

## Slide 1

Today we have reached the Great Apes.

Let's begin by delimiting them in terms of time and phylogenetic relationships.

## Slide 2

The prequel to the Great Apes is the divergence of apes, or anthropoids.

Proper apes today only live in southeast Asia: small-bodied, tailless but they do look quite a bit like a Great Ape as you can see in this Gibbon up here.

Great Apes appear to have emerged in Europe around 12 million years ago – although one never knows what the next finds will say about that.

What is known is that Europe was rich in anthropoid primate species and that several hominoid apes appeared here from that time and on.

As we may see from reconstructions, they would not strike us as particularly odd Great Apes if we saw them today.

What sets them apart from the Lesser Apes is, among other things, that they are large and have a strongly reduced prognathism. That is, less protruding snouts.

### Slide 3

After the split between our lineage and that of chimpanzees about 5-7 million years ago, the main novelty for a long time seems to have been that *bipedal* Great Apes emerged.

We evolved from one such lineage, although it is unknown exactly which one.

*Orrorin tugenensis* is the earliest confirmed Great Ape adapted to bipedal motion along the same lines as we are.

It lived some six million years ago.

These bipedal chimps, as we may view them, persisted in fact well past the emergence of *Homo*.

The robust Australopithecines – now known as *Paranthropus* – remained until about 1 million years ago, in wooded landscapes. They were slightly more large-brained than chimps.

## Slide 4

Let us begin by recalling the group structure of the Old World Monkeys, which I described as a probable type of group organization of our ancestors some 20-25 million years ago, based on similarities in overall and brain physiology, and based on continuity between these ancestral forms and their modern Old World Monkey descendants.

A typical Old World Monkey organization is based on matrilineal units organized as linear transitive dominance hierarchies.

Within the matrilineal unit, young females obtain a rank directly below their mothers.

This has nothing with intentions to do. The mother provides care and aids in agonistic support against lower-ranked females, and this will automatically slot the youngest daughter into the hierarchy at that place.

The daughter learns that she is above those below her, and those below her will learn that she is above them.

When the lineage grows too large, internal conflict and increasing confusion about the hierarchy will lead to its fission into two units. And so it goes on.

## Slide 5

This structure, and innate agreement on its validity, is the backbone for resolving conflicts and returning to status quo after upheavals in the group.

It allows the monkeys to persist in large groups and reap the benefits that come with large brains and large numbers.

In other words, the Old World Monkeys engage in intricate social interaction in order to maintain an organization that emerges directly from innate characteristics.<sup>1</sup>

---

<sup>1</sup> Read, D. W. (2012). *How culture makes us human: Primate social evolution and the formation of human societies*. book, Left Coast Press, Incorporated.

## Slide 6

We identified this as a Trans-Complex type of organization, which is typical for adapted or designed Complex Systems.

Many of the systems you will deal with are of this type.

That is: a complex dynamic with a sleek complicated backbone that cleverly directs and channels the dynamics.

Often this complicated structure will be emergent: its recipe will be hardcoded into the behavior of the components. When they interact, this complicated organization rises like a spirit from a bottle – or something – and governs the dynamics.

## Slide 7

The Great Apes are very different.

First of all, their social organization differ much more between species than it does for Old World Monkeys.

Orangutans are for example almost solitary.

Gorillas live in a stable “harem” organization: male-dominated units of one male and several females.

Chimpanzees and bonobos, like hunter-gatherer humans, have a **fission-fusion style** of organization: a larger community contains transient small groups that fission and fusion fluidly over time.

Let’s look closer at the chimpanzees as these are the best studied of the two.

## Slide 8

The chimpanzees are male-bonded, and the groups are based on grooming and agonistic interactions.

The communities defend their territories fiercely by forming coalitions of males that will attack other communities – finding lone males – and they will defend the community from attacks, not shunning lethal violence.

This already begins to sound very human doesn’t it?

