I have seen Professor Laithwaite's demonstration, which makes it quite obvious that most of us have very little feeling for the behaviour of gyroscopes, even if we are aware that the equations governing the motion of a rigid body include some which describe the effects of torques on angular momentum as well as those which describe the effects of resolved forces on linear momentum. On that occasion members of the audience were invited to try their hand. A secretary who did what she was told to do coped with the massive rotor very well, but a senior physicist who 'knew' he would have to exert a substantial torque on the end of the shaft to prevent the rotor from swinging downwards lost control in a fraction of a second!

The rotor demonstrations themselves have no relevance to Special Relativity, but a rotor does have one very important characteristic. While rotating at constant speed it experiences strong internal stresses, which if it is rotating fast enough can cause it to fly to bits. The existence of these stresses must therefore be recognised in every inertial frame, i.e. rotational motion is not relative, but absolute. It may be more than a coincidence that the experiments by Aspect which violate the Bell inequality (derived from Special Relativity) involve the observation of quantised rotations.

C.F. Coleman  
Grove  
Oxfordshire

# FEEDBACK

## Roberts Radio

We are currently considering publishing the history of our company, Roberts Radio Company Limited.

The company was formed in 1932 at 7 Hills Place, London W1 and shortly after moved to 41 Rathbone Place, London W1, prior to moving to Molesey in 1940. We would be pleased to hear from any of your readers who may have historical information of any kind on Roberts Radio. We are particularly interested in any photographs, product information and former employees who may have memories of the early days.

I would be most grateful if anyone who has any such information or material available would contact me at the address below.

R. Roberts  
Managing Director  
Roberts Radio Company Ltd  
Molesey Avenue  
West Molesey, Surrey KT8 0RL  
Telephone: 01-979 7474

## Where does the bus stop?

There's plenty of information on terminating unidirectional digital buses but I cannot find anything on terminating or loading bidirectional buses.

It probably doesn't make any difference whether the load is placed on the middle of the bus or shared at each end but is there an argument for placing the loading at the most important receiving end? Any advice on this matter would be greatly appreciated.

L.J. Silver  
Belmont  
Surrey

## S5/8

I would like to thank Mr Hardie for his suggestion and invitation (March).

On his suggestion, I telephoned the sales department of Amstrad, and enquired as to what serial interface was used with their latest computer. The predictable answer was: RS232. Had they considered using S5/8? The salesperson had not heard of it. Amstrad declined to comment

on their marketing policy, so I was unable to get the "forthright answer" referred to by Mr Hardie, but from the appearance of the product, I would suggest that Amstrad manufacture up to a standard, rather than down to a price.

I think that this illustrates one point that I made earlier, namely that there is little point in proposing this standard in isolation from the rest of the world. We can argue the technical niceties *ad nauseam*, but the real problem with British Standards lies not with technical matters, but with politics. Surely a system can be devised where a much wider canvassing of users is undertaken, to find out (a) if a new standard is required at all, and (b) what features it should employ well *before* any technical work is begun. Such users should include major importers of affected equipment.

Until such a radical change is introduced, I must regretfully decline Mr Hardie's kind invitation to participate.

Les Hayward  
Eastpoint Ltd  
Corfe Castle  
Dorset

Andrew Hardie is incorrect when he says in his letter (March 87) that the pull-up resistor at the end of a cable driven by an open-collector driver is not a proper terminator. In fact it is, because the wave is only travelling in one direction, towards the pull-up. The driven end is, however, not properly terminated, but this only matters if there is a reflection from the other end of the cable, which there won't be because it is properly terminated.

In the case of a floppy disc drive the termination may not be perfect because the impedance of the interface ribbon cable is usually fairly arbitrary, and as Mr Hardie says, various pull-up values are used in the drives.

Alun Morris  
Cambridge

## Planck

Ove Tedenstig (Feedback, February 1987) represents the equation

$$h = 2\pi m_e r_e c (a-1)$$

as demonstrating a "deep relation" between  $h$  and  $\alpha$ .

Not so, I fear.

$$E = h\nu_e = \frac{hc}{\lambda_e} = m_e c^2$$

where  $\lambda_e$  = equivalent wavelength of electron and  $\nu_e$  = equivalent frequency of electron

$$\therefore m_e = \frac{hc}{c^2 \lambda_e} = \frac{h}{c \lambda_e}$$

Substituting in Tedenstig's equation

$$h = \frac{2\pi \hbar r_e (a-1)}{\lambda_e}$$

— in other words,  $h$  has been craftily hidden in the r.h.s. For  $h$  may be substituted, with equal validity, the price of kippers or the mass of a distant galaxy.

