

**Audio tape****Characters**

- T** is Clyde Tombaugh  
**G** is Galileo Galilei  
**A** is Aristotle  
**H** is Caroline Herschel  
**C** is Nicolaus Copernicus

MUSIC

HUBBUB OF ACTIVITY OF PEOPLE GATHERING TOGETHER  
SHUFFLING ETC

- T** Alright ladies and gentlemen, yes, ladies and gentlemen, quiet please, welcome, welcome all. Welcome to our Yearly "Nullius in Verba" Scientific Review. I am Clyde Tombaugh acting as chairperson and I call the meeting to order. Welcome to you all. Lady Caroline Herschel here has agreed to take the minutes I believe.
- G** Oh Lady Caroline, I have been dying to meet you. The Milky Way is a myriad of stars. Yes. We have much to discuss?
- T** Order please Professor Galileo, order. The committee is now in session. Quiet please - we must have method - scientific method so to speak.
- G** Si, si Signor is good idea. Let us have the scientific method. After all I invented it. Maybe I should be chairing this committee. Anyone like to argue? I love to argue. I was nicknamed The Wrangler at Pisa University.
- T** I have assumed the chair for the moment Galileo, being the youngest amongst us at 97. We are all here are we not? Um Aristotle?
- A** Ne.
- T** Copernicus.
- C** Tak.
- T** Lady Caroline yes.
- H** Ya, ich I mean Yes I'm here.
- T** And Galileo of course.
- G** Si, si, Signor Tombaugh.
- T** Yes we have a quorum so the first item on the agenda - we elect a president.
- H** You Americans!
- T** (overriding her) And my vote goes to the oldest among us here today- the father of science - Aristotle.
- A** Thank you - I can see your logic and reasoning Mr Tombaugh. I deserve to be President. Before all, I was the first to establish that the Earth was round and that it was not a big planet.
- G** Ah,si,si, yes is good. How did you arrive at these conclusions?

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- A** Well Galileo, during an eclipse of the Moon, the shadow cast upon the Moon by the Earth is curved and when we view the sky from different positions upon the Earth, we see different stars. In the southern hemisphere, we see stars we never see elsewhere and in the northern hemisphere, the stars seem to rise and set above that region. The Earth must be of no great size for the change happens quickly even though the distance travelled is relatively small. Quod erat demonstrandum. I collected and observed many facts of this nature.
- G** Ah, si, si - what you don't say is that you also believe the Earth is round because Pythagoras say if you travel in one direction long enough you see elephants and if you travel in the opposite direction long enough, you see more elephants. There is no method in your madness. It just means there's a lot of elephants. What you see is not always what you get. Aristotle you get some things right but if you think as much as you did, you got to be right sometime! - but he make plenty mistake. You know why? He no experiment! He cannot be President.
- C** Yes but in a peculiar way, he help me in my work. He said that heavenly bodies move at a steady rate round the Earth but then I observe - they don't. I rack my brains why, why, why and then I see it - something else is moving - and it is us, the Earth rotates. Yes Aristotle, you were a great thinker, everybody thought in Greece they had schools for it - but it's not enough. You must speculate, hypothesise as I did in Poland many moons ago.
- T** Just why did you believe the universe was so different from earlier theories Herr Copernicus?
- C** I am great mathematician. We believe at the time that nature is simple and the Sun is the source of all the energy in the universe. Aristotle never measured the movement of the planets and Ptolemy's universe broke physical laws and both systems were too complicated. If the Sun were at the centre, all the other planetary orbits fell into place, and the previous systems had disrupted the calendar - no one knew what day it was. My system was perfect, perfect. I had it all in my grasp - and then I died.
- G** Si, you take a long time to tell anybody about your work. Is not so.

