Communicating Climate Risk - Kickoff Meeting - Report

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1. Executive summary

The kickoff meeting of the Communicating Climate Risk project brought together 25 scientists, policymakers, journalists and other experts to explore how to develop new metrics to better communicate climate risk - based on lessons learned from the COVID crisis.

Starting from existing COVID risk metrics, participants collectively identified a wide range of features of metrics which contribute to making them useful representations of risk. The identified features can be grouped around the following categories:

1. Objective and scientifically rigorous
2. Simple and suitable for intuitive evaluation
3. Temporal and spatial scale factors
4. How a metric is linked to decision making and action
5. How a metric can be explained narratively and graphically

Section 2 gives further detail of the particular features identified, and what makes them important. Combined, they form a checklist for assessing new climate risk metrics.

The participants' discussions also pointed to the fact that abstract quantities do not automatically come imbued with a risk meaning, but need to acquire such meaning over time (Section 3). Through this meaning-making, metrics can become good indicators of risk if:

1. They have as many of the useful features as possible.
2. People get an experience of the real-world risks the number represents.
3. The metric is used and explained over and over again.

The discussions also pointed to several dimensions which would need further testing and development in the context of climate change (see Section 4):

1. Do useful metrics need to be closely tied to the dynamics of the physical system, or is an 'engineered' metric of climate risk better?
2. Are metrics of the rate of change better than metrics of cumulative change?
3. Which are preferable: metrics of the causes or impacts of climate change?

Further themes identified are the likely need for more than one metric to capture the full extent of climate risk, the need for visual representation (e.g. in a dashboard), and the tradeoffs that would need to be made between simplicity and scientific completeness.

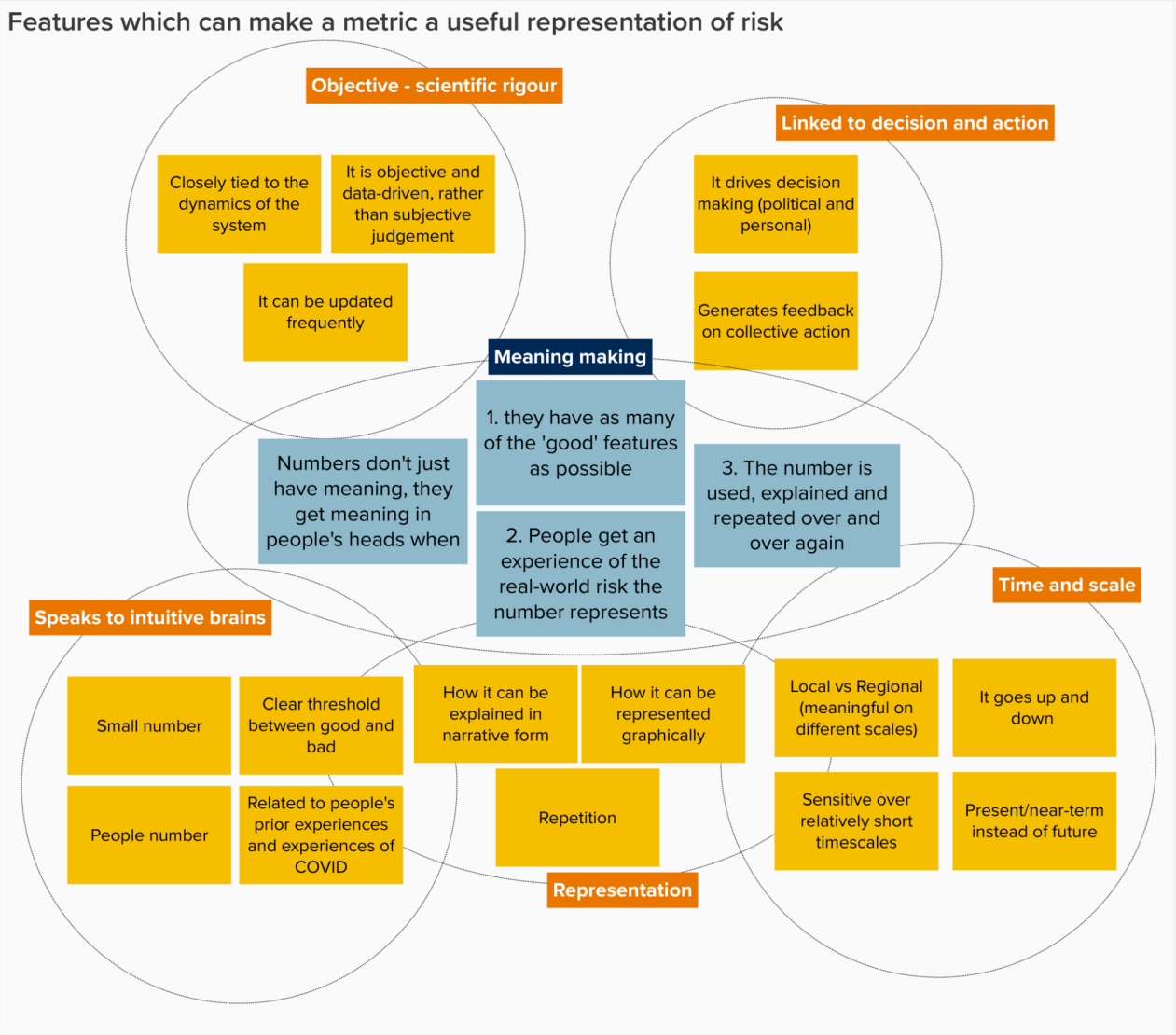
Based on these insights and specific suggestions during the kickoff meeting, 4 candidate metrics will be taken forward for feasibility scoping and development (Section 5):

