Climate Change Communicated in Style:
A Big Data Approach to Target the Most Effective Influencer

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Introduction

Climate change poses one of the greatest threats to the stability of our global civilization. (IPCC, 2018; Dai, 2013; Diffenbaugh, 2019). Yet, despite the growing body of scientific evidence of the effects of climate change and its devastating consequences, a great part of the general public is still indifferent or in denial of its existence (Bain, 2012). As a consequence, there is still insufficient pressure on policymakers worldwide to cooperatively work towards sustainable solutions for our energy and resources. Based on recent studies, it has been found that the scientific community and the general public that follows scientific views are somewhat clustered in their separate social network "bubble" (Figure 1A; Johnson, 2020). This clustering heavily restricts the spread of scientific views. Here, we propose the creation of an organization focused on targeting the susceptible part of the public and working with effective social media influencers. These are well connected to the general public, and have the highest potential to spread the scientific views on climate change. As a proof of concept, we developed an algorithm that analyzes the profiles of personalities on Twitter and generates multiple metrics helping to identify the most effective influencers. These scores can be used to better allocate resources and efforts into the social media influencers with the most potential impact in the general public. Our concept can be progressively escalated to involve a larger number of influencers and even to include other social media networks like Facebook, Instagram or YouTube. But how can we change the attitudes and behaviours of individuals who are not persuaded by current scientific arguments?

How ideas spread: the role of influencers

The theory of influencers and their role in dissemination of ideas have been studied for decades. Sociologists Paul Lazarsfeld and Elihu Katz suggested the idea of influencers back in the 1940s and 1950s, when they developed the two-step flow of communication model (Katz and Lazarsfeld, 1955). According to this model, ideas first spread from mass media to opinion leaders, and then from opinion leaders to the broad audience. Lazarsfeld and Katz identify opinion leaders as active media users who interpret and diffuse media messages to others. However, sociologists add that the influence of opinion leaders depends on their credibility, competence, and access.

Contemporary online social networks with their widespread accessibility and ease of use serve as perfect media for proliferation of ideas and enhance the role of influencers in this process. Our idea is to exploit the power of social media influencers to communicate the climate change issue to the broad audience. This is very effective, as social media opinion leaders have an outreach to many people, and they have a substantial impact on the attitudes and behaviour of their followers. Moreover, they can promote a specific climate-friendly behaviour by making it fashionable, even without persuading their followers with rational arguments.

As shown by Watts and Dodds (2007), success of dissemination of ideas is largely driven by easily influenced individuals. Thus, following the results of Johnson et al. (Johnson, 2020), who studied how pro- and against vaccination ideas spread to undecided individuals on Facebook, we aim to target undecided or ignorant individuals in order to convey the importance of the climate change issue to them through social media influencers. This approach has high and long-lasting potential.

The Lindau network can be helpful in reaching out to influencers as well as in motivating them. Nobel laureates and other members might already have some contacts to celebrities (e.g. Richard Thaler and Selena Gomez appear together in the movie 'The big short' [1], and even without that, influencers might be willing to answer and consider to participate if they are contacted by a network connected to such prominent names. They can get a special recognition in return, which may improve their popularity and credibility among their followers. After establishing the mechanism, the next step is to find the right message to convey.

Messages to convey

The goal of our project is to communicate irreversible changes to our planet caused by climate change and to promote behaviour mitigating the process, like buying less plastic, installing LEDs, using more public transportation or even making an effort to convince leaders that urgent climate action should be prioritized.

Empirical studies in psychology and behavioural economics show that individual choices and behaviours often deviate from rationality. Using the nudge of influencers through multiple channels such as twitter posts, videos, script on T-shirts, personal experience sharing in an interview, and showing before-after photos of places they care about [2], our project aims to change psychological and social factors that influence the individual daily behaviour, even though the standard economic drivers such as prices relative to incomes do not change. Our project is expected to increase the knowledge and awareness levels of individuals on the state of climate change which ultimately affects their decisions by changing costs and benefits of actions (Niamir et al., 2020). Additionally, imitating a specific good practice of an influencer can have an impact itself.

