Linnaeus

The future is mispriced

What if we could send wild animals money? What if they could spend this money on services they need for their own survival?

Wild animals suffer because they have no independent financial means. They cannot participate in the human economy except through the value of their processed body parts.

The purpose of interspecies money transfer is to make it possible for large numbers of humans to send money directly to species threatened with extinction—starting with wild animals and progressing to trees, plants, insects, and even microbial colonies. And for these other species to transfer money to humans in return for services they need for their survival.

Linnaeus

Linnaeus is an interspecies money transfer service named after the 18th century Swedish scientist who invented the taxonomic system by which we classify all life on Earth by genus and species—ergo Homo sapiens.

Linnaeus will develop digital wallets for animals and humans and build the artificial intelligence backend necessary for the safe and secure addressing of money across species. It will not provide conservation or science services. It is a simple financial mechanism motivating human behaviour to self-organise around money held by the animal.

Linnaeus will be designed to be used easily and profitably by the 1.7 billion people who do not have a bank account. It will work on the cheapest Android phones and be

interoperable across social media platforms. Verification of Linnaeus payments will be by biometrics; for wild animals their "wallet" will be activated by face recognition.

Linnaeus will use a "stable coin" such as Libra which offers affordable security and will be legal tender in most countries.

Linnaeus is a digital financial service for the unbanked

The poorest communities live closest to the greatest biodiversity, but receive very little reward for stewardship. Nearly all of these communities are unbanked, with little connection to financial services.

Because wild animals will spend their interspecies money on services provided by the poorest communities, Linnaeus can make a contribution as a digital financial services for the unbanked. By drawing wild animals and the community closer, Linnaeus will often disrupt traditional conservation.

Each community will decide how to receive Linnaeus income: as cash, in contributions to savings clubs, or investments such as solar lighting, fences, and scholarships for girls. Cash payments will often be in small incremental sums into mobile phones. The services an animal asks for will always be simple and easy to verify. Often the payments will be used to mitigate the worst effects of human encroachment: stopping poaching, controlling cattle, sheep and goats, planting trees, preventing fires. Many animals will choose to pay for improvements in farming which allow more healthy food to be grown on less land. They may pay for improvements in water sources, so the cattle and goats are not in competition with wildlife. Animals may also pay to preserve bees and other insects needed for pollination or breaking down the soil.

It is not possible to predict at this early stage Linnaeus financial models, but it is likely that some wild animals will act like a living bank to a community, offering micro loans

and micro insurance at preferential rates for as long as they are alive and well. In such a model the Linnaeus banking facility held by the animal may increase over time, allowing it to self-finance the verification system. It will be able to pay scientists and rangers.

Under every financial model the animal will be worth many times more alive than dead to the local community.

Know me

In order for its transactions to be made Linnaeus needs low cost verification. It needs to know where an animal is, what condition it is in, and whether it is receiving the services it paid for. Linnaeus requires only as much information as is needed to make a trusted and transparent transaction. It is not interested in the behaviour of an animal, only its condition and prospects. Nevertheless, data needs to be gathered persistently and accurately. That is why the first interspecies service that a wild animal will ask for is to be seen: know me, know who I am, where I am, what I am. This desire to be known more fully is the beginning of both an open source data set of use to scientists, governments, investors, and the digital platform for other species that people all over the world can begin to interact with. In other words, the verification Linnaeus produces the kernel of new understanding.

Made possible for artificial intelligence

Linnaeus will be built to acquire data in the wild. All of the data will be gathered into machine learning programmes and multi-agent simulations.

Linnaeus verification will be made possible by the convergence of cheap sensors and smart artificial intelligence. Mobile phones distributed to community rangers will record video and track the location of wild animals. Bespoke software will allow relevant information to be uploaded to the cloud. A range of camera traps and other devices will

be deployed at water holes and along paths to confirm the identity of a species and its condition. Payments will be made for the observation of spoor, prints, hair, and sometimes genetic sampling. Drone and satellite imagery will be gathered from above, taking account of relevant information such as slash and burn farming and presence of cattle. Further layers of information such as weather, agricultural and economic data, security and political volatility will be added.

