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CLIMATE

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Editorial

by Daniel Ochieng Orwenjo
GYA connections Editor, 2019/2020, GYA Member, 2017-2022

The choice of "Climate" as the theme of this edition of GYA connections is hardly surprising. Climate change is one of the most pervasive and threatening issues of our time, and is expected to have serious implications on human settlements and livelihoods. In many places around the globe, temperature changes and sea-level rise are already putting ecosystems under stress and affecting human and animal well-being. Indeed, changing weather patterns have led to both severe flooding and desertification in Africa, thus affecting crop yields and food security. Further, the ravaging bushfires in Australia have had unforetold effects on both flora and fauna, and low-lying Pacific island states such as Kiribati have been calling for climate mitigation for years as they lose land to rising sea levels.

This issue of GYA connections presents contributions dedicated to some of the enduring effects of climate change. For instance, we have an article that explores the nexus between climate change and global health, and another one focusing on how climate change affects ageism and creates intergenerational tension.

Further contributions provide insights into how the effects of climate change can be ameliorated by using adaptive, smart and resilient concrete infrastructures. There is also a thought-provoking article on how social media, specifically YouTube, can be harnessed to bring climate change issues and policies to the forefront, and to hold governments and political parties accountable for their actions and policies.

This issue also contains GYA Activities, a section that reports on selected projects and undertakings by GYA members. Here, we have a call to action by GYA members who are advocating for united actions to address climate change, our recent GYA Statement on COVID-19, and an exposé of the GYA's involvement at the World Science Forum.

The concluding section profiles the 2020 new GYA members. We on the editorial board take this opportunity to congratulate them for their achievement, and to welcome them to the GYA family.

In closing, I wish each and every member a fruitful e-AGM!

Daniel Ochieng Orwenjo
GYA connections Editor-at-Large

Climate change and global health

01 Climate

by Meghnath Dhimal

Climate change is an emerging global health risk. In the early 1990s there was little awareness of the health risks caused by global climate change, and the third assessment report of the Intergovernmental Panel on Climate Change (IPCC) concluded that "… overall, climate change is projected to increase threats to human health, particularly in lower income populations, predominantly within tropical/subtropical countries," (IPCC 2001). The fourth assessment report further concluded that "Climate change currently contributes to the global burden of disease and premature deaths… At this early stage the effects are small, but are projected to progressively increase in all countries and regions," (IPCC 2007).

The recent fifth assessment report (AR5 2014) of the IPCC concludes that greenhouse gas (GHG) emissions from anthropogenic activities are mainly responsible for the increased warming of the earth's climate since the 1950s, and it has been reported that global mean surface warming has increased in the range of 0.5° to 1.3°C over the period of 1951 to 2010. Moreover, this rate is likely to have increased by 1.5° to 4°C under different representative concentration pathways (RCPs) by the end of the 21st century compared to the baseline years 1850 to 1900 (IPCC 2013).

In recent decades, changes in climate have caused direct and indirect impacts on all continents and across the oceans. This has altered hydrological systems affecting water resources in terms of quantity and quality, changed the spatial and temporal distribution of biodiversity including diseases vectors, reduced crop yields, and increased the frequency and severity of extreme events such as heat waves, droughts, floods, cyclones, and wildfires (IPCC 2014). Furthermore, these climate-related hazards exacerbate other stressors resulting in negative outcomes for the livelihoods of those living in poverty (IPCC 2014).

Climate change and climatic variability directly and/or indirectly affect the health and well-being of all people. These effects occur directly due to changes in temperature and precipitation and the occurrence of climate-induced extreme events (IPCC 2014). The direct health effects of environmental and climate change result from an increased frequency and severity of heat waves, floods, landslides, droughts, and intense storms, whereas indirect effects include adverse changes in air pollution, the spread of

disease vectors and infectious agents, crop failures, food insecurity and under-nutrition, migration in the form of displacement, conflicts over resources, and mental illness. In other words, health may be damaged indirectly by ecological disruptions brought on by climate change (crop failures, shifting patterns of disease vectors and pathogens), or by social responses to climate change.

Climate change is projected to have significant adverse impacts on future morbidity and mortality. For example, the World Health Organization (WHO) projects that deaths related to heat exposure will have increased to over 100,000 per year by the 2050s, with higher mortality rates in low- and middle-income countries, and the highest mortality resulting from climate change in South Asia (WHO 2014). Another projection of WHO 2015 shows that climate change will cause an additional 250,000 deaths per year by 2030, when taking into account just five exposure pathways (undernutrition, malaria, diarrheal disease, dengue, and heat).

The greatest health effects of climate change occur in the most vulnerable populations residing in the least -developed countries who already now suffer from the heaviest burden of disease but are historically least responsible for GHG emissions. This indicates a growing "ethical crisis" (Patz et al. 2007).

The leading medical journal The Lancet first commissioned a review on "Managing the health effects of climate change" in 2009, which concluded that climate change is the biggest global health threat of the 21st century (Costello et al. 2009). A follow-up commissioned report on "Health and climate change" concluded that tackling climate change could be the greatest global health opportunity of the 21st century (Watts et al. 2015). This commission report made 10 policy recommendations. In order to track progress on these recommendations, the Lancet Countdown published a report in 2018, (Watts et al. 2018) and another was published in December 2019.

A recent study shows that climate change is threatening the achievement of sustainable development goals, including the achievement of universal health care (UHC) through negative health outcomes and healthcare system disruptions (Salas & Jha 2019). This study documents the effects of climate change on non-communicable diseases, infectious diseases and occupational diseases, but climate change also impacts mental health.

Policy response to address the global health risks of climate change

The United Nations Framework Convention on Climate Change (UNFCCC) from 1992 and its Kyoto Protocol adopted in 1997 refer to the legal frameworks that maintain the international climate change process and agenda. Article 1 of UNFCCC 1992 refers to health, which is adversely effected by climate change, while Article 4 refers to commitments of countries to assess the health implications of adaptation and mitigation policies.

Similarly, the Cancun decision on the UNFCCC in 2010 also identified health as a priority in climate adaptation actions. Parties to the UNFCCC have decided to provide financial support to the Least Developed Countries (LDCs) from the LDC Fund to formulate and implement the National Adaptation Plan (NAP). The LDCs and developing countries may wish to secure funding from the Green Climate Fund (GCF) through its readiness program.

The Paris Agreement adopted at COP 21 in Paris, on 12 December 2015, marked the beginning of a new era in the global response to climate change. As stated in the agreement, "the right to health", will be central to future actions taken. The Paris Agreement not only sets ambitious aims to curb GHG emissions to keep global warming well below 2°C, but it also commits countries to strengthen adaptation. Further, it commits countries to finance clean and resilient futures in the most vulnerable countries. Through monitoring and revision of national contributions every five years, the world will begin to see improvements not only in the environment, but also in health.

The 2030 Agenda for Sustainable Development includes 17 Sustainable Development Goals (SDGs), 169 targets and 232 indicators. Among the 17 SDGs, Goal 3 ("to ensure healthy lives and promote well-being for all at all ages") has a central focus on health, and Goal 13 focuses on climate change ("Take urgent action to combat climate change and its impacts"; (United Nations 2017). All SDGs are directly or indirectly interlinked to produce synergetic effects and emphasise health in all policies.

Similarly, the Sendai Framework for Disaster Risk Reduction 2015–2030, which is the replacement of the Hyogo Framework for Action 2005–2015, integrated key recommendations on climate-related disaster risk reduction (Habtezion 2016). In 2015, the WHO Executive Board endorsed a new work plan on climate change and health. This plan includes the following: partnerships; awareness-raising; science and evidence; support for the implementation of a public health response to climate change.

Accordingly, member countries of the WHO are working on mainstreaming climate change aspects in development plans such as through the development of national adaption plans and climate-resilient health systems.

Meghnath Dhimal *(Nepal Health Research Council, Nepal) is a Chief/Senior Research Officer at the Nepal Health Research Council, Government of Nepal. His research interests include climate change and health, environmental and public health and neglected tropical diseases.*
Email: meghdhimal2@gmail.com

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From asymmetry to dialogue? Collective imbalances and common challenges in the conceptual evolution of European Union and global sustainability agendas

by Cristina Blanco Sio-Lopez

"Are you afraid of the good you might do?"
Victor Hugo, Les Misérables

This contribution aims to analyse the historical evolution of the main conceptual premises guiding global decision-making regarding leading notions of "sustainability" from the end of World War II until present, taking the European integration process as a paradigmatic framework in this realm. Furthermore, the article examines the nature and implications of the key turning points and paradigm shifts in transnational institutional premises and the discursive apparatus sustaining changing agenda-setting priorities to "heal the world".

The article proceeds as follows. First, it addresses the post-WWII de-colonisation context, examining how development concepts were markedly framed by the weight of past imbalances and assymetries. In the long run, these initial asymmetries would be accentuated by the disregard of supranational organisations for socioeconomic cohesion responsibilities affecting sustainability liabilities at the global level.

Second, this piece studies the shifting paradigms of the diversity of (instrumental) meanings given to "sustainable development" in global policy-making in the post-Cold war period. These include an agenda-setting focus on the unifying notion of the compatibility between environmental protection and economic growth; the "democratic clause" (e.g., for European Union development cooperation) and its conditionality implications; and the "ecological modernisation" (EM) paradigm shift and its inner hindrances to a global "sustainability governance" self-assumed principle.

Third, this contribution examines the innovation capacity of the global civil society and activist movements' mainstreaming of concepts with a determinant social impact, also reaching the collective imagination of global agenda-setting actors in these key domains.

Asymmetry and collective imbalances in the post-WWII decolonisation context

Examining the post-WWII decolonisation context illustrates how development concepts were markedly framed by the weight of past imbalances and asymmetries in the incipient European integration process. Indeed, there was a resistance to express a common European memory, linking together intertwined instances of conflict and cooperation in the first integration phases. This resulted in a disruptive weight in the future European Union (EU) relations with the wider world. This semantic weight can also be associated to the neglected complexity of the post-colonial legacy of "recycling empire" notions, including the invention of a European development aid bureaucracy (Dimier 2014). In this respect, it is also important to note that European integration as a form of international institutional reorganisation in a post-colonial context very relevantly favoured a focus on development cooperation mechanisms centred on prosperity

notions and welfare state correlations with foreign policy (Burbanke and Cooper 2012). However, the EC foundational asymmetry between "donors" and "receivers" after WWII was precisely further internationalised by common European incipient policies in these realms (Cooper 2002).

In addition, it is important to note how such division was consolidated instead of a concept of ongoing and adaptable dialogue in European Commission (EC)/EU development cooperation. In the long run, these initial asymmetries were accentuated by the EC/EU Member States (MS) neglecting the fact that European integration implied not only individual MS socioeconomic cohesion responsibilities, but equally shared international cooperation and sustainability responsibilities.

The European Communities as trade actor and environmentalist player: a sustainability contradiction in terms?

From the late 1970s onwards, the trade-development imbalance gained political and conceptual salience, as did an increasing trade-sustainability asymmetry, with special regard to environmental protection.

Initially, the pressure to respond to cross-border pollution and, increasingly, to global-scale environmental changes, was combined with the EC's concern regarding the trade implications of environmental policy (Bretherton and Vogler 2000). Indeed, the need to respond to trans-boundary threats provided the impetus for the earliest major international negotiations in which the EC was engaged at that time, that is, the Trans-boundary Air Pollution (LRTAP) Convention of 1979.

The EC also participated in negotiations related to the sustainability of shared "common pool" resources. These include the negotiation of fisheries agreements, both bilaterally and in multilateral UN negotiations, such as those linked to "straddling stocks". In this regard, the Community was also a signatory, for instance, to the 1982 Third Law of the Sea Convention and of the 1982 Convention on the Conservation of Antarctic Marine Living Resources.

This EC imbalance of contemporarily acting as trade actor and as an environmental "activist" became exacerbated from the post-Cold War.

From a different perspective, MacManus (1996) also noted that the predominant, most widely-adopted environmental development discourse has increasingly changed, from the 1970s' notions of environmental limits to economic growth, to an environmentalism that incorporates growth (see Meadows et al. 1972).