One of the crucial tasks of the project is to deliver the messages in the most impactful way. Experimental studies have shown that people are more likely to acknowledge human-caused climate change if the proposed solutions or wording fit in with their broader stance on, e.g. issues of a free market, taxes and restrictions (e.g.: Hardisty et al., 2010). The existing research provides two important conclusions. First, influencers should be approached in a way that fits with their current actions to maximise the chance of convincing them to participate. Second, influencers should be supported in addressing their audiences in a way that fits their target, rather than with a preconceived uniform message for all audiences. Existing studies point at several challenges, like proper message structuring and framing (Bain, 2012), myth debunking, and the worldview backfire effect (Nyhan et al., 2014; [3]).

While communicating climate change certainly requires a more comprehensive strategy, we can think of starting small with a single action. Promoting a specific behaviour can have a result faster than changing the whole attitude towards climate change. Actually doing something is also more powerful than just learning about it. Besides, it can also serve as a gateway towards being more open to the issue. We can even create a challenge to promote the behaviour by having fun. Based on Wynes and Nicholas (2017) listing the individual actions with the largest impact we thought about potential challenges, like collecting and posting miles when you take the train or use video conference instead of taking the plane; posting images about stylish outfit for cycling or walking to workplace; or posting pictures meals on a "no meat and dairies week". Counting the number of steps it takes you to get to the first tree and post an instagram story about that could also raise awareness. While we are not the experts on creating the specific messages, a few other groups have worked on communicating climate change over the course of the sciathon. We hope to connect with some of them and help to deliver their messages.

Plan of action for long-term and large-scale impact

Having established the power of social networks in spreading ideas and promoting change, we propose the creation of a mechanism to continuously disseminate long-lasting impact through social media influencers. We could establish a Foundation supported by donations, with full-time data analysts focusing on developing strategies and metrics to approach specific social media influencers from all over the world. A committee of Nobel laureates, distinguished scientists and economists could oversee the Foundation's operations, establish and review annual guidelines, which would give credibility and encourage participation in the Foundation's activities. Voluntary Ambassadors being dedicated to the issue of climate change could be selected on a merit basis to help and facilitate the connection between the Foundation and the social media influencers from their respective regions. A motivation for the social media influencers to participate would be the eligibility for a recognition award, received from a Nobel laureate at the Lindau Nobel Laureate Meetings. The committee would select the annual winner with the highest impact based on quantitative metrics provided by the Foundation's data analysts. An important element is to be transparent with the whole setup from the very beginning. Having a webpage providing detailed information about the project with further information on climate change might be helpful.

Network analysis to identify the influencers to be targeted

The objective of our analysis is to identify influencers, i.e. accounts with a large number of followers where both the focal account and her followers have not yet publicly acknowledged climate change or have not chosen a side in the debate. To achieve this, we compute three measures using publicly accessible data from Twitter. The first two are based on analyzing the content of tweets while the third measure is based on the structure of the social network.

To classify if an account is agnostic to climate change, we created a list of keywords and hashtags related to climate change regardless of their affiliation (see also the colab notebook we provide.). We calculate the percentage of tweets that contain these terms from 1) the influencer's account 2) followers accounts.

Formally, we define the average tweets share as $\#matches_c/\#tweets_c$. The percentage of followers tweeting on climate change is $\sum_{F_c} I([\sum_{T_f} \#matches_f] > 0)/\#F_c$ where I is an indicator function, F_c denotes the set of followers of an influencer c and F_c denotes the set of tweets of a follower f. Based on these measures, it is possible to find accounts that are not (yet) involved in communicating climate change to an audience that does not (yet) engage with the climate change discussion.

