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# What is the Built Environment?

A Literature Study in Evolutionary Anthropology

Master's thesis in Architecture - MAAR2

Supervisor: Jørgen Hallås Skatland

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## **Abstract**

In this philosophically motivated essay, I use the evolutionary lens to search for and construct a theoretically foundational understanding of the built environment.

I describe various concepts in evolutionary theory, which I then use to interpret the physical-, ecological-, sexual-, social- and cultural pressures and adaptations found throughout deep human history. Finally, I use these findings to hypothesize what the built environment is, and what the premises for its optimal functioning might be.



## **Sammendrag**

I dette filosofisk motiverte essayet bruker jeg den evolusjonære linsen til å søke etter og konstruere en teoretisk fundamental forståelse av det bygde miljø.

Jeg beskriver forskjellige konsepter i evolusjonær teori, som jeg så bruker til å tolke de fysiske-, økologiske-, seksuelle-, sosiale-, og kulturelle press og tilpasninger funnet igjennom dyp menneskehistorie. Til slutt bruker jeg disse funnene til å lage en hypotese om hva det bygde miljøet er, og hva premissene for dets optimale funksjonalitet kan være.





## **A Thank You to**

My Father

For introducing me to the wonders of science, and for always cultivating my curiosity.  
For the good times that we shared together. Rest in Peace.

My Mother

For all of the emotional support, and for being there in the times I needed it the most.  
For inspiring me to work hard, and for teaching me decency.

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For being available and engaged in the material. For continuously encouraging me to make the assignment my own, even when we both probably knew better ;-)



# Contents

<b>0.0 INTRODUCTION</b> .....	<b>1</b>
0.1 MOTIVATION .....	1
0.2 THESIS AND MODEL.....	2
<b>1.0 PHYSICAL</b> .....	<b>4</b>
1.1 CAUSE AND EFFECT.....	4
1.2 SYNERGY AND EMERGENCE .....	5
1.3 ADAPTIVE EVOLUTION.....	6
1.4 TRADE-OFFS.....	8
1.5 DIVERSITY AND MALLEABILITY.....	10
<b>2.0 ECOLOGICAL</b> .....	<b>11</b>
2.1 STRUCTURE OF BIOLOGY.....	11
2.2 CELLS, ORGANISMS AND GENES .....	12
2.3 SPECIES AND NICHES.....	13
2.4 HUMAN HISTORY AND NICHE .....	15
2.5 AFFORDANCES & PERCEPTION .....	19
<b>3.0 SEXUAL</b> .....	<b>21</b>
3.1 SEXUAL DIMORPHISM & SELECTION.....	21
3.2 EVOLUTION OF HUMAN SEXUALITY.....	23
3.3 INTRASEXUAL COMPETITION .....	26
3.4 OFFSPRING AND PRO-SOCIALITY .....	27
3.5 VIOLENCE .....	29
<b>4.0 SOCIAL</b> .....	<b>30</b>
4.1 THE EVOLUTION OF SOCIALITY .....	30
4.2 MORALITY IN THE GREAT APES .....	32
4.3 PRO-SOCIALITY AND DISTRIBUTION.....	33
4.4 DEVELOPMENT OF NORMATIVE MORALITY.....	35
4.5 EVOLUTION OF PERSONALITY.....	39
4.6 DEVELOPMENT AND EFFECTS.....	43
<b>5.0 CULTURAL</b> .....	<b>45</b>
5.1 NATURE-CULTURE COEVOLUTION .....	45
5.2 CREATION OF CULTURE .....	50
5.3 POLITICS.....	52
5.4 RELIGION.....	54
5.5 TECHNOLOGY .....	57
5.6 THE BUILT ENVIRONMENT .....	59
<b>6.0 DISCUSSION</b> .....	<b>61</b>
6.1 WHAT IS?.....	61
6.1.1 <i>Universals &amp; Diversity</i> .....	61
6.1.2 <i>The Built Environment</i> .....	68
6.2 WHAT SHOULD BE? .....	71
6.2.1 <i>What do we aim for?</i> .....	71
6.2.2 <i>Maximizing Carrying Capacity</i> .....	74
6.3 HOW DO WE GET THERE? .....	77
6.3.1 <i>Shared Intentions</i> .....	77
6.3.2 <i>Theory &amp; Technology</i> .....	79
6.4 SUMMARY & FUTURE RESEARCH.....	85
<b>7.0 REFERENCES</b> .....	<b>86</b>



# 0.0 Introduction

## 0.1 Motivation

Through my master's degree in Architecture, I have been fortunate enough to experience four different universities from the inside. Consistently throughout, it has seemed to me that the study of architecture, as well as urbanism, generally lack a deeper theoretic foundation. It seems that the field of architecture in particular, is rather often split between the fields of engineering and design; where engineering is usually considered a science, and design is likened to an art. On some occasions, design has also taken on some philosophical properties, and particularly in my studies at NTNU in Trondheim. However, its extent has rarely surpassed the history of ideas and perspectives in poetics or aesthetics. It is my contention that the design aspect of these fields can be studied objectively and scientifically, and that we have much to gain from such endeavors.

At the same time, it seems to me that science is currently going through a slow-rolling expansion. From studying primary phenomena and constructing reductionist models and theories; towards more extensive interdisciplinary cooperation, powered by complex models and theories. This movement, I believe, is at least partially caused by novel and wide-reaching innovations in communication-technology, as well as increasingly sophisticated methodologies, resulting from rapid advances in computing power and programming. Granted this expansion is in-fact occurring, we as architects and urban designers might find ourselves in a novel situation shortly. Not only are we managing complex systems on a day-to-day basis, but we are in one of the fields in which many, many other fields converge. (Being at the right place at the right time, one might hear architects discuss a wide array of topics, ranging from politics, ecology and engineering, to art, culture and sociology.... You name it.) These considerations, coupled with our positional power to actually walk-the-talk, puts our profession uniquely positioned in this regard.

Further, granted that architecture and urbanism is best understood as; by humans and for humans; then these two facets of the positionality of our vocation ties in with another personal interest of mine; evolutionary theory. As I see it, the evolutionary lens brings two vital components to the conversation. First, it provides a tool-set in which to analyze and understand complex systems. This is directly applicable to the design of the built environment, and systems theory even seems to be a rapidly expanding subsection of both architecture and computer science. Second, it allows us to peer deeply into human history, and propose explanations for who we are as humans; through the consideration of the circumstances that we grew up in, and by comparing ourselves to other species.

This sets the frame for this assignment. Which tools do we need to manage complex systems? What does our evolutionary history and circumstance say about who we are, what we need, and what we should aim for? Further, and by extension; how should the built environment be conceptualized, and what are the foundational premises determining its success? I believe that discovering what these premises are, would be of tremendous value to several of the design fields, and those affected by it. It could become a measuring stick with which we evaluate and shape the goals and priorities set within design briefs at various scales. And while I do not claim that I have discovered what these premises are, it is the pursuit I have hopefully started with this Master's Thesis.

## 0.2 Thesis and Model

I propose that by understanding humans through selective pressures and mechanisms – both in terms of what unites us and makes us different– and responding to them through intensive cooperation; we can potentially direct our evolutionary trajectory towards an ever more ideal end-state. In the same vein, I propose that if we do not understand these pressures, and create overly simplistic or otherwise suboptimal solutions to these complex mechanisms; that we might instead move in an undesirable direction, even with potentially severe consequences. In my proposal, the built environment is conceptualized as a key domain in which these evolutionary selective pressures play out, and in which we can in-turn influence these pressures. Further, that the built environment is best theoretically conceptualized through the following series of statements:

1. The built environment is an extended phenotype of humankind.  
(It is an effect that our genes have on our environment.)
2. It is a tool –a way to adapt to selective pressures through the externalization of traits. This is a way to transcend physiological design constraints.  
(E.g., we do not need fur, because we make indoor environments.)
3. It is a cultural product, and is the environmental manifestation of human’s extended habitat. (Culture being humans extended community.)
4. In this role, it plays a part in determining how the relationships between cultural niches are organized, as well as perceived. (At the intersection between aesthetics and pragmatics, or alternatively; communication and cooperation.)
5. Additionally, it takes the place of the existing physical environment, becoming the very foundation of the selective pressure structure which determines human’s future evolutionary trajectory.

NB: As the essay progresses, there will be sentences that refer back to these statements directly, and they will be underlined. These statements will also appear again right before the section of discussion.

The structure of this essay follows a ‘model’ (Fig 1. Below), which is constituted by five primary categories: Physical, Ecological, Sexual, Social and Cultural. Through my studies I have found these to be useful distinctions when speaking and thinking of human nature. I also recognize that the list can –and should– expand or contract, depending on the context it is used in. E.g., one could reasonably group the first four categories under “natural” to contrast specifically with culture, as culture is somewhat distinct. Also, to expand the model, at least two more categories would fit naturally: “Familial” between sexual and social, and “Personal” between Sociality and Culture. With these considerations in mind, there is a few reasons for why the model looks as it does.

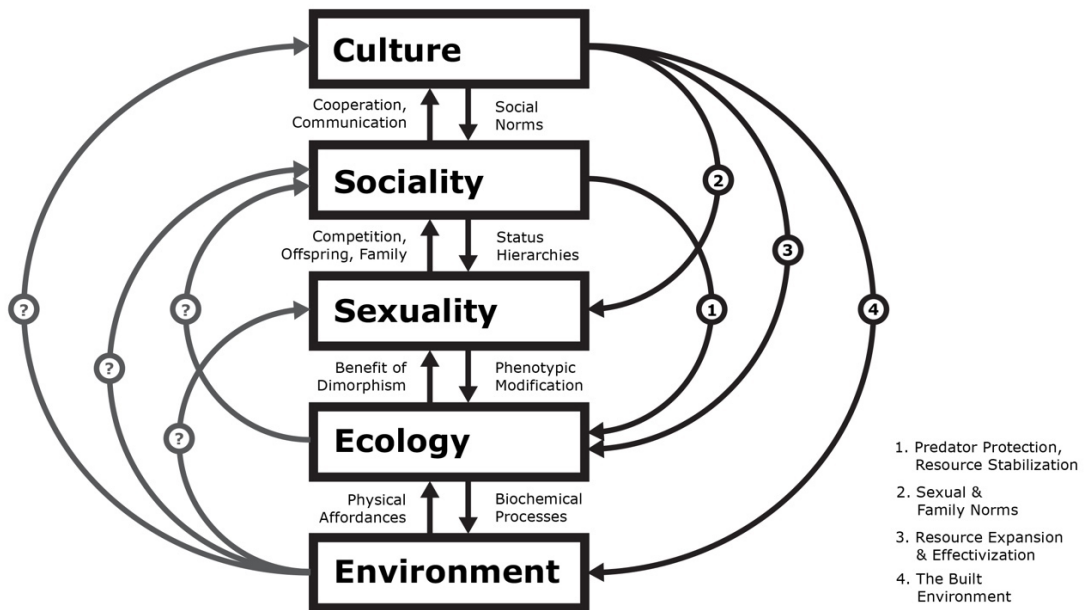


Fig. 1 – The Human Selective Pressure Structure

First, its structure implies the emergent nature of being. While we will get to emergence in the first chapter, it is sufficient for now to say that one category (e.g., ecological) springs out of –and is subject to the laws of– its underlying category (e.g., physical). As does it provide its own rule set and influences. As one might expect, this means that the ordering is usually chronological too, in regards to our evolutionary history. To me this implies that my model stands a chance at being foundational. (Discounting various metaphysical claims and hypotheticals.)

Second, its structure implies the semi-hierarchical nature of being. All living things have evolved to adapt to a certain climate, a certain range of physical conditions. They have then evolved based on each other. Then typically split into two or more sexes to gain further advantage of diversity and synergy. For some species raising offspring became increasingly difficulty over time, and so romance, family and social dynamics evolved in response. Finally, in our species, sociality enabled the development of more sophisticated communication and cooperative skills, in which our phenotype (observable traits) split into different personalities, further laying the groundwork for the advantageousness of culture. Culture is then finally the way in which a species gain access to conscious management of its own evolutionary trajectory, and the built environment is the way in which our species may manage the bottom category of our selective pressure structure.

Third, as implied by the two previous points– this structure is for the most part applicable across different types of life, which is further indicative of the priority that will usually be granted to problems at its different levels. I.e., From the top-down: It matters little to create a useful cultural product, if you and your creation are rejected from society. Being accepted by a social group is not sufficient to persistent across time unless you can also find a way to reproduce. It matters little to find a mate and have offspring if you have no food or water to sustain yourselves with. Hunger and thirst matter little if you are about to die because of a heatstroke the sun is giving you, a mudslide that is about to bury you, or a cliff-edge you are about to trip over.

Fourth, as a result of these pressures, physiological and cognitive mechanisms will –and do– evolve in response. Oftentimes, selective pressures can be reacted to in various ways, whether behaviorally or physiologically, which affords a species diversification. This means that there will oftentimes be variation across all relevant demographics in – and between– populations. The degree of variation depends on the degree to which more than one strategy is valid; the possibility of a creature to evolve towards those strategies; and the relative importance that the pressure has for the persistence of the individual’s genes or of other heritable material. That is, when pressures and potentials are highly significant, and there are little options in terms of ways to react, one would expect to see little variation in reactions to such pressures and potentials. With all of this said, we will start by looking at the foundation of the model, and progress our way all up to the top, then end with using our findings to consider the nature of the built environment, and how we might approach it.

## 1.0 Physical

### 1.1 Cause and Effect

Cause-and-effect is a fundamental principle of classical physics. For an effect to happen, there must be a cause, and a specific cause will have a specific effect. An effect of something can – and almost always will be – a cause of other effects. Looking backwards for the reason for an effect will therefore leave us with a string of causes –a cause-string– leading back to the unknown. A cause can result in divergent effects (like fission, the splitting of an atom), or convergent effects (like an atom absorbing energy from several sources). Meaning, that even a physical explanation of cause and effect will have several types of cause-string intersections. The entanglement of several cause-strings then, form a cause-web. The more precise we want to be when analyzing mechanisms, the shorter the chain –or smaller the web– must generally be. The shortest chains are the basis for what one might call reductionist science. This makes classical physics predictable, and observations are usually phrased in terms of *what* happened, and *how* it happened. However, there is nothing about the length of the chain that makes something more or less scientific, just more or less difficult to analyze with precision.

A lack of complete precision does not prevent us from observing and explaining patterns found in cause-webs or in cause-strings. When something is far enough back in the string that we cannot, or should not –for reasons of redundancy– precisely describe the cascading effects of a cause (or all its adjacencies); it is more natural to describe *why* something happens (without it implying that said cause or effect is mystical). Phrasing observations in terms of *why* has commonly been regarded as unscientific, due to its connotations with religious thinking or language. However, as defined in this essay, ‘*why*’ is not outside the realms of science, because ‘*why*’ and ‘*how*’ are simply conceptualized as being the two extremities of the same parameter, which is: proximity to effect. Why-questions need not refer to ideas like ‘*unmoved mover*’, ‘*origin of the universe*’, or ‘*divine purpose*’, even though they can.

We could in this way hypothetically describe things like morals scientifically by studying the pattern of their various cause-webs. The less proximate a cause is, or the bigger web you want to explain, the more general your theoretical explanation must be to be



practical. As the size of the web or length of string that one can analyze is arbitrary, one might conversely conclude that: "scientific theories and their components exist along a continuum from general to specific". (SCHEINER & MINDELL, 2020). In a similar way, cause and effect in biology are roughly divided in two categories (ADAPTED FROM MAYR, 1961): Evolutionary Biology, which deals with 'ultimate' causation, or why questions, like: why does this organism do that? This approach is holistic and teleological. Then there is Functional Biology, which deals with 'proximate' causation, or how questions: How does this organ work? This approach is reductionist and mechanistic. However, note that there is no discrete line separating proximate and ultimate cause.

While Ernst Mayr himself rejected the use of teleological<sup>1</sup> explanations in evolutionary biology, he thought it was "perfectly legitimate to use teleological language in the description of teleonomic processes and purposive activity" (MAYR, 1998). Teleological notions are in-fact "largely considered ineliminable from modern biological sciences" (COLIN & NEAL, 2020). Their use rarely implies any metaphysics. Instead, their use is metaphorical, which helps explain complex systems in terms that are relatable or intuitive. Indeed, using metaphors to explain concepts is a long tradition in the field of evolutionary theory. Perhaps even necessary to approach very complex ideas (SCHEINER & MINDELL, 2020). This might become apparent in this essay as well. A gene might "want" to do something: although it does not *literally* want it, but that *something* that is referred to, will cause (or increase the likeliness of causing) a gene to be propagated into the future. This is what the gene *metaphorically* wants. Assuming propagation is 'preferable' to extinction. Preferable, here, simply being a concept that we use to differentiate between effects that are constructive to the propagation of some part of a thing into the future, with those that are not. None of these ways of understanding reality is fundamentally mystical. But morals surely function differently than physics? How could they then be understood to exist within the same frame of reality?

## 1.2 Synergy and Emergence

Synergy and emergence refer to how things put together can cause effects that the parts cannot do individually. Perhaps the originator (SE SCHOLAR, 2019) of that famous saying, Aristotle writes: "In the case of all things which have several parts and in which the totality is not, as it were, a mere heap, but the whole is something besides the parts, there is a cause..." (ROSS, 1924) While Aristotle was dealing with the problem of definition in this case (SE SCHOLAR, 2019), he also pointed to questions of what something *is*. Defining a complex system through precise description of all of its parts is generally impractical, if not impossible, yet regardless they are the reasons for why the system behaves in the ways it does. Further, describing a complex system with that kind of precision can actually obscure the point as well, which is why metaphors and analogies are often used instead.

A battery is just a battery; a light bulb is just a light bulb. However, putting them together causes light to emerge (arise out of it). It is their synergy (constructive interaction) that allows it. Neither emergence nor synergy implies phenomenon that is beyond the physics of the object's individual parts. The light emerges because the bulb can radiate light if exposed to electric current, and because the battery is able to discharge electric current when its terminals are circuited. An emergent effect might also

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<sup>1</sup> Teleology: "The philosophical interpretation of natural phenomena as exhibiting purpose or design" (Ahdictionary, 2022f)

cause the properties of its constituent parts to change. In this case, the synergy of the light bulb and the battery will eventually expend the battery's discharge-capacity, ending the emission of light.

While this is a simple example, we might also consider that the light bulb is itself complex. It is constituted of parts that themselves have synergistic relationships. In this way, synergy-emergence structures are comparable to cause-webs, and should so be considered as complex and *nested* or *fractal* systems. This is particularly true when it comes to life. In speaking about animals, James Gibson (1979) states: "These bodies are subject to the laws of mechanics and yet not subject to the laws of mechanics, for they are not *governed* by these laws." Novel and definable laws of governance can emerge from complex systems, despite not being apparent through analyzing its constituent components by themselves. Although all underlying synergies will be consistent with the rules of the parts they are composed of. The general is made up of the specific.

