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Who Gets to Fly?

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The Challenge of the Century

We live in a world that has experienced unparalleled economic growth since the end of the Second World War. 'The great acceleration' has accelerated not just economic growth and consumption, but also environmental pollution, including CO_2 and other greenhouse gas emissions (McNeill & Engelke, 2016; Steffen et al., 2015a). The long-held belief that continued incremental economic growth can be a panacea to all societal ills has thus pushed up against a number of boundaries (Rockström et al., 2009; Steffen et al., 2015b), including climate change.

Researchers now stress that a rapid decrease of CO_2 emissions is needed to attain the 1.5 °C target of the Paris Agreement (2015) and to avoid the consequences of accelerated climate change. It is also becoming

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increasingly clear that the conception of climate change as an ominous threat that will affect us sometime *in the future* is a thing of the past, since human societies are pummelled on an annual basis by a toxic cocktail of increasingly severe heat waves, droughts, hurricanes, bushfires and other natural disasters. Earth is currently heading down a destructive path—a path that is hard or impossible to break away from if we do not change its trajectory soon (Steffen et al., 2018). Thus we urgently need to change course before tipping points and reinforcing feedback loops become a reality (Steffen et al., 2018).

In the Paris agreement, 189 signatories agreed on the end goal of keeping the average global temperature increase 'well below 2 °C' (e.g. aiming for an average 1.5 °C temperature increase above pre-industrial levels) (Paris Agreement, 2015). The Paris agreement does not, however, specify *how fast* CO_2 emissions need to be reduced if we are to attain that goal. Having a plan or a protocol for reducing CO_2 emissions is important since the cumulative effect of CO_2 in the atmosphere means that the longer we wait for reductions to be made, the faster the pace of reduction needs to be (Falk et al., 2018, 2019). Postponing emission reductions will thus make a hard challenge even harder, thereby decreasing the possibility of attaining the goal.

One way to concretise what needs to be done is to work with carbon budgets, that is, calculating how much space remains in the atmosphere for additional CO_2 emissions while still attaining the goals specified by the Paris agreement (Millar et al., 2017). Carbon budgets are helpful but again do not communicate the time scale and pace at which we need to act. One concrete plan for how to approach the transition is the idea of a 'Carbon Law' (Rockström et al., 2017; Falk et al., 2018, 2019) which states that we need to curb the increase of carbon emissions by 2020, and then reduce emissions by 50 per cent every decade between 2020 and 2050. The end goal is to reach (close to) zero emissions by 2050 on an aggregated global level (Rockström et al., 2017). The Exponential Roadmap report by the research organisation Future Earth (Falk et al., 2018, 2019) exemplifies in some detail how carbon emissions could be reduced by 50 per cent in every sector of society (e.g. transport, industry, buildings, etc.) between 2020 and 2030 (with food production being the only exception due to a growing global population).

Hence, while the Paris Agreement sets the goal, the Carbon Law specifies how we can achieve that goal. The reasoning behind the Carbon Law can be extended beyond specific industrial sectors and the general rule ought to be that emissions need to be reduced by 50 per cent every decade *in every country, in every city, in every industry, in every organisation, in every household and for every individual*.[1] By making the goals of the Paris agreement actionable, it becomes possible to develop a road map for any specific area (e.g. carbon emissions from flying) and at any level (e.g. in a specific organisation).

Reducing CO_2 Emissions in Academia

Research-intensive universities constitute a prime example of 'flight-intensive organisations' and flying is a major source of CO_2 emissions for universities in Sweden. Almost all Swedish universities are formally 'governmental agencies', and many of the top flyers (and top CO_2 emitters) among the 457 Swedish governmental agencies are in fact universities. At KTH Royal Institute of Technology (Stockholm, Sweden), flying constitutes 99 per cent of CO_2 emissions from business travel. To decrease CO_2 emissions from travel is thus equivalent to decreasing CO_2 emissions from flying. If we are to follow the Carbon Law, universities from now on need to decrease their CO_2 emissions from flying by 50 per cent every decade. Le Quéré et al. comment that if the goal is to limit global warming to 2 °C, there are no reasons 'to justify an exemption for the research community from the emission reduction targets applied elsewhere' (2015, n.p.).

There are, however, two reasons why it is possible to argue that universities' CO_2 emissions from flying should decrease by *more* than 50 per cent every decade. The first reason is that *flying* is a less essential need than *food* (emissions from agriculture), *warmth* (emissions from heating buildings) or *staying healthy* (emissions from the healthcare sector). While research and knowledge dissemination is important, other sectors in society arguably provide services that are even more important. Reducing emissions from flying at a faster pace than 50 per cent every decade would allow selected sectors in society to decrease emissions at a slower pace. The second reason is that it is easier as well as morally more acceptable that those persons with the highest CO_2 emissions (e.g. the rich, who fly a lot) should reduce their CO_2 emissions at a faster pace than others (Chancel & Piketty, 2015; Gore, 2015, 2020).