A different way to check the interest of followers is by measuring the number of joint followers between influencers and twitter users posting actively about climate change. Unlike the previous measure which examines the activity of the accounts, here we measure the passive involvement in climate change. Taking into account that influencers with many followers have a higher chance of joint followers, we estimate the relative number of joint followers of celebrity c and environmental activist e: $\sum_{F_c \cap F_e}/\sum_{F_c}$. Together, the last two measures represent the audience's interest in climate change. The analysis is available in a colab notebook [4].

Pilot results

We restricted our analysis to 8 accounts. These accounts represent users that are climate change activists, deniers, related to the lindau nobel meetings (scientists) or should be agnostic to the subject. The first measure relevant for effective communication is the followers count, which ranges from 718 for Nobel Laureate William Nordhaus to more than 82M for Donald Trump in this set of accounts (Figure 1B). Both climate change deniers, activists and scientists tweet about climate change regularly, with these tweets making up between 3% and 25% (with the exception of William Nordhaus who does not tweet) (Figure 1C). The exemplary celebrity Billie Eilish did not tweet about the subject. All of the mentioned accounts have followers who engage in the climate change debate, but notably for Billie Eilish and Donald Trump these only make up 4% while they are between 15% and 38% for the other activists and deniers (Figure 1D).

For the joint followers analysis, we focused on a few celebrities to demonstrate the diversity between possible influencers. Table 2 presents the relative number of joint followers with Greta Thunberg. While Leonardo Di Caprio and Beyonce have a similar number of followers, the latter influencer has substantially less joint followers, suggesting that Beyonce has relatively fewer followers who are active in the climate change debate and can be a better candidate to influence her audience.

Taken together this shows that multiple measures have to be taken into account to find effective communicators. They need to have a large followers base, they should not be engaged in the climate change discussion, and they should have a followers base that is also not involved in the climate change debate. From our analysis, Billie Eilish and Donald Trump would be good candidates to be targeted.

Conclusion

Despite the simplicity of this plan of action, it combines the benefits of the guided effort of data scientists specialized in social media with the actual social media influencers and/or celebrities. The latter could be reached via the strong Lindau network, that provides enormous outreach to the specific target audiences, i.e. the majority of people that are unaware of the risks related to climate change. This idea is easily scalable and can be initiated with just a few data scientists that could even do voluntary work at the beginning as a "proof of concept" without any massive financing. Even though the project may only target a subset of people, every action adds up and matters for our planet and the future generations.
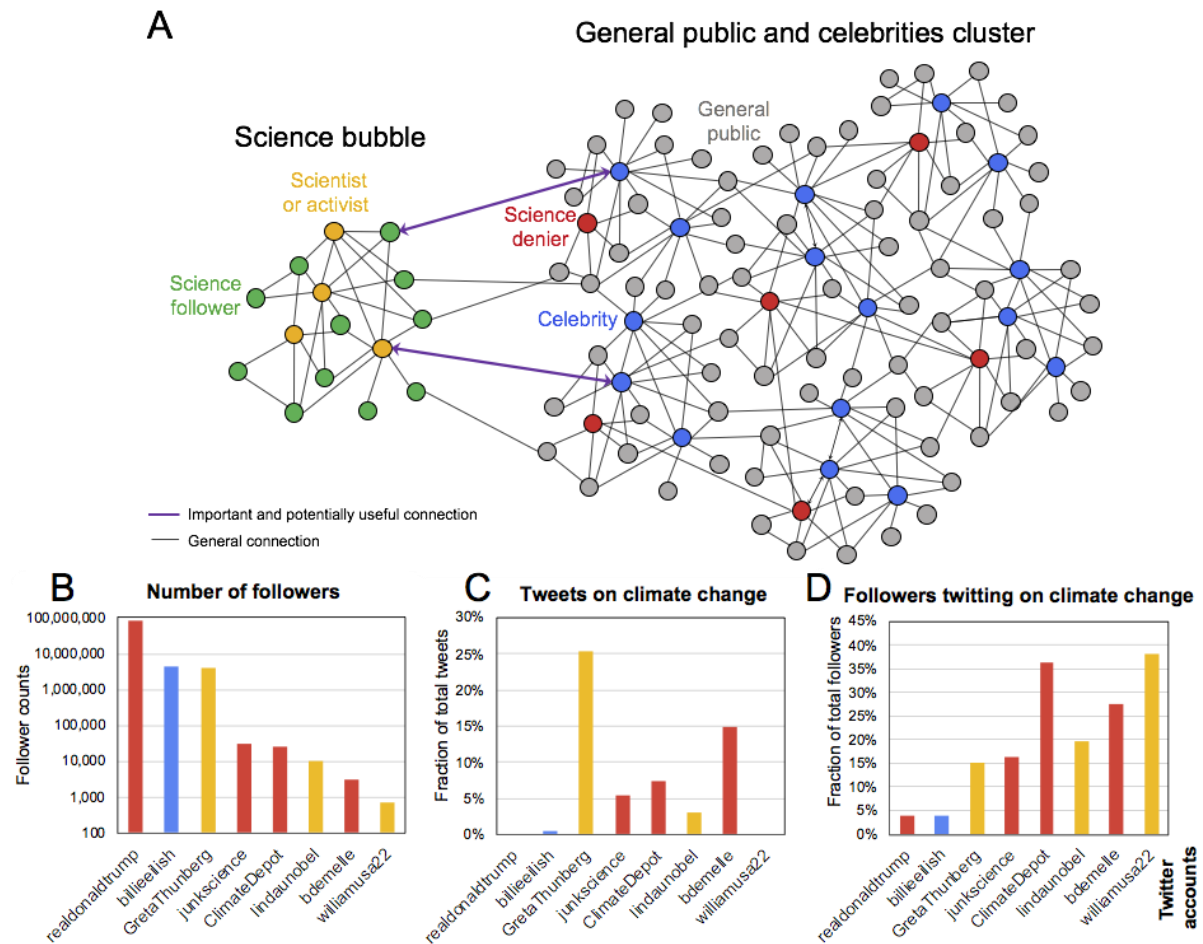
Figures and Tables

