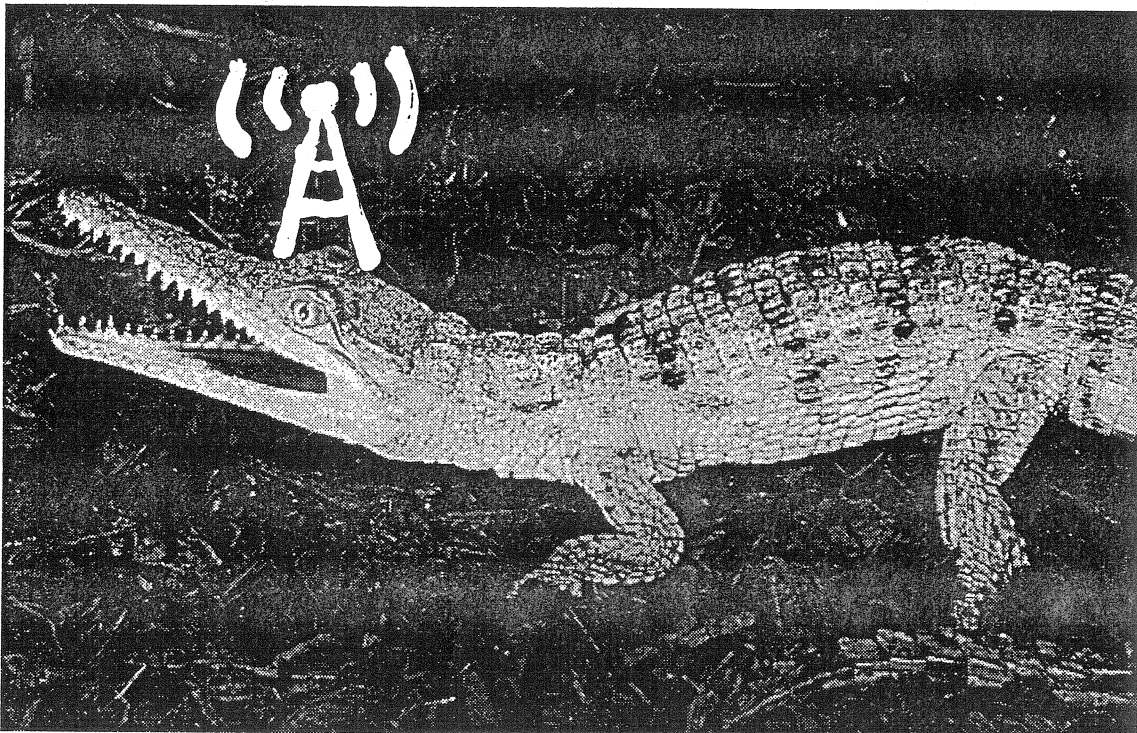


Jeremy

Journal of Physoc,
the Sydney University Physics Society.
Volume 16, Number 2, May 2000.



Editors: Chris Barton, Edward Boyce, Amy Dickings and Kiran Krishna.

Quotes

The same thing was done in Scotland, but you never read about it. Which just goes to show that the textbooks are written in America.

Have you ever seen a billiard ball diffract? Or is that your excuse for why it didn't go down the hole?

Of course, you never encounter these things in the real world, but, what the hell, this is physics.

This is *angstrom*². You can convert this to Christian units if you want. This is why the Americans lose spacecraft going to Mars.

0.963×10^{-37} . Which is stuff all squared, frankly.

Everything we've done is totally unphysical.

Just because you've never been that cold, doesn't mean that I've never been that cold.

Someone worked out that you can spell a message with electrons in an atom. That'll teach you not to listen to people saying that quantum physics isn't practical.

Undergraduates don't generally get a Nobel Prize. You generally find a staff member steals it from them.

Frankly, I don't have time to do four assignments. Nor do you, obviously.

John O'Byrne

This classroom can be modelled as a shoebox with infinite walls.

Martijn de Sterke

Well you're science students, so obviously I'd like you to think about it.

Charlie Macaskill

Now that I've [got the Jordan form] I can understand everything.

Steve Lack

I think the problem is that when students go into the exam they switch their brains off instead of instead of their mobile phones.

Alan Fekete

This is what [the halo] actually looks like... (puts up 4 graphs)

Ken Freedman

I see the integral sign as this big long S - it's the serpent of doom.