While some researchers argue that carbon emissions from flying should be reduced within academia (Glover et al., 2017; Higham & Font, 2020; Hopkins et al., 2019) and that 'Academic air travel … is an unsustainable and unethical practice given its environmental impact' (Glover et al., 2018, p. 757), this is unfortunately not yet a prevalent notion. At our university, KTH Royal Institute of Technology, and in our school, the School of Electrical Engineering and Computer Science, a large group within the faculty knows that reducing emissions is necessary, but they have problems seeing how this could be achieved (Eriksson et al., 2020). Also, others report that many researchers perceive flying to be an inherent and important part of academic work (Higham et al., 2019; Hopkins et al., 2019), for example for disseminating research results or for career progression in terms of building up and maintaining international academic networks (Parker & Weik, 2014; Storme et al., 2017). Many researchers perceive that there is a conflict between different goals, but they do not know how to resolve this conflict on a personal level and tend to propose solutions that do not include behaviour change but instead point to the need to change academic *structures*. While there is a need for academic structures to change, it is also all too easy to point to the necessity of structural change as a reason for non-action when it comes to personal behaviours and personal responsibility.

Other colleagues of ours at KTH are more averse to the idea of decreasing flying (Eriksson et al., 2020). They do *not* experience a goal conflict ('flying is only 2 percent of global CO_2 emissions'), or they state that they *cannot* fly less, thereby implying that *someone else* (presumably outside of academia) should reduce their flying if reduction targets are to be met. While there are few climate change deniers at our school or the university at large, there is however a large group of researchers who are unaware of the magnitude of the necessary reductions. These researchers can propose solutions that are superficial (e.g. 'pack light') or insufficient. A proposed solution is insufficient if it does not support the goal, for example rapid and significant CO_2 emission reductions from flying, and examples of such proposals are more energy-efficient jet engines, more streamlined airframes, 'green approaches' (Continuous Descent Approach, CDA, see Turner, 2007) and other 'techno-fixes' such as biofuels or possible future electric airplanes (Eriksson et al., 2020).

While it is possible to argue that it is important for researchers to continue to fly, or that a few per cent of global CO_2 emissions is not much, the crux of the matter is that if we are to attain CO_2 emission reductions of 50 per cent in 10 years, *each* profession (including researchers) and *each* practice (including flying) needs to aim for a 50 per cent reduction of emissions—unless some other profession or some other practice is to reduce emissions by more than 50 per cent. While there are many suggestions for how to decarbonise flying, average efficiency gains have been estimated to 1–2 per cent per year (Bows-Larkin, 2015; Gössling & Humpe, 2020; Kamb & Larsson, 2018) while the *volume* of flying has increased at a significantly higher pace.[2] Global CO_2 emissions from aviation could grow to 22 per cent of global carbon emissions by 2050 if efforts to combat climate change are further postponed within this sector (Cames et al., 2015). It is, in the end, impossible to get around the fact that if CO_2 emissions from flying are to be reduced by 50 per cent in 10 years, that goal will not be attainable unless we *significantly decrease the volume of flying*. While efficiency gains are important, there is no substitute for *flying less* both at universities and elsewhere.

Reducing Flying at KTH

We have thus far argued that emission reductions for academic flying should be no less (and possibly more) than 50 per cent between 2020 and 2030. Our university, KTH Royal Institute of Technology, is a research-intensive university that aims to be a leading technical university in the area of sustainable development (Pargman et al., 2020) and KTH is one of the 37 Swedish Higher Education Institutions that, as a signatory of The Climate Framework for Higher Education Institutions, has pledged that 'by 2030 … have implemented measures in order to be in line with the Paris Agreement's 1.5 °C target'.[3] KTH Royal Institute of Technology has also recently developed its own climate objectives and measures for the period 2020–2045 and these objectives state that KTH's climate impact from business travel (i.e. carbon dioxide equivalents per full-time equivalent) should decrease by 60 per cent between 2015 and 2030.[4] Since there is uncertainty about the 2015 baseline data, we here conservatively assume that KTH's CO_2 emissions from air travel have neither increased nor decreased between 2015 and 2020.[5] To attain the goal and to reduce emissions at an even pace, KTH needs to reduce CO_2 emissions from flying by 9 per cent every year between 2020 and 2030 (per full-time equivalent).

As part of a research project, we have access to detailed information about all KTH employees' flights from 2017 and forward. This data set is probably comparable to the data sets that underlie previously published studies about carbon emissions from flying at a Norwegian research institute (Stohl, 2008), at a Swiss university (Ciers et al., 2019) and at a Canadian university (Wynes et al., 2019). In the research project, we work together with different departments at KTH to study departments' and individuals' business travel. The project aims to guide and support departments in creating change towards more sustainable travel behaviours and CO_2 emission reductions that are in line with KTH's goals and with the Paris Agreement.

To decrease CO_2 emissions from flying at the breakneck speed of 9 per cent per year, there is a need for high-quality data, for tools to make sense of this data and for a better understanding of travel- and meeting-related practices both at the departmental and at the individual level. It also makes sense to first go for the low-hanging fruit, for example to decrease 'unnecessary flying'. This is a good goal because everybody agrees that 'unnecessary' flying should be phased out. The hard part is agreeing on what flying is 'unnecessary', since this is a value judgement. Before we start a process of working through what flying practices are 'necessary' and 'unnecessary' (or rather *more* and *less* necessary), we first need to better understand the flying that goes on at KTH, for example *who flies when, where and why?* Concretely we need to understand how flying is distributed over various schools, departments and positions at KTH in order to be able to discern where CO_2 reductions are most attainable, for example to understand *why* we fly, *what* flying needs to decrease, *whose* flying needs to decrease and what obstacles there are to reducing academic flying.