Figure 1 – (**A**) Illustration depicting the disconnectedness between the scientific community and the general public. Double sided arrows indicate mutual following. Adapted from Johnson (2020). Per account metrics compared across different Twitter influencers: (**B**) number of followers per account, (**C**) number of tweets that mention climate change or use related hashtags, (**D**) fraction of followers that mentioned climate change or related hashtags in their past 200 tweets.

Table 1: Per account metrics. Note, for realdonaldtrump only the last 40 tweets were included due to technical problems. William Nordhaus (williamusa22) only has one tweet, for all other accounts we were able to get 200 tweets.

Account	Follower count	Percentage of tweets on climate change	Percentage of followers tweeting on climate change
ClimateDepot	25,425	7%	36%
williamusa22	718	0%	38%
GretaThunberg	4,155,582	25%	15%
realdonaldtrump	82,328,143	0%	4%
billieeilish	4,525,681	0%	4%
bdemelle	3,018	15%	28%
junkscience	31,618	5%	16%
lindaunobel	9,939	3%	20%

Table 2: Joint followers with Greta Thunberg (among first listed 10,000 on 21 June 2020).

Account	Follower count	Joint followers/10,000
LeoDiCaprio	19,342,778	2.60%
realdonaldtrump	82,329,035	0.20%
paulkrugman	4,617,329	0.77%
billieeilish	4,525,767	0.66%
Beyonce	15,617,563	0.46%

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Notes

1. https://qz.com/1097965/the-2017-economics-nobel-prize-winner-richard-thaler-cameoed-in-an-oscar-winning-film/
2. This is already an existing 10-year challenge: https://amp.usatoday.com/amp/2618703002
3. A good guidance for communicating climate change is provided in the online EdX course "Making Sense of Climate Science Denial" by the University of Queensland http://www.edx.org/course/making-sense-of-climate-science-denial
4. Colab notebook of the data analysis: https://colab.research.google.com/drive/1NETYbZ1ybX_eMkWNMjQcObXdabJZvV3A