In this sense, the turning point marked by the Brundtland Report (World Commission on Environment and Development 1987) brought about the now classic definition of sustainable development: "Meeting the needs of the present without compromising the ability of future generations to meet their needs". This would introduce an ingredient of growing interdependence in the EC's tackling of common challenges in the intertwined realms of global development and sustainability, which would become fundamental after 1989.

Common challenges in the post-Cold War era: A chance for cooperative convergence?

Since 1989 we can observe shifting paradigms in the diversity of (instrumental) meanings given to "sustainable development" in EC/EU policy-making in the post-Cold war period. In this respect, the EU agenda-setting focus on the unifying notion of the compatibility between environmental protection and economic growth at the global level departs from the 1987 paradigm of the aforementioned Brundtland Report on meeting the needs of the present without compromising the needs of future generations. The incipient "democratic clause" for EU development cooperation and its conditionality implications also become key in this context, as does the "ecological modernisation" (EM) paradigm shift present in the EU's own approach to sustainable development as part of the sixth environmental action programme (6EAP), covering the 2001-2010 period. Indeed, this notion divergently implied that long-term economic competitiveness depended on the environmental sustainability of integrated policies. Nonetheless, the challenge of new EU governance vs. old MS politics (Griffin 2013) heavily affected the actual premium on old-style economic expansion at all costs (Pepper 1999). From a different perspective, both EU development cooperation and sustainability priority concepts suffered from a lack of "Plan D" concerning democracy, democracy and debate premises, which were being claimed in other EU policy areas. Moreover, contradictions have been a constant, as "sustainability governance" is theoretically at the core of both 6EAP and the Lisbon Treaty, despite the Commission's self-acknowledged limitations to move in this direction. In short, the lack of a concrete meaning for "sustainable development" seems to continue plaguing the EU's actual implementation in these vital areas to positively tackle global interdependences.

A way towards societal mainstreaming in the conceptual evolution of the EU development and sustainability agendas

Looking now at more contemporary developments, the innovation capacity of global and EU civil society and activist movements' mainstreaming of concepts with a determinant social impact have also reached the collective imagination of agenda-setting in European representative politics in these key realms. Indeed, these new vectors range from the roots of social and economic inequality to renewed priorities for development cooperation and sustainability. The main open question in this regard lies in determining whether grassroots mainstreaming phenomena could derive in new compelling narratives based on a desirable good global governance dialogue equally restating a global sense of community building.

From this mindset, Griffin sees the current sustainability discourse in Europe as being "ostensibly a unifying one, where potential conflicts between economic growth and environmental protection appear to be surmounted or even erased," (Griffin 2013). Nonetheless, the analysis of the successive efforts to implement governance measures for EU environmental sustainability via political reform still cannot connect self-portraying narratives with globally impactful good practice in a way in which humans could socially and environmentally continue to meet their needs in the future (Meadowcroft 2000).

Griffin also warns of challenges related to the fact that the signifier "progress" has become synonymous with a hegemonic discourse of "development" closely linked to the evolution of industrialised states. Indeed, as she explains, such a narrative would riskily comprise "notions of economic growth and managerial techniques for governing, so the concept of "sustainability" has also taken on these notions of growth and managerialism" (Griffin 2013). This implies an exacerbation of rationalisation, technocracy and modernity notions in such relations, and assumes that there can be continuing global marketisation under capitalism (Griffin 2013).

Conversely, the approach to sustainability often described as ecological modernisation relates to the search for "a way of governing that ensures that these aims can be pursued simultaneously" (Pepper 1999).

Above all, it is fundamental that the EU is able to engage in dialogue on long-standing ethical commitments beyond the language of technocracy, given the multiple connotations of an increasing global poverty.

The key factor in this context is ever-rising inequality, which could be tackled with redistribution instead of focusing on "rooted crises" linked to cycles of famine and natural disasters as sources of private fundraising. This would favour, in Lugo-Ocando's eyes, an understanding of global poverty according to which the poor would be part of our "we", instead of a perpetual "they" (Lugo-Ocando 2014).

Such an approach could temper the paradox of a multilevel degradation (environmental, political, socioeconomic, etc.) that spreads without even the faintest benefit to the a priori degraders.

In short, there is a diachronic suspicion regarding the possibility that European colonisation was not only internalised, but also substituted at the global level, with development cooperation under conditionality clauses. This perspective would bring us back to the notion of "camouflaged colonialism", present in meaningful European Parliament's critiques (Historical Archives, European Parliament, 1959).

Furthermore, a fundamental tension persists: the short term of economic priorities vs. the necessary long term for the consolidation of sustainable development within a global community of values.

And it is precisely here that not only the dilemma, but also the hope remains: could the triggering hopes of European integration be distilled into an unequivocal commitment to a global community of values?

Cristina Blanco Sío-López *(University of Pittsburgh, United States) is European Union Horizon 2020 "Marie Skłodowska-Curie Senior Global Fellow" at the European Studies Center and Jean Monnet EU Center of Excellence (JMEUCE) of the University of Pittsburgh, and at the Ca' Foscari University of Venice. Email: Cristina.Blanco.Sio-Lopez@EUI.eu*

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Ageism and intergenerational tension in the age of climate change

by Liat Ayalon

One of the most important inheritances we can leave to future generations is an intact world in which they can continue to live and flourish. Yet there appear to be high levels of ageism and a growing tension between generations in the ideological discourse surrounding climate change. As a result of climate change's gradual depletion of the earth's resources, intergroup threat is likely to increase and older people may be expected to give up their place in society and not to be a burden on resources that some people think more rightly belong to younger generations. The portrayal of older adults as powerful and self-centered may result in aggression or anger towards the powerful and egocentric. Unfortunately, we currently witness an attempt to solve one societal problem, namely, climate change, by instigating another one, namely, ageism and intergenerational tension between young and old. In order to live in a world for all ages, in which age is no longer seen as a burden or a liability, we have the responsibility to ensure that current ideological discourse is inclusive and respectful towards all age groups in society. This may also result in the greater commitment of people of all ages to the climate change movement.

Ideological discourse surrounding climate change started in the early 20th century and has been growing in intensity since the 1980s (Bord et al. 1998). Much of this discourse has emphasised power differences and hierarchies. Powerful groups in society are thought to benefit from maintaining the status quo, or even exacerbating greenhouse gas (GHG) emissions and the depletion of the earth's resources, whereas the less powerful are likely to be most affected by these activities and to suffer the most (McCright and Dunlap 2011). To describe this unequal balance between countries or groups, terms such as environmental racism, the ecological debt, food sovereignty, land grabbers and water justice have been used (Martinez-Alier et al. 2016).

Conflicts around climate change are not only geographical in nature, but also temporal. Although much of the discussion around climate change and power differentials emphasises wealth, developmental status and ethnic/racial identity, age and generation also serve as sources of power differential (Sachs 2014). Clearly, GHGs emitted by current generations impact future generations. Children are often thought to be the most affected by climate change because of their increased vulnerability to injury, disease, and extreme weather conditions, and because they are expected to suffer the effects of climate change for a substantially longer period of time (Gibbons 2014).

A major source of intergenerational tension in the case of climate change stems from the strong sentiment that views older adults as being better off than the younger generations. This sentiment is fueled by the fact that the lives of older adults today have improved compared to the lives of previous generations. Specifically, life expectancy has increased dramatically over the past few decades. Older adults are also doing better financially than in previous

generations. In contrast, young people may not experience the same demographic and financial benefits that were awarded to previous generations. For example, contrary to the general trend worldwide of a steady increase in life expectancy, life expectancy has been declining in several developed countries in recent years (Ho and Hendi 2018). Moreover, younger people today are facing unprecedented financial challenges, such as rising housing prices and high rates of unemployment, all of which are exacerbated by an uncertain future thanks to climate change (Moody 2007). A related source of intergenerational tension stems from a view that portrays older adults as "greedy geezers", selfishly caring about their own wealth and disregarding the welfare of future generations (Street & Cossman 2006).

Despite those who view older adults as depleting the earth's resources, a recent review has found limited differences between young and old people's attitudes and knowledge concerning climate change (Corner et al. 2015). Moreover, research has shown that it is older people who have been most affected by climate change because they are more vulnerable to the impact of extreme heat waves, severe weather disruptions, and polluted air (Yu et al. 2011). It is also important to stress that it is the current older generations that are expected to make sacrifices today for a future that they will not be a part of. Yet the majority of older people aspire to leave a valuable legacy for future generations (Frumkin 2012).

As the science around climate change has been contested, the role of ideology has become prominent. The use of ageism (in the form of age stereotypes) and/or the incitement of intergenerational tension is quite common, especially among those who advocate for immediate action to mitigate the potentially irreversible effects of climate change. A very subtle example of ageism can be found in Al Gore's book, An Inconvenient Truth. Gore invites readers to imagine a conversation with their children and grandchildren in the future. He argues that only the actions readers took in the present will answer their children's future questions concerning their involvement in mitigating the effects of the climate change.

More than a decade later, we are witnessing a 16-year-old girl from Sweden named Greta Thunberg, who has become a symbol of the fight against global warming (Stott et al. 2019). This teenager attempts to persuade us of the real effects of climate change, explicitly blaming adults for stealing her future, while the President of the United States, a 73-year-old man, denies the effects of global warming (De Pryck and Gemenne 2017). The movement inspired by this 16-year-old's actions, Fridays for Future (FFF), calls upon children all over the world to protest in an attempt to persuade adults who she feels have neglected their duty to mitigate the negative effects of climate change. As Greta states: "Since our leaders are behaving like children, we will have to take the responsibility they should have taken long ago… You are not mature enough to tell it like it is. Even that burden you leave to us, children," (Thunberg 2018). Other activists, such as Bill Nye, an American science communicator, explicitly states that climate science will advance only when old people finally "age out".

These arguments neglect the fact that older adults have an incentive to leave a worthy future to their children and grandchildren. In fact, there are several older adult movements that are active in raising public awareness to climate change. In 2009, the Elders, a group convened by Nelson Mandela, called for international action on climate change. The green AARP blog and the MacArthur Foundation Research Network on an Aging Society are additional examples of older people's movements that strive to facilitate action to address climate change.

Among those people who are cautious about the claims of climate change advocates, age, cohort, and time have only received limited attention, though many of the most prominent deniers are older adults themselves. Although much of older adults' ideological discourse around climate change concerns the lack of validity of the science and its interpretation, some of those who challenge the climate change movement argue that not creating potentially restricting regulations is a means to a brighter, more prosperous future (Hoffman 2011). Thus, this ideologically-based discourse about climate change also addresses time, but less directly.

The use of ideological discourse, which increases the division between generations is not unique to the climate change movement. The Brexit movement also represents a source for intergenerational tension. It is often said that older adults have made a life-changing decision for future generations who were not able to vote and express their opinion on a matter that was going to affect the rest of their lives. Consistent with this view, Die Partei (The Party), a German political party that is supposed to form a satirical response to the extreme right and has seats in the European Parliament, has advocated for taking away older adults' right to vote. In their supposedly satirical video, they show an old man, connected to a ventilator, followed by this message: "…This old white man is already considered dead, but still retains the right to vote. Like five million other German last-time voters, he is determining a future in which he will have no part." The video concludes with the following message: "Therefore we are demanding a maximum voting age. Just as people don't vote during the first 18 years of their life, they should not vote in the last 18 years of their life, either."

This discourse is detrimental to the lives of older adults. It also is likely to result in the exclusion of older adults from the global climate change movement. As the climate change affects all of us, young and old, it is important to gather forces to create societal change that is unrelated to chronological age. It is our duty to ensure that we do not solve one global problem, namely climate change, by exacerbating another global problem, namely intergenerational tension and negative agesim towards older adults.