Tom Mauch

He saw the light, and then he turned it off.

Peter Fletcher

That's zero and zero, which is one.

Jonathan Dixon

Which whole part of it?

Kiran Krishna

There's no way 0 can be less than 1.

Amy Dickings

If you can't write something good, at least make it rhyme.

Jocelynce Laurence

If your lecturer (or anyone else) comes up with a great quote, we'd like to know. Just email it to physoc@physics.usyd.edu.au, or drop it in the Physoc Contributions Box in the undergraduate office. Include your name and contact details if you'd like to be eligible for the prize for best quote of the year.

Vogon Poetry

Untitled

The blob ensconced in swirls of blue
Ah blob, thou blob amorphous
Your symmetry was not quite true
No other blob is quite like you.

Anon. + friend

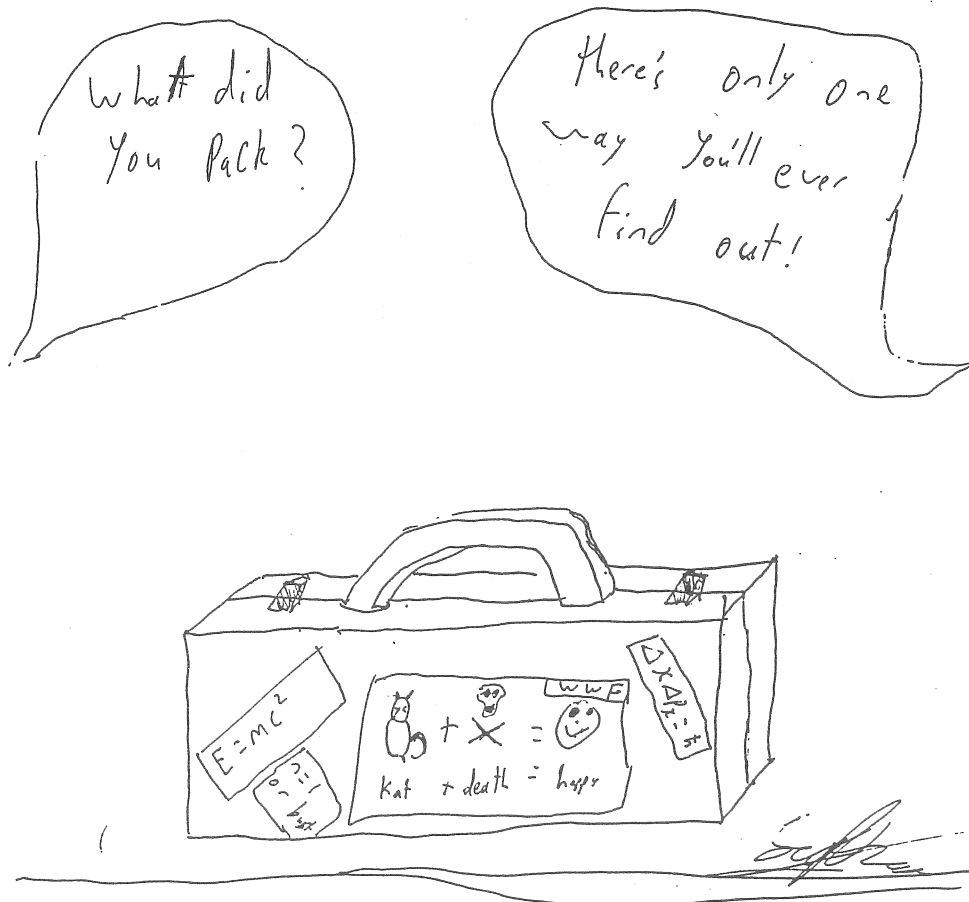
Elegy Written in an astronomy colloquium

Thoughts wandered lonely as a star
while watching that rotating bar
that showed how NGC 2915
could to tranquil sleep professors drive
Minds normally pulsating
a fruitful orgy of thoughts enticing
have now grown slow in languid slumber
on benches of awkward defaced lumber.

Anon.

Cartoon Corner

§ ch r ö d i n g e r ' s Hand-Luggage



Greg Arrow

The Relation between the arts and the sciences: An argument

There is no science without fancy, and no art without facts.