1. A metric of the Earth's energy imbalance
2. A rate and localisable indicator of temperature change
3. An 'unusualness' indicator for weather (local and aggregate)
4. A 'people number' focused on climate hazards or impacts

2. Useful features of risk metrics

The R number for COVID served as a prompt to explore which features of risk metrics make them effective tools for risk communication. During the session, participants mentioned COVID metrics other than R which had been effectively used. Below we report indicator features which were suggested as useful and give extra background on why they matter.

The identified features can be used as a checklist to test newly proposed metrics against, or to explore whether existing metrics can be modified to tick more of these boxes.



2.1 Objectivity and scientific rigour

Specific features identified

- It is a **number from the system**, closely tied to the dynamics of the system itself
- It is **objective** and **data-driven** rather than based on subjective judgement
- It can be **updated frequently**

"It was scientifically, objectively valid.
It wasn't just some subjective viewpoint from a bunch of people."

Why is it important?
The objective and scientific nature of metrics like the R number was singled out as an important factor to build trust.

2.2 Simplicity and suitability for intuitive evaluation

Specific features identified

- It is a **small number** (i.e, a single digit number rather than a large quantity).
- It has a non-arbitrary and easy-to-remember **threshold** between 'good' and 'bad'.
- It can be explained in terms of **individuals/people**. This triggers what is called a *social encoding advantage*, making it easier to understand and remember.
- It can be related to people's prior **direct experiences** (e.g., of catching a cold).

"It's incredibly intuitive, each step on the scale represents one more person that you pass the virus onto and we all have relatable knowledge of passing colds or catching colds."

Why is it important?
Roughly 95% of what brains do is intuitive and automatic processing of information - outside of conscious control and awareness. It is when a risk can be evaluated intuitively that we 'get' it. If a risk cannot be evaluated intuitively, it is likely to lead to incomprehension or indifference. In that case, the processing of information requires attention and mental effort. This means people may not engage with it, or they may reach widely divergent conclusions.

What is processed intuitively or not is shaped by people's lived experiences. Any abstract issue or quantity can become intuitively evaluable to individuals. This happens when we become experts in a given domain, or become passionately engaged with an issue (and our brains move from a slow *reasoning why* to an instantaneous *seeing that* a problem exists). However, there are intrinsic features that can aid the process of intuitive meaning making.