In the context of this research project, we have, as mentioned, access to a wealth of data about flying at KTH. The challenge is to make sense of that data and to make it 'actionable' (possible to act upon). We have chosen to work together with departments at our university and have developed tools to help these departments understand their flying. These tools include visualisation tools (Pargman et al., 2020; Biørn-Hansen et al., 2021) as well as a *workshop format* for presenting data, for discussing flying patterns at a department and for discussing challenges associated with reduced flying. The purpose is to start up and facilitate discussions about how flight-related CO_2 emissions can be reduced at the specific departments we work together with and at a pace that fulfils KTH's goals. Besides data and tools, there is a need to help these departments increase their understanding of their flying and to help them find ways to decrease their CO_2 emissions. To facilitate such an understanding and *motivate* departments to accept the challenge of reducing emissions from flying, we have developed a method where we use poker chips to visualise flying.

Material Visualisations

For this text and based on 2019 data, we have chosen to visualise and analyse two departments at KTH Royal Institute of Technology: a 'low flyer' and a 'median flyer' department. These are not departments that we work within our research project, but rather departments that fit the profile of flying little or flying in line with the KTH average. We have chosen to keep things as simple as possible in the text and chose not to include a 'high flyer' department; the median flyer here represents an average department and the low flyer represents something that the average department might strive for.

To select two departments, we first restricted the selection process to departments with 25 employees or more (there are 51 such departments at KTH and an additional 175 departments with less than 25 employees). We then chose the department with the *lowest* number of travel bookings and the *median* department at each of KTH's five schools. After discarding outliers, we chose one 'low flyer' and one 'median flyer' department that had similar numbers of employees. An example of an outlier that was discarded was a 'low flyer' department where the whole department had all but stopped flying altogether.

Department Median has 39 employees who in total booked 78 air trips in 2019 (for an average of 2 trips/person), and Department Low has 40 employees who in total booked 27 trips in 2019 (for an average of just below 0.7 trips/person). Some of these bookings were however one-way trips, some were round trips and some were complex (e.g. a month-long trip with several stops). We here assume that people conceptually think about their air travel in terms of *trips* with particular *destinations* rather than as combinations of more disjointed *bookings* or as the combination of several *legs* and *stopovers*.[6] When we scrutinised the *bookings*, we found that at Department Median the actual number of *trips* was considerably lower than the number of *bookings*, since two separate *bookings* for one-way *trips* often could be combined into a *round trip* and several *bookings* sometimes could be combined into a *complex trip*.[7] When we merged different *bookings* into more logical *trips*, Department Median went from 78 bookings to 62 trips (1.6 trips/employee). At Department Low, there was no discrepancy between the number of bookings and trips (since they never booked one-way trips or complex trips).

The flight patterns for Department Low and Department Median can be seen in Figs. 6.1 and 6.2. Each employee is represented by a post-it note, and each trip is represented by a poker chip. Green poker chips

Fig. 6.1 Each employee at Department Low is represented by a green post-it note. Only 12 out of 40 employees at Department Low made one or more trips by air in 2019

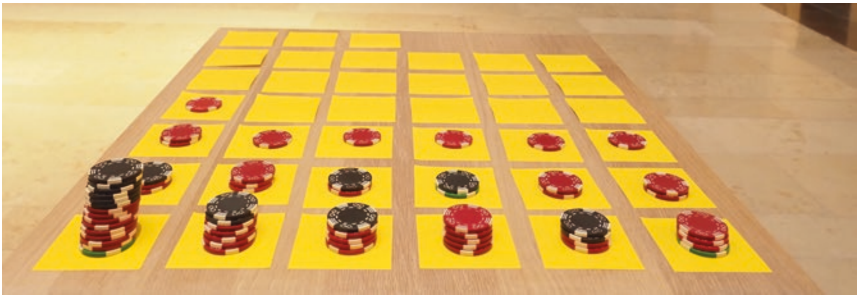

Fig. 6.2 Each employee at Department Median is represented by a yellow post-it note. Half of the employees at Department Median (19 out of 39) made one or more trips by air in 2019

represent *short-haul* trips (typically domestic trips or trips to a neighbouring Scandinavian country), red poker chips represent *medium-haul* trips (typically a trip from Sweden to a European country) and black poker chips represent *long-haul* (intercontinental) trips (typically a trip from Sweden to the United States). A trip between, say, Los Angeles and San Francisco has been coded as a short-haul trip since it has a similar carbon footprint as a trip from Stockholm to Copenhagen. In the following we analyse some of the flying patterns at these two departments. This analysis overlaps with the work we do in our research project before we visit a department to hold a workshop there.

What is immediately obvious from the images is that while the average for Department Low is 0.7 trips/employee and the average for Department Median is 1.6 trips/employee, these trips are very unevenly distributed *within* the departments. At Department Low, less than a third of the employees (e.g. 12 out of 40) made one or more trips by air during 2019, and just below half of the employees (e.g. 19 out of 39) made one or more trips by air at Department Median. The average number of air trips per *flyer* at Department Low was 2.2 trips, and the equivalent number at Department Median was 3.2 trips per flyer.