Liat Ayalon *(Bar Ilan University, Israel) is a Clinical Psychologist and Professor in the School of Social Work at Bar Ilan University, Israel. Her research concerns three major areas: ageism; the intersection of formal (paid) and informal (unpaid by family and friends) care to older adults; and the integration of mental health in primary care. Email: Liat.ayalon@biu.ac.il*

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Adaptive, smart and resilient concrete infrastructures

by Shima Taheri

Infrastructure systems are the backbone of any country, and are expected to provide services over a very long period of time; this increases the likelihood of them experiencing the ever-increasing impact of climate change over their lifespans. With the accelerated rate of urbanisation and the movement of people towards cities, we require more and more new infrastructures. Meanwhile, many of the existing ones are aging rapidly and becoming a potential risk to people's safety and a burden to national economies. How can we reduce the cause of climate change while making climate-resilience and climate-safe infrastructures? Perhaps optimising the concrete component of a structure can impact its climate-safety and prepare societies for future challenges.

More people will reside in urban areas than in rural areas by 2050, and based on a United Nations report, around 66% of the world's population is projected to be urban by then (Figure 1; United Nations, Department of Economic and Social Affairs, Population Division 2016, 2018). As a result, many countries – particularly lower- and middle-income countries with a faster pace of urbanisation – will face a more complex set of choices and challenges, including but not limited to the following: sustainable development, land shortages, climate change impacts, safety and security, healthcare and education, infrastructure networks (e.g. electricity, water, telecommunication and sanitation), housing and public transportation, and most importantly the emergence of "megaslums".

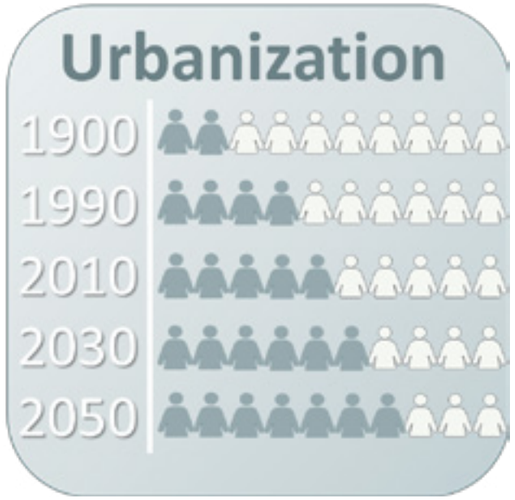

Figure 1: Trend in Urbanisation.

Source: Based on United Nations Department of Economic and Social Affairs, World urbanisation prospects: The 2014 revision.

One of the main challenges of excessive urbanisation is the need for extra infrastructure networks that will predominately be built from concrete. Concrete is an essential building material used in the majority of structures worldwide, with an estimated annual production of 10 billion tons on the global scale. This amount is set to increase between 12% to 23% by 2050. The demand for concrete-based infrastructures rises each year in line with population growth (International Energy Agency 2018).

Concrete is a versatile building material that facilitates the construction of durable, affordable, functional and attractive structures. From buildings to bridges, roads, runways, multi-story car parks, dams, tunnels, and sewage systems, our cities depend on concrete.

By itself, concrete is a very durable construction material. Concrete infrastructure, however, has a limited service life due to deterioration and degradation caused by the combination of several internal and external factors, including but not limited to poor design and construction errors, the exposure to severe conditions associated with the environment (frost, chemical attacks, etc.), excessive loading, the quality of embedded metal, concrete's resistance to volume changes, and abrasion/erosion (Taheri 2019).

The degradation of concrete over time increases the life-cycle cost of an asset due to repair or demolition expenses, with an estimated annual cost of billions of dollars to national economies. Other hidden societal costs associated with the degradation and maintenance of existing and aging infrastructures include the loss in productivity due to unavailability of buildings, traffic jams, the loss of confidence in government institutions, etc.

Additionally, problems such as the global sand shortage, escalating costs of construction, and cement/concrete being major contributors to the global carbon footprint (5% -7% per year) are other challenges associated with this accelerated urbanisation (Bendixen et al. 2019; Ghosh and Mandal 2018).

Meanwhile, recent structural failure and fatal accidents have raised concerns on the overall safety and reliability of existing and aging concrete infrastructures. Some examples of those recent fatal concrete infrastructure failures include:

- 12 October 2019; partially constructed Hard Rock Hotel Collapse, New Orleans, USA, 3 dead, 18 injured.
- 1 October 2019; Nanfang'ao Bridge collapse, Su'ao, Yilan County, Taiwan, 4 dead, 10 injured.
- 14 August 2018; Ponte Morandi motorway bridge collapse, Genoa - Liguria, Italy, 43 dead.

Infrastructure failure can be as deadly as war, weather incidents, or even transport accidents. Apart from climate-driven extreme weather conditions and natural hazards, the main cause of such accidents is the human factor (e.g., poor design, lack of maintenance, etc.).

Protecting vital concrete infrastructure is becoming critically important with the increasing severity of storm events due to climate change, as well as an increasing number of earthquakes. Keeping a bridge standing or a command post operational after a major event can mean the difference between minor and major loss of life. Some structures, including power plants, dams, and bridges, are too important to fail and need to be constantly monitored to ensure their continued integrity. However, current methods of the manual evaluation of a structure at fixed time intervals as well as repair and maintenance are both labor-intensive and costly.

Thus, there is an urgent need for disrupting innovations, and for them to be embraced in the highly conservative construction sector. Incorporating new and emerging technologies and innovative products could not only help to increase productivity, enhance structural performance, address environmental and sustainability challenges, but also increase structural reliability and service-life, and ultimately prevent personal injury through structural collapse and the associated disruption to our daily lives.

It is time to rethink how to build our future infrastructures and do things differently. How can science and technology transform current conditions to overcome the above-mentioned problems? The answer is designing structures that have the ability to adapt to their environment, develop immunity to harmful actions, self-diagnose the onset of deterioration, and self-repair when damaged. From raw material extraction to manufacturing, constructing, maintenance and ultimately recycling, every single step of a concrete structure life cycle needs to be optimised and revised.

The first step toward fulfilling our dream of constructing safer and durable concrete infrastructure is to make them disaster-resistant or resilient. A simple definition of a resilient structure is the ability to quickly restore full functionality following an extreme event. Following the biomimetic approach and introducing the capability of feeling/sensing and responding to problems to concrete structures is thus the key; this is similar to a wound-healing process, or feeling pain as an indication or symptom of a problem somewhere in the body.

Concrete suffers from numerous challenges such as corrosion, decalcification, unwanted cracking, excess capillary porosities, water permeating, etc. Thus, new advanced materials will need to be developed to handle some fundamental issues. Advanced materials are among the top ten disruptive technologies that have the potential to truly reshape the world, with

a potential economic impact of up to $500 billion by 2025. Additives that are self-healing, corrosion-resistant, fire-resistant, or water-repellant can be added to concrete systems and change the current practice of concrete manufacturing by improving both its quality and durability.

Making a resilient structure is an interdisciplinary field that requires several different advances in science and technology, as well as skills in engineering, biology, materials science, physics and mathematics. For example, one problem among many that can endanger the durability and the reliability of concrete structures is cracking due to stresses caused by mechanical, thermal, or chemical means. As cracks propagate through a structure, they can lead to more serious problems such as the accelerated penetration of aggressive agents and subsequent corrosion of embedded reinforcing steel, a weakening of the structure, and spalling of the concrete cover. Furthermore, the majority of cracks occur deep within the concrete in inaccessible areas that are invisible to normal inspection, causing a major serviceability problem.

Controlling and stopping crack propagation and enlargement is thus the key to protecting concrete structures, enhancing their performance and reliability, and extending their service lives. Self-healing cracked concrete, therefore, can help develop sustainable resilient infrastructures as it can restrain early-age micro-cracks from developing to larger cracks. There are many ways to create self-healing concrete, including a number of biological and chemical agents. Therefore, this interdisciplinary field of research not only requires mechanical or materials scientists/engineers, but other skills are essential to mimic crack propagation and simulate its development, to visualise cracks, develop damage models, or to create crack estimation equations.

The next step is to introduce intelligent systems and sensing capabilities to concrete structures, that is, to make concrete smart. The process of implementing a damage diagnosis and identification strategy in engineering for aerospace, civil and mechanical engineering infrastructure is referred to as structural health monitoring (SHM; Taheri 2019).

A structural health monitoring system can provide an early warning of abnormal changes in the in-service performance of the structure. It can also significantly reduce expenditures for maintenance and repair, as well as the risk of fatal accidents. Timely protective measures such as minor repairs and retrofitting can extend the useful life of structures and decrease the possible damages and loss of assets. Therefore, such a system is expected to receive great attention from government and authorities in the industry.

Climate-related factors such as temperature, humidity, corrosion of the concrete/rebar, are among key parameters in civil procedures and in designing and constructing new concrete infrastructures, as well as the asset management of existing structures in different regions. Thus, continued monitoring of structures while being in-service and controlling changes in parameters that have an impact on thier durability and safety can save huge amounts of money. As mentioned earlier, the manual evaluation of a structure at fixed time intervals is labor-intensive and costly. Intelligent systems can increase the risk of errors and diagnostic misjudgments (Taheri 2019).

Concrete sensors are subjected to a difficult life: frosts, extreme heat, imposed loads, corrosive environments (salty, alkaline or acidic conditions), and long-term placement within the concrete. A concrete infrastructure is designed for long service life, thus, the sensor drift (especially for embedded systems) in long-term monitoring becomes a big issue. There are also still issues with sensors' respective power supplies, gathering continuous information from sensors and transmitting them, data and digital resources management, data

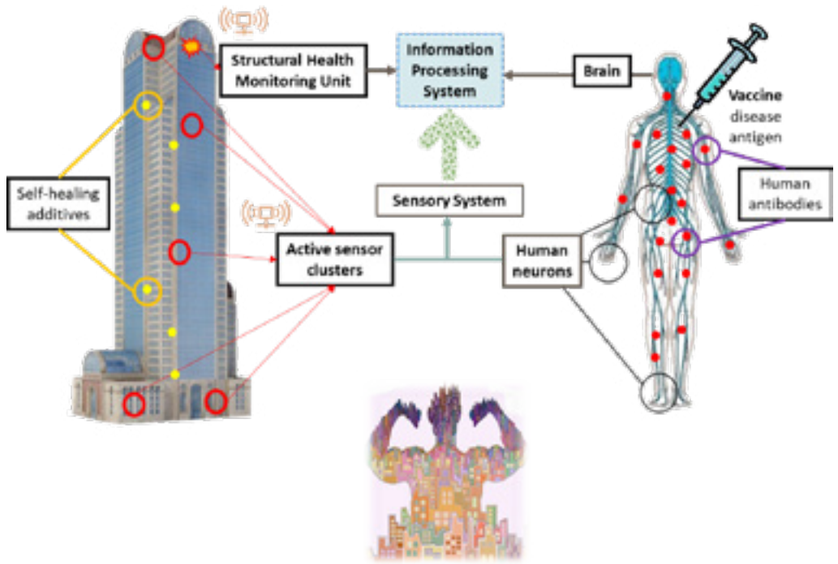

Figure 2- The concept of smart adaptive resilient infrastructures. Please note that such a system depends on the final application of the material and intelligent component of this model can be changed. Source: Author.

accuracy and location information, and using artificial intelligence (AI) and appropriate software in interpreting data. Data ownership, access, interpretation, sharing, use, and most importantly cybersecurity and data protection are also issues associated with the adoption of the smart approach in building concrete infrastructures.

While SHM still faces major challenges, advances in sensor technologies, wireless communications, data processing techniques, and AI have shown a promising future for the development and the deployment of smarter SHM techniques. A smart SHM system can be permanently installed for continuous and systematic diagnosis, monitoring, and assessment of structural and environmental conditions. These variables are then used to assess key structural performance parameters to derive conclusions about the health condition or performance of concrete infrastructure. The AI plays a very important role in not just generating algorithms for future prediction and response, but also in asset management through policy- and decision-making models. Eventually, implementing these smart systems will result in minimising maintenance costs, reducing the likelihood of in-service failure, and unforeseen downtimes of an infrastructure.

Digital construction (DC) or 3D-concrete-printing is another approach that brings intelligence to infrastructures. Such printed structures can be built with organic and eco-friendly materials. The technology is highly flexible and scalable, and significantly faster than traditional methods. Indeed, 3D printing technology can save up to 60% of building materials compared to traditional construction, and 50%-80% of manpower, which improves work efficiency and helps to reduce the costs. It can also boost productivity and limit environmental impact.

