1. Blue Planet `pathos' movie - play Schindler's List [link on request].

2. The Foundations of $\mathrm{C} \& \mathrm{C}$
3. GCI introduced C\&C imagery at COP-6.
4. Music, C\&C-Structure and Pythagoras
5. Can this help us deal with climate change?

Is music relevant to achieving the objective of the UNFCCC?
6. Cube 'logos' movie - Pythagroras, Hemiola, Bach and C\&C play Ave Maria [http://www.gci.org.uk/animations/Cube.flv].


## The Foundations of C\&C

That little movie signals the rising human cost of climate change but is really asking, what can we do to stop this going further. You run straight into UN politics - but that's the question.
But you might be wondering . . . . How did a musician get involved in the politics of climate change at the UN? Before climate change hit me, I had been a musician - a composer and a string-player - all my life. In 1988 I read about the murder of Chico Mendez in Amazonia and initially thought this might be the subject of the musical I wanted to write. I looked for more information but as information about him was hard to find, I only found out about the issues.
A year later my daughter Georgia aged four, came home from her Montessori Nursery School and going to sleep that night asked me, "Daddy is the planet really dying?"
I was gutted - music suddenly seemed really irrelevant and I sold my viola to buy a computer to learn how to communicate 'climate numbers'.
In 1990 GCI was founded on the principle of 'Equity and Survival' and I went to the UN to try and do something about global climate change. The model of C\&C emerged from that engagement has now grown to be the most widely cited - and arguably the most widely supported policy concept in the debate.
Only a few years ago I realized with a sort of 'slow shock' that far from being irrelevant, music is actually fundamental to the structure and to the success of C\&C.
You may wonder why so I'll try and explain that. But remember that I'm just one of those string players. If you ask any of us, 'how long is a piece of string?', we'll answer 'exactly twice half its length.

GCI introduced C\&C at COP-6 UNFCCC in 1996 with this the image. These were people involved.


But by 1998 the image that really caught on was this:


It got taken up and used all over the world.

Comments like an Australian in 1998 who said, "that says it all", or sitting in the US State Department with Climate Policy Guru Raef Pomerance in 1997 [verbatim],
"that's the best damn 'f***ing' graphic of what to about climate change I have ever seen."
At COP-3 in Kyoto in December 1997, the US faced calls for $\mathrm{C} \& \mathrm{C}$ in the negotiations from the Africa Group India and China and the US response was, . . . .
"It does seem to us that the proposals by for example India and perhaps by others who speak to Contraction and Convergence are elements for the future, elements perhaps for a next agreement that we may ultimately all seek to engage in."
The challenge of communicating and winning the C\&C idea this way has continued. As many more people are involved in the debate and C\&C gradually becomes 'policy' - for example in the UK Climate Act - the need intensifies to show clearly the 'structure' of C\&C and the variable rates at which this can be applied.
Here's a newer tool [and link to it] with 'zoomable' detail:

http://www.gci.org.uk/images/All_Country_C\&C.pdf

And here is a very recent one [with link] animating 'variable rates of C\&C', as at COP-15 in 2009, Copenhagen.

90\% Emissions Contraction by 2080
Convergence to Per Capita Equal Globally by 2020

http://www.gci.org.uk/public/COP_15_C\&C.swf
This helps show rates of: -
[1] contraction \& concentrations and
[2] contraction \& convergence and
[3] the political operating conditions and
[4] some of the putative 'alternatives' to C\&C
We can come back to this later if you like.

## Music, C\&C-Structure and Pythagoras

Mike Hutchinson and I made that 'Schindler's List' movie in 2006. At that moment the remnant musician in me cried out, you have to communicate your awareness of the pathos of climate change. Its sad and awful but can't be ignored. Hence the movie we made was a way of suggesting climate genocide without actually using the word.

However, at that time I gradually also realized around that what I had been doing with spreadsheets - which are basically interacting rows and columns of data - was painstakingly just like writing music - resolving melody and rhythm within a harmonic framework. Here are two images I put in an article for the CIWEM Journal then called "AMEN to climate change". A perfect cadence to climate change. The link is clear and striking.