One might for example imagine that creativity emerges from our psyche, which emerges from our neurology, which emerges from ecological evolution, which emerges from biochemical processes, which emerges from physical reality. And that, if this nesting principle holds true, it should be possible to explain any of these fields precisely, granted that the field it is nested in is sufficiently understood. That is, its nesting in its underlying field (that is sufficiently understood) is also sufficiently understood. Meaning, science can hypothetically progress with accuracy, through ever-increasing complexity, granted it continuously manages to formulate precise descriptions of the principles of the system-in-question's underlying components. As emergent phenomena can alter the parts they are composed of, one should therefore not be surprising that physical reality might interact with itself in a manner that is not explainable without emergence. As is the case when creativity, in our examples, 'decides' to shape sand into the shape of a castle.

Small disclaimer: despite sounding otherwise, I myself, am actually agnostically positioned towards many of the relevant metaphysical claims. (Like determinism, higher/lower dimensions, divinity, panpsychism, etc.) I simply am not aware of evidence that proves or disproves any of these ideas conclusively, nor do I think these ideas, as I am aware of them, significantly influences the conceptual validity of the nested principle as presented. Whether free will is a cause in a cause-string somewhere, does not change the fact that the string happened, nor that it can be analyzed with some precision. Just, in this case, that some cause/effects might be fundamentally unpredictable.

### 1.3 Adaptive Evolution

While adaptive evolution is usually associated with biology, its principles are actually highly generalizable, and is found in many other domains as well. Of particular note, in my view, is culture, which we will get to later, and the recent and rapid developments in computer science. In general terms, adaptive evolution is the process that increases an entity's 'fit' to its environment. There are three necessary components: a reproducing population (of entities), a source of diversity of traits between entities, and finally selective pressure. As long as the selective pressure has a variety of traits to 'choose' from, it advantages some traits in the population over others, giving higher chance of reproduction. (Also in biology: a lower chance of premature death for the entities that have those traits.) Over time, this will drive the population towards 'fitting' the pressures more closely.

Something can also evolve without being adaptive, the difference being whether or not there are selective pressures involved. Adaptiveness is not random, in the sense that the emergent population “will” be driven towards a set of traits that are selected for by the pressures. (While it is not certain that it will be driven towards the pressures, it is a question of probability. The stronger the pressures, and the more generations pass by, the lower the chance the population will not come to fit the pressures. At some point, such a scenario reaches mathematical absurdity, and it would make more sense to consider it in a deterministic fashion instead.)

Any system that have these components are adaptive. Weinstein and Heying (2021) created a three-part test to determine whether any trait is likely to be adaptive: “If a trait: is complex, has energetic or material costs – which vary between individuals<sup>2</sup> – and has persistence over evolutionary time: then it is presumed to be an adaptation.” Anything that follows this pattern then can be presumed to have its purpose rooted in fitting more closely to pressures. Moving forward, we will primarily use biological terms (defined precisely in the next chapter) and examples, since these are the most illustrative. However, all of the following concepts are generalizable to any real complex system<sup>3</sup>.

Fitness describes how well an entity is favored towards the relevant selective pressures. An entity’s fitness is not just about how well it survives and reproduces, but also how well its offspring, and its grand-offspring does. Ultimately, biological fitness is more about persistence than it is about temporary dominance, although those strategies sometimes overlap. Fitness is always about all levels of descent simultaneously (SEE WEINSTEIN & HEATHER, 2021), and the term for that is lineage. Fitness is, in other words, fractal. The importance of lineage on fitness depends on the selective pressures. In some situations, an organism’s survival and reproduction is almost identical to its fitness, as is the case for male spiders who are eaten after mating (KIDADL, 2021).

While in other cases, intergenerational dependence or population success is more important. Intergenerational dependence is found most clearly in humans, being that our developmental period is extremely long. An example of the population success being critical is that of hive-mind species like ants and bees. In this case, the queen and her reproduction are close to the only thing that matters for the colony’s fitness. And all the individual organisms in the colony are adapted towards ‘serving’ those goals (E.G., HOLBROOK ET AL. 2009). This is because their genes only persist through the success of the colony, and because they all carry approximately the same genes.

Another concept that is useful to understand for fitness is that of local/global optima/minima. These are terms primarily used in mathematics and informatics, but are applicable to any field dealing with optimization. Let’s make an example (ADAPTED FROM MILLER, 2015, CH. 5). The highest peak of a mountain could be described as its global optimum, if height is what is measured. It is the highest point (optimum) of the entire (global) area. However, the same mountain will also have other peaks, such that, if you stand on them, you cannot move in any direction without temporarily descending. This is

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<sup>2</sup> *Individual* here referring to humans, instead of the biological *organism*, or the abstract *entity*.

<sup>3</sup> Abstract- or Simulated systems need not be subjected to the same restraints. Unless “traits” and “trade-offs” are reformulated in a way that applies to those systems.

a local optimum, the highest point within a certain area of the mountain. The same applies to local and global minima, just that it would be about the lowest points in a valley instead.

In terms of fitness, a species can be trapped in a local optimum, such that it cannot increase its fitness in any directions, without first becoming less fit. To escape the trap, some set of unlikely gene-mutations must all occur simultaneously, or its environment must change in such a way that the 'mountain's' topology changes in such that a 'bridge' forms –connecting the local peak to a higher one. The 'mountain' in this analogy, is called the species' *adaptive landscape* (WRIGHT, 1932). As selective pressures change, a trait might evolve to fulfill some other purpose, which is called an exaptation. Traits that serve to fill a purpose, but which end up doing things that it was not originally evolved to do, are called *spandrels* or *by-products* (CALDWELL, 2021). With this said, how come an organism does not keep evolving traits to no end, continuously becoming more and more fit in the process?

## 1.4 Trade-offs

Trade-offs are negative relationships between desirable traits (WEINSTEIN, 2009). It can be roughly divided in two categories: Allocation trade-offs and design constraints. (WEINSTEIN & HEATHER, 2021). Allocation trade-offs can be summarized by saying that a limited resource cannot be used in an unlimited way. I.e., priorities have to be made in order to get the most value out of a resource. By spending more on something, you must spend less on something else. Design constraint, in turn, is not about resources, but about conflicting relationships between desirable traits. Not everything can be achieved in a single individual. E.g., to become stronger, one must build muscles. But muscles are heavy, and the weight will eventually limit the individual's speed. In this way, no-one can be both the strongest, and run the fastest, simultaneously. In fact, no one can even fully optimize any two traits, as anything that is even marginally different, will require somewhat different characteristics or properties. Every trait stands in relationship to every other trait (WEINSTEIN, 2009). If two traits are not conflicting at all, they are in-fact the same trait. Even if they do not arrive together, it is only because of trade-offs with other traits.

There are several other concepts that are tightly related to trade-offs: Carrying capacity, and diminishing returns. In ecology, carrying capacity is the "The maximum number of individuals of a given species that the resources available in a given environment can sustainably support" (AHDICIONARY, 2022E). A species' carrying capacity normally decides whether a species will grow or shrink over time. If the number of individuals is below carrying capacity, the population is expected to grow, and vice versa. Creatures that are able to plan ahead can increase their carrying capacity by managing resources over time (WEINSTEIN & HEYING, 2021). This is in turn an allocation trade-off; less individuals in the present, for more individuals over time. To increase carrying capacity, one can also be more efficient with the use of resources, or increase the collection or production of a resource, as well as discover or learn to take advantage of new resources.

The opposite – unsustainable spikes in growth patterns – is perhaps more common in nature. Weinstein & Heying (2021) coined the term "Sucker's Folly" to describe these situations, in which short term benefit wins out over long term consequences. In nature, this can even drive a species all the way to extinction, despite being a result of continuously adapting to pressures. However, while the growth was adaptive, it did not turn out

to be fit to the habitat. Examples of this include viruses that burn themselves out from “random” emergent traits. Or animals, if they accidentally completely exhaust their resources because they grew beyond carrying capacity. There are also trade-offs, as well as synergies, between different species’ carrying capacities. However, it is not clear how one could conceptualize a theoretically optimal carrying capacity for a whole community. Would carrying capacity be about amount of biological mass, number of individuals, or about quality of life?

Moving on, diminishing returns is more closely related to design constraints. The general principle is that it becomes increasingly costly for an organism as one of its traits approaches the theoretically optimal state. I.e., as every trait is in a relationship to every other trait, the maximization of one, leads to the minimization of every other. Absolute maximization/minimization probably does not exist in nature (due to the unlikelihood of only one trait being subjected to selective pressure). Despite this, absolute maximization (or the concept of purity) is a common element of human ideation. Taken to the extreme in utopic thinking, religious fundamentalism and other totalitarian ideology. (More under 6.2.2.)

First, let us exemplify this. Let us imagine that we were to build a creature that was able to run the fastest 400 meters. First, we would need a structure shaped for speed. It needs next to no organs, and negligible brainpower. The respiratory-, cardiovascular- and nervous system would be at the minimum required to start and to keep running. It only needs enough energy and stability for 400 meters, after all. Even the cells within its tissues only need some components, and we would sacrifice their ability to repair themselves or fight infection, in slimming them down. It does not have to have a skin, and its bones will be hollow, light, and strong, yet fragile. In-fact, sounds like a robot, does it not? Let’s say that that does it. We have made the fastest possible “animal” for a 400-meter dash! And while that’s quite an achievement, and something to marvel at indeed – as a living being, it is almost entirely dysfunctional. It can run 400 meters quickly, but it can do next to nothing else... Now, let’s consider it differently: How fast could we make an animal that is also able to sustain itself over time, let’s say, in a habitat with easy access to resources, and limited dangers? Here, the concept of diminishing returns would let us know that it would still be remarkably fast, as it is only the last tweaks of the single-trait optimization process that is (by far) the most expensive. And so, we would get much additional functionality for tiny sacrifices to speed.

Together, ‘carrying capacity’ and ‘diminishing returns’ leads us to the concept of frequency dependent selection. As the carrying capacity of a resource is approaching, the value of the trait(s) that allow a species to exploit that resource will slowly decline. In other words, increasing the prevalence of the trait among the population has diminishing returns. “So that natural selection places a ceiling on its predominance, thus leaving room for the alternative” (WRIGHT, 1995, CH. 3). This runs into the allocation of resource trade-off, which affords each organism with the trait less of the resource. This means that the species will now benefit from diversifying instead, to gain access to more varied resources. And especially for those whom did not develop the trait that is now approaching capacity. This mechanism therefore implies that trade-offs should be considered to be the driving force behind the differentiation (or divergence) of species (WEINSTEIN & HEATHER, 2021).

## 1.5 Diversity and Malleability

The richness in potential resources and ways of being, coupled with the fact that biological systems are always subjected to the principles of trade-offs, mean that ecological diversity will unfold over time until no species can make any adaptation that increases their overall carrying capacity. At which point one could argue that the community of species have reached their optimum. Diversity performs several functions in these equations. First, as described previously, adaptive evolution is not possible in the first place without variation in traits between individuals. Secondly, trait diversity in the population of a species, or even between species, makes the ecological community and its niches more resistant to environmental change. Further, trait diversity allows the type of habitat –or the species within it– to grow outwards horizontally, towards landscapes with increasingly different environmental properties.

Which leads us to the last point, that diversity is a powerful driver in circumventing design constraints. A resource that would otherwise be off-limits to a single organism, can sometimes be acquired if it can synergize with another entity. A separate entity might be an organism from a different species (symbiosis), an organism from the same species (cooperation), or indeed even inorganic objects (tool-use). The built environment is such a tool. The common of these three cases is that the organism's specific design constraints synergize with the other entity's design constraints –increasing access to resources, decreases its cost, or makes its use of the resource more efficient– in a way the entity could not do on its own.

Malleability is when something can synergize with many different things. It allows something to perform a variety of actions or to be put to different uses. One could think about this as the tool being malleable in the grip of the individual which uses it in synergy with various traits. E.g., using a magnifying glass together with curiosity to discover something, or using the same magnifying glass together with impulsivity to set fire to something. In this way, malleability is also one of the things that can expand an organism's niche. It is, among other things, necessary for the ability to learn, for example. Being malleable helps an organism take advantage of more resources, respond to change, decreasing both allocation trade-offs (more resources to allocate) as well as design constraints (the same mechanisms can be used to different effects). The flexibility that organisms has in their reaction to a certain circumstance can even be the difference between life and death.

Another advantage of malleability can be found in physiological structures that are genetically coded for, but which are only developed in response to stimuli, usually during the developmental stage of an organism. Due to entropy, all physiological structures require resources to maintain, so the benefit comes from the fact that a gene could provide the option to develop a trait, without paying the cost of actually building and maintaining it, if it turns out that it is not in-fact needed. And it "figures this out" through the proxy of not being subjected to stimuli. Alternatively, these situations might be caused by genes relying on some structures growing specifically in accordance with stimulation patterns, as coding for all the specific details might otherwise be too costly, inefficient, or genetically prohibitive.

Having access to more varied behaviors or traits might also be more genetically unstable, if it means more lengthy or specific genes. One of the reasons for that is that those chains might have a higher chance of being corrupted by various means. Efficient genetic programming is therefore an advantage in evolution. However, on this last point, there exist counter-arguments, laid out in Andreas Wagner's (2015) book *Arrival of the fittest*. One of his points is that recent research indicates that lots of nucleotide pairs (what genes are made of) are only there in order to fortify the genes against otherwise destructive changes. Further, that many traits can actually be coded for with different nucleotide combinations, and that phenotypes sometimes gradually change with only single mutations (FOX, 2017; McGRATH, 2015). This makes the genome much more resistant to destruction than previously believed, as does it explain how evolution can happen gradually to begin with.

Having access to more varied behavior, traits, and developmental pathways is also costly. Extreme circumstances can occur when an organism is prevented from developing a trait it might need to survive (E.G., HUBEL & WIESEL, 1964; TENER-TROLANDER ET AL., 2019). Further, if a species' niche does not afford it, then malleability will not increase access to resources in the first place (local optimum). If useful behavior for the niche can be coded for efficiently in genes, then it might also be more beneficial to simply hardwire behavior in, like the various types of reflexes seem to be. Avoiding the detour through conscious cognition and decision (a slow and expensive selective process) also allows for faster actions, which can be life-saving (More under 2.5). The key takeaway from all of this is that, when afforded, limberness will often win out over stiffness (WRIGHT, 1995).

## 2.0 Ecological

### 2.1 Structure of Biology

The field of biology is constituted of five theories: genetics, cells, organisms, ecology and evolution. (SCHEINER, 2010) While there are different ways to consider the relationships between these theories, we will use a specific one from Scheiner & Mindell (2020). We will consider evolution to encompass ecology, and ecology to encompass organisms, cells, and genetics. As "nothing in biology makes sense except in the light of evolution" (DOBZHANSKY, 1973). Evolution is considered the mechanism by which all living things in their environment (ecology) have come to be. Ecology is then considered at three scales: organisms, cells, and genetics. Put differently, ecology evolves over time, at three distinct, –but simultaneous– scales. We will define some of the useful terms and categories in biology, and explain their relationships.

The words environment and habitat in biology are both used at different scales and in different ways. Sometimes their use overlaps. The environment is used, for example, to refer to "The totality of the natural world", "A subset of the natural world; an ecosystem" or "The combination of external physical conditions that affect and influence the growth, development, behavior, and survival of organisms" (AHDICTIONARY, 2022c). We will use the latter definition, making the environment strictly about the inorganic properties of places that interact with life. This includes its available material, atmospheric conditions, geographical features, weather patterns and so on.

A habitat can refer to "The natural environment in which a species or group of species

live”, “A particular kind of natural environment” or “An artificial environment created for an animal to live in”. (AHDICIONARY, 2022D). In this essay, a habitat will normally refer to the specific place in which nature is found, the environment, and additionally includes all living things that relate to it in relative proximity. If we refer only to the living things of a habitat, the term community will be used. Ecological Communities can be thought of as “collections of species [...] organized into food chains and webs in which each species is a consumer of resources and is itself a resource for other consumers.” (SCHMITZ, ET AL., 2008).

Importantly, there are many significant relationships and interactions between environments, communities and habitats. The properties of the environment lay the foundation for all the life that evolves in said place, as well as the communities total carrying capacity. E.g., the longitude of a place relates to various intensities of solar radiation, which creates at-least three things that the community must adapt to in some way. In this case: infrared radiation (heat), which relates to the temperature in the environment; visible light, which relates to the visibility of the environment; and ultraviolet radiation, which can damage organic tissue. Since the functioning of various biological processes are sensitive to temperature, this is something that must be solved. Through finding shade, or regulating one’s internal body temperature, for example. Visible light has less obvious adaptive effects, although it could, for example, affect the sensitivity of one’s light detecting organs, or increase a need to camouflage to avoid detection by others. Finally, UV radiation can lead to skin-burns or things like cancer. In the case of humans, this has led to variation in skin color across environments, because protection against UV radiation stands in a trade-off relationship to the skin’s production of vitamin D (ARNST, 2013).

There are also many other relevant considerations of place/environment. Of note is the material composition of the place determining which building blocks life are provided in the first place. This affects the carrying capacity directly, as elements like carbon, for example, is used in all life (NATIONALGEOGRAPHIC, 2019A). Other important factors are topography, which largely influences wind patterns and access to fresh water (whether through rivers or precipitation). Clouds and wind patterns in turn influence the amount and type of solar radiation that falls on the place. In turn, the ecological community absorbs and transforms various elements, as well as radiation, in turn influencing various environmental factors. The important point being that the properties of the environment are as fundamental as any other pressure. In fact, one might argue it is the most fundamental, although not always the most influential on a moment-to-moment basis.

## 2.2 Cells, Organisms and Genes

Cells are the building blocks of all living things (MEDLINEPLUS, 2021). At the basic level, they contain many small parts that carry out different tasks necessary for the survival and reproduction of the cell, or the multicellular structure. These parts are encapsulated by a membrane that protects and regulates interaction with other things in the cell’s proximity like chemicals, viruses, or other cells. In biology, the term organism applies to all individual forms of life that can typically reproduce. Whether it is a single cell or a complex of cells (AHDICIONARY, 2022A).

Contained within all (re)producing cells is one or more strings of nucleotide pairs. The sequence and structure of which encodes ‘instructions’ for how to build the proteins that make up the structure of the cell (COOPER, 2000). The nucleotide combinations that produce



a specific trait are called genes (NIH, 2021). The set of all genes in an organism is called the genotype (NATIONALGEOGRAPHIC, 2019B). As genes are that which defines traits, as well as the place where changes between generations usually originate, it is often considered the level at which natural selection occurs, although it depends on how the situation is framed.