Vladimir Nabokov (*Interview with Alfred Appel, Wisconsin studies in contemporary literature, vol. VIII, no 2, Spring 1967 in answer to a question about C.P. Snow's complaint about the gulf between the "two cultures" - Art and Science*)

This article seeks to argue that the so-called "two cultures" are, in reality, intimately related, and that there is no real "gulf" worth speaking of between the two. I don't intend to wade, knees first, into the muck left by the Snow-Leavis debate, but present an argument independent of it, that starts from a totally different position.

Let me begin by clarifying what I mean by the terms "the Arts," and Art in general, and "the Sciences" and Science. My Dictionary defines Art as the expression or application of human creative skill and imagination, and the Arts as "the various branches of creative activity" or as "subjects of study primarily concerned with the processes and products of human creativity and social life," and Science as "the intellectual activity encompassing the systematic study of the structure and behaviour of the natural world through observation and experiment." Therefore, I am not talking here of the so-called "popular art," (which I find, at least as applied to most of contemporary vulgar trash, a terrible contradiction in terms) or the "art" of social comment, or for that matter of the various pseudo-sciences - Freudian psychology, wild and bizarre speculations, and the like, not based on observation or experiment. I really don't care if there is indeed a gulf between those two.

Let us then consider each of these "two cultures" in turn, starting in the reverse of their order of definition, and showing the elements of the one in the other. Science is a systematic study, and it may seem to a casual observer that it is much too systematic and regular to be connected at all with the arts, but the casual observation is hardly an accepted scientific method of study. There isn't, as Nabokov insisted, a science without fancy. Any observation or experiment can either demonstrate a known fact, or lead to something new. The interpretation of an experimental result depends at least to some extent, on the imagination of the observer. Indeed, observation itself is as much part of the arts as of science. Isn't Dickens's "silvery pools in the dark sea" a brilliant observation? Indeed, and my sympathies are with anyone who insists otherwise. Continuing on, where would particle physics be without *Finnegans Wake*? More seriously, science is inherently creative. Most modern scientific knowledge has come out of inspired imaginative leaps, from Newtonian mechanics to De Broglie's wave-particle duality, and quantum mechanics, and relativity. Moreover, science is creating "reality" in the sense that it is affording us a deeper look into the fabric of the universe, and refining our view of natural phenomena, which in the end is our "reality," so freely thrown about in billions of debates since the origin of time. Speaking of which, how can we hope to understand any of the basic mysteries of life, such as Time, without recourse to imagination? We can't.

Here a heckler asks, with the arrogant air of one wanting to see a gentleman's driving license, how I can argue that art and science are the same, when unbridled speculation which would be allowable in the arts, is not in science. Throw him out. I never did say that they are the same. I said that they are similar. Moreover, there is a "bridle" (a terribly trite term, that "unbridled"). In case of the arts as a study of the products of human creativity, the base that one must keep close to is that particular creation spoken of. In case of art, there is such a thing as taste, despite its denial by multitudes of the misguided, through the ages. And science's base is nature, and the revealed clues to its complex workings. In all cases, one makes the assumption that what we see does contain clues about the levels of reality underlying it, and in both cases, that assumption is crucial.

Moreover - and this bring us, by a commodius vicus of recirculation, back to our next related concern - Art isn't speculation. It is creativity - quite a different thing. As I have been arguing,

criticism that ignores the clues in the text, or indeed moves away from the text, is just as harmful to the arts, as "unbridled" speculation is to science. And while the arts ultimately aim to create a parallel "reality," that "reality," or rather its believability depends on the extent to which the artist has studied nature and the other "rivals" to his creation. Therefore, there is no art without fact.

As was already pointed out, observation is as much part of the arts as it is of the sciences. Must not all study, including the study of language and social structure, be ultimately scientific? Can the critic or the linguist say anything at all without being required to prove it? If indeed that had been the case, the arts would have been in absolute disarray. The greatest artistic studies, translations and adaptations have all been rigorously scientific, and scholarly. The arts, like the sciences, involve a rigorous analysis of the detail to understand the constructions/creations being studied. Art, it is true, owes no strict fidelity to the truth, or the reality outside itself, except to the extent that it chooses to be consistent with that reality, but there is still the requirement that it be self-consistent. If the sciences help us understand nature better, and thereby "create" as it were a new level of reality, the arts create an independent reality. As much rigour is required in the one as in the other. In point of fact, few works (even surrealist works) ever decide to totally forego a connexion with the external reality, as such an abandonment would produce its own serious problems of communication and conception. Then, we have works of art that choose the level to which they intend to confirm with reality. This, in turn, depends on the extent to which the artist understands his view of "reality," and the depth of his vision of the world, which is ultimately as scientific a process as any other form of research. Notice too the usage of terms. And moving on there is experimenting in art as well. Except in their subject matter, and the manner of conducting their experiments, how is the work of Beckett or Joyce different from any reputable scientific experiment?