The combination of advanced materials and SHM systems in a concrete infrastructure can create active adaptive systems and structures. Structures that can adapt to changes in their environment, can, for example, resist reverse loadings. This concept, shown in Figure 2, follows a biomimetic approach and is still in its infancy, but it is expected to become the future of concrete infrastructures. An SHM system functions like a human brain with its interconnected neurons, and the optimised concrete system (e.g. by addition of anticorrosive or self-repair meterials) can be compared to wound healing, vaccination and antibody components.

Most global efforts to address climate change impact are focused on greenhouse gas emissions, not in protecting society from the deterioration of important infrastructures. To adopt to a growing population and to ensure that developments make the most of smaller spaces, cities will need to employ more and more newer technologies and innovation across all sectors, as well as the integrated management of cities (using technology and data; Strange 2018). Indeed, we are beginning to see the emergence of "smart cities", which were once the stuff of science fiction.

The "smart city" label looks like a fuzzy concept. Nevertheless, a simple definition is that it uses next-generation information and communication technology (ICT) to connect all walks of life and to manage the flows of waste, energy, people, goods and services in an integrated way to meet the demands of its citizens. A smart city utilises a network that can connect zillions of connected devices, the so-called "Internet of Things" (IoT).

Smart, adaptive and resilient concrete infrastructure needs to be embraced by governments around the world as part of the smart city advancement. When optimising the design of concrete structures, the management of these assets, their durability, and their eventual disposal are essential for cost-effectiveness, sustainability, as well as reducing the CO_2 emissions and safety of infrastructures.

Resilient and smart structures, as might be expected, come at a cost. Their development requires accessing numerous resources (e.g. human, infrastructure, security, etc.) from the public and private sectors, as well as the need for multiple changes in current national and international policies and practices. However, smart, resilient and adaptive infrastructures in the long-term offer economic advantages. It is predicted that the adoption of smart technologies can raise GDP per capita by 21%, and population growth by 13% over the next five years (ESI_ThoughLab 2018). Government and businesses – including investors, lenders and insurers – should develop finance mechanisms to invest in necessary resilient and smart infrastructure projects and initiatives.

In addition to funding challenges, there is still a lack of coherence and collaboration between industry and academic research groups' ability to take innovation from the laboratory to the market place. It is clear that smart infrastructure design, development, and implementation is indeed a multidisciplinary field of research that reaches beyond traditional engineering and information technology disciplines.

Many factors can make a significant difference in shaping future infrastructures. However, only a few of them can be highlighted here. First, the energy efficiency of concrete infrastructures has to be considered, particularly when creating buildings that are energy producers rather than energy consumers. This way we can build infrastructure with the lowest impact on climate change. At the same time, we need structures that can withstand the negative impacts of climate change (Moser 2019).

As mentioned earlier, the failure of vital concrete infrastructure disrupts lives and can impact personal safety, business profitability, and the economy as a whole. Repair and maintenance are costly, hazardous to workers and unreliable. Smart, adaptive and resilient concrete structures not only help with fulfilling several United Nations Sustainable Development Goals, but also in the long-term it can address social equity issues by providing climate-safe and climate-adaptable materials for even disadvantaged communities. Just like biological evolution, the future only embraces the survival of the fittest and smartest nations.

Winston Churchill once said that we shape our buildings, and thereafter they shape us. To manage future urbanisation and environmental challenges and to live the life of our dreams, we need to start building resilient, smart and adaptive infrastructures now.

Shima Taheri *(Macquarie University, Australia) is an expert on materials chemistry, nanotechnology, polymers, complex materials synthesis and plasma polymerisation. Email: shima.taheri@mq.edu.au*

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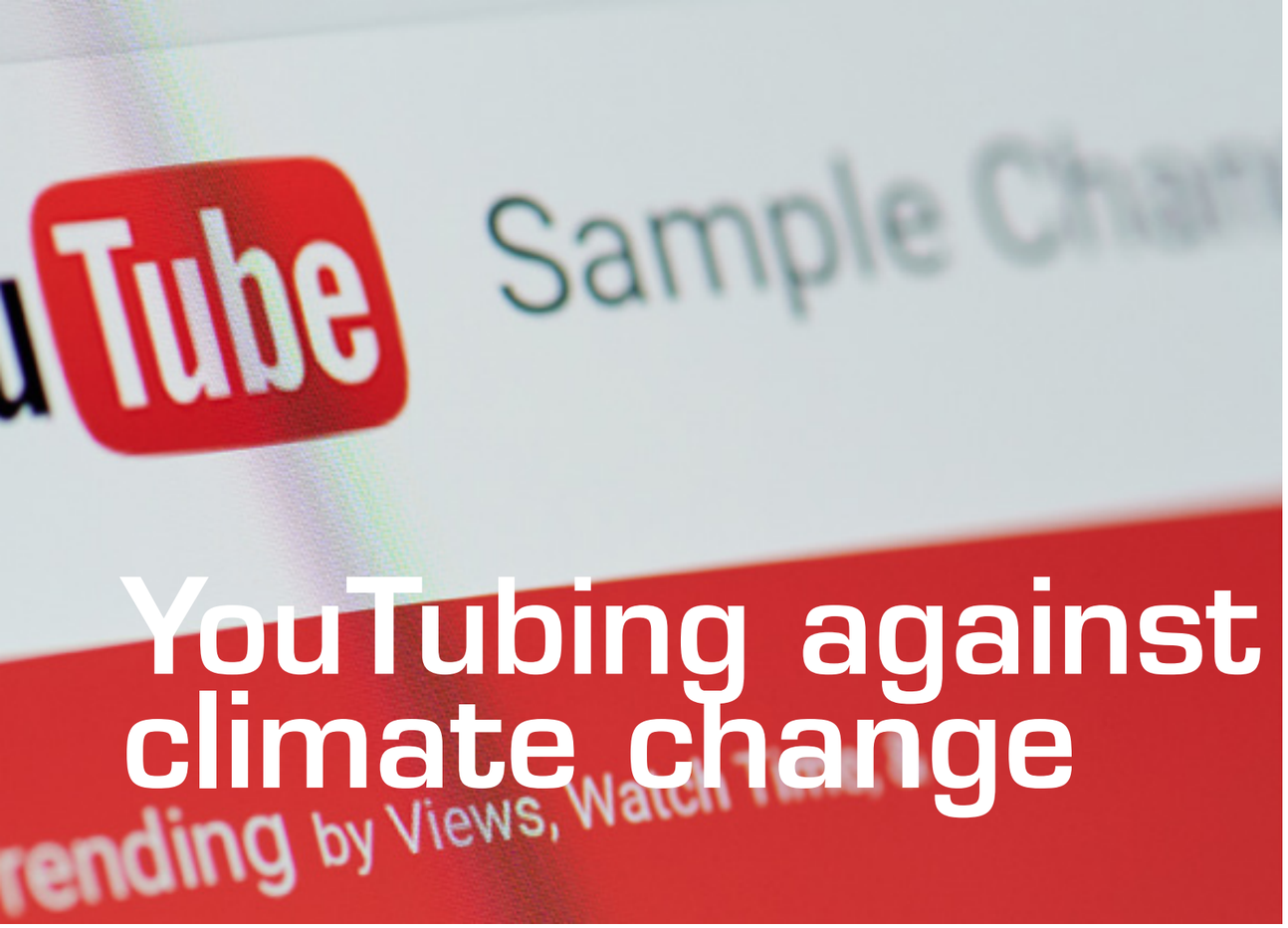


YouTubing against climate change

How an alliance of influencers and scientists is challenging the German government on climate protection

by Joachim Allgaier, Andrea Geipel, Shima Taheri and Jesús Muñoz Morcillo

German YouTuber Rezo has published an influential video that initiated a public and political debate on climate change and climate protection. Rezo's science and facts-based argument has shown, on the one hand, the politicians' as well as journalists' lack of YouTube literacy, and, on the other hand, an alarming divide between politics, journalism and new media culture. This comment considers the implications of this recent episode for civil society and academia.

Unleashing a public debate via YouTube

Rezo is a popular 26-year-old YouTuber based in Aachen, Germany, who normally posts funny clips and videos about music on his two YouTube channels. However, on May 18, 2019 he posted an unusually long video, which lasted almost an hour.[1] He called the video "The destruction of the CDU". The Christlich Demokratische Union Deutschlands (CDU) is the conservative governing party of Germany's Chancellor Angela Merkel.

Right at the beginning of the video the YouTuber makes it clear that destruction in this sense is only meant metaphorically. He moves on to explain that it is the purpose of the video to present reasons and proof why the governing party actually de-legitimises itself with its own politics. However, he does not exclusively take a swipe at the conservative party, but also at the party of the Social Democrats (SPD - Sozialdemokratische Partei Deutschlands), which forms a coalition government with the CDU in Germany.

In the video, Rezo attacks various policies of the governing parties, but the largest part of the video criticises the German government's policy regarding climate change. He is disappointed that the German government does not act according to the recommendations of climate scientists in the face of climate change. Furthermore, he describes some of the scenarios of what is likely to happen if climate emissions are not curbed very soon. In order to make his sources transparent, he puts a link in the description of the video to a 13-page document listing all the sources to which he refers.[2] In the section concerning climate change he mainly refers to scientific publications in high-ranking scientific journals and scientific reports, for instance, by the Intergovernmental Panel on Climate Change (IPCC).

The video was posted roughly a week before the European elections took place in Germany on 26 May 2019. In the video he calls on his predominantly young followers to participate at the European elections, but to vote for neither the CDU, nor the SPD and particularly not the far-right AfD (Alternative für Deutschland). From his point of view, none of the three parties provide any sustainable solution for dealing with climate change – the AFD would not even acknowledge that there is a problem with climate change.

The success of the video surprised even Rezo himself. Within a day, it had more than 1 million views and all the major German news outlets reported on it. By election day it was viewed more than 11 million times and reviewed in international news outlets such as The Guardian[3] and The New York Times.[4] Meanwhile, there is even a German Wikipedia entry about the impactful video and its reception in politics, media, science and society.[5]

Immediately after the video had been reported in the news, politicians of the conservative governing party heavily attacked[6] the YouTuber for spreading false information and fake news. The conservative party then announced that it would react in the form of a response video. However, briefly after that, the conservative party announced on its website[7] that a response video would not be in line with the communicative style of a grand national party and instead released an 11-page PDF-document, in which it tried to refute Rezo's claims. The different reactions and the time it took for the grand party to answer drastically displays their missing knowledge about YouTube culture and the world of creators and users who shape communication on the platform. Firstly, the party tried to ignore the video before realising that this was not possible. Then they tried to talk down Rezo's expertise and minimise the significance of the presented data.

Soon after the video had been released, various scientists entered the scene – such as the influential female science communicator Mai Thi Nguyen-Kim. She quickly produced a video[8] to check the scientific facts presented in Rezo's work. In addition, climate scientist Professor Stefan Rahmsdorf[9] and the Professor for Regenerative Energy Systems Volker Quaschning[10] checked the scientific facts presented in the Rezo video, as well as in the response by the CDU and generally backed up the claims that Rezo made in the video. Quaschning, for instance, writes that he did not find any proof in the response of the CDU that would substantially disprove the claims made in Rezo's video concerning climate change. Physicist Christian Thomsen, who is the President of the Technical University of Berlin, also backed Rezo's claims and stated in an opinion piece[11] that Rezo (and other involved YouTubers) were citing references more correctly and transparently than many of the Federal Ministers and professional politicians who were attacking him. Rezo not only received backing from scientists and other experts, but also from many citizens, religious institutions, and people from the arts and culture community, such the Artistic Director of the Berliner Festspiele Thomas Oberender.[12]

Meanwhile, Rezo had teamed up with further influential players in the German YouTube scene. On May 24, 2019, two days before election day, an alliance of over 70 popular German YouTubers released another video,[13] which they simply called "a statement of 70+ YouTubers". This video is less than three minutes long and contains a single statement issued by a very diverse set of YouTubers, with considerably differing points of focus, such as music, beauty, fashion, gaming and a range of other subjects. In addition, the statement posted underneath the video was later signed by more than 90 popular German YouTubers.

