

Translating Science for Young People through Metaphor:

“The world will warm up so much it might
blow into a ball of fire like the sun.”

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Structure of talk

- Metaphor and science
- The project ‘Translating Science for Young People’:
 - Background
 - Questions
 - Data
 - Preliminary analysis:
 - The ‘greenhouse’ metaphor in specialist academic writing and interviews with secondary school students;
 - ‘There’s like a band around the world’: a novel metaphor in an interview with students
 - Future work

Metaphor and science

- Metaphors are important in speaking and writing about science of all kinds.
- There are differences in metaphor use depending on the speaker/writer, the target audience and the type of communication.
- Different metaphors for scientific issues such may reflect and reinforce different understandings of those issues.

The project

‘Translating Science for Young people’

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- Research questions:
 - What do young people hear, read and say about climate change?
 - How does this compare with the expert view?
- Focus on metaphors for climate change in the language of young people and experts.

Background to the project

- Scientists have reached an almost unanimous consensus that climate change is real, anthropogenic and potentially severe.
- In the USA and Western Europe, media concern fluctuates with topical issues such as Hurricane Katrina (August 2005), the US film 'An Inconvenient Truth' (2006) and 'climategate' at the University of East Anglia (UK) (2009).
- In the UK, the media tend to present a divergence of views that is misrepresentative, because of the perceived need to give 'balanced' coverage. .

The UK Educational context

National Curriculum 2007-2013 Key Stage 3 (age 11-14, compulsory)

Geography

- Understanding that the physical and human dimensions of the environment are interrelated and together influence environmental change.
- Exploring sustainable development and its impact on environmental interaction and climate change

Science

human activity and natural processes can lead to changes in the environment

(from the National Curriculum programmes of study, on the gov.uk website archive)

The UK educational context

Post 2014 National Curriculum Key Stage 3

Geography

understand how human and physical processes interact to influence, and change landscapes, environments and the climate

Chemistry

the production of carbon dioxide by human activity and the impact on climate

(cited from the National Curriculum programmes of study, on the current gov.uk website)

Data

For the project, we will have collected three large language datasets (corpora), composed of texts about climate change, representing the following:

1. The language of science used by experts: research articles and policy documents (approximately 600,000 words);
2. The language of texts that young people access: popular and educational materials, including curriculum materials, educational websites such as 'BBC Bite-size', popular science texts, internet forums, Twitter feeds and other texts used by young people (approximately 300,000 words).
3. The language used by young people interviewed about climate change (approximately 100,000 words).

Data Collection – Corpus 1

- Corpus of academic and policy texts in the field of climate science
- Academic half of corpus 1 is built
 - Comprised of articles (published during 2000 - 2010) from 'Climate Change', 'Global Environmental Change' and 'Nature'.
- Policy half of corpus 1 in progress
 - Will be comprised of IPCC, CCCEP and Defra documents (published during 2000 - 2010).

Data Collection – Corpus 3

- Four secondary schools in Yorkshire were recruited
- Ten groups of approx. 6 pupils (aged 11 – 16) from each school were interviewed on the topic of climate change
- 20 minute (approx.) interviews with each group on the topic of climate change

Data Collection – Corpus 3

Interview questions

- Please can you tell me what you know about climate change?
- How would you explain climate change to a younger pupil?
- What is the greenhouse effect? How would you explain it to a younger pupil?
- How do you think climate change harms plants and animals?
- Is there anything we can do to help prevent climate change?

What the interview data sound like..

Interviewer: Can you please tell me what you know about climate change?



Respondent 1: Erm like it's erm, things that we do affect the environment. So like if you use lots of CO₂ it like might affect the polar bears and like melt their ice-caps and stuff.

Respondent 2: Erm, basically, CO₂ comes out of a car, it goes to the sky and stops there, and instead of letting heat straight out, like makes it bounce back in, and warm the world up.

Respondent 3: Yeah this is what he means, like, there's like a band around the world and it like lets some of the CO₂ out, and then it like goes, some of it goes out but some if it stays in cos the more CO₂ that we're using, erm, it's like the band gets tighter and tighter, and so like, until no air can, like CO₂ can get out, and it like bounces back and goes in the earth and then it warms the earth and then it melts the ice-caps.

Beginning the analysis

Corpus 1 (currently 300,000 words of academic texts) is in SketchEngine.

Corpus 3 (school student interviews, currently 87,600 words) is stored on the Leeds University hard drive, and we have done preliminary analysis using AntConc, and comparison with Sketchengine searches on Corpus 1.

Most frequent lexical metaphors in Corpus 1 (Academic papers)

	Word/ lemma	freq		Word/ lemma	freq
1	Model /s	917	12	Area/ s	200
2	Response /s	459	13	distribution	194
3	Scenario/s	455	14	approach	181
4	Impact /s	451	15	adoption	168
5	High/ higher	433	16	forcing	167
6	Value /s	375	17	greenhouse	130
7	Level /s	340	18	sensitivity	124
8	Low/ lower	286	19	strong	120
9	based	232	20	shifts	94
10	Growth	215	21	peak	94
11	large	208	22	patterns	92

Most frequent lexical metaphors in Corpus 3 (Student interviews)

	Word/ lemma	freq		Word/ lemma	freq
1	greenhouse	189	12	save	18
2	caps	83	13	Contributing/es	15
3	goes	75	14	low	14
4	Release/ released	73	15	Balance/d	13
5	Trapped/ traps/ trap	59	16	longer	11
6	rise	46	17	Knock (on)	9
7	Chain/ chains	27	18	band	8
8	Bounce/s bounced	24	19	barrier	6
9	Blanket	20	20	play	5
10	Lead /(li:d)/	19	21	view	5
11	slow	19			