For more details on the 'meaning making' process of generating intuitive understanding, see Section 3 below. For a further discussion of intuition vs reasoning, see the Appendix.

2.3 Appropriate temporal and spatial scales

Specific features identified

- It can be represented at different spatial scales: from **local** to **national.**
- It **fluctuates**: it goes up as well as down - rather than increasing monotonously.
- It is sensitive over relatively **short timescales**.
- It is a measure of **present or near-term** (instead of long-term) risk.

"The fact that you could track it from last week versus this week, and you could compare between different regions. So London's worse than Manchester is worse than London. So the compatibility across time and across space."

Why is it important?
This relates to the 'intuitive processing' reasons from Section 2.2: human brains can more easily deal with spatial scales of which people have direct experience (one's neighbourhood, town or country) than e.g. global scales. The brain is also better equipped to deal with change at a temporal scale of seconds to years, rather than anything much longer or shorter.

2.4 Intrinsically linked to decision and action

Specific features identified

- It can drive **political decision making**. Model simulations were often communicated to decision makers in terms of their effects on the R number or hospital occupancy: "If pubs are closed, R will likely drop to X; with schools closed, it will drop to Y".
- It can drive **personal decision making**: people who started to pay attention to it could use the R number as a metric to adapt their own behaviours.
- There is a close **feedback loop** (on the order of weeks) between collective actions taken (e.g., lockdown measures), and the effect on the R number, so the public and decision makers alike could get feedback on the effectiveness of these actions.

> *"It opens up mechanisms for action at a policy level, you simulate it, you see how it changes when you're bringing in certain measures. It also opens up for those individuals who started using it, their own agency, their own ability to act. So if the R number goes up, you can stay home, you can put on a mask, you can stay off public transport."*

Why is it important?
Psychologists have investigated the effects of fear and disaster messaging on people's risk perception and behaviour since the 1960s. This research indicates that threatening information is most effective as a driver of behaviour if the threat is accompanied by actions that feel doable, concrete, and meaningful to alleviate the threat.

If the communication of threatening information does not contain doable, concrete and meaningful actions, it becomes divisive as a communication tool. It may lead some people to accept it as truthful but others to reject it as misleading or manipulative. This is not only important for communication to lay people, but also for communication to policymakers and politicians: issues that feel threatening but are not accompanied by concrete, doable actions to avert it are more likely to fuel political paralysis and/or polarisation.

2.5 Explanation and representation

Specific features identified

- It can be explained in **narrative** form (e.g., 'ten people infecting twelve others')
- It can be represented **graphically** (e.g., using infographics)
- The explanation was **repeated** over and over again in the media

> *"It was a level of repetition, I can never remember being achieved at any time."*

Why is it important?
Participants observed that a metric like R may not be understandable at first, but requires repeated explanation to go from a 'confusing unit' to 'lingua franca'.

3. The process of 'meaning making'

The R number may not have been widely understood at the start of the pandemic.

> *"When it was initially launched, everyone was incredibly confused by it, in terms of actually what did it mean?"*

However, over time, it acquired significance and meaning. The features which aided this process of meaning making were the ones identified above: R was at heart simple and intuitive. It was explained repeatedly. It became linked to people's direct experience through case numbers going up or down, illness and deaths among family or acquaintances, and through the lockdown actions the government took.

> *"It became relatable to you, because you could look at how I was doing in Camden, and compared to my mom's area in rural Cambridgeshire, and so it became very real for me."*

Even if only a proportion of the public may have fully understood R, many people still had a sense that 'above 1 is bad, below 1 is good'.

> *"The R number became a signifier for how bad things were above and beyond what it was as a number. I think most people didn't know what the R number was, we just knew the number was bad. And that meant something. So probably the fact that it was so small, it became a symbol of something that took on a bigger cultural meaning."*

In contrast, participants from other nations (e.g., US, South Africa) reported that the R number had not been extensively used in their contexts. Other metrics such as case numbers, deaths or hospital occupancy rates were more frequently used.