Gene expression refers to how the information in the genotype (the genetic code) is used when building proteins (NHGRI, 2022), or how the genotype translates to an organism's traits (NCBI, 2017). As the same genetic code can be used to create different systems of protein structures, this means that the same genotype can, and is, used to build all the various cells that make up complex multicellular organisms. Epigenetics (literally meaning "above the genome") is the field that describes how gene expression is regulated. While this is often explained at the level of chemical processes, one could argue that any process which alters gene expression might be included. For example, your gene expression naturally changes with age, and can be altered by things like radiation, and germ infection (CDC, 2020). Culture also sits "above the genome" in the sense that it regulates how the organism's genes are expressed behaviorally. (WEINSTEIN & HEYING, 2021). (More under 5.0).

A phenotype is all the observable characteristics –or traits– of an organism or species (MERRIAM-WEBSTER, 2022A). It can refer to the species' morphology (form and structure), behaviors, or its physiology (functioning of organs and systems) (MUKARJEE, 2015). It is made up of the aggregate effects of the expression of the genotype, together with the habitat it develops in. However, an organism cannot gain a trait from its habitat that was not already made possible by its genotype. Nature-or-nurture is not as much a dichotomy, as it describes nurture's epigenetic effects, which translates into an alteration of the phenotype. Nurture patterns are also partially determined by genes, which further obfuscates the picture (Again, more under 5.0). The term 'extended phenotype' was coined by Richard Dawkins' (1982) in his book *the extended phenotype*. His main point is that a species' phenotype should not just be limited to its characteristics, but also all effects its genes have on its habitat. In this way, the beaver dam is part of the beaver's extended phenotype, or the bird's nest the bird's extended phenotype, and so on. By definition, this also makes the built environment human's extended phenotype.

## 2.3 Species and Niches

The term species is "a group of closely related organisms that are very similar to each other and are usually capable of interbreeding and producing fertile offspring." (AHDICIONARY, 2022B). Species are further divided into five general kingdoms: Monera, Protista, Plantae, Fungi and Animalia (TUTORIALPOINT.COM, 2022). For most purposes, only two classes are most relevant: plantae (plants) – organisms that produce their own energy through photosynthesis – and animalia (animals) – organisms that get their energy from eating plants or other animals. Plants and animals can be classified in many different ways: "Zoology classifies them by heredity and anatomy, by phylum, class, order, genus, and species" (GIBSON, 1979, CH. 1). They can also be classified behaviorally, where their behavior depends on what their traits and habitat is. (GIBSON, 1979). Categorizing complex systems, as hinted at previously, is not a simply task. Species inside a category, independent of category, are usually very different from each other, in several way. This makes categorization not particularly accurate, nor universally applicable. Certainly not in comparison to the mechanisms that makes a species function. Alternatively,

a species can also be defined by their niche (WEINSTEIN & HEYING, 2021): which is the role an organism plays in a community.

A species' niche encompasses both the physical and environmental conditions it requires, [...] and the interactions it has with other species" (NATIONALGEOGRAPHIC, 2020). In other words, all the relevant aspects of its habitat. James Gibson (1979) suggests that a niche is a set of affordances. An affordance can be understood as properties of the habitat that provide opportunities for action to an organism (JONES, 2003). E.g., a stone can be used as a projectile or a pavement material. Its use-quality (JEXKÜLL, 1982) (affordance) is both. Further, that something is only afforded to the species that can take advantage of it. E.g., the ocean affords oxygen to fish, because they have gills that can extract it. Conversely, the atmosphere affords oxygen to terrestrial animals, because they have lungs that can extract it. Gibson (1979) himself states:

*An important fact about the affordances of the environment is that they are in a sense objective, real, and physical, unlike values and meanings, which are often supposed to be subjective, phenomenal, and mental. But, actually, an affordance is neither an objective property nor a subjective property; or it is both if you like. An affordance cuts across the dichotomy of subjective-objective and helps us to understand its inadequacy. It is equally a fact of the environment and a fact of behavior. It is both physical and psychical, yet neither. An affordance points both ways, to the environment and to the observer. (p. 121)*

Since the community is made of species, it is also therefore made of niches. This creates a web of interactions that, together with the environment, make up the habitat. And in some sense, animals *are* the habitat in the same way plants, rocks and waterfalls are. A species' niche depends on other niches, the same way it does the environment. Meaning that if one niche changes, the others will have to as well, given the presumption that resources are stable. However, there is an incredible diversity of possible niches, or affordances to grab. "There are all kinds of nutrients in the world and all sorts of ways of getting food; all sorts of shelters or hiding places, such as holes, crevices, and caves; all sorts of materials for making shelters, nests, mounds, huts; all kinds of locomotion that the environment makes possible, such as swimming, crawling, walking, climbing, flying." (GIBSON, 1979, P. 121)

All members of a habitat afford each other different things. Remove a species from the community, and you will find a hole in the habitat the same shape as it. "The niche implies a kind of animal, and the animal implies a kind of niche" (GIBSON, 1979, P. 120). This suggests that by looking at an organism, one could discover what its niche is, its role in the community, and, in part, what its habitat is like. This is made possible because of trade-offs: "Typically, species must specialize to become dominant in their niche, and in the process sacrifice breadth and generality" (WEINSTEIN & HEYING, 2021, CH. 1). Meaning that one can look at the specialization of an animal to discover what its role in its community is. But given that humans seem to dominate close to every habitat on earth, what does that say about our niche? To answer that, we will first look into our deep evolutionary past.

## 2.4 Human History and Niche

It is not just our recent history as Modern Humans (*Homo Sapiens*) that explains who we are, but our entire evolutionary history –right back to the origin. (WEINSTEIN & HEYING, 2021). Phylogenetics is the study of lineages, and describe where species diverge. (Or if read the other way, who the most recent common ancestor between two species is.) By looking through our phylogenetic tree, we discover where we came from, and which categories of animals we are. In phylogenetics, the hierarchy of classes a species is never changes, even if their phenotype radically transforms. While it is not exactly clear how quickly adaptive evolution works, it surely depends on some known factors; which mechanism drives diversity or in what way the genes communicate with the organisms they are carried by, how much selection-pressure is put on the organism, and how much diversity is found within the species, and so on. It might also depend on currently unknown factors (UKESAYS, 2019). Regardless, for most time-frames, evolution is a slow and gradual process. By looking back through time then, we will see just how recent many of the major events of human history really is, and conversely, how deep and rich our evolutionary past and ecological origin-story is.

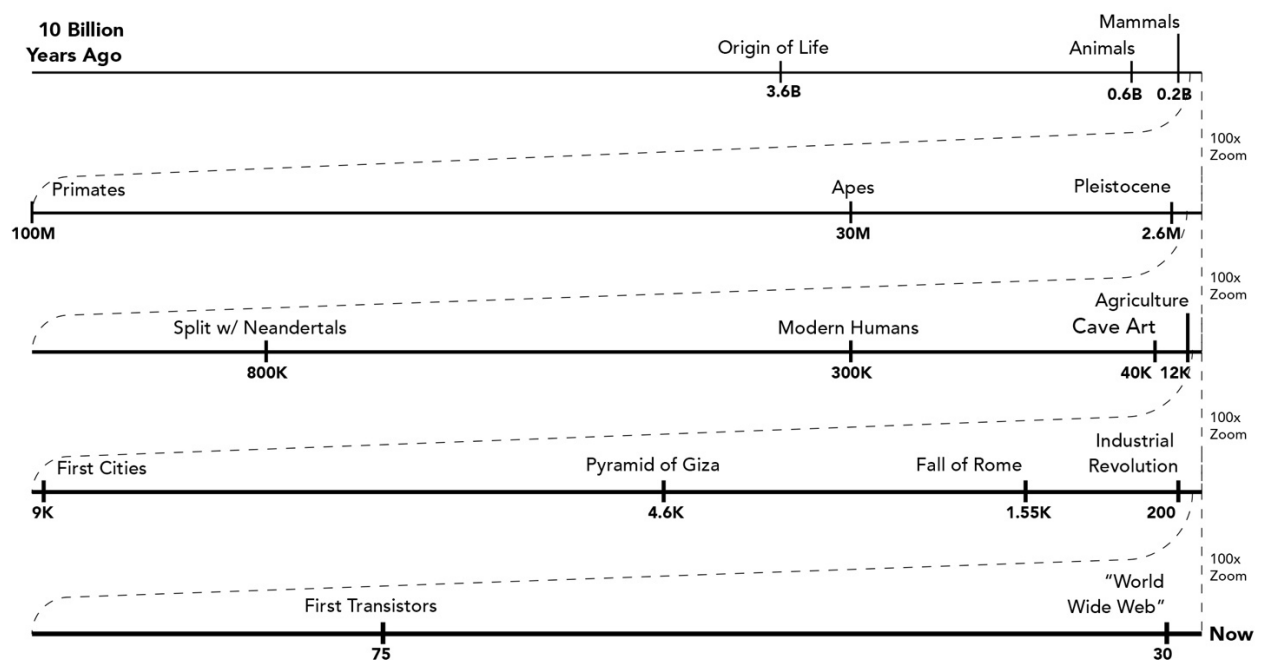


Fig. 2 – Timeline of Deep Human History (ADAPTED FROM: WEINSTEIN & HEYING, 2021)

We will not go into all of the marks on the scale, many of them are just there for context. But by comparing some of these numbers, we discover some jarring facts. First, Modern Humans have only occupied 1/17 500<sup>th</sup> the span of evolutionary time. Meaning the vast majority of our past lies in the deeper ancestral stages shown in Fig. 2. As one might expect, then, we find that we are much more similar to other animals –and particularly our nearest ancestors– than we are different to them. This holds true of our internal systems (morphology), the structure in our bodies (physiology), even most of the behavior we previously thought were unique to us. E.g., Crows, chimps and dolphins all use tools. (WEINSTEIN & HEYING, 2021). Furthermore, our “genome sequence identity” is estimated at 98-99% similarity to chimpanzees (FUJIYAMA ET AL., 2002).

The entire difference between now and the beginning of the end of hunter-gatherer societies (12 kya) is only 1/17<sup>th</sup> the timespan since our species diverged from the other great apes. This indicates, among other things, that we are expected to be much more similar to who we were as hunter-gatherers, than they were to our last common ancestors. This calls for some consideration of just how much of our current cognitive faculties were already present in these 'primal' times. Further, that we are still, at least genetically, more closely adapted to those ways of living than we are to contemporary life.

Not just is it highly unlikely that our genotype could adapt rapidly enough to keep up with the pace of societal development, but it is trivial to demonstrate that it has not. E.g., our fears and phobias do not match the dangers of modern human life. If they did, then instead of being afraid of snakes and insects, we would be afraid of fast-food and cars (E.g., FLEISCHMAN, 2019). When a species' phenotype/traits are unfit for its current circumstance, we call it *mismatch* (SEE LI ET AL. 2018). Human mismatch is particularly visible as we get closer to the contemporary circumstance. Not just have we had even less time to adapt, but change has not only been quick, but its rapidity appears to increase exponentially. (More under 6.1-2.)

Given our recent ecological emergence, what is it that makes us human then? How is it possible that societal development has happened too rapidly for our genome to keep up? The time frame we are most concerned with is the time slightly after the emergence of apes: the Pleistocene (2.6 mya), which lasted roughly until the beginning of Agriculture (12 kya). Being like the other great apes at this point: we should look for the ways in which we can have evolved capacities –that are different than the other great apes– at such a short time interval. A key aspect of this must lie in how our minds and cognitive abilities evolved (RICHERSON & BOYD, 2001).

But given that we managed to evolve so rapidly towards ecological dominance, why did no other animals also evolve in this fashion, even if only during the same time period? To answer this, we will look at the ways in which human physiology differ from other animals, and how these traits synergize to make up the human phenotype. As we will see (and know from experience too), humans do not have a niche in the typical sense of the word. Rather, we have invested in a brain that has afforded us great breadth at the population level, while maintaining great depth at the individual level. One could say that the human niche is niche-switching (WEINSTEIN & HEATHER, 2021). That is, we have specialized in malleability.

To begin, we have opposable thumbs, as does the other great apes. This allows us to grab, hold, and manipulate objects more precisely. Being able to create and use tools have made it possible for us to externalize some of our physiological properties into objects, then synergistically use those objects to gain back the access to those properties, and gain more resources overall. In this situation, a useful property is what characteristics something must have in order to achieve a certain purpose. E.g., to slice through something, the tool or physiological structure must have a sharp and relatively hard edge. This generalizability means that if you can make and use a knife, you do not need to grow strong and sharp claws, or teeth. The fact that our hands afford grabbing things and precisely manipulating them, sets the stage for technological advancement. And as we will see, technology is one of the key adaptations we acquired during the Pleistocene,

which in-turn afforded our great niche expansion (RICHERSON & BOYD, 2001).

We also stand up straight, which has been argued to be another decisive adaptation (TOBIAS, 1981). This makes it easier to carry objects, which increases the usefulness of the tools we make. E.g., we gain access to using tools like spears. As mentioned previously, emergent properties arise from synergy between separate entities or traits, and this can decrease the principal limiting factor of trade-offs. By creating and using spears we transcend various trade-offs. Firstly, the hardness, sharpness and weight of the spear free up specific physiological allocation of resources, (Like sharp teeth/claws and strong jaws) while maintaining access to hunting- and eating meat, and driving predators away. It simultaneously lifts design constraints. The spear allows us to reach relatively long distances, in a short amount of time, meaning that we ourselves, do not have to be able to run very quick in order to catch pray. This allows us to specialize more towards efficient and persistent movement instead, which expands the territory we can reliably cover, gaining access to additional resources without additional cost.

Standing up straight also enabled our vocal tract to develop in certain ways (SEE PROVIN, 2004), decreasing the constraints on our use of communication (e.g., we can walk and talk simultaneously), which later synergized with an evolution towards broader vocabulary of sounds (WEINSTEIN & HEYING, 2021). This is particularly useful for a social and cooperative species like ours. The broader vocabulary allows us to communicate more diverse information with the same effort and length of time. This in turn makes communication less costly and more practical. Our predispositions towards sociality and morality (chapter 3.4-4.4) coupled with our communicative abilities afforded us sophisticated cooperation, which in turn, allowed us to externalize various skills into each other. I.e., I do not need to learn how to fish, because you know how to. And since I know how to hunt, that means we can trade goods. That is, we can cooperatively use each other's expertise for mutual benefit.

Communication, cooperation, and ability to make tools all point to one trait: malleable and sophisticated cognition. More specifically –in our species– a brain that is able to learn and remember language and other skills; powered by various kinds of abstract- and social-reasoning and -perceptive abilities. Abstract and relational reasoning performs to primary functions: To create better, more useful tools and systems, and to manage social and familial relationships, in groups that are large enough to take advantage of increasingly diverse and specialized work. Other essential cognitive faculties include our ability to remember –and accrue knowledge over time– as well as learn from watching – or teaching– each other. Furthermore, we cognitively model future scenarios to consider our options, as can we imagine things with creative independence to actual experience.

This culminates in humans having comparatively heavy and expensive-to-run brains (AIELLO & WHEELER, 1995). While the average mammal spends around 1.5% of their energy budget on their brains, we spend 10% –more than six times that. As mentioned, there are two ways to deal with such a cost: increasing efficiency or increasing resources. We did both. Interestingly, many other mammals also had an increase in brain size during the Pleistocene, but presumably did not have the physiology to take full advantage of it (RICHERSON & BOYD, 2001).

With that said, and while there is some correlation between brain-to-body mass ratio and intelligence, there are too many exceptions for this metric to be definitive. E.g., smaller animals tend to have a larger brain-to-body mass ratios than larger ones (SERENDIP, 2018). This can be formulated with a generalized power-law relationship that predicts brain mass based on body mass. Humans' brain-to-body mass ratio is about 7 times higher than expected for an animal our size. Actual to expected ratio is called the encephalization quotient, and the idea is that the excess mass can perform other actions than simply controlling the body of a certain size (JERISON, 1973). However, the relationship between encephalization quotient and cognitive ability has been disputed in favor of numbers of cortical neurons and connections (ROTH & DICKE, 2005) and absolute number of neurons (HERCULANO-HOUZEL, 2011).

Of course, there is no reason to assume that these different measurements are not also synergistic. Abstract reasoning ability certainly requires some cognitive malleability which –thinking back to the heading of the same name– enables us to consider how niches –the behaviors they require, afford or select against– have effects on the brains that adapts to them. The variety of behavior needed, the complexity of the sense organs and morphology, and whether those functions can be made more neurologically or physiologically efficient; should influence the number of neurons semi-independently of the measure of intelligence. The intrinsic complexity makes it likely that there are exceptions to all of the proposed 'best' measurements, across the animal kingdom. Regardless of such considerations, humans rank –or is estimated to rank– the highest on all three scales (HERCULANO-HOUZEL, 2011). (More under 4.5.)

Putting this together, we can describe our ecological niche (or lack thereof). Sociality and communication afforded us cooperation, allowing each member of the social group to attain specialized behavior. This bypasses trade-offs. Tool-use allowed us to externalize various physiological properties onto objects. This bypasses trade-offs. The brain then expanded our ability to analyze, imagine and remember. This not only amplifies the ability to communicate and create tools, but allows us to accumulate the benefits of ideas, strategies, and observations as time progresses. Then our gradually increasing cognitive abilities starts taking hold: our ability and predisposition towards communication, learning and teaching, made possible by our awareness of others' intention and attention (more under 5.1). Cognitively modelling the future then decreases the risks- and increases the effectiveness of our actions, and imagination allows us to continue creating solutions to problems as they appear.

In other terms, by adapting to circumvent trade-offs, we "enjoy the competitive advantage of being specialists, without paying the usual costs of a lack of breadth" (WEINSTEIN & HEYING, 2021, Ch. 1). Further, it means that we are not limited to narrow resources, a specific habitat and a selection of behaviors. Rather, we have developed the hardware –opposable thumbs, an upright position, a sophisticated vocal tract and a big brain– necessary to adapt to changes in the habitat during a one or a few lifetimes. This malleability in turn makes us much less subjected to pressure from ecological dangers than most other species are. Which has given us the reach to dominate nearly every habitat on earth (WEINSTEIN & HEYING, 2021). We will go into more detail on these points along the way. But first, there is another important part of human physiology that are also uncommon across the animal kingdom: our vision. In order to get to it, we will look at what it is nested in: perception.

## 2.5 Affordances & Perception

Defining perception accurately is not a simple task, nor is one likely to find a definition everyone will agree to. However, perception can be contrasted with hallucination and imagination (CHARLES, 2017) (e.g., seeing faces in the dark of night), mere sense-stimuli (GIBSON, 1979), or even against reality itself. The following section is heavily based around the contributions of James J. Gibson's work (SEE GIBSON, 1979), and the research that has proceeded him. While his work has had broadly profound effect on the study and theorizing of perception and cognition, I will frame his contributions specifically through the evolutionary lens, and through some of his intellectual descendants.