The content of this video is remarkable from an academic point of view. In their video statement the YouTubers call on their followers to vote in the European elections, but not to vote for the governing parties or the right-wing AfD because none of them would act in the sense and logic of science. In the video statement, the YouTube creators explicitly aligned themselves with the scientific experts and also referred to the work of the IPCC[14] and a statement[15] signed by over 26,000 scientists and scholars from Germany, Austria and Switzerland. The statement explains that the governments of the three countries are not doing enough to limit global warming, halt the mass extinction of animal and plant species or to preserve the natural basis for life. Taken together, this group of YouTubers has millions of followers. So it was no surprise that this video also made nationwide headlines[16] and was viewed almost 3 million times within the first two days of its release.

This alliance of YouTubers was also heavily attacked and criticised by various members of the conservative governing party. When the results[17] of the European elections came in two days later, it turned out the governing coalition had experienced massive losses in terms of votes. The biggest winner of the election in Germany was the Green Party[18], receiving more than one-third of the votes of first-time voters. Environmentalism and climate protection have become a major topic in the EU-elections.[19]

The massive gain of votes of the Green Party in the European Election may not be a result of the YouTube videos alone. As there have not been any data collection regarding the influence of the videos on the votes, one can only speculate whether there was an effect. Many young voters in Germany already held a grudge against the government because their protests[20] against Article 13 of the draft EU Copyright Directive on copyright

(which would require internet platforms like YouTube to filter out copyrighted video content) were ridiculed by some conservative politicians. It did not help that the enduring wave of nation-wide Fridays for Future[21] demonstrations for climate protection had not been taken seriously by the government.

When the results of the election were official, the reactions coming from the Conservative Party were revealing. Instead of responding to the questions and concerns raised by young people about climate protection and sustainable plans for the future, Annegret Kramp-Karrenbauer, leader of the conservatives, proposed to have a debate on the regulation of political views[22] on the internet during election campaigns. This led to further furious debates, not just among young people, and a petition[23] campaign against the censorship of free speech on the internet.

German Chancellor Angela Merkel remained silent during this whole debate. It took nearly a month until she first spoke out on the issue on 19 June. In a discussion[24] with about 200 teenagers in Goslar, she said that she was not happy with the defensive reaction of her party when the Rezo video first appeared. When the young people asked her if she thought there were points that Rezo got right in his video she responded by saying that he was right that the government did indeed break its engagement on climate protection.

However, this is not the end of the story. Five days before the newly assembled climate expert commission of the German government met and the third global climate strike took place on 20 September 2019, YouTube scientist Mai Thi Nguyen-Kim and Rezo released a video[25] to mobilise people for the climate strike and to influence politicians' decision on pricing carbon. The 26-minute long video presents scientifically approved solutions about how CO_2 emission pricing could help to solve the climate crisis. The video prominently features economics professor Ottmar Edenhofer and engineer Klaus Russell-Wells, who is running a specialised YouTube channel on energy transition and sustainability. When the 'climate cabinet' of the government had presented a working plan about carbon pricing Mai Thi Nguyen-Kim quickly produced another video[26] in which she explained why the proposed solutions will not be effective from a scientific point of view.

YouTuber's underestimated influence

Several insights can be gained from this episode. A first insight is that the two videos by Rezo and his YouTube allies were enormously influential, and helped unleash an ongoing societal debate about climate protection and anthropogenic climate change. The content of the video was not only discussed in public media and among social media channels, but also in schools, where it forced teachers to have discussions on climate change and politics. The debate is also about holding the government accountable for missing emissions targets and failing to come up with sustainable solutions on how to deal with the global challenge of climate change and neglecting the expertise of scientists and climate researchers.

A second insight is that so far, the grand political parties in Germany have not yet learned how to deal productively with debates in social media, nor how to have fruitful dialogues on an eye-level with citizens, particularly young ones, who will suffer most by failing on climate targets. In addition, many of the journalists who covered the story did not really know how to evaluate what was happening. Until now, the consensus in the journalistic world seemed to be that most of what happened in the YouTube universe was not to be taken seriously, and driven by commercial interests or intended to misinform and manipulate audiences. That a colourful assemblage of beauty, gaming, comedy, music and other YouTube creators took sides with science in order to become influential actors of civil society came as a surprise not only to politicians, but also to journalists and maybe even to scientists.

Science communication via YouTube

Recent events, developments and analyses show that YouTube has become increasingly influential and professional, even when it comes to public science communication.

YouTube now has 2 billion monthly users (27). A recent study[28] found that 93% of 18 year-olds in Germany are using YouTube for learning, information and entertainment on a regular basis. YouTube is also the second-most visited website[29] in the world and many people worldwide use the platform as a search engine to get quick answers.

When it comes to science popularisation, American Scientist already reported in 2015[30] that popular science YouTubers reached more young people with their videos than the two most popular TV science communicators Neil deGrasse Tyson and Carl Sagan combined. However, from an academic point of view, surprisingly little is known[31] about how these science YouTubers see and legitimise themselves and whether they consider themselves to be influencers, journalists, entertainers, educators, scientists, or something else.

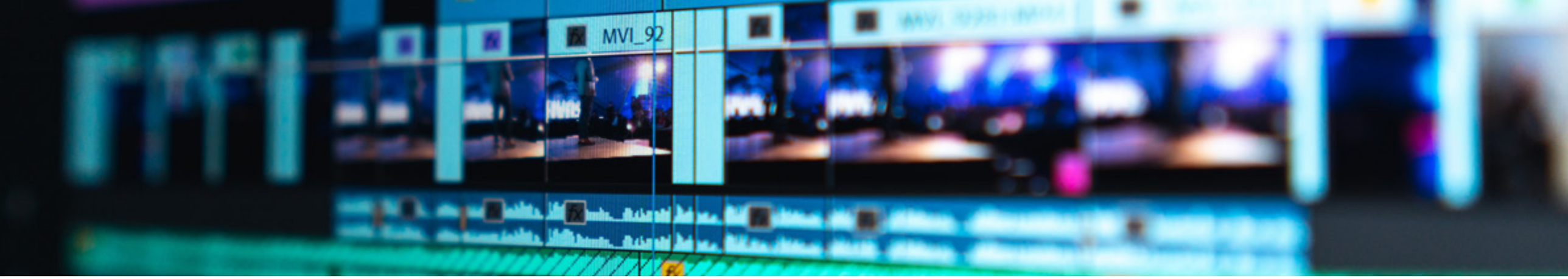
It is not only academic research that lacks insights about the platform and how expertise is negotiated there. Scientists or academic institutions talking about science and education seem to have problems in establishing their own brands and becoming part of the communication environment of YouTube. While the term "platform" underlines the idea of democratic public communication, making a highly-viewed video on YouTube is only possible by following platform-specific rules, and therefore the rules of the recommendation algorithms.[32] When looking closely, expertise seems to be attributed based on social markers instead of certified knowledge and expertise such as academic titles. When people gained access to television, they were keen to gain insights about countries they were not able to visit and to get a closer look on what is happening around the world. With the rise of YouTube, we are now in a time where a lot of people can travel anywhere they want to. Knowledge and information are now widely available.

What people are seeking for now is how to assess and negotiate accessible information, and who to trust when it comes to information selection. The mechanisms of professional journalism for some people seem to be obscure, so they tend to look for authentic and trustworthy people in public communication they can personally relate to. On YouTube, authenticity is the key for success, and YouTubers try to act as authentic as possible.[33] Already, producing a video right in their own living rooms seems to convince some users to trust in whatever is presented in the video itself. In addition, by presenting oneself on eye-level with the users, video creators also gain credibility in actively creating their community. In this sense, coherent storytelling, not only in presenting content but also in creating a coherent relationship between the users and the creators seems to be one important marker for attributing expertise on the platform.

When it comes to science content, videos produced by amateur users[34] are often even more popular than those from professional content producers on YouTube. Amateur users also apply professional cinematographic and other standards[35] when producing science videos. In contrast to conventional (science) journalism, many science online-video producers particularly value YouTube's potential for audience and community engagement, as well as carrying on a dialogue[36] and direct exchanges with their audiences. Most of the time, professional video productions from universities and research institutions use YouTube only as an archive, or for the dissemination of image films, thereby neglecting to actively engage with their community. Often the commentary function of such channels is even completely switched off.

YouTube shows great potential[37] for education and the public communication of science and environmental topics. The video format affords the use of animations and visualisations, night-vision, time-lapse, slow motion or high-speed cinematography, various languages and subtitles, and many other visual and auditory techniques that foster understanding of complex issues and topics. Many of the popular science YouTubers are doing an excellent job communicating science in public.[38] In addition, they are reaching new audiences that traditional media does not reach – specifically among young people. However, the knowledge landscapes that are provided on and by YouTube are so far quite uncharted territory.[39]

Moreover, YouTube is infamous for being a fertile ground for spreading misinformation and conspiracy theories.[40] A recent study[41] on climate-related videos on the site found that more than half of the videos in the sample spread conspiracy theories about science and technology. This is one more reason that science should be proactively communicated from the science side.



Challenges for academia

From an academic point of view, there is still a lot of research that needs to be done in order to better understand this influential video platform: It would be desirable to find out more about the scientific video content on YouTube, but also about its production[42], consumption and reception. Relatively little is known about how influential players on YouTube see themselves, what their motivations are, and whether or not their audiences ascribe new forms of authority, professionalism and expertise to successful YouTubers. And last but not least, academics, scientists, researchers and academic and research institutions need to develop concepts and ideas about how they want to position themselves and make use of online platforms such as YouTube, or maybe even think about collaborating with the successful (science) YouTubers who are experts in reaching audiences on this site.

We also need to keep in mind that YouTube algorithms are not very transparent. We should be aware that we are dealing with a very powerful artificial intelligence here that is already making decisions for us (for instance, if we chose to use YouTube's "auto-play" function). The algorithms for YouTube recommendations, which Google engineers are very proud of,[43] are complex. By basically teaching themselves about human behaviour and preferences, the platform is turning itself into a black box influenced by interactions between the users, the creators and the software engineers. Therefore, dealing with questions on how social media platforms like YouTube develop is also a question of responsible research and innovation.[44]

Furthermore, YouTube as a platform has a significant influence on the communication culture and the dissemination of information, which means that it should take responsibility for curating content, filtering false information and facilitating access to scientifically sound contributions. However, the solution currently under discussion, algorithmic curating[45] via so-called upload filters, should be questioned just as critically as an uncurated video collection.

The popularisation of other platforms beyond YouTube would also be an interesting option, but YouTube's monopoly extends to science communication as well. Therefore, it is becoming increasingly important to foster digital literacy[46] in citizens, starting from childhood onwards, so that the users have a better grasp of how the dissemination of information on the internet works, and also developing the know-how to evaluate conflicting information.

In this context, it is interesting to learn that France and Germany decided to create a Franco-German digital portal for audio-visual content and information in the Treaty of Aachen[47] in January 2019. In high-ranking political circles there was a lot of unrest and unhappiness about the spread of rumours, misinformation and political conspiracy theories on social media and the fear of political interference by the major commercial internet players and others. There will be many challenges ahead for a European digital media platform but increasing the diversity of platform providers and limiting the previous internet monopolies is to be welcomed. Furthermore, this would be very valuable for fostering open dialogues in civil society. It is more than likely that there will be further impactful interventions, such as the one by Rezo and his allies – and not just in Germany. Yet, we do not know where they will be coming from next and whether these will be science and fact-based videos or subtly misleading information. The role of academia in this context should be to understand the complexity of these communication mechanisms and to unravel the origins and paths of information, its interaction patterns, and how these build a new civil society or at least a crucial part of it.

GYA alumnus Joachim Allgaier *(RWTH Aachen University, Germany) is a sociologist and media and communications researcher. Andrea Geipel is with the Munich Center for Technology in Society, Technical University of Munich, Germany. Shima Taheri (Macquarie University, Australia) is an expert on materials chemistry. Jesús Muñoz Morcillo is with the Centre for Cultural and General Studies, Karlsruhe Institute of Technology, Germany.*
Email: joachim.allgaier@humtec.rwth-aachen.de.