Participants from nations with more visible signs of climate change (e.g. Bangladesh) reported that in their context, a metric would not be needed to explain the risks of climate change, as people have a more direct experience of it.

> *"In Bangladesh, we understand things much better when it comes to climate change. Because all I have to do is look out my window, and I see it, it doesn't need to be explained to me."*

What these different experiences indicate is the context dependence of the process by which real-world events and information may acquire meaning and generate an understanding of risk over time - rather than come imbued with such meaning from the start. This is important to keep in mind for the socialisation process needed to make new metrics useful. It is also important for the testing of new metrics: rather than testing them with yes/no questions ("Does this number convey risk to you?") the testing process should pay attention to how effectively a number or quantity may acquire risk meaning over time.

> *"I've had some experience where some truly rarefied units of measure, which no one understands at the beginning, become like lingua franca, as people understand the impact this input has to a wider set of aspects."*

4. Further insights and themes

4.1 Dimensions to test

Several dimensions of metrics led to interesting exchanges of ideas and questions which were not resolved. These are factors which require further testing and experimentation.

Metric of the system vs engineered metric
Questions were raised whether metrics would best be 'natural' to the system (as the R number was) or specifically constructed for communication purposes.

Rate vs level metrics
The R number for COVID is a rate number. Most existing indicators of climate change (like global average temperature or ppm) are cumulative quantities. Participants suggested that rate metrics of climate change might be more appropriate because they would be more dynamic, responsive to policy-making, and have a non-arbitrary threshold (usually 0).

> *"I wonder whether the population is particularly gripped by the notion of a kind of rate indicator, rather than a lot of climate metrics, which are level-based indicators."*

Cause vs impact metrics
Differences of opinion existed about whether the most useful metrics of climate change would be numbers describing the causes of climate change, or the impacts. The former was favoured because they would result in numbers closer to the dynamics of the system, whereas the latter could be brought closer to people's direct experiences.

4.2 Other important themes

More than one number or metric required
Several participants mentioned that, for climate change, multiple metrics would be required to cover all features which were covered by the R number for COVID.

A dashboard for visual representation
The idea that more than one metric may be required also sparked conversations around the need for a dashboard to visually represent the multiple numbers.

Trade-off between simplification and scientific completeness
Participants also mentioned the need for simplicity, which might come at a trade-off with the wishes of scientists to be thorough, nuanced or complete.

> *"It does need the scientific community to gather around something which, while they may have reservations about its precision, are prepared to accept that it gets the message across. I think that requires certain discipline from within the scientific community to accept the simplification of a very complicated issue."*

4.3 Reservations

Some participants expressed reservations, which are summarised here and linked to some of the other concepts (e.g., features, meaning making) discussed in previous sections.

The R number was not effective as a risk communication tool
Participants from the US and South Africa reported that R had not been used much as a risk communication tool in their context. This led some to question its effectiveness, an opinion which was countered by UK participants who said that R had been effective in conveying risk. These different perspectives between participants from countries where R was or wasn't used are not indicative of the intrinsic usefulness of a metric like R. Rather, they point to the centrality of the 'meaning making' process described in Section 3.

R was effective but a similar metric cannot be constructed for climate change
Some participants said that - whereas they thought that the R number had been effective for COVID - this would not be replicable for climate change.

Exponentiality
It was mentioned that R did not succeed in conveying the exponential growth rate of COVID. Research in psychology and behavioural economics has shown that humans make systematic errors in judging exponential growth, which has been explained as a natural inability of intuitive brains to process exponential growth. The available research suggests that conveying exponentiality and developing intuitive metrics may be mutually incompatible.

The importance of context
Several discussions pointed at the importance of target audience, and the context of the communication. A 'one size fits all' approach was deemed to be inappropriate.

5. Candidate metrics for development

Following suggestions during the kickoff meeting and via email exchanges after the meeting, the project will take up 4 candidate metrics for feasibility scoping and development.