AI solutions used by Linnaeus will need to be straightforward and flexible. It will have to develop an open category systems which knows that they are operating in the wild and in ignorance—that it can identify a moth but recognises that there are many other winged insects which are not moths.

There have been AI breakthroughs in face recognition and in machine sound and vision. A few examples include a solution for detecting pain in sheep from foot rot through their facial expressions, the ability to identify when a sow is pregnant in an industrial pig farm, a system to identify dugongs feeding in shallow water from drone footage, and the means to identify, count, and track species in the wild through images caught on camera traps. One of the early examples of the use of camera traps was in the Serengeti in Tanzania. Researchers identified 48 species from 3.2 millions images with 94% accuracy—far higher than the experts.

The bigger ambition for Linnaeus is in computational game theory. Game theory is used in antagonistic situations such as stopping malicious behaviour on a computer network or predicting pirate attacks on shipping lanes. It can also be applied to optimise complex networks such as flight paths into busy airports.

Linnaeus will turn interspecies money into a game by laying down a meta layer on the world which can be tweaked and improved. The game tells the community that wild animals have money and they want to spend it on services only the community can provide. The community tells the animal what it wants to do and what it does not want to do. Services and incentives will be adjusted towards an equilibrium that benefits both animals and community. The game will be played for as long as the extinction threat exists or until money is no longer relevant or welcome intervention in nature.

The use of scalable algorithms will make Linnaeus more nimble and affordable than traditional conservation. The game is an approximation and subject to bad actors. It will not work in every situation and especially not where communities are insecure from natural disasters or where they are powerless to stop armed gunmen from killing animals or cutting down trees for charcoal. It will not replace militarised conservation in protected areas. It will apply in unprotected areas which are safe but which little money or attention is given: most of nature. Where it does work, Linnaeus will be characterised by an ability to shift strategy on a weekly basis.

Which life forms will Linnaeus address?

In its early stage Linnaeus will transfer money to "charismatic" wild animals. It makes sense to send money to mega-vertebrates whose numbers are small and whose ranges are well-defined. The purpose will be to demonstrate interspecies money transfer vividly.

The more powerful and lasting application of Linnaeus will be towards numerous forgotten and never remembered species in less visited places. These will include animals but also "static" life forms such as trees and insect colonies which are easy to monitor.

Early recipients of Linnaeus may include orang-utans, dugongs, Hirola antelopes, and giraffes.

The orang-utan (*Pongo pygmaeus*) is critically endangered outside protected areas in Malaysia and Indonesia. It is the most intelligent primate and the most arboreal, eating and sleeping in the tree canopy. Orang-utans are found now only in Borneo and Sumatra. They have been eaten into oblivion by humans elsewhere. It is a soulful animal and receives much attention and financing; a captive orang-utan in Argentina was granted a landmark legal status of "non-human personhood". Total spending on orang-utan protection on Borneo is $20 million annually, or $200 per orang-utan at the estimated population of 100,000. This funding has not stopped a decline in orang-utan numbers as more humans seek to exploit the rainforest. Linnaeus will transfer money to the 75% of

Borneo orang-utans who live outside protected areas on Borneo. Orang-utans would be identified by face recognition on mobile phones and will receive money simply by being an orang-utan. Farmers are in conflict with orang-utans because of crop raiding. The orang-utan will pay farmers to be tolerant of it, to protect their crops, and for any damage done. The community will earn money by uploading data on the orang-utans. The animal will pay for sensors, drones, and satellite imagery. Testing will determine whether interspecies money transfer can increase orang-utan numbers.