Back comes the heckler, or his successor and heir: 'But, they do have different subject matter! You can't deny that.' Keep up the battle against them. As I said, I never did say that they are the same. I said that they are intimately related. If one is to consider different subject matter, how is the gulf between the sciences themselves any bigger than the supposed gulf between the sciences and the arts? It isn't. As I have been arguing all along, there isn't a gulf worth speaking of. Moreover, the Orwellian idea, that the arts and the sciences are totally full of people who don't know anything of the 'other' culture is a stupid one, too dumb even to require a refutation. There have been great scientists whose knowledge of the arts was remarkable, and there have been some marvellous artists who have made a major contribution to science. Chekhov was a qualified doctor, and Nabokov a distinguished entomologist, and we haven't even begun talking about Benjamin Franklin.

Even those from either side that didn't make a major contribution to the other usually knew a fair bit about it. I suppose it is quite unusual for a physicist to know the details of how to conduct a cardiac surgery. Why aren't we jumping up and down lamenting the gulf within the sciences? The fact of the matter is that all knowledge requires a great deal of fairly specific application, and that does mean that there will be elements of one 'culture' unknown to the other. That is just the human condition arising from the lack of time.

Apart from that, there is no real gulf between the "two cultures".

Kiran Krishna

Dodgy Theorems

The Ecology of Dragons

Although much studied in earlier times, dragons and their ilk have been largely neglected in the recent upsurge of interest in animal ecology and behaviour. An article by Hogarth (*Bull. Brit. ecol. Soc.*, 7 [2], 2-5; 1976) seeks to remedy this neglect.

In view of the lack of contemporary observational evidence, Hogarth necessarily relies on a survey of earlier sources. Most of these are from the 17th and early 18th century, an age when scientific curiosity was flowering. Later publications are increasingly sceptical, although Hogarth notes published doubts on the existence of dragons as early as Caxton's (1481) *Mirror of the World*.

Dragons appear to have been both omnivorous and voracious. Different records testify to their diet having been highly variable in both composition and quality: one dragon ate two sheep every day, and another which was kept captive by Pope St. Sylvester consumed 6,000 people daily. The population density was also highly variable (presumably in a way which correlated with the per capita food requirements): "in England, indigenous dragons were solitary and it is doubtful whether the resident population averaged more than a few dozen, although occasional migrant flocks of up to 400 were seen: in India, by contrast, the marshes and mountains were described as being 'full' of dragons". Estimates of their life table parameters are scrappy, but there seems to be general agreement on a typical lifespan of the order of 10^3 - 10^4 years.

The sexual display behaviour of dragons includes at least one remarkable and unparalleled manifestation, recorded by an 18th century author: "Dragons, being incited to lust through the Heat of the Season, did frequently, as they flew though the Air, Spermatise in the Wells and Fountains". This may be conjectured to have had adaptive value in reducing intrinsic fecundity. Such long-lived beasts would seem to have been at the extreme K-selected end of the r-K continuum,¹ and would therefore be likely to exhibit behaviour which had the effect of keeping population levels steady.

Hogarth concludes with speculation on the causes of extinction of dragons: despite persistent accounts of dragons and similar animals even in the present century, the typical mediaeval dragon was certainly extinct by the late 18th century. One contributing factor was commercial over-exploitation, primarily for pharmacological purposes. Only once was conservation legislation passed to protect dragons. This was in Rhodes, in 1345, when the king forbade any knight to attempt to slay a local dragon (although Hogarth conjectures that this edict stemmed from concern for the knights, not the dragon). If we accept the notion that dragons were extreme K-selected animals, then their rapid extinction under the diverse pressures exerted by man is not surprising (see for example, *Nature*, 257, 737-738; 1975).