Besides the differences *between* these two departments and between *flyers* and *non-flyers* at the departments, there are also large differences *within* the group of flyers at both departments. Out of the 12 flyers at Department Low, a large majority (8 persons) had made only one or two trips during 2019, while the top three flyers together had made almost half (48 per cent) of all trips at the department. At Department Median, a majority of the flyers (11 out of 19 persons) had made only one or two trips during 2019, while the top three flyers together had made 44 per cent of all trips at the department.

While each department will differ in terms of travel patterns, certain patterns do seem to recur in many departments, for example, many employees at a department do not fly at all during a particular year, and air trips are very unequally distributed among those who do fly. At one particular high-flying department (not discussed here), it turned out that a single individual was responsible for more than half of all trips at the department. On average, that person had flown more than once per week during the whole of 2019.

It should be mentioned that while it is intuitive and convenient to display and analyse the *number of trips* (see Figs. 6.1 and 6.2), KTH's goal is not primarily to decrease the number of trips but to decrease *CO_2 emissions* from air trips. This means that an analysis of a department's flying patterns has to discern between different kinds of trips (short-haul, medium-haul and long-haul) since they differ significantly in terms of their CO_2 footprint. Figure 6.3 complements Fig. 6.2 by showing the *CO_2 footprint* from flying at Department Median. To go from number of

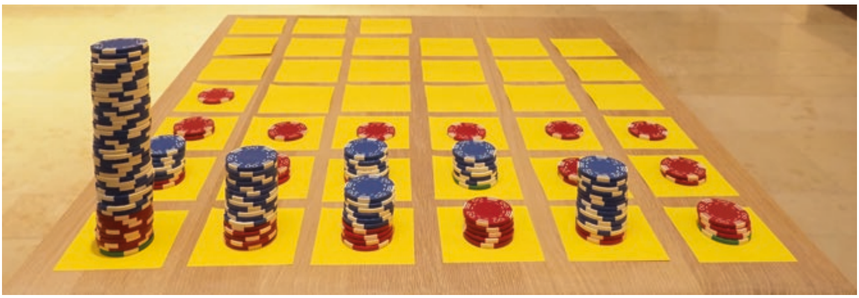

Fig. 6.3 Where each black chip in Fig. 6.2 represented one long-haul trip, each black chip has here been replaced by several blue chips. Each blue chip and each red chip represent the CO_2 footprint of a medium-haul trip (e.g. a trip from Sweden to the European continent). It is immediately clear that the major part of the emissions from flying at Department Median comes from the relatively limited number of long-haul (intercontinental) trips

trips (Fig. 6.2) to CO_2 emissions (Fig. 6.3), we added up all trips by air at the two departments and calculated the average CO_2 footprint for a short-haul trip, for a medium-haul trip and for a long-haul trip.[8] When we compared the CO_2 footprint for these three categories, we found that the CO_2 emissions of the average medium-haul trip (typically a trip from Stockholm to France, Switzerland or southern Germany and perhaps changing plane once, e.g. in Copenhagen) corresponded to 3.2 short-haul trips (typically a trip within Sweden or to a neighbouring Scandinavian country). The average long-haul trip (typically from Stockholm to the United States) instead had a CO_2 footprint that was equivalent to 5.9 medium-haul trips. Going from Fig. 6.2 to Fig. 6.3, we thus exchanged each black chip (representing one long-haul trip) for six blue chips (representing the CO_2 emissions of the average medium-haul trip).

At Department Median, 23 per cent of the total number of trips were long-haul trips, but these trips generated more than 64 per cent of the total CO_2 emissions (e.g. almost 2/3 of the chips in Fig. 6.3 are blue). It thus becomes clear that the easiest way to substantially reduce CO_2 emissions from flying is to reduce the number of long-haul trips, since a relatively small number of such trips generate most of the CO_2 emissions at this department. This is a pattern that is repeated also at many other departments. While the number of trips usually are very unequally distributed within departments (most employees fly little or not at all while some employees fly a lot), the CO_2 emissions are yet more unequally distributed. At Department Median, the top three flyers are responsible for 44 per cent of the trips and for 57 per cent of the total CO_2 emissions. A glance at Figs. 6.2 and 6.3 gives that almost every flyer who made a long-haul trip has a CO_2 footprint that towers over those who did not.

While we have here used poker chips to display the flying at two different departments, our research project is currently developing a prototype for a tool to visualise the same information on a computer screen. Such a tool will make it possible to quickly inspect data from any department as well as more easily facilitate online or face-to-face workshops.

Inequalities in Flight Distribution at KTH

Who flies at KTH? Having visualised differences (or 'inequalities') in trips and CO_2 emissions both between and within departments, we take a step back to discuss flying in general at KTH Royal Institute of Technology. In 2019 there were 4704 employees at KTH of which 41 per cent of the employees (1914 persons) made one or more trips by air. All employees together generated CO_2 emissions of more than 10,000 tons from flying. To better understand flying at KTH, we divided KTH employees into two categories; 'researchers' (or 'faculty', which includes PhD students, post-docs and all teaching positions) and 'administration' (all other positions). While 74 per cent of the KTH employees belong to the category 'researchers', this group is responsible for 89 per cent of all carbon emissions from KTH employees' flying (see Fig. 6.4). If KTH emissions from flying are to be significantly reduced, that work has to start with the researchers.