## Slide 9

Let's note that, contrary to OWN organization, the description I just gave is not a generative formula that will tell the chimpanzees where they belong in a group.

It will not tell them how to interact when they encounter one another, and it does not constitute an order to fall back on.

They must know a lot more about their fellow group members than Old World Monkeys must know:

Their present *and* historical, weaknesses, alliances, strengths, enemies and so on.

They must *know each other* in our human sense of the word.

They are, in other word, truly persons.

The chimpanzees, also notably, differ in social organization *within* the species.

For example, in chimpanzee communities around the Gombe Stream in Tanzania, males form small transient social units while the females are largely solitary.

In the Tai forest communities in the Ivory Coast, social units are composed of both males and females.

And so on... there are many small but distinct regional differences that are very hard to explain by recourse to the environment, which is what typically explains intra-species variability.

The chimpanzee way of life permits much more freedom than the monkey way of life, and this is reflected in their behavior.

Chimpanzees have been referred to as "political"<sup>2</sup> due to this freedom.

Notably, for our purpose, intelligence is not only applied to playing the game here – it is applied also to making the rules of the game.

---

<sup>2</sup> de Waal, F. (1982). *Chimpanzee Politics: Power and Sex Among Apes*. Jonathan Cape, London.

## Slide 10

If monkeys are hard to organize due to their intelligence, Great Apes are even worse.

While the typical Old World Monkeys' Neocortex Ratio is around **2.5**, chimpanzees have a neocortical ratio of **3.2**.

By comparison, the modern human value is **4.1**.

As we discussed last time, the two main envisioned drivers for primate brain evolution has been technical and social intelligence.

Now, great Apes are notable not for their large groups, but they are for **their technical skills as foragers**.

They compete directly and successfully with monkeys and they often do so by being more intensive as foragers: they are better at finding, discriminating and processing the resources.

Indeed, chimpanzees and pygmy orangutans **even make tools** for the purpose of better being able to get to resources.

Indeed, all Great Apes make and use tools with similar ease in captivity! They just don't all make any in the wild.

This also goes to show that intelligence is general: such a spectacular capability would not arise if its underpinnings in physiology were idle and not selected for.

So it seems that the Great Apes represent the technical side of intelligence getting back into the driver's seat: they are **powerful and autonomous forager "platforms"**

Their group dynamics was somewhat left in tatters as a consequence, with most species being unable to form more than very transient coherent groups.

## Slide 11

But what we see traces of in “chimpanzee politics” is interesting.

Chimps “perform” society<sup>3</sup> in a way that resembles humans much more than it resembles any other species.

Indeed, *we* are the closest living relatives to the chimp ... *not*, as one might guess, the gorilla.

This is also humans have been referred to as “the third chimpanzee” – in addition to the common chimpanzee and the bonobo.<sup>4</sup>

We share with them this entangled problem of playing social games while also being free to reinvent their rules – and needing to be prepared for others doing the same thing.

We too must keep track of, and clearly seek to uncover, the intentions, personalities and alliances of intelligent and individuated persons;

We too must constantly apply this knowledge to innovate in the social game, such as by deceiving, provoking, feigning, provoking and so on.

This intermixing between the organization of the game and the dynamics of the game is the signature feature of Wickedness: the type of system where the Simonean compartmentalization all the time threatens to break down.

We have a sub-wicked system: a wicked system that the agents can handle cognitively.

Like the Trans-Complex Systems it has a complex dynamics.

It also has complicated organization arising from the dynamics...

But the features that give rise to the Complicatedness **are not fixed!**

They are up for change as a result of the complex dynamics.

The linked qualitative and quantitative change, and the cascading of effects of change that results, is essential to what we typically know as **innovation** in human societies.

---

<sup>3</sup> Strum, S. S., & Latour, B. (1987). Redefining the social link: From baboons to humans. *Social Science Information*, 26, 783–802.

<sup>4</sup> Diamond, J. (1992). *The Third Chimpanzee: The Evolution and Future of the Human Animal*. New York: HarperCollins Publishers.