Hogarth's article is undoubtedly seminal, but I find it in some respects excessively uncritical. In discussing the evolution of dragons, and other "related species such as the cockatrice and griffon", Hogarth suggests they "probably originated as a distinct group only 5000 years ago". Quite apart from the inherent implausibility of this statement, it is well to begin by getting clear the morphological details of the animals loosely grouped together here. These can be obtained from bestiaries, or from any herâldry text. Setting aside relatively minor differences, such as whether the feet have talons or claws, or whether the head has teeth or a beak, the basic difference is that the griffon and the canonical dragon are six-limbed (four legs, two wings), whereas the wyvern and cockatrice are four-limbed (two legs, two wings).

This is an absolutely fundamental distinction. One of the most conservative features of vertebrate evolution is the tetrapod morphology: this may be seen in any museum exhibit of the 500,000,000 years of evolution from lobe-finned fishes through amphibians and reptiles to birds and mammals.

¹Explanation of r-K continuum for ignorant physicists: The r-K continuum describes the reproductive strategies of a species. r-selected organisms do not have a population limited by resources, and expend most of their energy in reproduction. K-selected organisms have a population limited by resources, and expend most of their energy in competing with other members of the same species.

This underlying conservatism in skeletal structure, despite great variation in outward form and function, probably reflects the relative ease of modification of genes which govern timing in development, as opposed to those governing basic structure (see for example, King and Wilson, *Science*, **188**, 107-116; 1975). The wyvern and cockatrice have this basic vertebrate tetrapod morphology, but the six-limbed dragon and griffon do not. The probable ancestry of these latter two, as an entirely separate group, therefore dates back at least to the Devonian. This basic distinction applies to other now-extinct beasts: despite superficial similarities, unicorns belong with the familiar tetrapods, but the pegasus belongs with the six-limbed dragon-griffon vertebrate phylum, as do centaurs. Some angels (the humanoid-plus-wings kind) also belong in this phylum, but in view of the bewildering complication of angel morphology (once one includes cherubim, seraphim, and so on; see Davidson, *Dictionary of Angels: Including the Fallen Angels*, Free Press, 1967), this point is best not pursued.



Mary Evans Picture Library

In brief, wyvern and cockatrice can be envisaged as radiation from the basic vertebrate theme. But dragons, griffons, centaurs and angels belong to an entirely different lineage, the evolutionary history of which is shrouded in mystery.

The loose association of these two fundamentally different groups provides a striking example of the pre-Darwinian tendency to regard each species as a separate act of creation, rather than to trace logical phylogenetic relationships.

On the other hand, grouping together dragons, wyverns and the like is understandable in the light of the similarities of their ecology, behaviour and superficial appearance. They provide a dramatic example of the evolutionary convergence, in the face of phylogenetic differences at least 400,000,000 years old. Such convergence implies some very tight evolutionary constraint somewhere in the "dragon" niche, a constraint hardly hinted at in Hogarth's account of their highly generalist diet and behaviour. This constraint may lie in the tendency exhibited by most dragons of record to be obsessive custodians of hordes of gold.

I conclude with the time-worn call for further research, modified by the highly contemporary remark that (if the above speculation is correct) such research may yield the literally golden fruits that grant-giving agencies increasingly desire.

Prof. Sir Robert May², Nature, 264, 16-17; 1976.

An Alternative Theory of Quantum Computing

Quantum computing is when you smash two computers together at high speed to find out what's inside them.

Deithard Peter and Feraz Azhar

²Professor May, a former head of theoretical physics at Sydney University, was recently appointed as head of the Royal Society in London. The editors would like to thank Dr. Ferg Brand for bringing one of his classic papers to our attention.

More Dodgy Theorems

Buttered Cats

When a cat is dropped, it always lands on its feet, and when toast is dropped, it always lands buttered side down. Therefore, if a slice of toast is strapped to a cat's back, buttered side up, and the animal is then dropped, the two opposing forces will cause it to hover, spinning inches above the ground. If enough toast-laden felines were used, they could form the basis of a high-speed monorail system.

Unknown Internet Author

More on Buttered Cats

In the buttered toast case, it's the butter that causes it to land buttered side down - it doesn't have to be toast, the theory works equally well with biscuits. So to save money you just miss out the toast - and butter the cats.

Also, should there be an imbalance between the effects of cat and butter, there are other substances that have a stronger affinity for carpet.