Another way to visualise the distribution of emissions from flying at KTH is to use a Lorenz curve (see Fig. 6.5). The Lorenz curve was

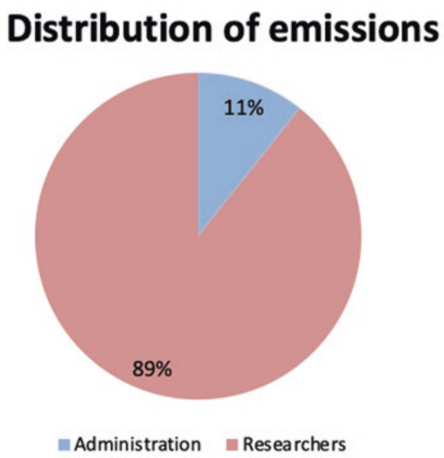

Fig. 6.4 The distribution of CO_2 emissions from flying at KTH broken down into two categories: 'administration' and 'researchers'. The former category comprises 26 per cent of all employees, but their CO_2 emissions from flying are only 11 per cent of total KTH emissions

originally developed to display the national income distribution over populations and income groups, but we use it here to display the distribution of CO_2 emissions over KTH employees.

As was mentioned earlier, 41 per cent of all KTH employees are *flyers* who made one or more trips by air in 2019, and the remaining 59 per cent of the employees are *non-flyers* who are represented by 'the long horizontal tail' of the curve in Fig. 6.5. The curve and the underlying data suggest that half of those who fly (e.g. 20 per cent of the employees at KTH) are responsible for 89 per cent of all emissions. Furthermore, it is possible to discern that 10 per cent of the employees are responsible for two-thirds (67 per cent) of the emissions and that the top 5 per cent are responsible for almost half (47 per cent) of all emissions from flying at KTH. The KTH numbers are reminiscent of data presented by Gössling and Humpe (2020, p. 7) that indicate that 53 per cent of all adult Americans did not fly in 2018 and that 12 per cent of all adults accounted for 68 per cent of all flights taken. An even more select group, the top 1 per cent of KTH employees (47 persons), are responsible for as much as 17 per cent of KTH's total emissions from flying. These persons will, for the most part, have higher-than-average salaries, and it is therefore

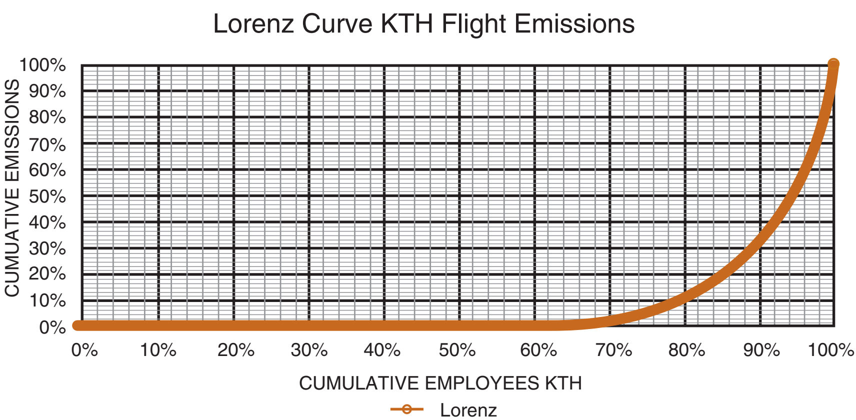

Fig. 6.5 This Lorenz curve displays total flight emissions as distributed over all employees at KTH. The X-axis represents the cumulative share of employees, and the Y-axis represents the cumulative emissions from flying

likely that they also outside of their official KTH business travel fly more and have higher CO_2 emissions than the average Swede.[9]

It is easy to ascertain that CO_2 emissions from flying are very unevenly distributed at KTH, but exactly how unevenly are the CO_2 emissions distributed? One way to calculate the 'level of unequalness' (e.g. inequality in the distribution of a resource) is to use the Gini coefficient (Gini, 1912). As with the Lorenz curve, the Gini coefficient is most often used to describe wealth or income disparities in a society, but we use it here to describe how unequal flying is at KTH. The unequally distributed 'resource' in question is, in this case, KTH's CO_2 emissions from flying (see Fig. 6.6). The Gini coefficient for KTH's flight emissions is calculated based on the relationship between two different areas in Fig. 6.6. The blue line represents a perfectly equal distribution of CO_2 emissions among KTH employees, and the red curve represents the real distribution of KTH's CO_2 emissions from flying. The Gini coefficient is the ratio between the area A and the area A+B, so the Gini coefficient for carbon emissions from flying at KTH is:

$$Gini\ coefficient = A \div (A + B)$$

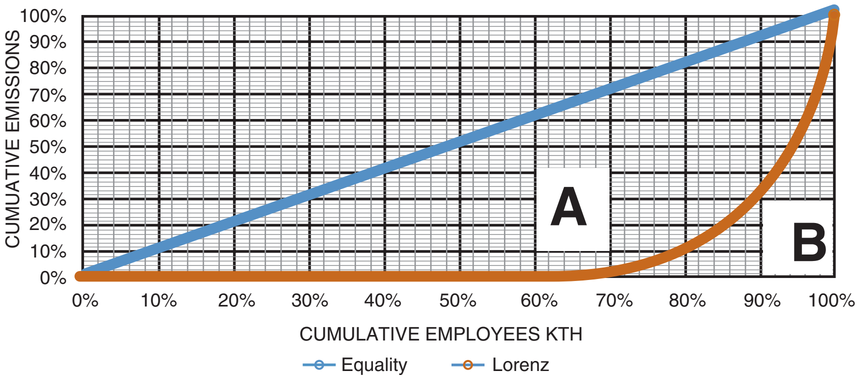

Fig. 6.6 The blue line represents a perfectly equal distribution of CO_2 emissions among KTH employees. The red line represents the real distribution at KTH. It is possible to calculate the level of unequalness, for example the Gini coefficient for CO_2 emissions from flying at KTH by calculating the ratio between area A and area A+B

The larger the area between the blue line (equal distribution) and the red Lorenz curve (real distribution), the greater the Gini coefficient. In a theoretical, maximally unequal scenario where a single person would be responsible for *all* emissions, the Gini coefficient would be 1. In a theoretical and perfectly equal scenario, the Gini coefficient would instead be 0. KTH flight emissions have a very high Gini coefficient of 0.83. This can be compared to the Gini coefficient for the world economy, which has been estimated to be in the range of 0.61–0.68 (depending on the source).

Discussion

The analysis presented here points out a future direction for CO_2 emission reductions in academia *and* functions as a backdrop to discussions with individual departments about their flying patterns and individual researchers' flying habits. The title of this chapter is, however, 'Who gets to fly?'. So who will get to fly if we are to reduce flying? This question can yield several pertinent questions such as 'Who should fly less?' and 'What types of flying should decrease?'. How should we reason about flying in terms of destinations, duration, academic position or reasons for flying?[10] In short, *What flying is 'unnecessary'?*

While we certainly have suggestions, it would be presumptuous to prescribe specific answers to that question without having a better understanding of the reasons for why people fly. No matter how good the purported reasons are, and no matter how necessary each trip is perceived to be, the facts remain: CO_2 emissions from flying need to be reduced by 9 per cent per year at KTH if we are to reach our emission reduction goals. This means that the bar for what qualifies as 'necessary' flying should be raised every single year.

While various forms of force (rules, regulations etc.) certainly can be an option in any organisation, such tools are not at the disposal of our research project, and, we believe in the power of initiating conversations that can lead to negotiations among those who need to reduce their flying, for example with the researchers themselves. While we have pilot tested the material visualisation described earlier (Figs. 6.1, 6.2 and 6.3), planned visits to departments have had to be postponed due to the 2020 COVID-19 outbreak. We will visit different departments during 2021, and we are keen to learn how researchers understand and handle the challenges we have outlined in this text when the questions and the data get close up and personal. If we must decrease unnecessary flying, what flying do researchers themselves deem 'unnecessary' after deliberating and discussing this question with their colleagues and in relation to their own flying? We hope that our workshops will not only be eye-openers but also expect that they will lead to tough but necessary conversations about flying and about who gets to fly.

We have this far implicitly assumed that all departments should decrease their carbon emissions at the same pace (e.g. 9 per cent per year). It could be argued that it is reasonable or even 'fair' that all departments should reduce their flying by the same factor since the task of reducing CO_2 emissions by 60 per cent in 10 years is equally challenging for all departments no matter what their current volume of flying is. Reducing emissions from flying could be construed as a *harder* task at departments that fly a lot since flying could be an integrated part of the micro-culture at that department and since such a department would need to make larger cuts in terms of the absolute number of trips compared to a department that flies less. However, since Department Median has CO_2 emissions that are more than twice as large (per employee) as Department Low, it is also possible to argue that it is more 'fair' if emission reductions were modified based on current levels of flying; perhaps Department Median should reduce their emissions at a faster pace to create space that would allow the already low-flying Department Low to decrease their emissions at a slower pace?

These are two distinct points of view, and they represent different answers to the question 'who should fly less?'. One answer is thus that *everyone* should fly less, but another answer is that those departments (and those individuals) who fly the most today should decrease their emissions at a faster pace than others. An emphasis on current habits and patterns raises the issue of 'carbon inequality' (Chancel & Piketty, 2015; Ivanova & Wood, 2020) at the local KTH level. Instead of 'Sharing global CO_2 emission reductions among one billion high emitters' (Chakravarty et al., 2009), perhaps the onus of reducing KTH's CO_2 emission should primarily be shared by the 100 highest emitters at KTH?