As described previously, a species' niche consists of a set of affordances (opportunities or threats). These affordances transmit patterns of information that travel through various mediums: chemical compositions, sound waves, temperature, pressures, light, radiation, and so on. If an organism has the right perceptual system (sense-organs, cognitive structure and physiology) it can pick up on those patterns and act on them to its own benefit. Patterns that relate approximately one-to-one with an affordance is called a *specifying variable*, while patterns that correlate with the affordance –but are not specific to it– are called *non-specifying variables* (E.G., MICHAELS & DE VRIES, 1998).

Since a niche consists of affordances of various importance to the organism's fitness; and these affordances create patterns of information variables that exist on a spectrum from one, to basically zero, correlation (MILLIKAN, 2000); then one would expect a species to evolve a perception system that picks up the patterns that correlate strongly with the most important affordances in its niche, while varying more across the variables that are of less importance (SEE WITHAGEN & CHEMERO, 2009). In many cases, not even picking up the variables that are insignificant. In other words, a species will evolve to perceive "behaviorally relevant properties of the environment" (CHARLES, 2017). Granted that the system required to perceive such properties are not exclusive to genotypes that the species have no plausible evolutionary trajectory towards (local optimum problem) (SEE WITHAGEN & CHEMERO, 2009). If that is the case, or the pattern-to-be-perceived is not behaviorally relevant, then that kind of perception will not evolve, or at least not persist (unless the pattern correlate with other patterns of importance).

A further observation of adaptive perception is that evolution 'always' favors what is fit over what is accurate, when those are in conflict. (Although accuracy significantly overlap with fitness in many cases.) Millikan (2000) made an example of a flying predator and the shadow it casts below. While the shadow carries information about the predator, it is not a specifying variable. On a cloudy day, the shadow will not be present, and on a sunny day, the shadow could be cast by something else than the predator. This non-specificity means that a prey animal might not react in time on a cloudy day, or it might 'escape' something that poses no danger to it on a sunny day.

In either case, the prey animal perceived what it could of the world, which was not enough. How might it solve this problem? As perceiving the shadow is not enough, we might imagine that the species instead evolve towards caution. It might pay more attention to other cues like sound or rapid movements in the visual field, while also being more physiologically prepared for 'activating' evading-maneuvers. This might cause the prey animal to falsely 'perceive' a predator, which it evades from. If only on the grounds

of a sound that in-fact only correlate lowly with it. (The sound could also be made by many other things than the predator.) However, as losing one's life is such a large price to pay, evolving 'oversensitive' perceptive and reflexive systems might be fit, even if it means incorrectly perceiving something as dangerous much of the time. Simply stated, the cost of reacting to a false threat is often smaller than failing to react to a real one (FLEISCHMAN, 2019). This last point also explains why overreacting to a shadow on a sunny day could be a worthwhile trade-off.

This kind of overreaction or overestimation is very common. For example, correctly estimating the distance from a small ledge to the ground might follow with an underestimation of the consequences of jumping, potentially resulting in a costly injury. However, if one overestimates the height, one might correctly estimate the consequences, avoid the jump, which leaves one better off. Alternatively, if someone is afraid of heights, they are less likely to be close enough to the edge to accidentally fall off. This is not an arbitrary example: in-fact, overestimating cliff-heights (while standing on the top of it) is found in humans (JACKSON & CORMACK, 2017). As do roughly 28% of people have VHI<sup>4</sup>, while 6% have Acrophobia<sup>5</sup> (SEE KAPFHAMMER ET AL. 2016). Goats, sheep and chicks are also found to avoid cliffs from their very first day (E.G., GIBSON & WALK, 1960).

Perception also often wins out over cognition in time sensitive situations (WITHAGEN & CHEMERO, 2009). E.g., It is generally more fit to instinctually or reflexively perceive large animals as dangerous (and therefore something to run away from), than it is to notice the animal, infer its likely threat, roughly estimate how fast it moves, to use that information to consider how one might optimally react to it. Relying on "good enough" signals often make much more sense evolutionarily. Not just because of reaction times, nor the fact that less energy is spent on cognitive resources, but also because properly assessing a situation is difficult, and genetically prohibitive (1.5).

It is in this very same vein that some have hypothesized that our visual abilities have come to be. More specifically, "snake detection theory" (ISBELL, 2006) suggests that the threat that snakes posed to us in the past, caused specific adaptations to our perceptual system. Snakes are often difficult to detect, because of camouflage, as are many of them a significant and direct threat to our lives. Primates generally, and ourselves included, quickly detect snakes (OHMAN ET AL. 2001; SHIBASAKI & KAWAI, 2009), perhaps even before conscious awareness kicks in (OHMAN & SOARES, 1993). Although the last finding is disputed (GRASSINI ET AL. 2016). Snake detection is also found in young children (LOBUE & DELOACHE, 2008) and we react more to snakes than reptiles, spiders and slugs (VAN STRIEN ET AL. 2014A, 2014B). 'Snake-stimuli' is further found to be particularly perceptually distracting (SOARES, 2012) as is ophidiophobia (fear of snakes) one of the most common phobias (CLEVELANDCLINIC, 2022).

Of course, there is no singular "snake-variable" in our visual perceptive system. Although through some specific combination of many variables being triggered in such a way to cause conscious recognition of- or reflexive reaction to them. Whether or not snake-detection was the primary reason for the evolution of our sight, sight has turned out to be one of the important parts of the human phenotype. So much so, it seems, that "half of the human brain is devoted directly or indirectly to [it]." (MRIGANKA SUR, TO MIT,

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<sup>4</sup> Visual Height Intolerance: Feeling and acting imbalanced in response to heights.

<sup>5</sup> Phobia of Height: Symptoms of panic attacks, and other psychological impairment.



1996). While it is not always simple to parse out to what degree –and which of– our perceptions are innate or acquired with experience: there is no doubt some of each. This is the case with many other facets of human life as well, as we will see moving forward.

## 3.0 Sexual

### 3.1 Sexual Dimorphism & Selection

Sexual dimorphism refers to all observable phenotypic differences between the sexes of a species (in species that have two<sup>6</sup>). While not all species have more than one sex, the overwhelming majority do. However, there is a rather clear disadvantage of reproducing through copulation: An organism's genes will only make up half the genes of its offspring, as the other half will come from its mate. Why then would an organism not just self-fertilize, and create identical clones of themselves instead? To transmit all of its genetic material? The most natural explanation is because mating is a good source of variance (MOELLER & HUTTON, 2018). Mixing the genes of two organisms, in different ways, gives access to more diverse traits than does cloning one's own genes. And, as we know, variance is necessary for adaptive evolution to occur, which affords a species more resistance to changes in the habitat. Or frankly, any at all. Without it, its niche will gradually be squeezed until it can no longer fit in the community, and it goes extinct. Being that dimorphism is the overwhelming norm in ecology, what does it mean?

To reproduce sexually, you need a way to mate, some way for genetic material from two different organisms to meet, and to start some process that causes the offspring to develop from the genetic material. That typically happens through the sperm (gene carriers and fertilizer) from the male, entering the female to fertilize one or more of her eggs (gene carriers and offspring-building-machines). These eggs then either grows into an embryo encapsulated by a membrane which proceeds to leave the animal (an egg). It then continues developing outside the female, until the embryo is mature enough that it can survive outside, at which point the egg hatches. Alternatively, as is the case for mammals, the egg turns into an embryo that the female carries inside of her, until the offspring is developed enough to enter the world. To achieve this process, the male and female have usually developed different sex-organs to perform the different functions of copulation and of 'growing' the offspring. These organs, that are directly involved in the mating process, are called primary sex characteristics, and is one form of sexual dimorphism. While there are exceptions to this across nature (homosexual reproduction, sexual transformation, and so on.), these are less common.

As the genotype needs to be able to develop into both a male and a female, it sets the stage for the sexes to evolve other phenotypic differences as well. These other dimorphic traits are called secondary sex characteristics. These differences allow the sexes to specialize, whether that turns out to be cooperative, antagonistic, or a mix between the two. For the sexes to specialize in such ways can be advantageous, whether it is through synergistic cooperation, which lifts design constraints, or through inhabiting different parts

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<sup>6</sup> While some humans are intersex, dimorphic development is by far the most common. Some argue that as much as 1.7% of the humans is intersex (FAUSTO-STERLING ET AL. 2000) while others argue it to be as low as 0.018% (SAX, 2002).

of the habitat. This essentially splits the species into two ecological niches, so it can take advantage of different resources, in-turn increasing their carrying capacity. Another thing it does is set the stage for another selective force, that is, sexual selection.

Sexual selection regards how – within a species – individuals of one sex will be differentially selected for by the other sex, and how this alters the species' evolutionary trajectory. Since individuals vary in their traits, and they transmit them through offspring, a less fit individual will usually produce less fit offspring. Since an organism's offspring will inherit fitness from both parents, organisms will benefit from copulating with a fit mate. This triggers a cascade of sexual adaptations. First, there is pressure to select the right mate, so the selective sex evolves the perceptive tools needed to discriminate fitness. Second, those perceptive tools pressure the other sex to adapt to that discrimination. This can be achieved not just by being fit, but appearing fit. The existence of false appearances could, in turn, pressure the selective sex to evolve even better perceptive abilities, to differentiate between the true signs of fitness with the false ones. These two latter adaptations pressure each other until some equilibrium is met.

Sometimes, this happens quickly. Other times, it means that one or more of the secondary sex characteristics of a species ends up being maladaptive for ecological survival, while being well-adapted to sexual perceptive preferences. These preferences apply to behaviors as much as they do physical characteristics, perhaps even more so. (It is probably less complicated to evolve deceptive behavior, than it is deceptive physiology.) However, deceptive physiology does exist, and the sexes of some species are even split into different morphisms, to achieve mating through different strategies. E.g., this could be achieved by: appearing like the other sex, to avoid detection from same-sex rivals, and achieve sneak-copulation; By being bigger and stronger, to achieve copulation through physical domination of same-sex rivals; or through forming strong pair-bonds with members of the opposite sex to attain copulation loyalty. These different strategies can even become balanced and stable over time. In this example, sneak-copulation beats physical dominance, which beats pair-bonding, which beats sneak-copulation (OPENSTAX, 2020). Here, whoever is most successful depends on the relative frequencies of the other strategies. The moment one strategy becomes more common, another strategy will be more favored, thus becomes more common, and so on. This will either stabilize the share of strategies, or result in the cycling of which strategy is dominant at any one point.

While fitness always varies for both males and females, the extent of variation and the importance of that variance is rarely the same. The sex who invests more resources in its offspring has more to lose from a poor mating choice and will usually have stronger preferences (THEORY OF DIFFERENTIAL PARENTAL INVESTMENT; TRIVERS, 1972). Females generally have a higher initial investment due to the cost and danger of pregnancy, and tend to be more selective about choosing mates. However, in species where the males invest more, they also tend to be more selective (DALY & WILSON, 1983; TRIVERS, 1985). In mammals, the difference in investment is especially pronounced, as females carry the young inside their bodies and usually nurse them after birth. Males however, often reproduce with little cost, typically only a single act of copulation. In those species, males, as expected, tend to be nonselective, whereas females will be very selective (KENRICK & TROST, 2004). A result of this kind of asymmetrical selective pressure often results in a higher degree of male intrasexual competition, which is often channeled through physical fights (or displays of fitness).

Which can, through sexual selection over time, increase the size difference between males and females, as well as select for psychological traits that assist in such competitions like aggression, competitiveness or strategic ability.

### 3.2 Evolution of Human Sexuality

In the Pleistocene, we lived in small groups of closely related individuals, and married people genetically similar to us – oftentimes a cousin from a nearby group. (LUMSDEN & WILSON, 1981; TOOBY & COSMIDES, 1992). While sexual and familial stereotypes are significantly influenced by culture, there are some situations in the hunter-gatherer life-style we would expect to transcend the specifics of the local habitat. We would furthermore expect to see the adaptations to these situations to be similar cross-culturally (BROWN, 1991). The typical sex-specific division of labor during the Pleistocene were likely generally that of men hunting animals for food, fur and bones, whether through direct contact, or devising and laying traps. Women, and oftentimes children, collected edible fruits and berries. Women also took greater responsibility for raising children, particularly in the earlier stages of development. Please note though, that all further presented research that point out differences between the sexes refer to statistical averages. Not all traits apply to everyone of the given sex, nor are they exclusive to that sex.

These differences in roles would be expected to affect our physiology. As it does. Men are larger and stronger, generally better equipped for hunting. The increased upper body strength is of particular note, since it is precisely what is most useful for carrying and throwing heavy objects. Which is useful for hunting, of course. Women, conversely, are physiologically adapted to carrying children, through their reproductive system (including lactate glands) and by developing a more responsive immune system. Women, on average, have particular and superior spatial location memory and a wider visual focal area, both of which are useful for gathering certain foods, like berries (SILVERMAN & EALS, 1992). Men, conversely, have superior mental rotation and vector integration abilities, thought to relate to navigational problems central to hunting (NEW ET AL., 2007). Further, women have more fat than men, and gain it in different areas of their bodies. This is believed to relate to having enough energy reserves for feeding offspring in times of scarcity. As well as serving to signal health, probably. In fact, when women loose too much of their fat, it can lead to the cessation of periods, which some argue could be an adaptation. Point being to avoid bearing offspring into a world in which they are not likely to survive (DELAIVIER, 2003).

These physiological pressures and work roles, alter what is considered fit between the sexes, which is, in turn, likely to influence sexual preferences, and the following sexual behaviors. Since pregnancy is a physiologically demanding –as well as dangerous– thing, fertility and health is particularly important for women’s fitness. As one might expect then; their cues, youth and physical appearance; are conversely highly valued by men cross-culturally (BUSS, 1989). Further, because of the strength difference, providing safety from other men and providing resources during pregnancy, demand strength and competence of men as mating partners. The cues of such traits are less obvious, although safety relates to size, as well as social status, while ability to acquire resources might relate to traits like ambitiousness and intellect (BUSS & BARNES, 1986; DALY & WILSON, 1983; SYMONS, 1979). As one would expect then; earning capacity is highly valued by women cross-culturally (BUSS, 1989), as are the traits that such capacities consist of (BUSS, 1989; KENRICK & KEEFE, 1992).

Sex differences in mate preferences might also be becoming smaller as a consequence of increased gender equality (E.G., KASSER AND SHARMA 1999; MOORE AND CASSIDY 2007; ZENTNER AND MITURA 2012). Men and women's preferences converged from 1939 to 1996 towards similar preferences for physical attractiveness, financial prospects, and mutual attraction (BUSS ET AL., 2001), indicating that sexual preferences in humans are at least partially malleable. This does not prove the unimportance of genetically encoded preferences though, instead it indicates the importance of sociocultural influence. Other sex differences, like personality and interests, actually do the opposite, increasing as societies become more egalitarian (SEE STOET & GEARY, 2018).

In any case, men and women are predicted to be similar in all domains in which they have recurrently faced similar adaptive problems (BUSS, 1995). And while there are preferential differences between the sexes, there is also considerable overlap (BUSS, 1989). Vitality and physical attractiveness are not only useful for women, nor strength and competence only useful for men. And despite being relevant to sexual fitness, it is not obvious why they should be the most desirable traits either. Nor do they seem to be, in fact, both sexes rank empathy and intelligence as more important than both financial capacity and physical appearance (BUSS, 1989). Characteristics like agreeableness, kindness and faithfulness are also mutually desired, presumably because we raise offspring together (BUSS, 1989; KENRICK ET AL., 1993). Other mutually desirable traits include sense of humor, being sympathetic, well-mannered, and well-groomed (BUSS, 1988A).

A vital point on the similarity of men and women is that human infants are notoriously helpless, making them difficult and expensive to raise. (At least in comparison to the offspring of other animals.) Both on a moment-by-moment basis, and as a result of human children's extensive developmental period. This difficulty and cost make certain traits in one's mating partner more useful, and in-turn attractive. Particularly, it is helpful for mates to bond romantically, in order that the offspring have two places where resources and support comes from. This, alongside the cost of pregnancy, likely made women strongly selective for traits in men that caused them to assist more with raising children. Romantic affection being one of those traits. Love (romantic affection) is the human emotion determining long-term mate choice (BUSS ET AL., 1990; FISHER, 2004; SYMONS, 1979), as well as a mental mechanism that commits the individuals involved towards long-term devotion of relevant resources (BUSS, 2006; FRANK, 1988). (More on offspring under 3.4.)

As women select for men that assist in raising offspring, the cost of copulating for men generally increases, which might be why men are also quite sexually selective: even if these preferences are not as strong, nor for the same traits. The difference in strength of preferences can be explained by a few things: women's large up-front cost of pregnancy, the fact that it is easier to scale the enterprise of attaining physical resources than it is attentional or emotional resources, and the fact that men, unfortunately, have other and more sinister mating strategies available. Presumably, these factors also explain the observable differences in short term relationship preferences (SEE PETERSON & BUSS, 2022). E.g., women are more selective with regards to short-term relationships, and less willing to have sex with strangers. While men and women both desire above average intelligence in a partner for a long-term relationships, this criterion does not hold up for men's desires with short-term relationships.

Since men and women are both selective, albeit in different ways, fitness assortment occurs. People that are perceived as having high mating value often have stricter preferences (BUSS & SHACKELFORD, 2008). This can lead to people with valued traits looking for people similar to them, be it empathy or intelligence, for example. Or it can be cross-character assortment, the most well documented modern example being the pairing of physically attractive women with high status and resourceful men (BUSS, 1994, 2003). It seems likely to me that this is the primary cause for the 0.2 correlation between height and intelligence (E.G., PEARCE ET AL., 2005; TANNER, 1966) and 0.4 correlation between intelligence and physical attractiveness (KANAZAWA, 2011). Also –in agreement with Kanazawa & Kovar (2004)– that human mating assortment is probably one of the reasons why beautiful people are perceived as more intelligent (JACKSON ET AL., 1995; ZEBROWITZ ET AL. 2002) as well as possess other desirable qualities<sup>7</sup> (EAGLY ET AL., 1991; FEINGOLD, 1992; LANGLOIS ET AL., 2000). Intelligence also stratifies, with a correlation of 0.4-0.5 between partners (PETERSON & BUSS, 2022).

On the other side, conflicts of interests between the sexes set the stage for another robust and rapid evolutionary process—sexually antagonistic co-evolution. “Antagonistic co-evolution can occur whenever the fitness optimum for each sex differs. If the optimum emotional involvement is higher for women than for men, sexual conflict can ensue. A woman cannot attain her (higher) optimum investment prior to sex without simultaneously preventing the man from attaining his (lower) optimum investment” (BUSS, 2009). One of the results of this is human intersexual deception, which is strongly related to theories of human sexual selection in general. Men deceive women about their feelings, commitment and love (HASELTON ET AL., 2005), while women –likely as an adaptive response– prolong courtship before consenting to sex, to have more time to evaluate intentions (BUSS, 1994, 2003). In turn, women deceive men about the likelihood of sexual access (BUSS, 2003) and men –more than women– get angrier and more upset when deceived in this way (HASELTON ET AL., 2005).