Removing  $h$

$$\frac{2\pi r_e (a-1)}{\lambda_e} = 1$$

an expression relating the circumference of a resting electron to its equivalent wavelength.

T.H. Brindlea  
Isle of Luing  
Oban, Argyll

## Mathematics

I was delighted to read Messrs Coleman and Ridley's (March) confirmation that if one removes every vestige of energy from a system (a catastrophic procedure) one ends up with nothing (0) which is what the "proof" is all about and lay behind what I said. I did use inverted commas round the word.

The stage  $(a + b) = b$  is an entirely fresh start following the nothing (0) which is left after several catastrophes, this being the essential part of *my* logic, missed by Mr Ridley, hence his long rigmarole. No proof can have a fresh start in the middle of it — it becomes a presumptive statement as I said.

I suggest, Mr Ridley, that one should be sure of the logic before attempting to discredit anything. That is in line with my second point, and I return your compliment in thanking you for demonstrating it so clearly.

Mathematicians may claim that maths are a dynamic logic, but in the final analysis maths are no more than a universal analogy to the physical systems

from or into which they may be translated. No driving energy, dead system. No constitutional energy, no system at all. Thus maths are not a dynamic logic, and must be supported by one, as I said.

As a schoolboy, I was also taught the fallacy of the so-called "proof", and thus the fallacies which *can* lie behind mathematics: I would expect the process to be normal — it should be, to keep maths pushers under control.

Thank you, gentlemen. I now suggest that you both look more carefully into the logic of removing energy, more especially in the Einsteinian context as outlined in my letter, because that is the precise procedure which modern science has followed, leading to the claimed warping of space and time, which is a technological impossibility even for Brits, however clever they may think they are.

James A. MacHarg  
Wooler  
Northumberland

Notwithstanding Mr Ridley's comments in the March issue of *E&W*, perhaps Mr MacHarg needed only to select a different approach in order to demonstrate "the lack of value of mathematics..." (January 1987 issue).

If one takes, as first axiom, that mathematics is a form of communication and, as second, that all communications can be represented as Markov processes, then the subject becomes entirely out of probability. This is also to say that the "active dynamic logic" of which he speaks is entirely that of words. Such an approach should appeal to specialists in the field of communications since an adequate definition of probability is "average frequency of occurrence". In other words, all mathematics is expressible as average frequencies. But what of the associated arithmetic?

Conventionally, number theory is based on sets of objects and Peano's postulates. However, if one takes a single bacterial cell (representing a primitive object), places it in nutrient medium on a microscope slide, and keeps it under observation for twenty minutes or so, then it will normally *divide*. Clearly, this violates Peano's first postulate

that "one is a positive integer". With the right conditions, the cells will continue to divide. This violates the postulate that "no positive integer has one as its successor". Only replication, not multiplication or addition, is found in nature. Why, then do we humans make computers in which  $1 + 1 = 0$ , carry 1? Can we really expect to understand the physical universe on this basis?

B.E.P. Clement  
Crickhowell  
Powys

## Wide-area binary paging

Mr Kirby's article gave a very interesting introduction to practical wide-area radiopaging. Some amplification of his comparison of the two codes (POCSAG and Golay) might be helpful.

Firstly, there is a body called the Consultative Committee for International Radio (CCIR) appointed by the United Nations to create world-wide standards in radio matters. The experts of CCIR, drawn from all over the world, considered various radiopaging codes (including POCSAG, Golay and NEC). In 1982 they adopted the POCSAG code as their first world standard paging code. The POCSAG code has been renamed the "CCIR Radio-Paging Code No.1" (here called RPC1). The Post Office Code Standardisation Advisory Group (POCSAG) which developed the code is discontinued and any future development of RPC1 will be within the CCIR. In 1986 Golay was proposed as a second standard but not adopted.

In the CCIR studies it was noted that initially, by using conventional "hard-decision" decoding, RPC1 pagers offered 2-bit error correction in the address codeword and 1-bit correction in message codewords. However, it was also noted that the code could be used with a variety of error correction algorithms, e.g. by using "soft-decision" decoding up to 5 random errors or a single error burst up to 11 bits long can be corrected in any (address or message) codeword. At 512 bit/s the potential maximum signal drop-out tolerance of RPC1 thus is 21 ms (compare Kirby, Table 2).

Clearly the potential of RPC1 was under-utilized, largely because of lack of available low-voltage, miniature processing power.

An important point is that RPC1 pagers are made by a growing number of competing manufacturers. Consequently there is considerable drive to achieve a competitive edge by employing more of the potential of the code. Already RPC1 pagers using hard-decision decoding have advanced beyond the initial error correction algorithms and performance mentioned in Mr. Kirby's article. Improvements in low-power processing technology will allow this advancement to continue rapidly towards the full potential of the code. Whilst the other codes studied by CCIR also possess potential greater than their current implementation, they are proprietary and so lack the multiplicity of competitive developments which are being applied to RPC1.