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Justice in a more-than-human world

by Özge Yaka

The climate crisis has unveiled a fact that had been ignored by humanity for some centuries: the ecological embeddedness of our social existence. We have long maintained nature – and the environment – to be external to human life and society, and have established our economies, institutions and sciences accordingly. We behaved as if we are independent from the earth's ecosystems when in reality our physical and social existence are transversally connected to and dependent on them. It is time to challenge the dualistic understandings of the social and the ecological, and of nature and culture. It is time for the so-called social and natural sciences to free themselves from archaic disciplinary boundaries to face the challenges of our age. It is also time to rethink our social and political categories that are built on the very dualism of the social and the ecological and, thus, remain short of responding to the problems of the Anthropocene.

Justice is among the categories that should be rethought in relation to the problems and struggles of our time. Climate and justice has been used together since the term "climate justice" was coined by climate activists and picked up by scholars of ethics and justice. The term climate justice indicates an intellectual and activist effort to frame the issue of climate change and its immediate effects as a matter of justice.[1] The obvious context is that people from the poorest regions of the world, who are least involved in causing the climate crisis, are – and will be – the most affected by its destructive impacts. In relation to the disproportionate distribution of climatic impacts, climate change has a potential to deepen ever-growing inequality at the global scale.

The term climate justice is an important attempt to link issues of justice with the ecological challenges we are facing. This link between justice and ecology, however, should be further deepened. Our connection with our environments, and with the non-human ecosystems that run through and across everything we call "human", should be included in our definitions of justice since it effects our well-being in very fundamental ways.[2] Hence, our understanding of justice should not be limited to distribution – that is, (un)just distribution of environmental and climatic impacts in this

case. The disproportionate distribution of environmental/climatic hazards and benefits is definitely a matter of justice and should be highlighted even more. Justice, however, is always more than distributional. Justice is also about having a say about your own environment. It is also about being recognised and respected, not only in terms of your social and cultural identity, but also in the way you pursue your life.[3]

Non-human life on earth, "nature" as we call it, is not just a background upon which we build our "social" lives. It is an integral part of our everyday lives as we eat and breathe, as we sense and feel. The human body is not an isolated unity; it extends into the world in many different ways. We are intrinsically connected to our environments not just through various physical and chemical processes. We are also socially connected to the non-human world. We sense, we feel, we act, we come to know ourselves only through our environments, through our connectedness with other bodies, organisms and things. The human subject, in this sense, is formed in relation to the other, within a world of encounters, not only with human but also with non-human bodies and entities.

When we come to recognise the social as being entangled with the ecological, it becomes clear that the idea of social justice should also be modified. Justice should no longer be concerned only with intra-human relations. An extended notion of justice should take into account the relationality of human life and non-human environments, organisms and ecologies. In other words, it should build on the awareness that our social existence is ecologically embedded. Hence, social justice should reinvent itself as socio-ecological justice.

Many local, native/indigenous, urban and rural communities struggle currently to protect environmental commons against profit-driven energy and infrastructure projects all around the world. They demand justice for themselves and for the environmental entities they aim to protect. My own work on local community struggles against hydropower plants in Turkey has shown that what those communities fight for is not, or not only, their economic livelihoods (Yaka 2019). In this sense, the justice they demand goes beyond the limited conception of (re)distributional justice. It contains their intimate relations with their environments as they fight to protect a certain socio-ecological existence, that is, a certain way of living together with non-human entities – with forests, rivers, animals, etc. Those non-human entities are not secondary to their "social" ties; they are central and essential to their everyday lives, memories and identities. Their understanding of justice, of fairness and of a good life contains their relationship with their non-human environment. Demanding justice for themselves, and for the trees, rivers, and animals they live with are not separate things for them. Their demands have the potential to unite social and ecological justice: the rights of non-human nature and the rights of human communities as a part of nature.

Building on the insights derived from the struggles for environmental commons, the notion of socio-ecological justice is an attempt at bringing social and ecological justice together, not in a contradictory way but in a complementary relationship with each other. By framing the relationality of human life and non-human world as a matter of justice, socio-ecological justice maintains that our well-being, as well as our prospects of having a fair, decent life as human societies are bounded to, and entangled with, the well-being of the non-human ecologies that are under threat. Socio-ecological justice derives inspiration from the idea that what we experience and identify as injustice and what we demand as justice necessarily involves our transversal connection to our environments. The ecological crisis, which involves but is not limited to the climate change we are living through make us face the fact that we are living in a more-than-human world. In response, we urgently need to invent new concepts, mechanisms and new modes of living, which would make a "progressive composition of a common world" (Latour 2004) possible, both for us and for our non-human companions. Justice in a more-than-human world should embody the rights of human societies and non-human ecologies to coexist and flourish free from institutionally sustained injustices that are experienced as ecological destruction, degradation, pollution and dispossession.

Özge Yaka *(University of Potsdam, Germany) is a research fellow at the Centre for Citizenship, Social Pluralism and Religious Diversity.*
Email: ozgeyaka@gmail.com.

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1. For a detailed discussion, see Heyward and Roser (2016) and Jafry (2019).

2. Scholars of science and technology studies, especially those who follow the work of Donna Haraway and Bruno Latour, have long maintained that our "human" societies are, and have always been, hybrid collectives that contain human and non-human elements (see Latour 1993 and Murdoch 1997).

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A global call for united actions to address climate change

by Sandeep Kaur-Ghumaan, Nova Ahmed, Boon Han Lim, and Shabana Khan

The world is changing by the day. While some changes are visible over a short time-span, such as the changing skylines in our cities, others are not. Climate change is one such long-term change that is staring us in the face but is not always visible. We are witnessing climatic conditions previously unheard of, for example, flooding of parched lands in India and Sudan, snow in the deserts of the United Arab Emirates, heat waves in temperate regions such as Europe, and ice-melts in Arctic regions. These are all the adverse effects of rapid economic development on a global scale.

All around us we see the rapid pace of development, which emphasises profits and costs without considering sustainability. Some 30 years ago, the bulk of industrial activity was centred in Europe and North America, where population density is relatively low. Such intense business activity spread over a small(-er) population seemed somewhat less threatening from the climatic perspective.

We then witnessed staggering manufacturing shifts to the continents of Asia and South America. These areas, especially in Asia, are densely populated. Abundant labour meant low wages, which brought down the prices of goods and boosted consumer demand all over the world. Large-scale industrial activity no doubt brought increased prosperity, but there was also a flip side.

Apart from industrialisation, due to a large population base and the varied economic strata of the developing world, markets in these regions continued to expand to fulfil various needs and demands. This sizeable population is aspiring to move to the next level of consumerism, and that adds up to a larger carbon footprint, which appears insignificant on a per capita basis, but the cumulative value is as threatening as that of the developed world due to a large population living in the developing countries.

For example, people are moving from bicycles to petrol-driven scooters and motorbikes, from scooters and motorbikes to small cars, and from small cars to SUVs.

Globally, the transportation sector consumed 25.5% of the world's energy in 2015 (Carlton 2020). In Malaysia, the shared portion of energy consumption by the

transportation sector increased from 37.6% in 1996 to 42% in 2016 (Energy Commission 2018). The growing popularity of private taxis such as Grab or Uber, as well as the increased frequency of using food delivery are both foreseen to impact energy consumption.

However, despite a growing awareness about the effects of consumerism, changes in public behaviour are difficult to change. Once a certain standard of living has been reached, it is challenging for a person to return to a less comfortable lifestyle.

Another sector that has quietly increased its energy consumption is aviation. Air-travel, once considered an occasional mode of transportation for longer distances, has become ubiquitous. Indeed, the sky is cluttered with budget carriers across the world. According to some studies, the aviation industry contributes 2% of the total CO_2 released by human activities (ATAG 2020). Yet awareness of this issue among the general public is patchy, and there is a need for greater dialogue to discuss the consequences and possible alternatives.

Inadequate policy intervention and implementation in developing countries further delays corrective actions. In many cases, climate change movements are labelled as political or even conspiratory, rather than environmental or humanitarian and in general, people are not aware of the broader consequences involved (Kamol 2019).

Globalisation has also led to unprecedented levels of smog across cities in the developing world. In fact, climate change is also closely related to pollution. Phenomenon like smog not only add to pollution, it also acts as a greenhouse blanket that accelerates global warming, which only a limited population can understand.

Countries and governments across the world have started realising the dangers that climate change poses to the very existence of the human race. The United Nations has urgently called for action through 17 Sustainable Development Goals, and the Intergovernmental Panel on Climate Change (IPCC) has been active in providing studies/information for people to understand the seriousness of climate change, for example the recently published "Special Report on Global Warming of 1.5 °C" (IPCC 2018).

Moreover, an agreement was signed by 196 state parties at the 21st Conference of the Parties of the UNFCCC (COP21) in 2015 to reduce global CO_2 emissions. However, despite these efforts, both developed and developing countries are still intensively emitting CO_2 due to inadequate policy implementation.

Actions taken to combat the issue are still slow compared to its urgent nature, but citizen participation has shown great promise in this regard (Davis 2019). The Fridays for Future movement has shown promising effects, but concerted efforts are still needed to address the challenge – schools, individual citizens, industry, and governments all need to do their parts. Each country has to determine its own unique approach to tackle this problem. The problem is global but due to varied impacts, it has to be addressed at the local level.

Schools, colleges, and universities across the world should develop a detailed curriculum on climate change. As citizens, we should make all efforts to reduce our carbon footprint and inform others around us on the subject. Factories should also join the pursuit. When we have an active interest and participation of all concerned, the job of governments becomes relatively simple.

The climate change movement should also engage with marginal communities such as low-literate and low-income communities who are frequently not a direct part of such discussions. These communities (often living in rural areas or urban slums) are harshly impacted by climate change, but must be considered as active social agents to make positive change and reduce their vulnerability. Non-traditional engagement must exist along with traditional approaches that encourage everyone to play an active role.

For example, the GYA's Climate Change and Disaster Risk Reduction working group is actively engaged in various activities in the academic and public domains to help facilitate climate change dialogue and response. Group members not only contribute to international conferences and reports on climate change such as the IPCC and AASSA Report of Climate and Health, they also create new frontiers of public awareness and engagements with scientific knowledge. For example, the GYA Climate Change YouTube channel was launched in 2019. The working group's ongoing media work, which includes radio and TV content, is also creating ripples in the public domain. The impact of such activities can be further enhanced with the active engagement of National Young Academies. Nonetheless, more work is required to build momentum.

In summary, stakeholders need to come together to find ways to address the problem of climate change, and GYA members can play a significant role here. First, however, they must raise climate change awareness in their respective countries and then collaborate internationally on its multidisciplinary aspects.

Sandeep Kaur-Ghumaan *(University of Delhi, India) is actively involved in promoting science among the younger generation. Executive Committee member* ***Nova Ahmed*** *(North South University, Bangladesh) is an Associate Professor with a deep interest in working with distributed sensing systems.* ***Boon Han Lim*** *(Universiti Tunku Abdul Rahman, Malaysia) focusses on comprehensive solar photovoltaic power plant optimisation.* ***Shabana Khan*** *(School of Planning and Architecture, India) is a World Social Science Fellow on Risk Interpretation and Action with the International Social Science Council, and a visiting faculty member at the School of Planning and Architecture.*
Email: sandeepkaur.du@gmail.com, kshabana1@gmail.com

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GYA group releases COVID-19 Statement, launches dedicated NYA COVID-19 page

Beyond Boundaries: A global message from young scientists on COVID-19

The Corona Virus Disease 2019 (COVID-19) pandemic has disrupted the world and it will not be the last pandemic to wreak havoc on humanity. To mitigate transmission of the virus, we need rapid, synchronised international action. Governments must consider the best science available to make informed decisions, the public must act responsibly, and young researchers must recognise that they can be a crucial part of the solution. This Global Young Academy (GYA) Statement delivers specific recommendations for governments, the public, and young researchers.