The Hirola (*Beatragus hunteri*) is a critically endangered antelope which lives in southern Somalia and eastern Kenya. It has a delicate snub-nose Star Wars face. Hirola numbers have collapsed to 500, down from 16,000 in 1979. The Hirola might be the first terrestrial mammal endemic to Africa to go extinct in modern times. Interspecies money could help it pay for its own protection. The Hirola is threatened because of habitat loss and being killed for meat. The service the Hirola will ask for will firstly to be known and secondly to pay the local community to seed "grass islands" on which it can graze. The community will also earn money from the Hirola by keeping livestock away, driving off lions and hyenas, and helping stop poaching.

The dugong (*Dugong dugon*) is a remarkable but not very well-known sea animal. Together with the manatee (Trichechus) it is the last remaining member of the family Sirenia. The dugong is dying out across its range in the Indo-Pacific after 35 million years. If it becomes extinct an entire tree of life dies with it. There are some 40,000 dugong left alive outside Australia (where they are well protected but also hunted under native title). Dugongs are the only exclusively marine vegetarian mammal, feeding on rich sea meadows. They are hypersensory, with acute hearing and the most developed sense of touch of any animal. Only three dugong survive in captivity. No scientist has seen a dugong mating. There will not be face recognition for them for the foreseeable future and even scientists cannot identify individuals swimming away at speed. Instead, a Linnaeus digital wallet for dugongs will be held by a herd of animals. The herd will pay the local community to know them by tracking them from boats and drones and by changing their fishing practices to avoid accidental drowning of dugongs in nets. Dugongs will also pay to stop being eaten and they will pay to preserve and even improve

the seagrass meadows on which they depend. Sea grass also serves as a fish nursery and a major store of carbon—so called blue carbon.

The giraffe (*Giraffe*) is among the charismatic animals. The mental impression of the giraffe in the human mind, from childhood onwards, bears no reflection to its actual numbers. There are only 97,000 giraffe left alive in the wild, down from 163,000 in 1985. There are some 1700 in captivity. The giraffe is threatened in much of its range; in some areas its numbers have collapsed by 95% by fragmentation of its range, tree cutting, incursion of farmers and cattle herders, and poaching. But conservation initiatives have been successful in Niger and elsewhere and, in less remote areas which are secure, the giraffe is easy to track with face recognition, with mobile phones, and is and non-threatening to communities (unlike elephants). The giraffe also depends on trees and water which in turn support other life forms. Translocations of giraffes are well established; in the future herds of giraffe may pay to be moved to safer habitats. Particular attention will be given by Linnaeus to the most endangered subspecies of giraffe such as the Kordofan giraffe (2000 individuals), the Nubian or northern giraffe (less than 2200), and the reticulated giraffe (less than 10,000). If a success is made of giraffes, with local communities benefiting while cohabiting in new ways, Linnaeus can be applied to the Hirola and other critically endangered hoofed creatures like giant elands (less than 12,000) and Heuglin's gazelle (less than 3000).

Case study

The following illustration demonstrates how giraffes will use Linnaeus interspecies money transfer to increase its numbers. It shows how the money humans are willing to pay to keep giraffes alive on the planet, so-called existence value, can be applied with precision in a shared ecosystem. The services a giraffe pays for improves its life and the life of the local community.

Problems: Giraffe numbers are falling because of human encroachment. Giraffes are killed for their tails, which are used for ceremonial purposes. They are killed for their meat and bone marrow. They are hit by vehicles when crossing roads. They are restricted by new farms and new barbed wire fences. The trees on which they graze are cut and burned for charcoal. Their water holes are taken by cattle and goats. They are stressed by human noise. They die of human spread diseases like anthrax. They suffer from plastic and other pollution.

Verification: Linnaeus pays money into a digital wallet owned by a giraffe. The giraffe pays for more information on its condition using drones, satellite imagery, and sensors: know me! A community ranger gathers information on a giraffe using his mobile phone. He identifies the giraffe using face recognition, uploads the relevant information, and receives a payment.