This point illustrates a major advantage of a standard over a proprietary code. New standard-code pagers, from whatever source, can be deployed immediately alongside existing standard pagers. Users can always be given access to the very latest technology, and have a variety of styles and prices of pager to select from.

RPC1 (or POCSAG) was designed to be very flexible and work alongside other code formats. British Telecoms Radiopaging used three codes, including RPC1 and Golay, for several years on its channels. BT now are turning over completely to RPC1 because of its many advantages. Regarding voice on the same channel, RPC1 certainly could be used since each batch lasts 1.06 second at 512 bit/s (or 453 ms at 1200 bit/s), which is a negligible delay for voice. However, there is little call now for speech paging because of the much greater air-time efficiency of digital message paging compared to speech. Additionally digital message paging is not affected by poor quality speech or loud noises, does not demand immediate attention and each message can be read many times, and is discreet.

Another advantage of RPC1 is that for alpha-numeric messages the 7-bit alphabet used is the international standard CCITT No.5 (also known as ASCII or ISO

7-bit). RPC1 alpha-message paging offers the potential of being connected directly to any briefcase or other processor since all such machines inherently cater for this alphabet. In contrast, the Golay code uses a special 6-bit limited-facility alphabet, not inherent in any common processor.

### References

CCIR Recommendation 584, titled "Standard Codes and Formats for International Radio Paging"

"The Book of the CCIR Radiopaging Code No.1" available from Multitone Communications Systems Ltd. and some other radiopager manufacturers, or BT Radiopaging.

R.H. Tridgell

Formerly chairman of POCSAG and BT delegate to CCIR  
Welwyn Garden City  
Hertfordshire

## Magnetism

I am fascinated by P.J. Ratcliffe's experiments with high-flux pulsed magnetic fields (Feb.1987). He says his stream of projectiles simulate "magneto-hydrostatic phenomena". Surely the phenomena are magnetohydrodynamic effects caused by the motion of flux of a fluid medium, an ether wind or current.

I am even more fascinated by Lee Coe's letter (Jan. 1987). If the relative velocity of an electromagnetic wave in the linear accelerator is increased by a magnetic flux flowing in the same direction as the wave, a reversal of the direction of flow of the magnetic flux would surely cause an equivalent reduction of the wave's velocity relative to the accelerator. This would seem to indicate that the magnetic flux is a flow of the wave's medium, a Newtonian ether wind.

It is possible to make a simple mechanical model to simulate the Newtonian actions and reactions of two magnets or Ampèrian magnetic shells by suspending two electric fans facing each other. When the two atmospheric winds flow through both fans in the same direction, the two fans attract each other at a distance. When one fan is turned through 180 degrees so that the two winds flow in opposite directions, the fans repel each other at a distance. These actions are

effects caused by pressures due to fluxes of the surrounding fluid medium moving at a finite velocity, not by two central forces attracting or repelling each other instantaneously at a distance.

A tissue paper streamer glued to the end of a plastic knitting needle simulates a magnetic needle, and traces the direction and strength of the lines of atmospheric flux or Faraday's lines of magnetic force in the vicinity of the simulated magnets. Each simulated line of magnetic force is, as Faraday insisted in para. 3117 of his *Experimental Researches* "... a closed circuit, passing in some part of its course through the magnet...". Faraday's first explicit rejection of magnetic poles as centres of instantaneous attraction or repulsion at a distance, and the source of Maxwell's equation of magnetic continuity,  $\text{div } B = 0$ . In Maxwell's Newtonian mathematical model of an electromagnetic medium in space,  $B$  is an element of the medium's magnetic flux or ether wind flowing in closed circuits at a finite velocity.

In Lorentz's non-Newtonian mathematical model of the electron, two stationary electrons mutually repel each other with a Coulomb force acting instantaneously at a distance, and when set in motion begin to mutually attract each other with an Ampère force which depends on their absolute velocity, an action strictly forbidden by the law of the conservation of energy. The energy of any system of central forces depends only on their relative position.

The mutual effect of the central forces acting between two fans, or the Sun and the Earth, is caused by an action which depends on their relative position, not on their velocity. In other words, on their mutual potential energy, or atmospheric or gravitational pressure, never on their kinetic energy. Maxwell's quantity  $M$  is the mutual potential energy of two circuits, a system of central forces, and depends only on the relative position of the central forces. In Lorentz's model,  $M$ , if it exists at all, depends on the absolute velocities of the electron's central forces.

M.G. Wellard  
Kenley  
Surrey