GOVERNMENTS SHOULD:

1. Promote a shift from global health security to global health solidarity. Although we need to temporarily close borders to contain the spread of COVID-19, in the long term we need to change the current framing of health security. Instead of believing that we can protect borders from the incursion of disease, we should build global partnerships that benefit our collective health.

2. Exchange information quickly and openly, promote information exchange networks between national science advice mechanisms and implement open science policies. More efficient and free exchange of information will let us gain invaluable time in responding to crises, saving many lives.

3. Recognise the importance of multiple disciplines for decision-making. Given the evolving nature of the science underpinning pandemics, the science advisory mechanisms supporting policymaking must be composed of diverse perspectives so that a full assessment of the intended and unintended consequences of policy actions can be quickly and thoroughly made.

4. Take into account the long-term impact of the pandemic on health and society as well as the importance of prevention. Young researchers, accessed through the National Young Academies and the GYA, can provide important contributions to both immediate and long-term responses.

THE PUBLIC SHOULD:

1. Take precautions to avoid the spread of COVID-19, and play our part in controlling the pandemic by following guidelines, sensibly using and distributing resources, and supporting vulnerable members of society.

2. Avoid spreading misinformation. Encourage responsible use of social media. Learn to distinguish fear-based from fact-based information to avoid rumors or "fake news", and highlight when we are uncertain about the veracity of the information (or we should simply not share anything that cannot be verified).

3. Seek expert opinion and guidance about our local situation, and ensure that the information we accept about the situation around the world is from a reliable source.

YOUNG RESEARCHERS SHOULD:

1. Act responsibly in our use of global platforms to share and exchange information and experiences, and present the credentials for statements we make.

2. Contribute by translating science communication to local languages and "lay person" terminology, and adapting the message to local contexts. Play an active role in interpreting complex scientific information to the general public in non-technical language.

3. Help to bridge the gap between science and policy. Take the initiative to approach the government if we have relevant knowledge, whether this is directly regarding the pandemic or in fields relating to human reactions and behaviour.

4. Play an active role in promoting good practices and advising the people around them. Establish strong connections across various stakeholders, such as the government, civil society and the wider public regarding the role of science in improving our global health.

Dedicated COVID-19 page highlights initiatives of GYA and young academies

As the COVID-19 crisis unfolded, the GYA, National Young Academies (NYAs) around the world, and many of our Partners began producing and sharing important information that could potentially save lives.

As this body of information grew, we decided to launch a dedicated COVID-19 repository page: https://globalyoungacademy.net/covid19/

The page contains the GYA Beyond Boundaries Statement (download the full version here), as well as its accompanying infographic (available in 26 languages and counting - see below).

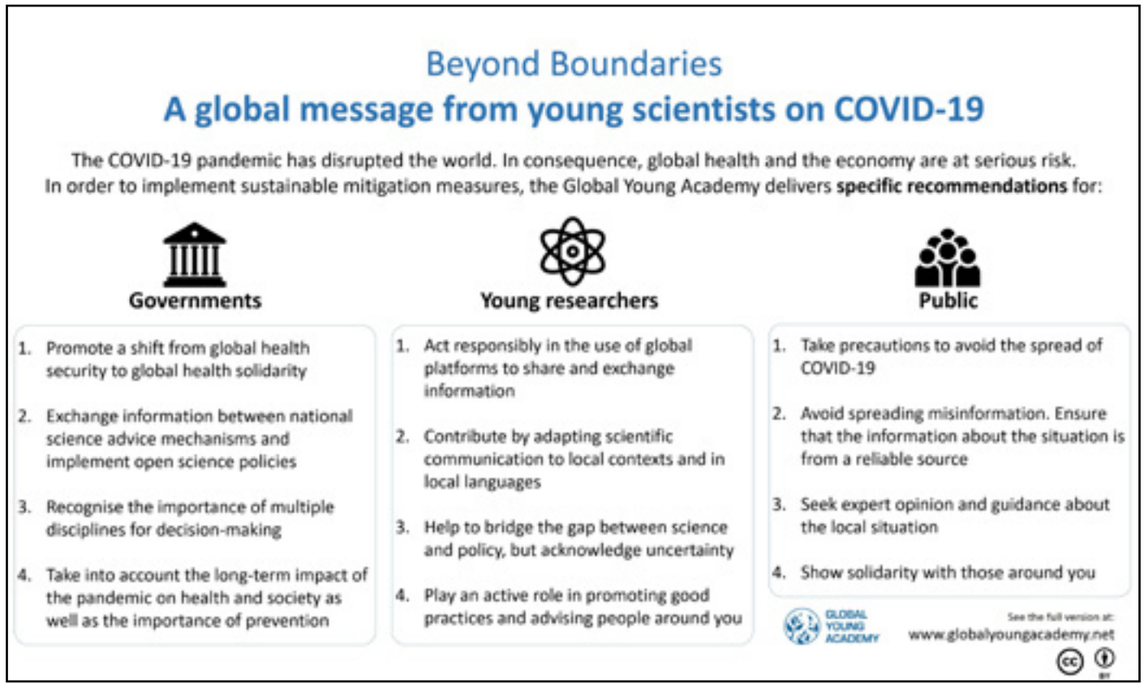
Importantly, the repository also contains links to NYA and Partner sites and information.

With this page, the GYA aims to provide a repository for global and National Young Academies as well as Partner institutions to link their work on COVID-19, including any statements or information dissemination activities that help support scientists inform institutions or governments.

Please contact info@globalyoungacademy.net if you want to share what your academy is doing, or want to contact other young academies for joint activities, or an exchange of experience and best practices.

Furthermore, use the hashtag #covid19ya to link what you, your NYA or partner organisations do to fight the COVID-19 pandemic.

The infographic below was created by Felix Moronta (International Centre for Genetic Engineering and Biotechnology, Italy), and is available in 26 languages here.



Global Young Academy prominent at the World Science Forum 2019

The 2019 World Science Forum (WSF) brought together over 1,000 scientists and scholars, policymakers, society, industry and science communicators to discuss "Science, Ethics and Responsibility" in Budapest, Hungary from 20-23 November 2019. At least one early- to mid-career researcher spoke on each of the five plenary sessions at the Forum.

The high rate of inclusion of the voice of early-career researchers was facilitated by the GYA, which joined the WSF Steering Committee in February 2019, represented by Co-Chair Connie Nshemereirwe (Actualise Africa, Uganda). Selection and nomination of young scientist plenary panelists was coordinated by the GYA, together with the InterAcademy Partnership (IAP), the World Association of Young Scientists (WAYS), and the International Consortium of Research Staff Associations (ICoRSA).

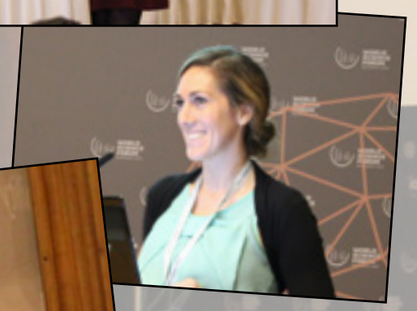
One of the major outcomes of the Forum is its final Declaration (available here), which extols the responsibility of scientists to communicate science findings to society, as well as strengthening global standards of research integrity.

See more photos at the GYA's WSF Flickr gallery.

Above: GYA members, alumni, and Office staff.

Above: Representatives of nearly 40 National Young Academies from around the world.

Above: Ali Douraghy (United States), Marco Masia, Michel Vanbiervliet, Ola el Zein, and GYA Co-Chair Koen Vermeir (France)



Above: Teresa Stoepler (United States)

Left: Maral Dadvar (Germany)

Young science leaders as modern polymaths

Biljana Gjoneska, Natasa Simic, and Ana Chies Santos

Leading up to the WSF, nearly 40 young scientists and scholars from 23 countries participated in a 1.5-day Science Leadership Workshop, co-organised by the GYA, the InterAcademy Partnership, and the Hungarian Academy of Sciences. The workshop, facilitated by KnowInnovation, practiced the collective leadership model used in the Africa Science Leadership Programme, focusing on creative leadership, problem-solving and communication skills, enabling participants to harness the knowledge of a diverse group, and arrive at complex solutions.

One of the conclusions from the workshop is that we should reconsider the roles of young science leaders by drawing inspiration from both the past and present. Specifically, we should acknowledge the emerging polymaths, or Renaissance Women and Men of today, as professionals with multifaceted knowledge and versatile skills. These people can assume different roles (depending on the context) and successfully combine different approaches (based on science-informed strategies) when tackling major ethical challenges in a responsible way. To be effective, promising leaders in science should blend no less than six vital roles.

As communicator scientists they should strive to bridge the existing gap between science and society. In a world so vehemently perturbed by vicious circles of disinformation, establishing direct links with citizens will perpetuate virtuous circles of valuable information. As mindful scientists they can enhance inclusivity and strengthen bonds with underrepresented groups in science, to ensure that our world accurately reflects the diversity of its constituents. The role of entrepreneur scientist will encourage science leaders to seek out and advocate fair funding opportunities, while the unbiased handling of ethical challenges across scientific domains will establish them as role-model scientists. Nourishing the link with oneself and enabling continual self-development can help one grow into a reflective scientist. Finally, communicating effectively and appreciatively with others, regardless of their positions, bears equal importance as it will help one become inspiring to others.

The real world wide web is moved by people who serve as nodes: those who establish links and see them flourish. The true collective leaders in science can employ those networks to turn the wishful "cans" into powerful "wills", and change the uncertain present into the hopeful and promising future. We believe that these modern Renaissance Women and Men are the ones who will utilise integrated knowledge systems, academic virtues and networking skills to inspire large societal shifts for a greater good of the humankind.

***Biljana Gjoneska** is with the Academy of Sciences and Arts of North Macedonia (email: biljanagjoneska@manu.edu.mk). **Natasa Simic** is in the Faculty of Philosophy, University of Belgrade (email: nsimic@f.bg.ac.rs). **Ana Chies Santos** is in the Department of Astronomy, Federal University of Rio Grande do Sul, Brasil. Email: ana.chies@ufrgs.br).*

Workshop output: "S.O.S. Booklet for Young Global Scholars: Facing the Scientific and Ethical Challenges of the Modern Age."

Left: Connie Nshemereirwe, GYA Co-Chair (Uganda)

Below: EC member Michael Saliba (Germany), Managing Director Beate Wagner, and Immediate Past Co-Chair Tolu Oni (United Kingdom)

Above: Tyrone Grandison (United States), Alexander Kagansky (Russia)

Left: Khayriyyah Mohd Hanafiah, Rosdiadee Nordin, past Co-Chair Orakanoke Phanraksa (Thailand), Chai Lay Ching, Wibool Piyawattanametha (Thailand)

Alma Hernández-Mondragón (Mexico)

Chemist / Science policy advisor

Alma is a chemist turned science-policy interface practitioner leading science advising efforts in México, particularly in México City. She has experience in the legislative and executive branches as a scientific advisor and public servant, respectively.

Amy Quandt (United States)

Assistant Professor / Environmental geography

Amy is a human ecologist and environmental social scientist specialising in the intersections of environmental conservation and rural livelihoods. She previously worked as the Global Coordinator for the Land-Potential Knowledge System Project Leave geography site.

Andreea Molnar (Australia)

Senior Lecturer / Information systems

Andreea is a Senior Lecturer at Swinburne University of Technology, Australia. Her research focuses on computing for the social good, and she incorporates various aspects from information systems, human-computer interaction, and educational games.

Carlo D'Ippoliti (Italy)

Associate professor / Political economy

Carlo obtained a joint PhD in economics from Sapienza University of Rome and from the Goethe University of Frankfurt am Main, Germany. He specialises in the economics of science (with a focus on economics) and in the political economy of the European Union.

Chandra Shekhar Sharma (India)

Associate Professor / Chemical engineer

Chandra is the Chair of the Indian National Young Academy of Sciences and is with the Department of Chemical Engineering at the Indian Institute of Technology Hyderabad. His research interests include energy storage devices and nature-inspired functional surfaces.