If successful, the output of the project will be new and updated metrics for climate change, presented in graphical form on a dashboard. Moreover, through the co-productive approach that the project will employ to develop these, it will also establish new working practices for the collaborative development of future climate change metrics.

The candidate metrics span the range from cause to impact. Collectively, they cover many of the features which can make a metric an effective representation of risk. Several of the candidate metrics below are based on or would be an evolution of existing metrics.

5.1 A metric of the Earth's energy imbalance

As the primary driver of climate change, some climate scientists already put the Earth’s energy imbalance forward in the 1990s as a better metric than global average temperatures (which is a secondary effect of the energy imbalance). It never really took hold. Attempts to socialise the rate of EEI in terms of 'atom bombs per second' were only marginally effective:

the comparison fails the 'simple and intuitive' test. The challenge for this metric will thus be to find comparisons and representations which are better suited to intuitive evaluation.

> *"The best option I can think of would be the rate of addition of heat energy to the earth system. There is a threshold for that, which is zero. And we could actually go below zero, which would be the point where the risk starts decreasing instead of increasing."*

5.2 A rate and localisable metric of temperature change

The cumulative increase in average global temperature is probably the most established existing metric of climate change. It was suggested by several participants that this would be better expressed as a rate of change rather than as a level of change.

> *"How many people know the world is warming at over 0.25C per decade compared to the people who've heard it is 1.2C warmer than pre-industrial?"*

In contrast to the EEI, the challenge for this metric will not so much be to find a more intuitive representation, but to decide the optimal period over which to average the rate of change, and to explore how the metric can be localised to the regional, national or city level.

5.3 An 'unusualness' indicator for weather events

One of the primary ways that people make sense of climate is through their experience of weather.[1] At the moment, there is no easy way for people to gauge how unusual a particular weather event (or combination of events) might be. The challenge in the development of this indicator would be the precise format to make the metric intuitive, and the data processing required to produce localised as well as aggregate versions of the metric.

5.4 A 'people number' focused on climate hazards or impacts

Metrics that show the impacts and effects of climate change were deemed important.

> *"The framing around emissions or temperature targets doesn't express what people feel on the ground. There's a missing link that translates to what sort of impact that means."*

This is likely to be the hardest-to-define category, because there are many impacts that matter to different groups, or which would matter locally or regionally. Despite the associated challenges, it will be important to attempt to develop such a metric or group of metrics.

[1] Hulme, M. (2016) Weathered. Cultures of Climate. Sage

Appendix

A.1 The intuitive evaluation of risk

The difference between automatic, intuitive cognition and deliberative reasoning is one of the fundamental principles across the neuro- and psychological sciences.

Applied to risk perception, it is apparent in the work on 'risk-as-feeling' vs 'risk-as-analysis'.

Sources on the intuitive evaluation of risk:

- Slovic P. et al. (2010) The Feeling of Risk
- De Meyer, K. (2019) Geosci.Commun. Discuss. DOI 10.5194/gc-2019-1-SC1

General sources on intuitive cognition vs deliberative reasoning:

- Haidt, J. (2012) The Righteous Mind
- Kahneman, D (2011) Thinking Fast and Slow

A.2 Threatening information and the need for a link to action

The idea that fear and threat messaging (and therefore also risk communication) can have adverse side effects is prevalent in the work of many psychologists. One good entry point is:

- Aronson, E. (2008) Fear, denial and sensible action in the face of disasters

The available evidence indicates that there is no single 'right' level of threat in risk communication: if the threat feels low, the risk is unlikely to register. The higher the threat levels communicated, the more a message will divide and polarise people's reactions if it doesn't contain concrete, doable and meaningful actions to avert the threat.

The conclusion is that communicating climate risk may be necessary but not sufficient to generate action - unless there is a direct link from the risk communicated to the action needed to avert it (as was implicit in the R number and other COVID metrics).

A wider discussion of the links between climate communication, awareness, worry and action can be found in:

- De Meyer, K. et al. (2020) Environ. Res Lett. DOI 10.1088/1748-9326/abcd5a