## Slide 12

Such systems can grow only to the extent that the cognitive capacities of the individual components can keep track of what's going on.

That is, unless we invent other types of complicated organization that can help us out!

The chimps have very little of this. They do have modified activity sites that structure their behavior, but it is next to nothing compared to us.

The human saga appears to be describable as one of reconstructing, from scratch, a way of maintaining Sub-Wicked groups of highly intelligent individuals.

The “easy way out” was never an option: seeking stable innate forms of organization would allow very large groups but it would rob us of the flexibility that is so essential for our remarkable adaptivity.

The expansion of human social and technical organization has been accomplished by means of culture: culture itself and the cognitive capabilities for maintaining culture.

Culture permits the maintenance of persistent organization that is not biologically inherited and that may, therefore, be adapted in other and more flexible ways.

Great Apes, notably, give evidence of cultural traditions.<sup>5</sup>

Examples include both social and technical traditions.

The social traditions include for example different greeting and grooming customs that differ regionally and where the variation has no obvious functional significance.

The technical traditions include tools and behavior patterns for things like cracking nuts, sponging water and fishing for termites.

These are concrete examples of the design of Complicated Systems – and they are part of cultural systems, together with which they provide functionality, such as obtaining termites where none could otherwise have been obtained.

---

<sup>5</sup> E.g. Whiten, A., Spiteri, A., Horner, V., Bonnie, K. E., Lambeth, S. P., Schapiro, S. J., & de Waal, F. B. M. (2007). Transmission of multiple traditions within and between chimpanzee groups. *Current Biology : CB*, 17(12), 1038–43.

## Slide 13

We know that at least some of these traditions may be very long lived.

For example, nut-cracking sites have been excavated and found to have been around continually for 4,300 years.<sup>6</sup>

But while they can be long lived, chimp traditions are not what is normally meant by “cumulative”

By cumulativity I mean that culture can build upon itself to become increasingly refined and increasingly complex.

But also that it can be organized into cohesive cultural systems within a group.

As opposed to chimp culture, human hunter-gatherer culture is not just a collection of distinct cultural traditions: it is a tight-knit system of traditions that are carefully interlinked into a sophisticated functional whole.

As we will see next time, this is what made the *Homo* group into an apex predator!

---

<sup>6</sup> Mercader, J., Barton, H., Gillespie, J., Harris, J., Kuhn, S., Tyler, R., & Boesch, C. (2007). 4,300-Year-Old Chimpanzee Sites and the Origins of Percussive Stone Technology. *Proceedings of the National Academy of Sciences of the United States of America*, 104(9), 3043–8.

## Slide 14

The transmission of culture among chimpanzees is, not surprisingly, intensely studied these days<sup>7</sup> in order to understand the similarities and differences between humans and their closest relatives: why is our culture so strongly cumulative while chimp culture is not?

There are several possible answers to this question, all of which are probably part of the answer.

One is that chimps tend to *emulate* each other rather than *imitate*, which is what humans tend to do.<sup>8</sup>

If you emulate, you will essentially try to come up with your own way of solving the problem, which means that you actually have to work through the whole solution in order to arrive at it.

Humans, by contrast, often imitate also behavior that they do not understand the point of: children do this the whole time.

While this may seem to be a mechanistic and uncreative way of going about learning, the beauty is that our cultural practices may then embody knowledge that we cannot understand.

If you think about it, if you had to understand the point of learning everything you have learned, when you learned it, you wouldn't have learned much – in particular not as a small child.

Later on, all those pointless things that we learn come in very handy as building blocks when we learn and design solutions to all sorts of problems.

Quite often, things make sense only long after they are learned.

Another difference is that chimpanzees are very unwilling to shift to new ways of solving problems, even when they are presented with obviously superior alternatives.<sup>9</sup>

A final difference is that chimps do not appear to re-apply solutions found in one domain to problems found in another domain.<sup>10</sup> So if they come up with a good way of trapping one kind of insects, they will not modify it to catch also some different species of insects, or begin using the sticks to probe holes for other purposes.