Improvements: The poachers and charcoal burners are kept at bay. Trees are planted. The cattle are dispersed. A giraffe drinks freely at the water hole. A giraffe receives veterinary care. Money is sent to humans by the growing number of giraffes. The money is spent on seed and fertiliser, new fences, solar lighting, and school fees.

Linnaeus will make money

Linnaeus will be a business proposition and will seek to make money in order to exist at scale over a long period of time. It must ensure its operations are open to investigation. Information always available will include the value of all Linnaeus digital wallets, details of all Linnaeus transfers, and the form of those transfers in payments, loans, grants, or insurance policies. Information must be displayed clearly and simply to allow those with limited formal education to participate.

Biophilia needs a direct payment scheme in which a few cents on a cup of coffee can be directed from humans to other species. Linnaeus will attract small sums from large numbers of people who regard themselves as lovers of nature. An active Linnaeus user may donate the equivalent of a subscription to a digital streaming service each year.

The architecture for the digital exchange of small sums at massive scale already exists. At Chinese Lunar New Year, it is a tradition to exchange with friends and family red envelopes containing money known as “hong bao” or “lai see”. The red envelope marks good luck. In China, where many workers in the cities are a long way from their families in the countryside, 90% of red envelopes are sent digitally. 2 billion digital red envelopes were sent in 2019 through mobile money platforms. The money in each red envelope varies: $220-$550 to parents; $25-$120 to siblings, children, and close friends; $3-10 for acquaintances. Money shunts around for good luck.

What if other species were to be made an acquaintance and received $3 in a digital green envelope? What if that became good luck?

Linnaeus will work because the economy is changing. Money held in a Linnaeus wallet by a dugong may be tax deductible if it helps secure seagrass meadows as a carbon sink. We will make more use of the material living world; recycled materials, renewable energy, better farming, better gardens, cleaner food, smarter buildings. Insurance companies say that fossil fuel companies have $100 trillion in stranded assets; they will

have to reposition themselves closer to nature and natural living systems in order to survive. Linnaeus is part of that shift.

Humans already spend lavishly on other species—pets. In 16th century England a pet was a lamb fed by hand. Eventually this came to include dogs and cats and other species. What made a pet was its connection to the human and the human care for it. American spending on pets rose from $17 billion in 1994 to $75 billion. Global spending on pets will reach $150 billion.

Linnaeus will earn money in transaction fees and in its banking and insurance facility. Open computing models built off Linnaeus datasets will be applied to make investments in biodiverse areas. A wild animal may earn money in ventures such as wind power, or the production of nuts, honey, and botanics.

In this context $1 billion a year into a Linnaeus interspecies money transfer service is attainable and certain to be dwarfed by other interspecies services.

Linnaeus is self-organising

Linnaeus money will go to communities that are willing and able to provide simple services to other species. If a species suffers as a result of a failure of the community to provide agreed services payments and loans may cease. Linnaeus uses the power of peer sanction to motivate stewardship.

The issues around Linnaeus are mind bending. Is human common feeling for non-human life too fragile to build a financial system on? What happens to a digital wallet when a species is predated upon, or moves on to another area, or dies in a drought? You can wrap artificial intelligence around another species but who really is the arbiter of the decisions it takes? How is that administered? Does legal status matter? If another species has rights, does it also have responsibilities? What is it to have money but no language? How do you manage technology off-grid? How do you take advantage of technology while

remaining deeply sceptical of its limitations? How do you make interspecies money transfer secure from hackers, minimise its energy consumption, and design an interface which engages a young woman in Shenzhen and a smallholder farmer in Uganda? How do you design Linnaeus as a game in an open world where you cannot know the outcomes? How do you deal with failures?

It is possible here to assert that digital wallets will be reapportioned in a fair way with no disadvantage to the community and that a Linnaeus interface will be saturated in colour and accessible to all. But all of these questions need to be worked out in the field.

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