Women also have a set of behavioral and psychological defenses against sexual assault; a specialized fear towards it, formation of female coalitions, avoidance of risky situations, use of male friends as protectors, as well as fear of damage to social reputation as an additional consequence (BUSS, 2003). As have they likely adapted towards motherhood in some ways; women are better at picking up non-verbal cues, presumably because their mating is more dangerous, and because, as mothers, they typically spend more time with their children when they are very young. It might also bode well with the fact that gathering food provides more opportunity for conversation than hunting does, as well as the fact that women compete intrasexually through reputation. In any case, women are also more empathic, presumably because of how demanding small children are. During the early years, women are more vulnerable as a result, which also explains why men who are able and willing to protect them are generally desired (SEE PETERSON & BUSS, 2022).

### 3.3 Intrasexual Competition

As a sex evolves mate preferences, it “logically follows” that the other sex will compete with each other to meet the criteria (BUSS, 1988A). In general, sexual competition is closely

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<sup>7</sup> Of course, this would be relevant to any section on evolution of a preference for beauty. We might intuit beautiful non-human objects to have other good qualities too.

linked to desirable traits for long-term relationships (BUSS & BARNES, 1986; KENRICK ET AL, 1990, 1993). In men, this often takes effect as chasing social status and resources, as are the male status hierarchy “almost certainly a product of adaptations that evolved as a result of recurrent male intrasexual struggles” (BUSS, 2009; REFERRING TO BUSS, 2008). The status hierarchy replaces the violent dominance hierarchy for two reasons: once you know who beats who, there is little reason to fight (E.G., DEWAAL, 1989A), and competing non-violently is also much less costly, and hazardous.

Importantly also, is that more useful traits might emerge from physical competition, since “mere bodily strength and size would do little for victory, unless associated with courage, perseverance, and determined energy.” (DARWIN, 1871). Men compete sexually in other ways as well (BUSS, 1988A; MILLER, 2000; SCHMITT & BUSS, 1996). Like humor, manners, being groomed, offering help, keeping physically fit, wearing stylish outfits, giving gifts, cooking a gourmet meal, planning a date, signaling commitment, declaring love, and expressing self-confidence. Men also sabotage for their sexual rivals (BUSS & DEDDEN, 1990; SCHMITT & BUSS, 1996).

Women compete with other women by enhancing their physical appearance. Which they use for mate attraction (BUSS, 1988A; SCHMITT & BUSS, 1996) and retention (BUSS & SHACK-ELFORD, 1997). Women, more than men, denigrate their sexual rivals’ appearance. They convey that their rivals are fat, unattractive, or wrinkly (BUSS & DEDDEN, 1990). Since sexual fidelity is highly valued by men; women’s derogation tactics focus on calling their rivals promiscuous, loose and easy (BUSS & DEDDEN, 1990). However, since this tactic can backfire – if the man is looking for a short-term mate– women adjust their derogation tactics according to context (SCHMITT & BUSS, 1996). In both men and women, the adaptations to these intrasexual pressures also seem to bleed out into other adversarial behavior that is not clearly motivated by mating. Like men physically abusing their partners or women emotionally manipulating theirs. Again, we should point out, how this research presents differences in averages, which does not imply that these stereotypes apply generally or evenly across the board.

Interestingly, while homosexuality is a bit of an evolutionary curiosity –especially considering its relatively high prevalence– it might in some ways actually be informative of sexual mechanisms in general (BAILEY ET AL., 1994). Across studies, homosexual women, like heterosexual women, were relatively uninterested in casual sex (C.F., BUSS & SCHMITT, 1993; KENRICK ET AL., 1990, 1993) (This preference is clearly not due to the perceptiveness of the relative costs of pregnancy.) They also found interest in physical attractiveness and patterns of age preferences to be identical in homosexual and heterosexual men. (This finding runs counter to the idea, among others, that men’s preference for fertile and attractive mates is caused by media emphasis on female beauty and youth. Although, of course, such things might factor in to the relative intensity of such preferences.) They also found that biological sex differences were stronger than the effects of sexual orientation. Which again indicates that we have independent preference biases in us, that are active independently of cognitive reasoning. Meaning also, that a change in one component, should not necessarily lead to a change in all others. So, if there is a biological mechanism that controls sexual orientation, a change in it need not necessarily be accompanied by changes in other sex-typical mechanisms (KENRICK & TROST, 2004).

### 3.4 Offspring and Pro-sociality

Again, unlike most other mammals, humans tend to form long-term romantic relationships<sup>8</sup>. Whose adaptive functions are assumed to be sexual reproduction and pair-bonding for the care of offspring (KENRICK & TROST, 1987; MELLEN, 1981; MORRIS, 1972), as well as giving secondary benefits to fitness like resource sharing, social support, and protection (KENRICK & TROST, 2004). Another human experience that might have originated from the care of offspring, is sympathy. Particularly, since infants are so helpless, they often need to grab attention by signaling to have their basic needs be met. So, they end up being quite demanding, as well as very loud. This might have been managed through the evolution of more sympathy or empathy. One might imagine that lacking these emotions could cause someone to raise their children in a way that does not work out particularly well. Alternatively, that the lack of such regulators might lead to someone trip over the edge, and lose their temper to devastating effects. Sympathy and empathy have other uses, as well, of course.

In any case, while mothers provide almost all of the childcare among the other great apes, human mothers (traditional and modern alike) typically provide around half of it, to which the rest is typically shared among the father, grandparents, and other women (TOMASELLO & VAISH, 2013). The benefit of being raised by two parents is well established. Single parenthood increases the risk of the offspring experiencing negative sexual situations (DUFUR ET AL. 2017), is correlated with adverse health conditions (NISHIOKA ET AL., 2021) –which is partially mediated by financial status (SCHARTE & BOLTE, 2013), negative academic outcomes – which are mediated by national family policy (part of social game theory) and financial status (E.G., HAMPDEN-THOMPSON & SUET-LING, 2005; PARK, 2008; WANG & NGAI 2011), and worsened by re-marriage (JEYNES, 2011).

The absence of fathers, particularly, increases rates of juvenile crime, depression, eating disorders, teen suicide and guardian-child abuse (SINGH & KIRAN, 2012). The effect of absence of mothers are less studied, presumably as a consequence of being less common. Although, in mice, motherly absence increases the prevalence of chronic hyperactivity and anxiety (GEORGE ET AL. 2010). Most of these effects might be explained by a lack of (financial, attentional and affective) resources negatively affecting children's physical and psychological development; and that single-parenthood is correlated with the lack of these kinds of resources. Basically, two caretakers can usually provide more than one can. An important consideration though, is that these effects are more pronounced in early development than they are in late development. And that the negative effect can be negated by particularly resourceful single parents, or through the assistance of family and friends. However, the effect of the other-than-parent caretaker might be significantly negatively affected by kinship bias, as we will see later.

As offspring become more costly, we tend to have fewer of them. Meaning, in turn, that the success of each one becomes more important to one's own fitness. Even to the degree that one might sacrifice one's own life in order that their offspring survives. Inclusive fitness refers to the idea that genes might persist through their "indirect contribution to the survival and reproduction of relatives who share copies of their genes" (HAMILTON, 1964, P.?). And we do see, after all, that being genetically related often produce abundant acts of helping (BURNSTEIN ET AL., 1994; JEON & BUSS, 2007). This is called *kinship*

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<sup>8</sup> Only around 3-5% of mammals have something comparable (PETERSON & BUSS, 2022).

*bias*. This (somewhat ironically) refers back to the idea that genes are the target for natural selection, laid out in Richard Dawkins' (1976) book *the selfish gene*. This fitness-through-sacrifice also becomes favorable in other family relationships. E.g., relatives benefit disproportionately from mutual-assistance –and particularly siblings. Even if one is taken advantage of by the other, they still carry many of the same genes, so there is a certain kind of genetic fitness related to self-sacrificing for family (KENRICK & TROST, 2004). Under scarcity of resources, one's genes might therefore fare better through helping one's sibling raise their offspring, instead of having one's own (TRIVERS, 1985).

This genetic fitness mechanism also seems to be supported by a study that showed that people would help their sick and elderly relatives in everyday situations (the socially appropriate behavior), while they would help their healthy and young relatives in life-or-death situations (the genetically appropriate behavior) (BURNSTEIN ET AL., 1994). One might also wonder whether psychological disorders are generally less prevalent in communities where strong familial ties are the norm (KENRICK & TROST, 2004), as they would be expected to have more access to help, in turn making them less vulnerable. Kinship bias is expected to be strongest towards those who are the most genetically similar, but might also apply to some degree to cousins, uncles/aunts and nieces/nephews. Or, naturally, from grandparents to grandchildren. It could actually become fit in any type of relationship, even with strangers, granted the altruistic behavior is in balance with a psychological demand for reciprocity, or a sophisticated mechanism to detect when one is being exploited. The expansion of pro-sociality would first go towards one's own tribe, then out to generally similar-looking people, and finally towards all humans, then even animals. While this gradation idea might seem a little unintuitive, as it does to me, it would go some way to explain racial bias, as well as our tendency to call things we do not care for beastly or otherwise inhuman.

The gradual expansion of pro-sociality might be caused by an adaptive feedback loop. (C.F., THE EXPANDING CIRCLE, SINGER, 1981). As the stability of romantic relationships and empathetic parents increases the availability of resources for offspring, they can invest in longer developmental periods. This affords more sophisticated and large brains, which is better equipped for dealing with complicated social dynamics, among them the tension between being cooperative and the chance of being exploited. (Explored under "The Evolution of Sociality".) It further equips them, now grown to become parents, with better tools with which they can use to raise their children. As more individuals within the tribe evolve towards romance, sympathy, and social sophistication, the cost/benefit analysis of being prosocial shifts, making cooperation easier, and the chance of exploitation lower. This chain of events potentially feeds back into itself, until it hits equilibrium at some point. Likely when individuals start sacrificing themselves beyond their ability to recognize when they are being exploited. If this happened to be the case in human history, it would mean that the collaborative raising of offspring might even be one of the primary causes of human hyper-sociality (Like the donation of blood, or going to war on behalf of others) (RICHERSON & BOYD 2005A). as others have also pointed out (E.G., HRDY, 2009). There will be more on sociality later, but first, its opposite.

### 3.5 Violence

Both intrasexual competition and kinship bias are related to our evolved capacity for violence. There is evidence for the adaptiveness of killing other humans in paleontological, archeological, ethnographical, and psychological studies, along with defenses to being



killed (BUSS, 2005; DUNTLEY, 2005). Men have, for example, used warfare as a means to capture women, and resources like food, tools and territory. As have we found specialized psychological adaptations to warfare in men (BUSS, 2005; TOOBY & COSMIDES, 1988; VAN DER DENNEN, 1995). Successful warriors in traditional tribal cultures also attained higher social status, attracted more wives, and had more children (BUSS, 2005; CHAGNON, 1988; PATTON, 2000).

Male violence may also have served another function. While both men and women are selective, they are not selective to the same degree. It is different enough, in fact, that there are only half as many male ancestors as there are female ancestors in (known) human history (WILDER ET AL., 2004). While the full picture is undoubtedly complicated, it shows that polygyny (men with several wives) has been, as it is now, much more common than polyandry (women with several husbands). Whether that is several partners at the same time, or through remarriage. Also, polyandrous relationships have been almost exclusively with brothers (PETERSON & BUSS, 2022). This makes sense because it counters the pressure caused by male intrasexual competition, which can manifest itself in violence. So common is it, in-fact, that the typical person people fantasize about murdering is a sexual rival (FLEISCHMAN, 2019). Another such person is those that have humiliated them in public (PETERSON & BOYD, 2022).

In a study, McDermott & Cowden (2015) analyzed data from 171 countries and showed that polygyny –controlled for GDP and sex ratio– were significantly related to a host of negative outcomes. Ranging from increased social inequality, domestic violence and defense spending, to decreased educational and health outcomes for children. Additionally, it was negatively correlated with GDP, which further exacerbates these effects. Another finding that supports this argument is that male violence is particularly pronounced among young, unmated and poor men (WILSON & DALY, 1985). All traits that relate negatively to sexual selection in some way. Whichever cause had what effect on the evolution of male violence, its compounding effects are clear to see across the modern world, where men never commit less than 80% of homicides in any society (WILSON & DALY, 1985).

Further, jealousy is the predominant reason for a man to kill a woman cross-culturally (DALY & WILSON, 1988A, 1988B). When a woman kills a man, she is more likely to be protecting herself from the man's jealous threats (DALY & WILSON, 1988A). In the rare cases that fathers kill their own children, it is usually accompanied by suicide and/or wife-killing (DALY & WILSON, 1994). When mothers kill their children, it is more often because they lack the resources needed to raise it (DALY & WILSON, 1988A) or because they think doing so increases their mating value (BUSS, 2005). Key preconditions include lacking a mate who provides resources, being young, and having a deformed infant (DALY & WILSON, 1988A).

Most homicide victims labelled as 'relatives' are in-fact spouses or step-relatives (DALY & WILSON, 1988B; KENRICK, DANTCHIK, & MACFARLANE, 1983). Note that: neither spouses nor step-relatives share any genes. Homicide risk is 11 times greater among unrelated co-residents than among related ones (DALY & WILSON, 1988B). Cohabiting with a step-parent is the strongest predictor for child-abuse and -murder (DALY & WILSON, 2005). In two samples, children living with a step- or foster-parent were 70-100 times more likely to be fatally abuse than those who live with biological parents (DALY & WILSON, 1988B; DALY & WILSON, 1994). In contrast to biological fathers, men who kill their step-children are unlikely to commit suicide or wife-killing, and the murder is more likely to be brutal (like being beaten to death) (KENRICK & TROST, 2004). In one study, the reverse is also indicated: of those who had lived

with a step-parent for more than 6 years, 59% had had at least one fantasy of killing that parent. In comparison, this was 25% for biological fathers and 31% for biological mothers (KENRICK & SHEETS, 1994). These findings are, perhaps needless to say, consistent with pressure of intrasexual competition on violence, and the opposite effect of kinship bias.

## 4.0 Social

### 4.1 The Evolution of Sociality

Granted there are several reasons for why violence evolved, and one can reasonably argue that we have evolved biases for kin, and for self. How come we live together in relative civility today, across collections of expansive societies filled with relatively unrelated people? We have already looked at the possibility that sociality emerged out of romantic and empathetic emotions that afforded better collaborations for raising children, and how this could lead to the sophistication of social mechanisms. However, we have not seen how it might be that this process started. Again, we will look to the Pleistocene to look at some social adaptations (RICHERSON & BOYD, 2001).

A plausible explanation of how it started can be found in Turner et al.'s (2017) book: *The Emergence and Evolution of Religion* (ADAPTED FROM FREEMAN, 2018). Here, the authors argue that the regions of the brain responsible for emotion enlarged as humans transitioned from the forests to the more dangerous habitat of the Savannah. Being exposed to predation created selective pressures towards certain emotional responses like anxiety (cautiousness) and anger (aggression). The increased range and capital of our emotional systems –likely synergized with the added benefits of social cooperation to– form stronger emotional bonds, which in turn caused the human group size to increase, leading to various other brain enlargements and social sophistications.

The enlargement of our emotional capacities might partially explain how both romance and empathy started out, as well as why children would grow larger brains to begin with, to deal with predators, as well as being highly useful in cooperation. Of course, once in place, cooperation is useful beyond raising children. In the Pleistocene, co-residential groups –only slightly larger than chimpanzee groups– collaborated to survive (DUNBAR 1992). These groups were linked to a broader social context, a tribe, where mates were sought and help elicited during pressing events. These tribes would number a few hundred to a few thousand, and would share language, ceremonial system, and defenses. In turn this meant that maintaining internal peace was necessary, and new social mechanisms, norms and behaviors emerged.

Richerson & Boyd (2001) argue that these emergent tribal instincts are “laid on top of more ancient social instincts” (p.?) and that this creates internal tensions between mechanisms that benefit self, the family, and the tribe. What exactly sociality is, is difficult to pinpoint, although there have been made many attempts. (DICKINSON & KOENIG, 2018) The general gist is that sociality is the degree to which individuals in a species tend to group up and cooperate. There are several behaviors we look for in order to classify sociality (ADAPTED FROM: LASKE, 2018), and they are arranged in order from most prevalent to least: parental investment, intergenerational cohabitation, joint care of offspring, division of labor, authority hierarchy, overlapping adult generations and altruism.

There are several individualistic benefits to being in a group: shared workload, cooperation between specialized roles, increased food stability, power in numbers, proximate access to mates and so forth. While the sociality of a species will necessarily always have initially evolved to adapt to natural selection, it does not mean all social behavior is beneficial to all parties involved. (E.G., DICKINSON & KOENIG, 2018). Some behaviors that lead to benefits for an individual –like attaining more mating partners, more or better food, or some advantage to their offspring– can simultaneously be detrimental to the group. Most notable perhaps are actions clearly perceived as manipulative, sabotage, oppression, or violence. A clear example of the latter is that when a new silverback gorilla takes over a group, it might commit infanticide. Presumably in order to increase his own chances of mating, and having successful offspring (DIAN FOSSEY GORILLA FUND, 2013). Graphic example aside, there are also behaviors that benefit a group, while costing the individual (more under 5.3-4), or things that advantage the individual that also benefit the group.

Proceeding from this, we will set some terms straight. We should distinguish between unfair and unequal. Unevenly distributing resources can be a mechanism to incentivize behaviors that are overall positive for a group, as well as a prerequisite for various symbiotic or cooperative relationships, since different niches require different means. Unfair however, points to behaviors that favor individual fitness over the group, or which preferentially favors one over another. Behaviors that lead to unfair distributions or which otherwise damages more than it benefits, will in this essay be considered immoral. Immoral behavior will be selected for inside a social group if it is beneficial for an individual, and allowed to continue by its group. Immoral behaviors can also be selected for on a group level, to the detriment of the tribe or species. Clear Examples of this is warfare and genocide. An example of this is found in the instances of Chimpanzee warfare, first discovered by Jane Goodall in 1974. (GOODALL, 2010). That said, threat of war can also be a pressure that selects for intragroup altruism at the same time as it selects for violence.