Flying at KTH is, as has been demonstrated, extremely unequally distributed between employees. This is all the more noteworthy since the distribution of *salaries* at KTH is remarkably equal compared to most other countries. The average full professor's salary at KTH ($n = 240$) is less than 150 per cent higher than the salary of the average PhD student ($n = 998$).[11] As was shown earlier, 'top flyers' at KTH rack up most of the emissions, and they are almost exclusively to be found in the category 'researchers'. Therefore, the relevant reference group for top flyers is *other researchers* at KTH rather than the average KTH *employee* (since 26 per cent of the KTH employees are *administrators* who as a group make few business trips). If the top flyers at KTH flew as much (or 'as little') as the *average researcher* at KTH, KTH's total CO_2 emissions from flying would decrease significantly. If the top 5 per cent of KTH employees flew in line with the average KTH researcher, KTH's total emissions from flying would decrease by 22 per cent, and if the top 10 per cent flew in line with the average KTH researcher, total emissions would decrease by 31 per cent. Such reductions would contribute tremendously to KTH reaching its emissions reduction targets in 2030, but they would still not be enough.

To further complicate matters, there is yet another category of air travel that we have not yet touched upon in this chapter, and this is air travel by people who are *not* employed by KTH, but where KTH pays for the trips. It might seem counterintuitive that KTH would pay for non-employees' travel, but a few examples will clarify when and why that is the case:

- KTH regularly pays for air trips so that international researchers can be part of the grading committee at PhD dissertations. KTH also pays for many other high-profile guests to visit KTH for various academic, educational and other official purposes.
- Some PhD students are not formally employed by KTH, but are rather supported by a scholarship or a stipend from their home country (for example China). Such PhD students will still work in research projects that will pay for air trips to present research papers that are written within these projects.

- Sometimes KTH pays for students' trips, for example, when students do Minor Field Studies (MFS). MFS is 'a travel grant that allows students to perform a field study for eight consecutive weeks in a developing country, resulting in a bachelor's or master thesis'.[12] The money originally comes from a governmental agency, 'The Swedish International Development Cooperation Agency' (SIDA), but is distributed to students through KTH (who then formally pays for the air trip).

While it is easy to identify all air trips that have been made by non-KTH employees, the current computer systems do not allow us to see who made the trip, why such a trip was made or indeed even where (at which specific department) such a trip originated. This information certainly does exist (or has existed) *somewhere*, but it is distributed and hard to get access to since no one has previously perceived a need or expressed an interest in collecting this data. This lack of data makes it hard to analyse these trips except at the most superficial level, and to a large extent, the trips are currently unaccounted for.

These trips would perhaps not be a big problem if it wasn't for the fact that a *significant proportion* of KTH's air travel is made by unknown and anonymous travellers rather than by identifiable KTH employees. Where Fig. 6.4 presented the breakdown of CO_2 emissions for KTH *employees*, Fig. 6.7 represents an updated version of that image which also includes the CO_2 emissions of all 'unknown' travellers.

The magnitude of this problem is hard to overestimate. If KTH's CO_2 emissions from air travel are to be reduced by 60 per cent in 10 years, the 2030 emissions will be equivalent to 40 per cent of KTH's current emissions. If KTH fails to reduce the CO_2 emissions from 'unknown' travellers, all CO_2 emission reductions would have to come exclusively from KTH employees, and their emissions would, in the span of 10 years, have to be reduced by almost 90 per cent compared to current emissions. This is not reasonable, but there is currently no easy way to understand who flies when, where and why when it comes to 'unknown' travellers.

Returning to the topic of 'who should fly less', we have proposed that there are two ways to think about this issue: either *everyone* should fly less, and everyone (each department) should decrease emissions at the

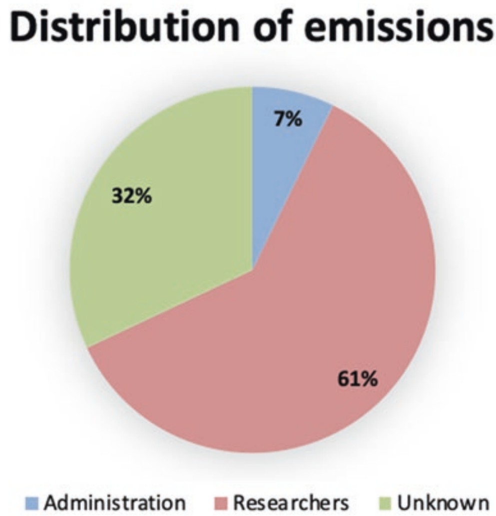

Fig. 6.7 The distribution of CO_2 emissions from flying at KTH broken down into three categories: 'administration', 'researchers' and 'unknown'. The latter category includes all air travel by persons who are not formally employed by KTH. Unknown travellers are responsible for a third of the total CO_2 emissions from flying at KTH

same pace (9 per cent per year), *or some* should reduce their emissions at a faster pace than others. In the latter case, we have suggested that top flyers (or 'heavy emitters' be they departments or individuals) should reduce their emissions at a faster pace. There are, however, other possibilities as to who should bear a larger burden for reducing CO_2 emissions from flying. One option could be that KTH non-employees ('unknown travellers' above) should decrease their emissions faster, thereby creating space for KTH employees to decrease their emissions at a slightly slower pace. Yet another option would be to tie emission reductions to some sort of measure of academic 'performance', 'output' or 'excellence'. Perhaps 'ordinary' departments should reduce their emissions at a faster pace, thereby creating space for departments that perform extraordinary research to reduce their emissions at a slower pace? Yet another possibility is to take seniority into account. Tenured (senior) researchers will presumably have established their research networks, while more junior researchers have a greater need to travel and to make contacts and to establish networks (Le Quéré et al., 2015).

