The CO_2 cost of transport.

As part of our commitment to responsible innovation, we decided to look at the transportation costs of what we order. Our DNA caught our attention as it was shipped in from IDT and Coralville, Iowa. We felt we needed to remedy this and to do so we must first find out the carbon impact from shipping across the globe.

The Journey.

To calculate the cost of the journey we must first assume the journey taken from Coralville to Exeter. The parcel was delivered using UPS express. This tells us that it flew most of the way. We have then assumed that from door to airport and airport to door it was transport by lorry. From UPS's list of airports, the closest top Coralville is Des Moines (1). However, the DNA classifies as dangerous goods (UN3245) (2), and from UPSs list of approved dangerous goods routes we can see that UPS does not fly dangerous materials from Des Moines. The nearest approved airport that does fly out dangerous goods is St Louis (3). We can assume that the trip flew out of St Louis and into London Gatwick (the nearest airport to Exeter that UPS fly dangerous goods into). From either end we can assume that the DNA went by truck. We have assumed the trucks on both ends are standard 44 tonnes lorries (4) and the Plane in question was a Boeing B767-300F of which UPS have 85 in total (5). We can then take the distance of each of the three parts to our journey. From Coralville to St Louis the distance by road is 403.1km. From St Louis to London Gatwick the distance by plane is 6,770km. And finally, from London Gatwick to Exeter is 292.1km. We can then assume that two trips take place: a plane journey of 6,770km and a truck journey of 700km (we have rounded this for sake of ease in our calculations).

CO_2 cost of plane transport

To work out the CO_2 cost of plane transport we much find out the fuel efficiency of the aircraft and the CO_2 output of the fuel. As we are only transferring a small weight in comparison to the total payload weight, we have decided to divide the total CO_2 by the per centage of payload weight of our DNA, we will also take into account the per cent capacity the aircraft is. From this we have developed an equation for the CO_2 cost the plane journey of our DNA:

$$CO_{2\ released} = \frac{Package\ weight}{ratio\ capacity * payload\ capacity} * fuel\ consumption * distance * CO_2\ released\ per\ litre\ fuel$$

Quantity	Value	Reference
Package weight	1.5kg	
Payload capacity	47808kg	(6)
Fuel consumption	1.5574 gal/km	(6)
CO_2 released per litre fuel	9.75 kg/gal	(7)
Ratio capacity	0.7-1	Estimated two bounds

As we have got two bounds for our ratio capacity, we have developed two answers for the mass of CO_2 released with higher and lower bound. These two bounds are 3.23kg and 4.61kg for the lower and upper bound respectively.

CO_2 cost of road transport

Although we expected that the CO_2 emissions of the road transport to be less than that of the air transport, we wanted to include it rather than just assume it to be negligible. We have used the same equation as previous for transport with alternate values representing the different method of transportation.

Quantity	Value	Reference
Package weight	1.5kg	
Payload capacity	28000kg	(8)
Fuel consumption	0.09 gal/km	(9)
CO2 released per litre fuel	8.887 kg/gal	(10)
Ratio capacity	0.7-1	Estimated two bounds

From these values we get a range of 0.03-0.04kg of CO_2 from the road transport. This takes our total CO_2 emissions of transport to 3.26-4.65kg of CO_2. For sake of comparison this is the equivalent of the amount of CO_2 emitted by the average private jet in 5.89s and 8.37s respectively (11). This in fact shows that the impact of importing DNA is minimal, especially for something you need to import so rarely. This is partially due to how light the DNA is and the benefit of economies of scale in the shipping industry.

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