The following section on sociality is based around Tomasello & Vaish's (2013) review paper *Origins of Human Cooperation and Morality*. Now that we have already given two gruesome examples from the great apes (of which we are part), we will expand the picture of morality. While individual dominance is an important factor in ape-societies, apes also cooperate with each other in order to attain and protect resources. Although, all of these behaviors largely revolve around reciprocity and social relationships. Tomasello & Vaish (2013) argues that reciprocity is made possible at all through "complex social lives in which many different activities are important if an individual is to survive and thrive in the group." Basically, referring to the advantages of synergy that comes from dividing labor, or specialization. They also argue that morality's main function is to regulate social interactions in the general direction of cooperation, which is a prerequisite for dividing labor in the first place. Whether morality comes in the form of suppression of self-interest in favor of others (helping and sharing), or through equating self-interest with others' interest (reciprocity, equity) or through culture (in this case norm-creation, -conformity and -enforcement).

In the case of the great apes, de Waal (2005) has argued that reciprocity is probably not as much about calculation, as it is about attitude. Individuals will develop positive affect towards others who are helpful to them, and negative affect towards those who are adversarial. The resulting behavior that comes from this affective bias then provides social

regulation of the members' actions. Tomasello & Vaish further thinks that much of human morality is based around this kind of affective/attitudinal reciprocity too, even though we have developed other moral motivations and mechanisms as well. Being so close in history to the other great apes, we will briefly look towards their morality first, to later put our own into perspective. While individuals of many other social species only stay close to each other –with little interaction beyond mating and fighting– great apes are much more social. They –and especially chimpanzees–will in some contexts behave in ways that seem moral, even altruistic (not expecting payback).

## 4.2 Morality in the Great Apes

Chimpanzees might help others with simple, non-rewarding tasks (WARNEKEN & TOMASELLO, 2006) even at some personal cost (WARNEKEN ET AL. 2007). They might help others get food too, under certain conditions (MELIS ET AL. 2011). They will select the right tools to help others with (YAMAMOTO ET AL. 2009) and understand when they themselves need help (MELIS ET AL. 2006). Food sharing occurs, but under limited circumstances. Mothers let their offspring grab less desired food from them (UENO & MATSUZAWA 2004), as might apes let others in their same group do too. They might even occasionally share actively with friends (DE WAAL 1989B). However, not if the food is highly valued and relatively monopolizable, then subordinates may annoy the 'dominants' until they get a share (GILBY 2006). Further, reciprocity is found in grooming (GOMES ET AL., 2009) helping (MELIS AND COLLEAGUES, 2008) and supporting others in fights (DE WAAL & LUTTRELL, 1988). Coalitions may form, which results in several kinds of reciprocity, like actively sharing meat and fighting together (MULLER & MITANI 2005). Males might also share food with ovulating females (HOCKINGS ET AL. 2007). If someone's food is stolen, a chimpanzee might engage in retribution, to no benefit to themselves. Unless it is stolen by accident. (JENSEN ET AL. 2007).

As mentioned, great apes form alliances to collaborate in fighting (HARCOURT & DE WAAL 1992) and usually reconcile among themselves after fights (DE WAAL 1997). Whether coalitions are between kin or non-kin depends on the species (LANGERGRABER ET AL. 2011). Great apes also engage in group defense, like patrolling borders and being hostile towards individuals from other groups (GOODALL 1986). Tomasello and Vaish argue that this reflects mutual individual interdependence on the group. Whether that is towards specific partnerships or the strength of the group as a whole. Great apes forage for food almost exclusively individually (SURBECK & HOHMANN 2008) However, to capture a monkey, chimpanzees need to coordinate with each other to some degree (BOESCH & BOESCH 1989) and typically all the participants –even bystanders– will get some of the meat (BOESCH 1994). While chimpanzees may coordinate to reach a personal goal, they do not seem interested in achieving joint goals. E.g., If their partner disengages during a shared activity, they make no effort to reengage them (WARNEKEN ET AL. 2006). However, in meeting new individuals, captive chimpanzees quickly figure out who they will partner well with and will subsequently choose them over others (MELIS ET AL. 2006).

To contrast this with humans, we will look at the development of morality in young children for two reasons: First, seeing the difference between adult chimpanzees and human infants is rather remarkable, in my opinion. Secondly, and more importantly, there is evidence that cultural and experiential influences has effects on children's prosocial behavior (SEE EISENBERG 1989, 1992) and that this puts into question the innateness of human morality. E.g., while instrumental helping has been found to be similar among 18-

month-olds in Canada, India, and Peru (CALLAGHAN ET AL. 2011); 5-year-olds differed in their behaviors between German and Israeli children on one side, and Indonesian and Malaysian children on the other (TROMMSDORFF ET AL. 2007).

In response, Tomasello & Vaish point out how pro-sociality is not a simplistic process but open to a diverse set of influences. Further, they argue that these influences do not create the prosocial tendencies, but only modify them. Similarly, to Rawls (1971), who made the linguistic analogy of moral intuitions. Stated briefly, it proposes that we share the same innate abstract moral principles, but that the parameters and the content of our morality (what we apply those principles to) are culturally contingent. Looking back at the early stages of life then, is a great way to discover what these principles might be, since young children are affected by fewer types of –and fewer overall– experiences than adults and older children have been. An added benefit is that we might discover in which order different developments usually occur, which might indicate the structure of our moral intuitions more broadly.

Human infants begin forming social relationships with others already during the first year. Although young children are often selfish, they also –in some situations– subordinate their self-interests to collaborate-, sympathize-, help-, and share resources with others. They evaluate others in terms of such behaviors too, and, in turn, become more selective with whom they cooperate. Already early in the second year of life, toddlers can take turns to achieve social coordination (E.G., ECKERMAN ET AL. 1989; ECKERMAN & DIDOW 1989). When a cooperative activity breaks down, 1.5-2-year olds actively try to re-engage their partner rather than try to continue the activity by themselves (WARNEKEN ET AL. 2006; WARNEKEN & TOMASELLO 2007), even when the partner is not needed to complete the activity (WARNEKEN ET AL. 2012). Furthermore, once a joint goal is formed, children feel committed to it, and do what they can not to opt out or disappoint their partners. When 3-year-olds need to break with a commitment to a partner, they do not simply walk away but “take leave” from the other. Presumably to acknowledge breaking the commitment and excusing themselves (GRÄFENHAIN ET AL. 2009). When working collaboratively on a task, 3.5-year-olds continue to work until their partner has received a reward –even if they already received their own (HAMANN ET AL. 2012).

### 4.3 Pro-Sociality and Distribution

When 1-year-olds see an adult searching for an object that they themselves know the location of, they point and direct the adult’s attention to it (LISZKOWSKI ET AL. 2006, 2008). 14-18-month-olds readily engage in instrumental helping such as picking up things adults drop or open a door when the adult’s hands are full. They do not do this when the adult does not need help (WARNEKEN & TOMASELLO 2006, 2007). Toddlers even help others at some cost to themselves (SVETLOVA ET AL. 2010). Some believe children need to be rewarded to become helpful. However, when 20-month-old children were materially rewarded for their help, their helpfulness decreased over time, once the reward was taken away. This decrease did not occur for those that were not rewarded or rewarded simply through verbal praise (WARNEKEN & TOMASELLO 2008). This suggests that young children’s motivation to help is not dependent of concrete rewards, and can actually be undermined by them (LEPPER ET AL. 1973). However, expectations might be fine –even useful– if the reward is normally given by others (through praise or a thank you), or one can give it to oneself (*I feel good about being helpful, because I believe it is good*).

2-year-olds are not just motivated to help others themselves, but rather by a need to see the person helped (HEPACH ET AL. 2012). Young children also begin to provide comfort and assistance to those in emotional distress (E.G., BISCHOF-KÖHLER 1991, EISENBERG & FABES 1998, ZAHN-WAXLER ET AL. 1992) This concern correlates with –and is thought to motivate– prosocial acts (EISENBERG & MILLER 1987). It is not an automatic response to cues of distress or observing harm either, but is sensitive to both. 1,5-2-year-olds show concern and prosocial behavior toward people who are harmed even if they do not display distress cues (VAISH ET AL. 2009). 3-year-olds, however, show reduced concern and prosocial behavior towards those that act distressed –without being harmed– over those that are similarly distressed while also harmed (HEPACH ET AL. 2013).

Even at a few months old, infants distinguish between prosocial and antisocial characters and prefer to engage the former (HAMLIN & WYNN 2011, HAMLIN ET AL. 2007, KUHLMEIER ET AL. 2003). 2-year-olds help those who were helpful to them more than those who were not helpful (DUNFIELD & KUHLMEIER 2010) and 3-4 year-olds reduce their prosocial behavior toward those who cause, or intend to cause, harm to others (KENWARD & DAHL 2011, VAISH ET AL. 2010). Tomasello & Vaish concludes:

*Together, these findings on children's instrumental helping, informative pointing, concern, comforting, and selective helping of harmed and/or cooperative others demonstrate that from early on, children are tuned to others' needs and emotional states and are motivated to act prosocially toward them. Moreover, the research shows that children's early prosociality is the real thing in that it is intrinsically motivated, based in concern for others, grounded in an interpretation of the situation, flexible depending on interactions and evaluations of others, and facilitated by collaboration. (p. 242-3)*

As early as 8 months of age, infants may show or give toys to others, even when resources are low (E.G., HAY 1979, RHEINGOLD ET AL. 1976). But sharing becomes increasingly selective over time, and even 1-year-olds make distinctions between the recipients of their prosocial behavior (YOUNG & LEWIS 1979). Previous studies found that young children distributed less equitably than older children (BROWNELL ET AL. 2009; FEHR ET AL. 2008; LANE & COON, 1972; ROCHAT ET AL. 2009). However, Tomasello & Vaish argues that since these studies involved the distribution of unearned rewards (a “windfall”), they are removed from the evolutionary mechanisms that shape behaviors in early development, and thus set an inappropriate context for the experiments.

In accordance with this view, more recent work shows that 3-year-olds who obtain rewards by working collaboratively distribute the spoils equitably, even when monopolizing them would be easy (WARNEKEN ET AL. 2011). And more poignantly, that 3-year-olds are more likely to distribute equitably if they obtained the rewards collaboratively than individually or through windfall (HAMANN ET AL. 2011). Young children also recognize inequality and prefer equal distributors and distributions. 15-month-olds expect resources to be distributed equally (SCHMIDT & SOMMERVILLE, 2011). When 16-month-olds see two distributors treating a recipient with different degrees of fairness, they expect the recipient to approach the equal distributor, and they themselves also show a preference for them. (GERACI & SURIAN, 2011) 3,5-year-olds distribute more resources to individuals who have previously shared with others, than those who have not (OLSON & SPELKE 2008).

Across development, children's judgement become more sensitive to reciprocity, relationships, and others' behavior. 3-year-olds share more with peers that have previously shared with them (LEVITT ET AL. 1985). 3-year-olds display negative affect to distributions in which they receive less than other children –and even occasionally when they receive more (LOBUE ET AL. 2011). 4-year-olds share, even at a personal cost, more with their friends than with nonfriends or strangers (BIRCH & BILLMAN 1986, MOORE 2009). And 8-year-olds share more with their in-group than out-groups (FEHR ET AL. 2008).

More sophisticated fairness emerges in the school years. (NISAN 1984) Young children progress from weighing characteristics –like height and age– of others, to a preference for equal distributions at about 5-6 years of age, to a preference for a fairness between contribution and reward among children older than 6 years of age (E.G., DAMON 1975, HOOK & COOK 1979). In time, children integrate both need and merit. By 8 years of age, children's distribution choices depends on context. They use *proportionality* in work-and-reward, *equality* in voting, and *need* for charities (SIGELMAN & WAITZMAN 1991). With that said, a more recent study found that the collaborative context alters even young children's understanding of equity (NG ET AL. 2011). 3-year-olds judged the equal distributor to be nicer than the unequal distributor, but only in the collaborative context; children did not mind the proportional distributions in the individual context.

#### 4.4 Development of Normative Morality

Toddlers certainly respond when adults enforce norms, although it is not clear whether they are responding to the norm itself or the adult's imperative. Toddlers build up knowledge of what the norm is over many situations. They learn and apply words like broken, dirty, and bad to situations that go beyond the normal (KAGAN 1981). Children approximately 3 years of age start actively intervening in situations to correct deviations or violations of the norm. They also do this from an outside perspective and often use normative language<sup>9</sup> and terms that mark the agent neutrality of the judgement<sup>10</sup>. In a study, 3-year-olds watched as an actor destroyed the another's creation (drawing or sculpture) when they left the room. They generally protested against their actions, with around one quarter using normative language (VAISH ET AL. 2011B). Though pilot work with 2-year-olds showed almost no protest. In a similar study, 3-year-olds protested when someone tried to take or throw away another's possession, whereas 2-year-olds protested only when it was their own possessions (ROSSANO ET AL., 2011). 3-year-olds who saw an actor destroying a recipient's artwork also later told the recipient (VAISH ET AL. 2011B).

3-year-olds act similarly when conventional norms<sup>11</sup> are broken, too. In a study, children watched a puppet that would "dax", but then performed a different action than the one the child had previously seen an adult doing and calling "daxing." Most children protested this, even though "daxing" was a solitary game, which played incorrectly would not harm or inconvenience anyone. Here, also two-year-olds protested to some extent, but rarely normatively (RAKOCZY ET AL. 2008). Further, children did not just object to the puppet not performing the action he said he would, as a following study got the same

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<sup>9</sup>Saying "You can't do that", instead of, for example, "I don't want you to do that".

<sup>10</sup> The norm applying independently of who breaks it.

<sup>11</sup> The way in which something is usually done, or the way in which people agree that it should be done.

results in a nonverbal context (WYMAN ET AL. 2009). 3-year-olds also objected when an object was used as a pretend sandwich, if the object had previously been designated as pretend soap. The same object was later designated as a sandwich, and was then used as soap, and again the children protested (RAKOCZY, 2008). This demonstrates that young children can understand that the norms making up a game can be changed.

Young children also selectively enforce different types of norms depending on group membership. 3-year-olds protest equally when they see an in-group and an out-group member break a moral norm, but they protest more against in-group members when a conventional norm is broken (SCHMIDT ET AL. 2012). This would suggest they have a sense that conventions are decided by –and only applies to– one’s own group, while moral norms are of a more universal character. These studies suggest that, by the age of 3 years, children do not view norms solely in terms of authority. Rather, they are perceived as general and agent-neutral expectations, which applies differently to different groups depending on its form (moral or conventional). Tomasello & Vaish further argues that norms represent a kind of implicit agreement of how we ought to behave.

Children seem to know that their behavior is assessed normatively, and they sometimes alter their behavior accordingly. Previous research suggested that it was only around 8 years of age that children started to doing this (E.G., BANERJEE 2002). However, two newer studies found signs of such behaviors even in preschoolers. 5-6-year-olds were given a difficult rule-based task while being watched by either an “invisible person,” an adult, or no-one. Children cheated significantly less when they were being watched, even by the “invisible person” (PIAZZA AND COLLEAGUES, 2011). (More on invisible observers under 5.4.) Similarly, children stole and tended to help an imaginary child recipient more, if being watched by a peer (ENGELMANN ET AL. 2012). 4-year-olds conformed to their peers’ perceptual judgments if they had to express their judgment publicly, but not if they expressed it alone (HAUN & TOMASELLO, 2012). Thus, not only do young children judge and form reputations about others’ behavior, but they know that they are being judged and actively try to manage those judgments.

Furthermore, children also anticipate being judged and avoid having norms applied to them. When children transgress, even if no one sees them, they will still quite often apply the norm to themselves via guilt or shame. This self-punishment might function to prevent them from repeating the transgression, in turn decreasing the chance of punishment from others in the future. Individuals may also reward themselves by feeling pride for having followed a norm, when they could have gotten away with ignoring it. This self-praise presumably, and conversely, leads to more norm following in the future (TANGNEY ET AL. 2007). These emotions might therefore be internalized versions of the judgments that we apply to others who violate or follow social norms. School-age children may even feel ashamed if an in-group member does something worthy of criticism (BENNETT & SANI 2008).

Displaying guilt also serves to appease others. Showing others that one is already being punished (by themselves); might evoke concern or forgiveness, further decreasing the chance of punishment by others (KELTNER & ANDERSON 2000). Such displays may also indicate that the person did not intend to cause harm. And that they are aware and committed to the group norms, willing to make amends, and act better in the future (CASTELFRANCHI & POGGI 1990). Remorsefulness may thus imply self-policing, dependability, and cooperativity; eliciting forgiveness, affiliation, and cooperation in return (DARBY & SCHLENKER 1982, 1989;



GOFFMAN 1967).

4-5-year-olds regard situations in which a transgressor apologizes as better and more just than if they do not apologize (IRWIN & MOORE 1971, WELLMAN ET AL. 1979). Even absent an apology, 5-year-olds prefer transgressors who display guilt, and they distribute more resources to them than to unremorseful ones (VAISH ET AL. 2011A). 6-year-olds blame apologetic actors less, punish them less, forgive them more, and like them better than unapologetic actors (DARBY & SCHLENKER 1982, 1989). Conversely, a study found that 4.5-6-year-olds preferred those who enforce norms over those who do not, even as the enforcer was more negative and unpleasant in their behaviors. They were found to think the enforcer did the right thing, and evaluated the nonenforcer as less good, and less preferred. (VAISH ET AL. 2012).

Tomasello & Vaish argues that the most distinctive feature of human sociality is in-fact its normativity. We do not just expect what others *will* do; we also have expectations for what they *should* do. The content of these expectations varies cross-culturally, and form a continuum from morals (E.g., how we treat each other) to conventions (E.g., dressing a certain way for a funeral). Peterson (PETERSON & PATRICK, 2021) points out how we want others (and especially those we do not know) to be simple. This is so we can better understand them, and have predictable interactions with them. This refers back to the benefits of perception over cognition. Social norms in this sociopsychological sense, especially broad scale ones, are about simplifying our behaviors and expressions to avoid costs. Whether that is in the danger of interpersonal tension, cause by a misunderstanding, or the resource-intensive process of interpreting others' intention through complex cognitive inference.

Considering the concept of resource allocation, this also makes sense, and it goes to explain why we become less normative (that is, we "drop the façade") as we get to know others better. We can allow ourselves to engage in complex interactions with those we trust, to form bonds, to learn from each other, and gain support. However, if we were to do that around everyone we met, or if everyone we saw grabbed our attention, we would simply not have enough attentional resources to go around, and other aspects of our lives (that need attention) would suffer as a consequence. With this personal cost in mind, it might not be too surprising that when people break these normative expectations, we might show disapproval or gossip as a way punish and 'correct' them. That said though, there are significant cross-cultural differences in how we consider fairness and in willingness to punish (HENRICH ET AL. 2004).