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- C** A lot of facts I accepted proved to be wrong. I had to take new measurements. I had to make reliable instruments to do this and I was scared. It could have caused a revolution.
- T** I understand you first saw the finished book you wrote on the day you died.
- C** Tak.
- G** You are lucky man. You die in bed. Giordano Bruno was burnt at the stake for believing in you.
- T** Indeed you must have been aware of the jeopardy in which you placed yourself Galileo.
- G** Si, si, Signor Tombaugh. I was as the Americans say, as nervous as a long-tailed cat in a roomful of rocking chairs. For me is not speculation, hypothesis only. I am experimenting. I am proving. Mathematics is a language of the universe. I see the cathedral lamp - it swing. I time with my pulse. Same time swing no matter distance travelled. I reason, I standardise time. Aristotle he think when he drop objects of different mass, they take different time to reach the ground. I experiment - is not so. And Aristotle, he dismiss the work of Aristarcus who believe the Sun is the centre of it all.
- C** Yes I know of Aristarcus's work. Excuse me what does happen?
- G** When?
- C** When you drop the objects of different mass.
- G** Oh Copernicus. They land at same time. Is good experiment - in Pisa.
- H** But the results of your Pisa experiment change because the figures change Galileo depending on the distance from the Earth's core - likewise the same length pendulum swings in a different rhythm in India to China - to Italy. This was proved before I was born and was an accepted fact - gravity.
- G** I no know about gravity. I no see that.
- H** The Earth is not circular. No - there were a lot of things you didn't see.
- G** I knew you bring that up sometime.
- T** What's this - the inventor of the scientific method missed some thing. Oh, this I gotta hear.

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- H** Professor Galileo, while searching for the moons of Jupiter, to prove that the Earth was not unique, overlooked a rather bright object nearby - Uranus. If he had seen it for what it was, he would have tripled the size of the known universe.
- G** Ah well we all make mistakes.
- T** I myself have studied the patterns of Uranus to help in our search for Pluto. Of course we had the finest telescope.
- G** I have refractor - but I cannot rid myself of the colours. I cannot grind the glass to get rid of what you call it?
- T** Chromatic interference.
- H** You should have used mirrors Galileo. A reflecting telescope. It was invented by Newton in 1668. My brother made a telescope of 14 metres with a 1.5 metre mirror. It was 2 metres in diameter. We saw the stars shine so brightly.
- T** Yes wasn't that your biggest error.
- H** What sir. How dare you.
- T** Your brother used Newtonian technology but he also used Newton's misplaced assumptions about the brightness of stars. Sirius was the brightest star so you made that your benchmark - if all stars were as bright as Sirius, they would all be the same distance away. So the degree of brightness of the star indicated the distance from the Earth. You could call that a Sirius mistake. Was this not so?
- H** Yes, William was so clever in so many ways and so foolish in others. He wouldn't listen to me. I was the observer. How I slaved for him. I wrote everything down. I recorded it all, working nights and day. The candle bill in that house was enormous and then - then we discovered binary stars.
- G** Lady Caroline, binary stars? Now there you have lost me.
- A** I was lost when we started hypothesising.
- H** A binary is a double star Aristotle, both stars orbiting the same centre of mass. We discovered binaries which were obviously the same distance from the Earth yet they differed in brightness. It destroyed our earlier theories.
- T** Uh, uh - hoist by your own pair of stars. When was this?
- H** Let me see. I have it here - binaries early 1802.

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- T** You mean you observed stars for twenty years using false premises. And yet you personally discovered seven comets. Think how many you could have found working with the correct facts.
- G** Signor Tombaugh you are too hard on the lady. We have all travelled down blind alleys. We have all made mistakes but others who followed have gained from them. Aristotle, there is no such thing as forced motion - it is not important what starts things moving, they are already moving old friend. And Copernicus, there are indeed a myriad of stars in the Milky Way but they are not all at the same fixed distance from the Sun.
- T** Yes your benchmark, Sirius, Lady Caroline is 10 light years, at least 60 million million kilometres away and many other stars are a hundred times further away. It is impossible for our minds to conceive the distances. God knows how big it is. If I may offer some homespun wisdom and scientific method to close this meeting. There have been many contributions to the study of the universe by thought, hypothesis, measurement and experiment and some of those strongly supported by evidence. Many of these contributions have been proved to be wrong and all may yet prove to be wrong. We do not yet know the truth. We only believe we do. In order to progress, however, the scientists have built on the work of others - standing on the shoulders of giants using their evidence for new theories - but wait a minute, if they are wrong - then new theories are wrong. No I think maybe we need original thinkers, we need Aristotelians. Aristotle, we need Aristotle. Oh no, we're going round in circles.
- G** Ellipses Signor Tombaugh.
- T** What's that you say?
- C** He said ellipses - we're going round in ellipses. Kepler was right. I was wrong.
- H** I'll make a note of that.
- H** Let me see. I have it here - binaries early 1802.

MUSIC TO FADE