---

<sup>7</sup> Yamamoto, S., Humle, T., & Tanaka, M. (2013). Basis for Cumulative Cultural Evolution in Chimpanzees: Social Learning of a More Efficient Tool-Use Technique. *PLoS ONE*, 8(1). <http://doi.org/10.1371/journal.pone.0055768>

<sup>8</sup> Whiten, A., McGuigan, N., Marshall-Pescini, S., & Hopper, L. M. (2009). Emulation, imitation, over-imitation and the scope of culture for child and chimpanzee. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 364(1528), 2417–28. <http://doi.org/10.1098/rstb.2009.0069>

<sup>9</sup> Hrubesch, C., Preuschoft, S., & Van Schaik, C. (2009). Skill mastery inhibits adoption of observed alternative solutions among chimpanzees (Pan troglodytes). *Animal Cognition*, 12(2), 209–216. <http://doi.org/10.1007/s10071-008-0183-y>

<sup>10</sup> Davidson, I., & McGrew, W. C. (2005). Stone Tools and the Uniqueness of Human Culture. *Journal of the Royal Anthropological Institute*, 11(4), 793–817.

So, in summary, if you insist on coming up with the solution yourself, *and* you are very unwilling to adopt others' solution, *and* you are unwilling to reapply a solution to a different domain...

Then you have a very good way of safeguarding specific and useful traditions across time, but you don't have what it takes to innovate large complicated social and technical systems.

Humans have in fact developed a whole range of cognitive adaptations specifically in order to facilitate the type of learning that our cultural system depends on: what has been called a "natural pedagogy"<sup>11</sup>

The case for a suite of cognitive capacities for pedagogy is based on the observation that learning is a great deal more common than *teaching*.

Another way to put it is that social learning and communication is common among animals but learning *by* communication is unique to humans.

Even chimpanzees will, for example, never explicitly *show* each other how to do something. They keenly learn, but they do not *teach*.

We have also developed intricate institutions, such as apprenticeship, to design and sequence the enculturation of new generations into highly sophisticated systems of cultural knowledge.

---

<sup>11</sup> Csibra, G., & Gergely, G. (2011). Natural pedagogy as evolutionary adaptation. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 366(1567), 1149–57. <http://doi.org/10.1098/rstb.2010.0319>

## Slide 15

Cultural systems consist of two main types of organizations: Complicated technological designs and Trans-Complicated social designs.

These types of organization are intimately entangled.<sup>12</sup> For example, the chimpanzee nut cracking site will combine modifications of landscape with rock artifacts and social behavior into a single functional whole.

The same goes for just about anything that we do.

Our social organizations are largely built around physical artifacts, including landscape modifications and buildings, which have greater persistence and serve to cue the social behavior.

We also interpret and adorn natural variations, distinctions and periodical features with culture, using them as cues for what and when to do things: seasons, gender, age and so on.

Modern human social institutions will also be organized, like technology, in a modular way: different people and artifacts are composed to make units with specific function, and these units, in turn, are combined to realize an even higher level of organization with some other function.

Just like the innate organization of Old World Monkeys served as a basis for settling conflicts by determining who does what and when, the same goes for cultural social and technical structures in humans.

We do have innate structure, of course, but this structure appears to be mostly very abstract – leaving a large range of flexibility.

Next time we will go more into pre-human and modern humans.

We will find that building cohesive and powerful groups was the main evolutionary concern.

It was the **human group** that was revolutionary – **we** were merely cogs in a machinery!

Human groups eventually turn into Trans-Complicated structures, capable of packing more degrees of freedom than we can juggle cognitively.

---

<sup>12</sup> Hodder, I. (2012). *Entangled: An Archaeology of the Relationships between Humans and Things*. Wiley-Blackwell.