In extreme cases, we might socially ostracize or imprison (or what is worse) the individual in question. The typical example of the recipient of such measures are emotionally unregulated and aggressive people, typically young men (RICHERSON & BOYD, 2001) (3.5). As one would expect though, these punishments are commonly geared exclusively towards actions that are considered severely morally reprehensible. Tomasello & Vaish point out that these punishments, together with our reliance on each other, likely causes humans to be vigilant about our social reputations and actions. So much so, that we do not just engage in norm-enforcement of others, but also punish ourselves emotionally (guilt and shame). They argue that this results in a "collective morality in which individuals [regulate] their actions via the morally legitimate expectations of others" (TOMASELLO & VAISH, 2013, p. 240) and point out that "if the glue of primate societies is social relationships, the

superglue of human societies is social norms" (p. 238).

Norms also set the 'rules' of social relationships in more work-oriented ways. E.g., we attain the vast majority of our food through a diverse set of collaborative efforts. Ache foragers in South America spends between 10-50% of their time engaged in this (HILL, 2002). In such societies, human share the resulting spoils fairly (HILL & HURTADO 1996). In contrast, we also agree to private ownership in other contexts, which are also a strictly cooperative effort. I.e., for ownership to apply, people must agree between themselves that such claims can be made in the first place. Unless ownership is maintained by force, although such means are generally not stable at the level of individual (More under 5.3).

Sharing and trading in small traditional societies are not strictly reciprocal either, but based on "more complicated social arrangements, [like when] social support is provided only if one adheres to socially negotiated sharing norms" (GURVEN, 2004, p. 559). These kinds of societies also use gifts to establish and cement cooperative bonds and obligations of reciprocity (GURVEN, 2004). This point is of note also, because humans 'infuse' objects with memories. As do we sometimes become emotionally attached to them –even perceive them to have human-like properties (SEE WAN & CHEN, 2021). Which leads us to two other functions of norms: to save acquired wisdom over time, whether that is through objects of habits. And to signal to others –or indeed oneself– belonging or commitment to one or more identities. (Which we will see under 5.0.)

When norms reach a certain degree of agreement among the collective, or they are set into law, they become what we call institutionalized. Tomasello & Vaish argues institutions sets a basis for joint goals, and creates stable social roles. As people assume these roles, they take on special status (SEARLE, 1995). Roles such as "spouse" and "parent" are generally recognized and carries with them certain social privileges and responsibilities. In ecological terms, we might say these roles come together in social or familial niche-structures, performing different functions in the family unit or social community. While cultures do vary in what privileges and responsibilities these roles hold, these roles are often quite similar overall. As we saw under "Sexual", it seems like some sexual and familial dynamics tend to work better than others. Specifically, the dynamics that minimize violence resulting from intense intrasexual competition, and maximizes the advantage of kinship bias, and providing sufficient resources (financial, emotional, educational) for children.

While these roles might appear restrictive –and in some sense they are– it might also be that they should be, granted that they are based in a sufficiently sophisticated understanding of human nature. In any case, the 'rules' around such roles should probably be few, simple and generalizable. Not just as they are less restrictive, easier to grasp and follow, but also because bad rules drive out respect for good ones (SEE PETERSON & PATRICK, 2021). Rules also have to be enforced to have effect (over time), which is untenable for a complex ruleset centered around day-to-day sociosexual roles. The presence of norms and normativity –and presumably the innate mechanisms supporting it– does not imply that there is no room for diversity though. Perhaps quite on the contrary, a normative framework for social-interactions may indeed make diversity more tenable, and may also function to respond to specific conflicts between different individuals.

One of the advantages of large social groups is that they can collaboratively divide their

labor amongst themselves. Meaning that individuals are incentivized to specialize and become increasingly efficient at their tasks. Presumably some of these tasks require different kinds of predispositions, skills, and goals- and value structures, meaning that there is a bigger range of potentially useful variance within the human genome in larger social groups. Furthermore, one might expect that the larger the group, the more specializations are needed, and the more innate diversity is favored, as well as the potential that these variances in personality feed back into things like sexual and familial strategies and structures. In any case, the advantageousness of differential specialization gives rise to human personality.

#### 4.5 Evolution of Personality

There are a few relevant evolutionary mechanisms that relate to variation in human personality. First is the effect of the sociocultural habitat, in which people perform different roles. The specific skills one must have, and behaviors that one must perform, mean that these roles like fit different personalities differently. Through that, the diversity of personality blossoms as a consequence of the benefits of synergy between variation in what different roles 'require'. As an economy are biased towards some personalities over others, one would imagine that this can lead to the selection of personality traits in a multi-factorial frequency-dependent-selection process. E.g., a culture heavily geared towards collectivism may be constituted somewhat differently than one geared towards individualism (SEE TRIANDIS & SUH, 2002) –in a way that differentially selects for certain personalities. Whether that is through economical-, sexual-, or social means. This selective pressure, would in-return create tension, which would over time likely lead to either an update of the culture, or a split into sub- or countercultures.

If a culture affords the persistence of alternative strategies, it can lead to something called *genetic drift*. If a specific facet of human personality is relatively inconsequential to an individual's fitness, one would expect to see variation in this facet across the population, because of the simple fact that this drift is not selected against. In some way, this would seem to imply the opposite of frequency-dependent-selection, namely that variation can imply indifference towards selection. There is a common factor though, which might be described something like: subtly different strategies being equally valid according to the specific pressures of one's habitat. This might end up looked less like random distributions of traits, and could lead to aggregations of different traits in different social stratifications, resulting from *mating assortment* (See "Synergy and Conflict" under "Sexuality"). If persistent across very long periods of time, this could cause a species to diverge. That is, split in two.

Lastly, and importantly, during a change in the selective pressures of one's habitat, variation in some traits might exist only temporarily, until the pressures have had time to select it out of the population. Another possibility that obfuscates this point is the argument that personality has less to do one's genotype, as much as it has to do with the arbitrariness of an individual's developmental circumstance. Simple differences in circumstance can cause people to learn different strategies, some of which happen to work better than others. Alternatively, that our genes rely on us having a long developmental period, and so will develop traits only in response to stimuli. In effect, that the difference in personality is caused by some stunting of a child's normal development. While there is undoubtedly some truth to such an argument, it is also one of those things that evolution would benefit greatly from hard-coding cognitive, affective or behavioral

mechanisms instead.

While much of this might sound grim, which it indeed also is –from the perspective of those selected against– it is also the way evolution works in every species on the planet. However, it does not usually take the shape of dramatic –or even particularly noticeable– events, but blends into the experience of the day-to-day lives of individuals. In any case, as we see, the context surrounding the presence of diversity matters for understanding why it is there. And we will look to research in personality psychology for more context. The following section is largely based on Roberts & Yoon (2022) literature review. In it, they point to four distinct domains of personality: traits, motives, skills, and narrative identity, as well as their development across time and situation. While we see high enough levels of continuity to support the concept of personality, we also see maturation, or change, in all domains and individual differences in trajectories in response to important life experiences.

Personality traits are usually understood as distinct and automatic patterns of thinking, feeling and behaving, being consistent across time and situation (ROBERTS 2009). Stated differently, they describe an individual's average cognitive, affective and behavioral *tendencies* across situations (FLEESON & JAYAWICKREME 2015). The five-factor model (FFM/Big Five) of personality traits is, and are becoming more, widely accepted in the field of personality psychology. And "a large volume of cross-cultural evidence has been accumulated in [...] support of [its] structural stability" (TRIANDIS & SUH, 2001, p. 152). Studies on identical vs. non-identical twins indicate approximately 40% genetic heritability (JOHNSON ET AL. 2008; POLDERMAN ET AL. 2015; VAN DEN BERG ET AL. 2014; VKASOVIĆ & BRATKO, 2015) and family and adoption studies indicate approximately 30% (BOUCHARD & LOEHLIN, 2001; RIJSDIJK & SHAM, 2002). The FFM proposes that people differ on five traits, described briefly below (ADAPTED FROM: PSYCHOLOGISTWORLD, 2022; DEYOUNG ET AL. 2007).

Openness to Experience is characterized by a willingness to try new activities, and being amenable to unconventional things, like artistic- and cultural experiences. It can be split into *openness*, and *intellect*. Conscientiousness relates to awareness of our actions and their consequences. It further relates to being tidy, organized, goal-oriented and productive. It can be split into *industriousness* and *orderliness*. Extraversion is characterized by being outgoing, sociable and talkative. It relates to enjoyment of being around others, as well as grabbing others' attention. In some ways, it is a positive emotion dimension. It can be split into *enthusiasm* and *assertiveness*. Agreeableness relates strongly to sociality. Agreeable individuals are appeasing, likeable, cooperative and altruistic. They generally dislike arguments, conflict and confrontation. Agreeableness can be split into *Compassion* and *politeness*. Finally, Neuroticism relates to various negative emotions. Neurotic individuals are fearful and anxious, often overthink and focus on the negative aspects of a situation. It further correlates with depression. The trait can be split into *volatility* and *withdrawal*. Several lines of research also point to the existence of one additional dimension: Honesty/Humility (ASHTON & LEE 2020, THALMAYER & SAUCIER 2014). Which is argued to be a distinct and useful addition (ZETTLER ET AL. 2020).

Assuming these traits are in-fact *the* traits of human personality, one would expect them to stand in causative relationship to various life outcomes, as well as hold explanatory power for related phenomena in human psychological variation. As they do. Traits predict many important life outcomes, like work achievement, relationship outcomes,

well-being, mental health, and physical health (CASPI ET AL. 2005, OZER & BENET-MARTINEZ 2006), and often at similar levels to strong predictors like cognitive ability and socioeconomic status (ROBERTS ET AL. 2007). Further, it turns out that there is a “strikingly high” (ROBERTS & YOON, 2022) overlap between the content of FFM and personality disorders in the DSM-5<sup>12</sup> and the Hierarchical Taxonomy of Psychopathology<sup>13</sup> (KRUEGER & MARKON 2014). Even that there is a close relationship between several aspects of personality and the development of psychopathologies (KRUEGER ET AL 2001). That should not be entirely unsurprising considering that, e.g., variations in measurements for sub-clinical depression has implications for behavior and well-being (FURR & FUNDER, 1998) and antidepressants work on non-depressed individuals (KNUTSON ET AL. 1998), indicating that at least some psychopathologies exist on a spectrum.

In any case, traits are not a complete explanation of psychopathology. E.g., while narcissists score high on extraversion and low on agreeableness (PAULHUS & WILLIAMS 2002), that is not enough to classify someone as such. It must be combined with a persistent motivation to be the center of attention and promotion of self over others (ROBERTS & YOON, 2022). Similarly, an authoritarian personality (ADORNO ET AL. 1950) would be high on conscientiousness and low on agreeableness and openness to experience, but these traits do not tell the whole story (FUNDER, 2001). Further, while the Big Five is useful and related to many factors, there is no simple conversion between genes and these traits. Traits likely being at least as polygenic<sup>14</sup> as psychiatric diseases (CHABRIS ET AL. 2013; HART ET AL, 2013), it indicates that these traits might still be composed of many different mechanisms, the specifics of which might be important if the Big Five model is to be applied pragmatically.

There are also efforts to introduce the Dark Triad to the list of personality traits. These traits are, briefly (ADAPTED FROM PSYCHOLOGYTODAY, 2022A): Narcissism is characterized by excessive self-regard and arrogance. Psychopathy is characterized by a lack of empathy and remorse. And Machiavellianism describes those who manipulate and deceive others to achieve their own goals. However, it is unclear to what degree these are distinct from the other six. Over two studies, measuring and comparing the Dark Triad with the Big Five traits in individuals, Jonason et al. (2013) simply concludes that “behind the Dark Triad is a sense of instability. This instability was a function of limited emotional stability, agreeableness, and conscientiousness. Each of which was a function of volatility, limited compassion and politeness, and low rates of industriousness and orderliness.” (p. 87-8). These all being Big Five traits. Also, through only momentary consideration of what ‘Machiavellianism’ and the proposed sixth Big Five trait ‘Honesty’ would mean for personality, one would be hard-pressed not to predict that they are almost entirely overlapping, although I am aware of no such research.

In contrast to patterns, skills are capacities: what is someone capable of when presented with a certain situation? Someone who is not typically assertive (trait) might be able to provide leadership when needed (skill). Teaching children *how* to control themselves (skill) is different than teaching them *to be* self-controlled (trait). The skills domain has

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<sup>12</sup> A US-based authoritative source on diagnosing mental disorders. Made by the American Pediatric Association.

<sup>13</sup> HiTOP “attempts to address limitations of traditional nosologies, such as the DSM-5 and ICD-10.” (HiTOP, 2022)

<sup>14</sup> A trait is polygenic when it is affected by “many, many different genes” (LAWRENCE, 2022).

mostly focused on cognitive abilities (RITCHIE ET AL. 2015). General Intelligence (IQ) being a very common measurement. General intelligence has a few components: mathematical-, visual-spatial-, and abstract reasoning skills. This is often coupled with both short- and long-term memory (ADAPTED FROM CHERRY, 2021). This often results in intelligent people learning faster, and retaining more information. While cognitive ability and background factors are related, they are independent in their effects (KUNCEL & HEZLETT 2010), and cognitive ability is not fully explained by a family's socioeconomic status or affluence. That said "there is a consensus that cognitive skills have important effects on economic and social outcomes" (PALCZYŃSKA & ŚWIST, 2018, P. 2) and even predict various life outcomes like occupational success and physical health (KUNCEL ET AL. 2004). However, selecting for cognitive abilities in recruitment processes has led to adverse effects (NEWMAN & LYON 2009).

Motives/motivation applies to a large range of topics, such as achievement (ELLIOT & HARACKIEWICZ 1996), power (SCHULTHEISS ET AL. 2005), life goals (KASSER 2016) and values (SCHWARTZ 1994). And attempts to define core motivational domains has ranged from: predictability, acceptance, and competence (DWECK 2017) to prominence, inclusiveness, negativity prevention, tradition (WILKOWSKI ET AL. 2020) and physiological, self-protection, affiliation, status, mate acquisition, mate retention, and parenting (COOK ET AL. 2021).

Narrative identity is about an individual's experiences and the integration of them into their personality or self-identity (MCADAMS 2013). By encoding the features of the stories people tell about themselves; like emotional tone (SENGSAVANG ET AL. 2018), meaning (PALS 2006), and motivational content (ADLER 2012); three large domains have been found; motives and affect, autobiographical reasoning (e.g., meaning), and structural (ADLER ET AL. 2016, MCLEAN ET AL. 2019). A common goal has been to demonstrate that narratives add additional validity to traits and motives when predicting outcomes in development and well-being (LODI-SMITH ET AL. 2009). A recent meta-analysis showed exactly this predictive power, controlling for FFM traits (ADLER ET AL. 2016).

While the number and type of dimensions in these personality domains have grown, an integrative structure has not been accomplished. McCrae & Costa's (2008) FFM3 proposed that personality traits are immutable causes of all other types of constructs, including motives and narratives. Dweck's (2017) BEAT model (belief, emotion, and action tendencies), inversely placed goals at the core of personality and proposed they are the cause of traits, which emerges from the interaction between goals and situations. McAdams (MCADAMS & PALS 2006) proposed that traits, motives and narratives manifest at different levels of analysis, to which Roberts (ROBERTS & WOOD 2006) went on to argue that personality should include skills, and counter-argued that all domains can be considered from broadly to narrowly. E.g., A motivation can be to want an ice-cream at this moment, or it could be to save up to buy an ice-cream factory in 20 years. Sufficient to say, there are many others that have made similar observations as Robert's (E.G., MCLEAN ET AL. 2019; SCHWARTZ 1994; SU ET AL. 2019; WIRTH ET AL. 2020). Meaning that we will have to make-do with the domains as unintegrated components for now.

## 4.6 Development and Effects

In individuals, personality traits are moderately to highly consistent (correlating 0.4-0.6) over relatively long periods of time (4-10 years). However, the longer one tracks it the lower the consistency gets (E.G., DAMIAN & ROBERTS 2015), although it plateaus above zero

(FRALEY & ROBERTS 2005). Consistency increases with age, peaking around 25 –which is the same time the brain is believed to have finished developing (MENTALHEALTHDAILY, 2015)– with some decreases again in very old age (LUCAS & DONNELLAN 2011). Genes contribute to the consistency in personality across one’s lifetime (SEE SANCHEZ-ROIGE ET AL. 2017).

To the extent vocational interests reflect motivation, it is actually more consistent than personality at a younger age (LOW ET AL. 2005) and are similarly consistent later (NYE ET AL. 2020, SCHULTZ ET AL. 2017). Other constructs like major life goals (ATHERTON ET AL. 2021) and values (DOBEWALL & AAVIK 2016, VECCHIONE ET AL. 2016) show the same consistency as traits over similar time spans. Cognitive ability is more consistent than any other domain, exceeding 0.8 for individuals over 20 years of age (DEARY ET AL. 2004, TUCKER-DROB & BRILEY 2014). While narratives vary more: sometimes showing the same consistency as traits (MCADAMS ET AL. 2006) but other times much less (DUNLOP ET AL. 2016).

It is generally thought that childhood and adolescence hold little significance for systematic changes, while the transition to young adulthood is crucial (E.G., BORGHUIS ET AL. 2017, GÖLLNER ET AL. 2017, MROZCEK & SPIRO 2003, ROBERTS ET AL. 2006). Worthy of note, however, is an increase in neuroticism for girls–and aggression for boys– around puberty (PETERSON & BUSS, 2022). Meta-analysis shows significant change (on average) in all traits in young adulthood (ROBERTS ET AL. 2008). Assertiveness (a subdomain of extraversion), agreeableness, conscientiousness, and emotional stability (inversion of neuroticism) all steadily increase through midlife. This is also replicated in newer work (LUCAS & DONNELLAN 2011; DAMIAN & ROBERTS 2015; OLTMANN ET AL. 2020; VECCHIONE ET AL. 2012).

Not only can skills, motives, and narratives develop or change, but the fact they develop differently than traits suggests that these domains are distinct. Fluid cognitive abilities typically peak in early life and then declines, while crystalized cognitive abilities typically peak in midlife and then drops off (SCHAIE & STROTHER 1968). Motivation, when measured as the importance of a goal, is very consistent –with no changes (on average) or decreases across lifetimes (ATHERTON ET AL. 2021, STOLL ET AL. 2021). Values like universalism and conformity has been found to increase in young adulthood and plateau thereafter (SCHULTZ ET AL. 2017). Furthermore, as one would expect, some individuals change more, and some less than others (E.G., DE FRUYT ET AL. 2006) while some are stable (MROZCEK ET AL. 2021).