Chika Ejikeugwu (Nigeria)

Lecturer / Pharmaceutical microbiology/biotechnology

Chika completed a postdoctoral fellowship at the Institute for Frontier Life and Medical Sciences, Kyoto University, Japan, where he studied HIV-1 reservoir and cure. He is the founder of www.microdok.com, Africa's Number 1 Microbiology website.

Meet the New Members of 2020

David Fernandez Rivas (Netherlands)

Assistant Professor / Molecular biology

David works on three topics: cavitation (or bubbles), renewable energy, and process intensification through microfluidics. He has co-founded two companies, and since 2014 has focussed on biomedical projects, particularly needle-free injection for small volumes delivery.

Derya Baran (Saudi Arabia)

Material Scientist / Optoelectronic materials

Derya is an Assistant Professor at King Abdullah University of Science and Technology (KAUST), Saudi Arabia. Her research group (OMEGALAB) focusses on engineering organic and hybrid materials for energy harvesting devices.

Devina Lobine (Mauritius)

Research Fellow / Pharmacology

Devina's research centres on ethno-pharmacology, drug discovery and development on non-communicable diseases. She is a research fellow at the University of Mauritius, investigating herbal phosphodiesterase inhibitors as therapeutics for managing Alzheimer's disease.

Erna Karalija (Bosnia and Herzegovina)

Associate Professor / Plant physiology and biochemistry

Erna is a member of the University of Sarajevo Faculty of Science, and has research interests in plant physiology, biochemistry and in vitro culture. She is a member of the Board of Directors of the International Consortium of Research Staff Associations.

Eshchar Mizrachi (South Africa)

Molecular Biologist / Plant systems biology

Eshchar is an Associate Professor at the Department of Biochemistry, Genetics and Microbiology (BGM) and the Forestry and Agricultural Biotechnology Institute (FABI) at the University of Pretoria. His research focusses on modelling how wood forms in trees.

Estella Carpi (United Kingdom)

Anthropologist / Conflict-induced displacement

Estella focusses on humanitarianism, conflict-induced displacement, and identity politics in the Middle East. She is presently working on southern-led responses to displacement from Syria in the Department of Geography, University College London.

Janilyn Arsenio (Canada)

Assistant Professor / Immunology, single-cell genomics

Janilyn trained at the University of Manitoba, Canada, and the University of California San Diego. Her research studies immune responses during infection and chronic inflammation at the single-cell level. She is the Vice-Chair of Women in Science: Development, Outreach, and Mentoring (WISDOM), and a member of national societies for women in science.

Josep Armengol (Spain)

Senior Lecturer / Gender and cultural studies

Josep lectures in gender and cultural studies at the University of Castilla-La Mancha, Spain. He has authored and edited several books, and is currently directing a European Union-funded project on ageing masculinities in contemporary European literatures and cinemas.

Justine Nzweundji (Cameroon)

Plant Biotechnologist / Medicinal plants

Justine's research interest is tissue culture of medicinal plants for domestication and production of secondary metabolites. She is a Steering Committee member of INGSA-Africa, a TWAS-DFG fellow, and President of the Cameroon Academy of Young Scientists.

Karen Cloete (South Africa)

Biologist / Ion beam analysis

Karen is a postdoctoral fellow at the University of the Western Cape, South Africa, specialising in elemental fingerprinting and mapping of biological matrices using ion, nuclear, and synchrotron beam techniques.

Leila Niamir (Germany)

Researcher / Behavioural climate change mitigation

Leila is a researcher at the Mercator Research Institute on Global Commons and Climate Change, Berlin, Germany. She is also working on the Intergovernmental Panel on Climate Change Sixth Assessment Report as a Chapter Scientist and Contributing Author.

Mai Tolba (Egypt)

Pharmacologist / Molecular cancer pharmacology

Mai is an Associate Professor of Pharmacology and Toxicology, Faculty of Pharmacy, Ain Shams University, Cairo, Egypt, and an Affiliate of the African Academy of Sciences. Her work focuses on the mechanisms of resistance of cancer cells to chemotherapy and immunotherapy to develop novel approaches to convert nonresponders to responders.

Markus J. Prutsch (Belgium)

Historian and Political Scientist / Cultural and identity studies

Markus is a senior investigator and official at the European Parliament, and associate professor of modern and contemporary history at Heidelberg University, Germany. His main interests are constitutionalism, democracy and dictatorship in the modern world.

Menattallah Elserafy (Egypt)

Assistant Professor / Genomics

Menattallah is currently at the Center for Genomics, Zewail City of Science and Technology (ZC), Egypt. She did her MSc and PhD at Heidelberg University, Germany, and her postdoc at ZC. Menattallah is a recipient of the L'Oreal-UNESCO fellowship for women in science.

Mita Dasog (Canada)

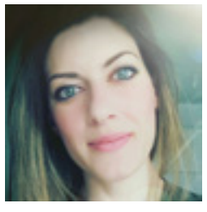
Assistant Professor / Materials science

Currently with the Chemistry Department at Dalhousie University, Mita's research group focusses on the development of nano- and micro-materials for solar light absorption, chemical fuel generation using renewable energy, and plasmonics-driven catalysis and desalination.

Muhammad Farooq (Oman)

Associate Professor / Agronomy

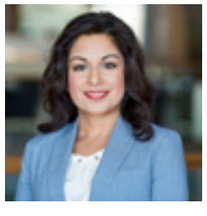
Muhammad is an Associate Professor in Crop Sciences at the Sultan Qaboos University, Muscat, Oman, Associate Professor in Agronomy at the University of Agriculture, Faisalabad, Pakistan, and Adjunct Associate Professor at the University of Western Australia.



Myrtani Pieri (Cyprus)

Assistant Professor / Molecular biology

Myrtani holds a PhD in Molecular Biology and Genetics from the University of Oxford, and is currently an Assistant Professor at the Department of Life Sciences, University of Nicosia. Her research work focuses on kidney and gastrointestinal tract physiology.



Nafissa Ismail (Canada)

University Research Chair / Stress and mental health

As the leader of the NeuroImmunology, Stress, and Endocrinology (NISE) laboratory, Nafissa and her multidisciplinary research team investigate the mechanisms through which stress and inflammation can induce stress-related mental disorders during adolescence.

Natasha Gownaris (United States)

Ecologist / Marine and freshwater conservation

Tasha is an Assistant Professor in the Environmental Studies Department at Gettysburg College. Her research uses natural history and quantitative ecology to inform the conservation of marine and freshwater systems.

Nina Yasuda (Japan)

Associate Professor / Marine biology

Nina is with the Faculty of Agriculture in the University of Miyazaki, Japan. She joined the Science Council of Japan in 2017, and worked as a secretary of the Sub-Committee of International Activities, Young Academy of Japan. Her research focusses on the conservation of coral reef ecosystems.

Nurcan Tuncbag (Turkey)

Associate Professor / Computational biology

Nurcan develops computational frameworks using graph theory, optimisation and informatics techniques to reveal how the interactions between proteins and genes are altered during disease.

Patrick Roberts (Germany)

Archaeological Scientist / Tropical forest prehistory

Patrick is Group Leader of the Stable Isotope Laboratory at the Max Planck Institute for the Science of Human History, Germany. His research interest involves how our species has adapted to tropical forests, from its earliest evolution in Africa through to modern conservation tensions.

Pei Sean Goh (Malaysia)

Associate Professor / Chemical and energy engineering

Pei Sean is an associate research fellow of the Advanced Membrane Research Technology Research Centre, Universiti Teknologi Malaysia (UTM), and also the Head of Nanostructured Materials Research Group at UTM.

Prabhat Singh (India)

Chemist / Application of stimulus-responsive materials

Prabhat finished his PhD in 2011 in the field of ultrafast fluorescence spectroscopy of Amyloid markers. He is currently a scientist at Bhabha Atomic Research Centre, and a member of the Indian National Young Academy of Sciences and National Academy of Sciences, India.

Pradeep Kumar (South Africa)

Pharmaceutical Scientist / Regenerative medicine

Pradeep is an Associate Professor of Pharmaceutics at Wits University and is an NRF Y1-rated researcher. His multidisciplinary expertise involves core pharmaceutics and regenerative medicine concepts. Pradeep is an inventor on 11 granted patents.

Prosper Ngabonziza (Germany)

Experimental Physicist / Nanotechnology

Prosper's research is in the fields of experimental physics and material science. He has been working on topological insulators, which have potential technological application in quantum computation. He is currently at the Max Planck Institute for Solid State Research in Stuttgart.

Ramia Albakain (Jordan)

Associate Professor / Analytical chemistry

Ramia holds a PhD with honour degree from Université Pierre et Marie Curie and Ecole Supérieure de Physique et de Chimie Analytique, Paris, France. Her research focusses on the impact of using analytical chemistry for developing new methods in water-energy-food security.

Saja Al Zoubi (United Kingdom)

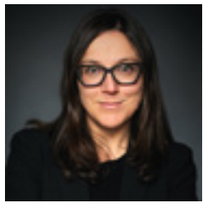
Researcher / Gender and forced migration

Saja's research focusses on issues of gender and rural development, including issues of women's empowerment. Since war broke out in Syria, she has researched ways to improve the livelihoods and food security of affected households – especially women-headed households.

Sami Miaari (Israel)

Lecturer / Economics

Sami currently lectures in the Department of Labor Studies in Tel-Aviv University, Israel, and is a Research Fellow at the Blavatnik School of Government, Oxford University. His research focuses on labor economics and the economic causes and consequences of conflict.



Sophie Theriault (Canada)

Legal Scholar / Constitutional and environmental law

Sophie is a Full Professor and Vice-Dean of Academic Affairs in the Faculty of Law, Civil Law Section, at the University of Ottawa. Her current research interests focus on Indigenous peoples' rights in the context of natural resources extraction and environmental justice.

Sri Fatmawati (Indonesia)

Assistant Professor / Natural product chemistry

Fatmawati is a scientist in the Laboratory of Natural Product and Synthetic Chemistry, Institut Teknologi Sepuluh Nopember, Surabaya - Indonesia. She is also Chair of the Organization of Women in Science for the Developing World – Indonesia, and Vice Chair for Frontiers of Science of Indonesian Young Academy of Sciences.

Syed Abbas (India)

Associate Professor / Mathematician

Syed is currently Chairperson of the School of Basic Sciences at the Indian Institute of Technology Mandi, India. He is also a fellow and currently core committee member of the Indian National Young Academy of Sciences.

Victorien Tamègnon Dougnon (Benin)

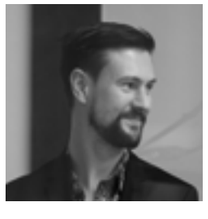
Senior Lecturer / Molecular microbiology

Victorien is involved in antimicrobial resistance research in Africa, applications of microbiological techniques to the resolution of development problems, and the exploration of Benin's flora for the treatment of infectious and non-communicable diseases.

Zhen Wang (China)

Distinguished Professor / Network science

Currently at Northwestern Polytechnical University, China, Zhen is the founder and Director of the Net-DataSci Lab, and was nominated as the Vice Dean of the Institute of Science & Technology. He is an elected member of the Academia Europaea, and The Academy of Europe.



Jonathan Tennant (Indonesia)

Independent researcher - deceased

Jon completed his award-winning PhD at Imperial College London, where he researched evolutionary patterns in animals such as dinosaurs and crocodiles. He was the founder of the Open Science MOOC, and the digital publishing platform paleorXiv.

John was set to join our ranks this year and his shining light would have bolstered the GYA in ways that we can now only imagine. The GYA Family join all who knew John in mourning his passing.

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Editor-at-Large:
Daniel Ochieng Orwenjo (Technical University of Kenya)

Associate Editor-at-Large:
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Article Reviewers:
Sabrina Wurzba (McGill Univeristy, Canada)
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Executive Editor:
James Curtiss, GYA Press Officer
james.curtiss@globalyoungacademy.net

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About the Global Young Academy

The GYA is an organisation of 200 diverse early-to-mid-career researchers across disciplines who are selected based on their scientific excellence and their commitment to using their research to make the world a better place. It presently has members and alumni from 83 countries, who are passionate about the role of science in creating a better world.

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