We believe that all of these suggestions have merit, but we also believe that the best suggestion is the one that has the potential to gain the largest possible support from faculty—and we do not yet know which suggestion that is. It is difficult, however, to sidestep the fact that top flyers have the largest emissions and thus also the largest potential to reduce their emissions in terms of absolute numbers. Gössling and Humpe suggest that 'the share of the world's population travelling by air in 2018 was 11%, with at most 4% taking international flights' (2020, p. 1). Taking frequency and type of ticket into account (business class, first class), they further estimate that 10 per cent of the travellers (e.g. 1 per cent of the world population) are responsible for 50 per cent of the emissions from commercial air travel. Any solution for reducing emissions from commercial air travel that does not take this select group into account will surely be destined for failure for two different reasons. The first reason is that emission reduction targets will be hard to reach unless this group of hypermobile travellers, who are responsible for a very large share of the total emissions, begin to fly less. The second reason is that a solution that did not restrain hypermobile travellers would not be seen as legitimate by the large majority of air travellers. Analogously we believe that any suggestion that does not take academic top flyers—be they departments or individuals—into account will be hard-pressed to gain the necessary support.

We end this chapter with a short note on language. In this chapter, we have used words like 'low', 'high' and 'top' descriptively to refer to a 'low-flying department', to a 'high-flying department' and to 'top flyers'. There is, however, something that chafes, since words like 'high' and 'top' have positive connotations that are easily connected to 'excellence' in a research context. Who does not want to work at a 'top department'—or be a 'top flyer'? Referring to someone who flies a dozen times per year or more as a 'top flier' is in this context a euphemism that hides the downside of excessive flying, for example the high CO_2 emissions that are associated with hypermobile lifestyles. Words like 'low' instead have negative connotations. 'Department Low' might bring to mind a *low-performing* department or a department that lacks energy or is depressive. Linguist George

Lakoff has written extensively about the connection between language and cognition and about framings and biases that are invoked when particular words are used (Lakoff & Johnson, 1980; Lakoff, 2014). Lakoff and Johnson (1980), for example, noted that our culture organises our values spatially so that 'up' (an upward orientation) is positive and good (e.g. 'rising to the top', 'being in top shape', 'having a high-level intellectual discussion', 'do high-quality work') while 'down' (a downward orientation) is negative and bad (e.g. 'feeling down', 'coming down with the flu', 'falling from power', 'being at the bottom'). There is thus a need for new terms that turns these connotations upside down when we speak about flying. Perhaps we should not refer to 'top flyers' but use the more neutral term 'frequent flyers'? Or perhaps it is high time to instead refer to such persons in terms of 'high emitters', 'top polluters', 'superspreaders' or simply as 'flight addicts' (Cohen et al., 2011)?

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Notes

1. If it turns out to be hard (or undesirable or 'unfair') to reduce emissions at that pace in one sector of society (for example food production) or in certain countries (for example poorer countries), other sectors and other countries will need to reduce their emissions at a faster pace.
2. These efficiency gains are primarily based on technical progress and increased capacity utilisation.
3. The Climate Framework for Higher Education Institutions is available at https://www.kth.se/en/om/miljo-hallbar-utveckling/klimatramverket-1.903489
4. KTH's Climate objectives and measures 2020–2045, available at: https://www.kth.se/en/om/miljo-hallbar-utveckling/klimatramverk/kth-s-klimatmal-1.926003

5. KTH's CO_2 emissions from flying increased by 28 per cent between 2016 and 2019, but an unknown part of the increase is due to increased compliance with rules that specify that all trips should be booked through KTH's official travel agency.
6. Our unit of analysis is thus a *trip* to a certain *destination* for some particular (but to us unknown) *purpose* at some particular *point in time*. Travelling from Stockholm to Los Angeles to attend a conference is thus one trip no matter if this trip corresponds to one booking of a direct round trip between Stockholm and Los Angeles, one booking with one or more stopovers in Europe or the US, or several bookings that (through careful detective work) can be combined into a trip between Stockholm and Los Angeles.
7. Data about 'bookings' came directly from the university's travel agency. We have naturally discarded cancellations and so on.
8. For this particular data set (e.g. combined data of 2019 flights at Department Low and Department Median), the distance of the average short-haul trip (11 trips in total) was 960 kilometres, the average medium-haul trip (58 trips in total) was 3060 kilometres and the average long-haul trip (20 trips in total) was 18030 kilometres.
9. The average (consumption-based) CO_2 emissions for a Swede are around 9 tons per person and year according to the Swedish Environmental Protection Agency. See further: https://www.naturvardsverket.se/Sa-mar-miljon/Statistik-A-O/Vaxthusgaser-konsumtionsbaserade-utslapp-per-person
10. It goes without saying that a trip from Stockholm to Los Angeles for a year-long sabbatical is more justified than a trip from Stockholm to Los Angeles to participate in a two-day workshop.
11. PhD students have high salaries in Sweden and the salaries are yet higher at a technical university such as KTH in order to compete with industry.
12. See further https://intra.kth.se/en/internationalisering/program/minor-field-studies-1.17564

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