http://www.gci.org.uk/Documents/Amen_to_Climate_ Change.pdf

So structurally C\&C is 'full-term' and has a lot in common with music. What was this really about? As I said earlier;
'I realized with a sort of 'slow shock' that far from being irrelevant, music is actually fundamental to the structure and to the success of C\&C.'
Like C\&C and with playing the fiddle, music is just about 'unit-time-management'. In plain talk this is just playing 'in-tune' [pitch] and 'in-time' [meter/rhythm] together. In his book "The Grand Design", Stephen Hawking cites Pythagoras and his 'musical framework' like this: -
"According to legend, the first mathematical formulation of what we might today call a law of nature dates back to an Ionian named Pythagoras [who] is said to have discovered the numerical relationship between the length of the strings used in musical instruments and the harmonic combinations of the sounds."
He goes on: -
"In today's language we would describe that relationship by saying that the frequency - the number of vibrations per second - of a string vibrating under fixed tension is inversely proportional to the length of the string. One could call that simple mathematical formula the first instance of what we now know as theoretical physics."
What's really important here is the 'harmonic structure' seen in this 'first' in human history. It is 'scientifically' seeing the 'law' that governs the sub-divisions of a length of vibrating string, is measured and constant.
In music we call the first two such divisions 'perfect': -'halve-the-length/double-the-frequency' = perfect octave 'third-the-length/treble-the-frequency' = perfect fifth
The 'hemiola-structure' of the 'overtone' series emerging is a function of the whole length of the constant string.

## is a'Hemiola'


is a'Hemiola'
Music and the miracle of this 'perfect cadence' - think the 'Amen Cadence' - or 'diatonic harmony' comes from the simple 'truth' of this transparent perennial law.
The fabulous and diverse legacy of all the music we have from our forebears, lasts and will yet last over Centuries, because it is an expression of this universal 'law'.
Put these fractions together and you get the 'Hemiola'. Exactly 'Two Groups of Three' and 'Three Groups of Two' are in precisely the same length of time.


As a proportionate truth this is true at any frequency. It is true when there are hundreds of vibrations per second or Herz [Hz] as pitch. Orchestras tune to A 440 Hz .


It's true at one, two and three Hz per second as rhythm or metre. Think of West Side Story: -
> "I-like-to, Be-in-a, Me-Ri-Ca", or if you prefer, "Wel-come-to, Pre-si-dent, Gor-Ba-Chev"
 FUNCTIONAL or 'DIATONIC' HARMONY


It's true down to one, two and three Hz per decade. In fact this perfect Hemiola is true on any scale of time and space. Like this it is true over decades at whatever rates we choose, as choose we must, for 'full-term' C\&C.
Can this help us deal with climate change? Is music relevant to achieving the objective of the UNFCCC?
20 years ago I believed I had to walk away from music to begin the campaign that led to C\&C. Now I see the 'political harmony' of assuming an equality of emissions rights under the global limit we must observe to survive makes sense, as assuming anything else assumes chaos.
So, like the unit-equality in the pitch and rhythm of the Hemiola and like the twelve equal steps of the Well Tempered scale, C\&C assumes unit-equality between people in the restricted use of the global atmosphere over time.
The structure creates a organisational rationale that generates cognitive resonance to help agreement for the full term event needed for UNFCCC-compliance. As such, it is a helpful reference 'signal' in the midst of the increasing 'noise' and discord that has been generated in the climate politics at the UN over the past 20 years.
It is a goal focused - or 'teleological' - mechanism. Like music, it knows where its going simply because we tell it where to go. C\&C's 'radar' tells us where we are and where we need to be and its 'rudder' steers us there. Of course we need 'efficiency' and global 'climate justice' but we need these without rhetoric, weasel words and without vengeance. C\&C embraces this and makes it possible to negotiate this. With a C\&C framework in play it means that we will all start acting a bit more like an orchestra together in concert rather than continue moonlighting separately in the din of the band room. A simple lesson from South Africa where I grew up, is that, "Separate Development is not Sustainable Development."

C\&C is getting together intergenerationally. It remains true over time, as soon as we agree negotiating equal rights under global limits to be in tune with each other now. This principle can enable us to keep acting together to cope with the difficulties that are coming, while still acting in time to avoid the dangerous rates of climate change that are increasingly threatening.
This structured rationale certainly has Centuries of success with music. Facing the future using this has to be better than continuing with the noisy, random and inadequate negotiations that we have generated so far and are now becoming the victims of. C\&C is just 'sensible'.
If as the UNFCCC Executive said in 2004, "C\&C is inevitably required to achieve the objective of the convention", it says to me now that in fact, far from being irrelevant, the simple logic and harmonic structure of music is fundamental to dealing with our problems and crucially the success of achieving the objective of the UNFCCC.
The short draft movie coming now is conceptual 'draft' making these links. Music is by the man Casals called the God of music. Adding the liberty that Gunoud took with it as well, it is the first prelude of the Well Tempered Clavichord by Johann Sebastian Bach.
Perhaps, you don't feel ready to make these links. But we can still wonder why with C\&C as the most frequently cited and arguably the most widely supported model in the debate, we still continue to cause the climate problem we face, faster that we act to avoid it. So far we appear to continue accepting it - a failure that haunts the climate politics at the UN and that augurs disaster.
Music will still be true, even if we fail to prevent dangerous rates of climate change. However, I am with those who hope and strive for our children's sake - perhaps with the help of music as C\&C - that we don't.

Cube 'logos' movie - Pythagroras, Hemiola, Bach and C\&C - play Ave Maria [link on request].