Probability of carpet impact is determined by the following simple formula:

$$p = s * t(t)/t(c)$$

where p is the probability of carpet impact, s is the "stain" value of the toast-covering substance - an indicator of the effectiveness of the toast topping in permanently staining the carpet.

Chicken Tikka Masala, for example, has a very high s value, while the s value of water is zero.

t(c) and t(t) indicate the tone of the carpet and topping - the value of p being strongly related to the relationship between the colour of the carpet and topping, as even chicken tikka masala won't cause a permanent and obvious stain if the carpet is the same colour.

So it is obvious that the probability of carpet impact is maximised if you use chicken tikka masala and a white carpet - in fact this combination gives a p value of one, which is the same as the probability of a cat landing on its feet.

Therefore a cat with chicken tikka masala on its back will be certain to hover in mid air, while there could be problems with buttered toast as the toast may fall off the cat, causing a terrible monorail crash resulting in nauseating images of members of the royal family visiting accident victims in hospital, and politicians saying it wouldn't have happened if their party was in power as there would have been more investment in cat-toast glue research.

Therefore it is in the interests not only of public safety but also public sanity if the buttered toast on cats idea is scrapped, to be replaced by a monorail powered by cats smeared with chicken tikka masala floating above a rail made from white shag pile carpet.

Unknown Internet Respondent

An Alternative Second Law of Thermodynamics

Heat is work and work's a curse
And all the heat in the universe
Is gonna cool down, 'cause it can't increase,
Then there'll be no more work and there'll be perfect peace.
(Really?) Yeah, that's entropy, man!

Michael Flanders & Donald Swann, "First and Second Law"

A Glossary for Research Papers

A highly significant area for exploratory study: A totally useless topic selected by my committee.

Of great theoretical and practical importance: Interesting to me

It has long been known that: I haven't bothered to look up the original reference.

It is believed that: I think.

It is generally believed that: A couple of other people think so too.

System X was chosen as especially suitable to show the predicted behavior: Somebody already had System X running in the lab next door.

Three of the samples were chosen for detailed study: The results of the other samples did not make any sense.

Handled with extreme care during the experiments: Not dropped on the floor

A fiducial reference line: A scratch.

Although some detail has been lost in reproduction, it is clear from the original micrograph: It is impossible to tell from the micrograph.

A careful analysis of obtainable data: Three pages of notes were obliterated when I knocked over a glass of beer.

Typical results are shown: This is the prettiest graph.

These results will be reported at a later date: I might get around to this sometime.

The most reliable results were obtained by Jones: Jones was my student.

In my experience: Once.

In case after case: Twice.

In a series of cases: Thrice.

The agreement with the predicted curve is: excellent: fair

good: poor

satisfactory: doubtful

fair: imaginary

as good as could be expected: non-existent

A definite trend is evident: These data are practically meaningless.

Correct within an order of magnitude: Wrong.

According to statistical analysis: Rumor has it.

While it has not been possible to provide definite answers to these questions: The experiments didn't work out, but I figured I could at least get a publication out of it.

Presumably at longer times: I didn't take the time to find out.

It is clear that much additional work will be required before a complete understanding of this phenomenon occurs: I don't understand it.

After additional study by my colleagues: They don't understand it either.

Unfortunately, a quantitative theory to account for these effects has not been formulated: Neither does anybody else.

A statistically oriented projection of the significance of these findings: A wild guess.