'Greenhouse' in academic texts

the atmosphere and (2) the enhanced **greenhouse effect** (higher radiative forcing) higher radiative forcing i.e. the enhanced **greenhouse effect**) with temperature rise leading issues. Agriculture also has impact on the **greenhouse gas balance**. Forests and soils are region in response to elevated atmospheric **greenhouse gas concentration**. This change can be system, such as the radiative forcing of **greenhouse gas concentrations**, with multiple net present marginal costs and benefits of **greenhouse gas emission reduction** need to be taken to avoid this. The implications of **greenhouse gas emission reduction** may be insect outbreak and estimated that its net **greenhouse gas impacts** over 21 yr (990 Mt carbon culation with increasing concentrations of **greenhouse gases** - if the warming is strong an 'off' state in response to increasing **greenhouse gases**. A reduction of the meridional role in managing the sources and sinks of **greenhouse gases**. Forest and land management can is caused by anthropogenic emissions of **greenhouse gases** and aerosols may help assess different atmospheric lives of the different **greenhouse gases** and the possibilities of their warming is academic. The current level of **greenhouse gases** ensures that the world will of Canada's emissions. The emissions of **greenhouse gases** from Canadian agriculture are corporate changes in individual well-mixed **greenhouse gases** including carbon dioxide and greenhouse gases. As the climate response to **greenhouse gases** is subject to different sources substitutes the major source of anthropogenic **greenhouse gases** currently being released into

‘Greenhouse’ in school student interviews

I'd say it's like making a **greenhouse** all around the world.

's like the earth's in a massive **greenhouse** and you can't escape it

They just bounce across the **greenhouse dome** and come back in and sun-rays a

Instead of saying the **greenhouse effect** I'd say it makes it warmer
e would be and that's called the **greenhouse effect**. Respondent 3 is it that when
e stuff to the pollution and the **greenhouse effect**. S: what is the greenhouse

earth, but because of the **greenhouse effect**, those gases form a second dome
release methane, which is a **greenhouse gas**, and there are, there's not a

For the atmosphere called **greenhouse gases** and erm what they're doing
Global warming is where the **greenhouse gases** are put into the air, stopping
Change because of all these **greenhouse gases**, it's like trapping us slowly a
Isn't global warming caused by **greenhouse gases** and something like that, and

Cos of the increase of **greenhouse gases** leading the temperature to
en you drive around you release **greenhouse gases**. They never used to go into
living in a greenhouse but the **greenhouse** is a lot bigger and you're just

Around the world and in the **greenhouse** it's really hot so that's trapping all

Atmosphere because the **greenhouse outer layer** that increases the
don't want the earth to be in a **greenhouse** that's why we've got greenhouse gases

‘Greenhouse’ in academic articles

- In almost every case, a noun modifier, sometimes one of several in a long noun group, e.g. *greenhouse gas concentrations*, *greenhouse gas mitigation strategy*
- Seems to have purely technical meaning: no evidence of active link to the original source domain of the metaphor.

‘Greenhouse’ in school student interviews

- Strong collocates include *gas*, *effect*. However, not always used as a noun modifier.
- Many citations suggest reference to the grounds for the metaphor.

‘greenhouse’ citations from school student data

- There’s a massive *greenhouse* and the world’s inside and it just keeps getting hotter.
- Put a *greenhouse* around the world, all the gases, so then the heat can’t escape so it just keeps getting hotter and hotter.
- Like when you go into a *greenhouse* it’s like really warm and stuff. And like imagine that but it’s like all around us and you can’t like escape.
- ... my mum has a *greenhouse* so I kind of like refer back to that

A metaphor developing in the discourse

The band metaphor

Year 7 (aged 11- 12, the first year of High School in the UK)

Occurrences of 'band' in transcript. 8 citations; did not occur in any other interview.

band

Student 3: there's like a *band* around the world and it like lets some of the CO₂ out, and then it like goes, some of it goes out but some if it stays in cos the more CO₂ that we're using, erm, it's like the *band* gets tighter and tighter

Student 1: It's to do with the erm, *band*, like the, a bit like a bubble round us, erm, that's like getting thicker kind of thing, and it's not letting as much out, as much CO₂ out.... [...]

band

Student 3: Like there's like a *rubber band* around the earth and then we're in the middle of it. And then there's this like thing called CO₂ and it comes out of cars and stuff. It's like pollution from factories and stuff like the smoke that you see and stuff that's CO₂. And then, it like goes up, yeah.

Student 4: It goes up into the air and bounces off the *rubber band* and warms up the world and there'll be different effects from that.

Student 3: Yeah and we're using more CO₂, so the *band* gets tighter and tighter like, when you put a *rubber band* around your finger or something, it gets tighter and tighter. It's like that around the earth, and then eventually the CO₂ can't get out and it like bounces off it and goes into the earth and warms the earth up.

band

Student 4: It's like erm, erm, with all the pollution that's going up into the air, that erm like, erm, *the like band* around the earth, like erm getting tighter so it's not letting things in, so it's like the world like trapped in a giant greenhouse and it's just getting hotter and hotter

Preliminary observations

- Different metaphors are used by experts vs. secondary school students to talk about climate change.
- There are differences in how the same metaphor (e.g. 'greenhouse') is used by experts vs. secondary school students.
- Novel metaphors may be invented and rapidly adopted and developed by students as non-experts, resulting in understandings that contrast with those of experts.

Future work

- Finish compiling Corpus 1 (policy documents);
- Compile Corpus 2 (texts used by young people: coursebooks for science and geography, revision websites, youth campaign materials, popular science texts for young people etc);
- Detailed analysis and comparisons of figurative language, modality, markers of stance and attitude;
- Impact work.



Thank you

Any questions?