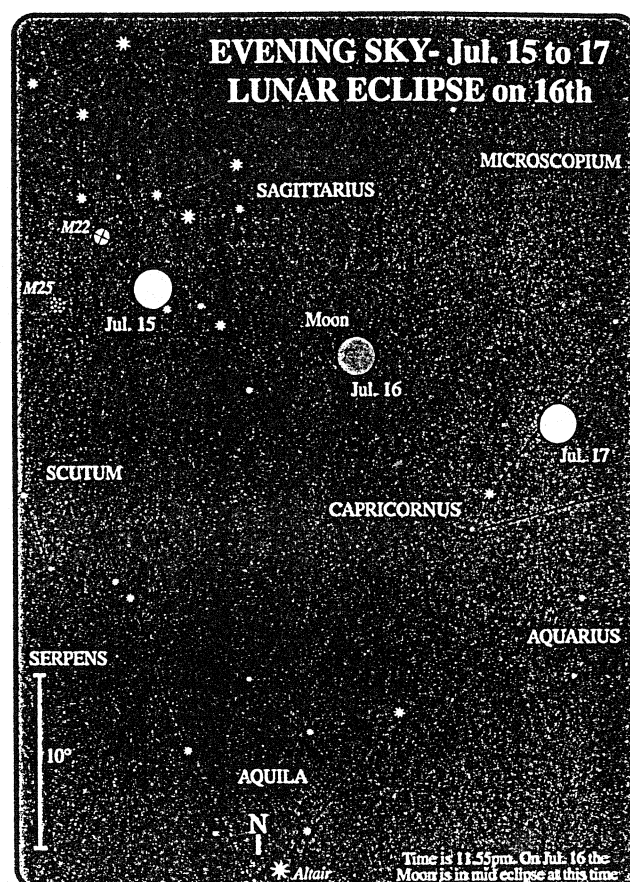
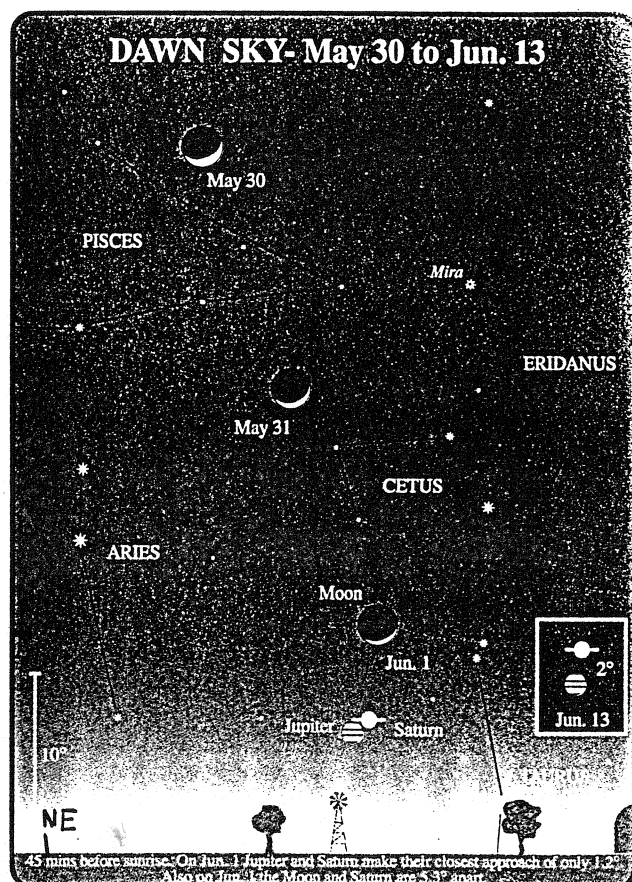
Thanks are due to Joe Blotz for assistance with the experiment and to Andrea Schaeffer for valuable discussions: Mr. Blotz did the work and Ms. Schaeffer explained it to me.

It is hoped that this study will stimulate further investigation in this field: This paper isn't very good but neither are any of the others on this miserable subject.

Unknown Internet Author

Upcoming Astronomical Events

There will be some interesting astronomical events in the months ahead. A conjunction of Jupiter and Saturn only occurs once every twenty years, so don't miss the next one, early in the morning on 1st June. There's also a total lunar eclipse on the evening of 16th-17th July. To see these events, just go outside at the times and look in the directions indicated on the diagrams below.



Late News: Trivia Team Triumphant!

On Tuesday, 16th May a trivia competition was held between the physics societies of USyd, UTS and UNSW, at the UTS Bar. The Physoc team, "I'm surrounded by Bosons (Dog's Bollocks) (I want to get in Thorpedo's Speedos)," were ultimately triumphant. Team members Damien Buie, Peter Ireland, Jocelyn Laurence, Chris Barton, Tom Oates and your correspondent scored a massive 61 points, while the next best team languished in the mid-50s. Special thanks are extended to Jocelyn for helping to organise the event and to Chris for his talents in cryptography and graphic design. No thanks are extended to the treacherous Steve Edney for deserting to a team from UNSW.

For me, the highlights of the evening were the seven consecutive questions on legendary Australian cricketer Boonie, copious free drink bonus prizes, copious other bonus prizes and the songs with banjo accompaniment from Angus of UTS. I was also amused to discover that while all three physics societies have male-dominated memberships, all three have blonde female presidents.

A great time was had by all!

Edward Boyce