Achieving life goals related to relationships and work can cause a decrease in individuals’ family and work-related goals (SALMELA-ARO ET AL. 2007). A closer fit between one’s occupation and interest profile predicted changes in one’s interests (NYE ET AL. 2020), while losing one’s job was associated with increases in enterprising interests (SCHULTZ ET AL. 2017). Getting cancer decrease achievement and leisure goals, with no difference to health-related goals (PINQUART ET AL. 2007). Becoming a parent is associated with changes in goals. Becoming a mother increases one’s goals related to family and health and decreased those related to achievement (SALMELA-ARO ET AL. 2000). Some research found little or no changes to traits with becoming a parent (VAN SCHEPPINGEN ET AL. 2016) although changes in family goals are associated with changes in agreeableness (ATHERTON ET AL. 2021). And changes in goals are generally associated with changes in personality traits (HUDSON ET AL. 2020). E.g., changes in economic goals were related to changes in extraversion (ATHERTON ET AL. 2021).

There is solid evidence for changes in traits across life, even in old age (GRAHAM ET AL. 2020,

SCHWABA & BLEIDORN 2018). Children who spend more effort in school increases in conscientiousness (GÖLLNER ET AL. 2017). Similarly, an increase is found for commitment and investment in one's work as well (HUDSON ET AL. 2012). Attaining higher status at work is associated with increases in assertiveness and sometimes conscientiousness-like traits (LE ET AL. 2014, ROBERTS ET AL. 2003), and those who are called upon to be leaders at work increase in extraversion (WILLE ET AL. 2012). Positive experiences at work are also reliably associated with decreases in neuroticism (LE ET AL. 2014, SCOLLON & DIENER 2006, VAN AKEN ET AL. 2006).

An increase in conscientiousness and a decrease in neuroticism is also found when individuals form serious romantic relationships (LEHNART ET AL. 2010) or become married (HOPWOOD & BLEIDORN 2018), even in late-middle life to old age (MROCZEK & SPIRO 2003). As do fulfillment and satisfaction within the relationship (LEHNART & NEYER 2006, ROBINS ET AL. 2002, SCOLLON & DIENER 2006). A gene informed study also supported the argument that marriage can cause trait change (BURT ET AL. 2010). Increases in neuroticism is associated with negative relationship experiences (LÜDTKE ET AL. 2011), as well as negative experiences generally (LACEULLE ET AL. 2012, LÜDTKE ET AL. 2011). Substance abuse are associated with difficulty in increasing conscientiousness, as well as an increase in neuroticism (LEE ET AL. 2015). Mental health changes and depression are associated with decreases in several traits, and a particularly high increase in neuroticism (CHOW & ROBERTS 2014). Receiving more support from one's family between puberty and adulthood is associated with an increase in agreeableness (BRANJE ET AL. 2004), and travelling to another country were likely to cause an increase in agreeableness and openness to experience, and decrease in neuroticism (LÜDTKE ET AL. 2011). For Sojourners (temporary residents) this effect increased more the longer they stayed (ZIMMERMANN & NEYER 2013).

In a large review, traits –but especially neuroticism– were found to be modifiable through clinical intervention. With average changes of half a deviation over only 6 weeks, which remained in place for considerable time afterwards. (ROBERTS ET AL. 2017) Other research has shown that other trait domains can also be changed through (even non-clinical) intervention (STIEGER ET AL. 2021). Large RCT's (Randomized Control Trials) show that interventions have long-lasting effects (E.G., KOSSE ET AL. 2020) and that these changes predict long-term outcomes (HECKMAN ET AL. 2013). This is presumably good, because trait neuroticism correlates negatively with several outcomes that are generally undesirable. More socially anxious people<sup>15</sup> tend to be less accurate about how they are perceived, which contributes to them being less liked at first encounters (TISSERA ET AL. 2020). People high in neuroticism also tend to perceive their partners as more positive than they are (HANNUSCHKE ET AL. 2020). And neuroticism is related to lower relationship satisfaction across different relationships (ROBINS ET AL. 2002) which leads to outcomes like elevated rates of divorce (SOLOMON & JACKSON 2014).

Conscientiousness is a predictor of school grades (NOFTLE & ROBINS 2007, POROPAT 2009) which can be explained by conscientious students engaging in behavior like setting more effective goals and having more tenacious study habits (CORKER ET AL. 2012). Conscientiousness also indirectly predicts work performance by influencing things like motivation (CAMPBELL & WIERNIK 2015, VAN IDDEKINGE ET AL. 2009). Extraverted people report being happier (COSTA

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<sup>15</sup> "It is well established that social anxiety (SA) has a positive relationship with neuroticism and a negative relationship with extraversion." (KAPLAN ET AL. 2014)



& McCRAE 1980) and extraversion leads to greater amounts of social interaction (BREIL ET AL. 2019), which contributes to greater well-being (SUN ET AL. 2019).

Individuals high in approach motivation (a tendency to move towards reward) are usually more satisfied with their relationships, while individuals high in avoidance motivation (tendency to move away from punishment) are usually less satisfied (IMPETT ET AL. 2010). High approach motivation is associated with involvement in behaviors and events, such as special events, which could lead to positive emotional- and relationship outcomes. Avoidance motivation contributes to overreaction to negative events, which decreases well-being (ELLIOT ET AL. 2006, GABLE & IMPETT 2012). It seems likely to me that approach motivation correlates positively with openness to experience and extroversion, while avoidance motivation correlate negatively with openness to experience and positively with neuroticism.

Faster declines in cognitive ability in old age are associated with susceptibility to mental health issues (MCINTOSH ET AL. 2013) and a decline in physical (especially visual and auditory) functioning (VALENTIJN ET AL. 2005). On the other hand, maintaining better physical functioning in old age is associated with less cognitive decline (TABBARAH ET AL. 2002). Traits are now considered distal causes of proximate health factors, like health behaviors (SEGERSTROM 2019) and linkages to health behaviors are common (TURIANO ET AL. 2012). The association between neuroticism and mortality is mediated by smoking (MROCZEK ET AL. 2009), and the relation between conscientiousness and longevity is mediated by cognitive functioning (HILL ET AL. 2011). However, some links were not found to be mediated. Even when controlling for multiple factors, conscientiousness maintained an independently negative relationship with Alzheimer's disease (WILSON ET AL. 2007). Changes in neuroticism also predict health outcomes such as treatment progress (NGUYEN ET AL. 2020) or lower chance of relapse (TANG ET AL. 2009) better than changes in depression does. We will come back to some of these points in our discussion, but for now, we will look at what culture is, how personality plays into it, and then use that to explain a few of the most significant institutions.

## 5.0 Cultural

### 5.1 Nature-Culture Coevolution

Culture from an evolutionary perspective has been defined in many ways. I will define it broadly as *all things socially inherited or transmitted*. In this general sense some capacity for culture is close to universal even across birds and mammals (WEINSTEIN & HEYING, 2021). This definition is not just broad enough to be functional across many species, but also the hierarchically fractal –and complexly intertwined– social networks of human societies. This gives credence to subcultures also, of sizes ranging from aggregations across large internet forums, to sections of a geographical population, all the way down to family and friend groups. This is useful, because of the fact that we all have multiple identities (GRAUMANN, 1983) and essentially perform different roles in different contexts.

In this definition, we also capture "all group-typical behavior patterns" (LALAND & JANIK, 2006) beliefs, values, norms and techniques (including language and technology) (RICHESON & CHRISTIANSEN, 2013), as well as objects (like artworks, furniture and buildings) and systems

(like economic, religious, educational and political institutions). These things, will, moving forward, be referred to as cultural products. This makes the built environment an emergent phenomenon of culture. Humans learn and manage culture through several deep arrangements in our brains. As we will see: "Culture is a major aspect of what the human brain does, just in the same way as smelling and breathing are what noses do." (RICHERSON & BOYD, 2001). While some might find this way of defining culture too broad, I believe it captures the essence of culture reasonably well. It also allows culture a status similar to nature, which I believe is a useful dichotomy.

Culture is beneficial for many reasons (See 1.5 for details). By inheriting things like behavior and belief, genes do not have to hard-code for them. Flexibility oftentimes affords an organism more access to more diverse resources. It is also useful in the case where an environment or habitat changes too quickly for genes to adapt; making cultural adaptation, in some situations, the only conceivable way to survive (BOYD & RICHERSON, 1985). Finally, culture can become sophisticated enough to fundamentally change how an organism relates to its natural pressures. E.g., by making clothes, we don't need to spend resources on fur. By making fire, we do not have to climb up trees to sleep safely. By sowing seeds, we do not have to search for food. What essentially happens is that a species' physiological design-constraints are lifted through synergizing with the tools they create. This in turn expands their carrying capacity. Perhaps the most crucial part of the cultural mechanism still, is that its gains accumulate over time.

As my supervisor, Jørgen H. Skatland, told me: "we store information in the environment around us". Our creations often speak of how they are created, and they say something about their creators and the cultures they come from as well. Especially when symbolism is used, or when aesthetic expressions or motifs are used to transmit messages or signal virtue. Through an institution structure, we also save communication channels, as well as system solutions we have previously invented to solve our problems. Like third-party law creation, implementation and enforcement, firefighting, healthcare, education and so on. These institutions are stable enough to have clearly perceptible marks on the physical environment, both spatially and formally. However, the social communication structures –as well as the specifics of many other social and sexual norms– are saved in behavior, myths/stories, values or beliefs, through memories, belief and value structures, emotional associations or behavioral habituation in individuals. They become passive framings through which we experience, consider and understand life, and automated cognitive, affective or behavioral responses to more immediate and everyday situations. This latter point is essentially the definition of a personality trait (4.5).

Culture is transmitted through various means (GIULIANO, 2016) like teaching, observation and imitation. These are again composed of different mechanisms, including weights and biases. They can also be attained through more intentional engagement, like a study of- and adoption of behavior or belief, or through the attainment of objects, and inspirations used for some kind of self-reflection. An important feature of human cognition –which is otherwise uncommon among animals– is shared attention (RICHERSON & BOYD, 2001). We can pay attention to the attention of others, as can we guide their attention towards things that are of interest to ourselves, or which we assume they might like (TOMASELLO, 1999). Even young infants point to interesting objects even if only to share their excitement (LISZKOWSKI ET AL. 2004, 2006).

Humans also actively teach their young for their own benefit. Some think this teaching is critical to the human way of life (CSIBRA & GERGELY, 2009). Which makes sense, considering the difficulty and importance of rearing children well, along with the tremendous resources that modern societies put into public education. This type of communication stands in contrast to the other great apes, which communicate with others mostly to get them to do things for them (TOMASELLO, 2008). One of the ways in which we follow the attention of others is by looking at their eyes, or noticing where they are looking towards, to infer what they are paying attention to. Being able to do this seems to have been so important for us, in fact, that we are the only animal that has significant portions of white in our eyes (AERIA, 2016). Presumably, this was selected for because we could better trust those of whom we could track the attention of.

After early development, children start understanding others as intentional agents with their own motivations (RICHERSON & BOYD, 2001). By our rather constant observation of others, we discover that we can learn from their actions and behaviors to achieve our own goals, or prevent making the mistakes we see them making. And so, we can learn both what to do, and what not to do, without any significant personal risk or effort. If we can then copy their fittest behaviors, it stands to reason that our fitness will increase as well (RICHERSON & BOYD 1985, 2005B). Being able to imitate like this means that fit variations of behavior may survive for long periods of time, or be altered along the way and evolve into something different (SEE RICHERSON & BOYD, 2001). We can also observe several variations, try them out as we go, then retain the one we deem best.

Even though the effects of one such decision is small on the scale of the individual, it can be powerful at the effect of a population (RICHERSON & BOYD, 2001). Seemingly this fact of learning, trying and choosing can be reformulated in the following way: a source of variation (granted there is experimentation happening too) in a population under selective pressure. Meaning, that the behavior, belief or value itself is subjected to the laws of adaptive evolution. And so, we find our first example of culture being directly adaptive. Richerson & Boyd (2001) argue that the evidence shows that adaptive success under these circumstances rests on the cultural product being able to accumulate complexity, which can then eventually come to rival genetic adaptive "design" (BOYD & RICHERSON, 1996). This also mirrors Coccia & Watt's (2020) hypothesis of the evolution of technology, which we will get to under 5.5.

Similarly, to what we saw with morality, even children as young as 2 are more sophisticated with imitation than fully grown chimpanzees are (WHITEN & CUSTANCE, 1996) and in-fact, any animal tested (PEPPERBERG, 1999). Even then, there's a rapid increase in children's imitative fidelity from 2 until 4 years old. And while children are generally unselective about the content they learn, they are quite selective about whom they learn from (GIULIANO, 2016). But by which means do we judge who we should pay attention to, and imitate? Assuming prestigious people have a better-than-average track-record of success with their behaviors, people who learn from or imitate them will presumably take part in some of the same success (GIULIANO, 2016). This works with signaling, attraction and preference too (See 3.1). Assuming the copied part of the prestigious individual is the cause of them appearing fit to others.

The copying of prestige for signaling purposes, together with frequency-dependent-

selection goes a long way to explain clothing fashions, for example, and how they inevitably change. Especially high fashion, where the signaling is presumably highest. As fashion icons and trends are copied, their “coolness-signaling” (SEE ARIELLI, 2020) loses strength, and they will need to reimagine their style to retain their beneficial appearance. This makes fast-paced and individualized worlds like fashion especially unstable, and can drive signaling away from its ecological adaptive origin (Look up ‘Fisherian Run-away’ for more details). Moving too far outside the norm can also lead to unintended consequences, e.g., mockery of high-fashion among the uninitiated. Another –and largely different– attention/imitation strategy is found in conformity. Conformity is generally a safer option, as the most common thing people are doing also tend to work well enough. It further signals that one is on the same page as others, follow the same norms, and belong to the same group. In this sense, conformity preserves intergroup variation and suppress intragroup variation.

The last strategy, is one that I have not seen other authors mention during the research for this essay. While many inevitably look towards those whom they believe to be the most widely accepted prestigious individuals or the most common behaviors/beliefs; there is also a case to be made for differences in values or preferences (More in the next subchapter). If it was only imitation of prestige and imitation of the norm out there, there would be no variation, since prestige and conformity would always be driven towards the same results. I.e., if some are copying prestige and most others copy the average, then the average will inevitably tilt towards prestige over time, as it is the only source of variation in the system. But this is not what the fashion world appears to do, rather there are many different segments of style, and attitudes towards them. Neither does it explain why prestigious individuals appear prestigious to begin with, or even how they can rapidly create new or reimagine old fashions. There seems to be some tension within culture, whose resulting mechanisms might be required to answer this. Actually, which might be necessary to understand culture at all.

Culture does not come for free; it also comes with drawbacks. “The brain that picks up culture is big and energetically expensive to run; the process by which culture is transmitted is prone to error; and the content of [...] culture frequently blocks fitness-enhancing opportunities.” (WEINSTEIN & HEYING, 2021). The degree to which a species will develop culture depends on how these factors relate to the affordances of its habitat. This makes culture necessarily constrained by nature to some degree. Further, in the same way that social sophistication can be used to create immoral transactions through manipulation or violence, so can culture be used as a means to an immoral end. As we will see, culture also creates new and influences old selective pressures, which, depending on where one stands, might be seen as either a drawback or a benefit.

While culture emerges out of nature, culture on its own in-fact fulfills the three requirements of adaptive evolution. First, culture works through a population that vary in traits. In our case, the populations are found in the different categories of cultural products. Some of which have physical shape, while most live in various neural structures in the populations of human brains. The location matters not. Secondly and thirdly, these populations are exposed to variations across “generations” as well as selective pressures. Both the variation and selective pressures happen through conscious processes like exploration, creation, and judgement, as well as various partially subconscious processes like perception, preferences, and affection.

Culture is also selected for through natural selection, and nature by cultural selection (SEE RICHERSON & BOYD, 2001), becoming a coevolutionary process (SEE LUMSDEN & WILSON, 1981). A group whose culture is better fit to the habitat will usually do better than a group whose culture is less fit, and an individual who is less fit to the specifics of that culture will be selected against as well. Culture can act through relatively mild means. Like influencing someone's beliefs and values, and therefore social or sexual affiliations and preferences. Or it could set specific rules with which we are judged collectively. Throughout history, culture has likely been relatively stable for longer periods of time. There were fewer problems to solve as there was less complexity in social arrangements, and in the relationship to our environments. This meant that social institutions could over time select for us through the implied agreement of norms. "Institutions achieved the tribal (and now larger) scale of organization by partly domesticating genes." (RICHERSON & BOYD, 2001) On the evolutionary effect of norms and institutions, Richerson & Boyd (2001) writes:

*If cultural institutions can generate sufficiently costly punishments for deviations from their rules or provide the benefits of group cooperation mainly to cooperators, any genetic variation underlying behavioral dispositions will fall under selection favoring genotypes that avoid the punishments and earn the rewards. We suppose that the resulting tribal instincts are something like principles in the Chomskian linguists' "principles and parameters" view of language (Pinker 1994). The innate principles furnish people with basic predispositions, emotional capacities, and social skills—the principles—that are implemented in practice through highly variable cultural institutions—the parameters.*

Being that cultural norms can cause selective pressure against individuals; this would in turn select for traits that can work around or alter said norms. Social or cognitive mechanisms that afford conscious control over the evolution of culture becomes valid as a strategy not just to survive its selective force, but to make it better fit the individual, group or population. Furthermore, at its extents, to entirely circumvent specific sociocultural pressures, by establishing new sub- or counter-cultures. The benefit of individual adaptation towards culture, whether that happens through blending in with the norms (which affords cooperation); or through alteration of the norms, whether for individual gain, or to better adapt the population to a changing environment; ensures culture persists over time. Conversely, this implies that culture has been "elaborated, enhanced, and extended by genomic evolution over time" (WEINSTEIN & HEYING, 2021). That is, provided it has been with us for a sufficient amount of time, which I think this essay's definition of culture indicates.

I would argue that cultural and natural selection function similarly enough in our species, that one can argue that culture stands in relationship to nature, as nature does to the environment. Nature emerges from matter, are subject to its laws, but also creates its own set of laws and shapes matter. Culture emerges from nature, are subject to its laws, but also creates its own set of laws and shapes nature. In this way, culture would not only be considered phenotypic, but also a kind of extended community, situated in the ecological *environment*<sup>16</sup>. This makes the built environment the physical manifestation of

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<sup>16</sup> Normally: ecological *community*. But in this analogy, it takes the place of the physical environment.

human's extended habitat. The population that inhabits said culture effectively functions like an ecological community does, with its own selective pressures and niches. And in turn, changes in the population, causes a change in the culture. I think it stands to reason to call a cultural niche-structure an *economy*. In doing so, one also implies that economists should be equipped with the evolutionary tool-kit, a case that has been argued several times before (E.G., GIULIANO, 2016). Further, we could argue that institutionalized sexual-, familial-, social-, and economic roles form the adaptive landscape of the cultural community, to which individuals naturally diversify to fill niches within it. The diversity of strategies that come with complex relationship structures, together with the extensive human cooperation leading to ever finer division of labor, form much of what is considered *personality* today. Which is akin to *species* in this analogy.

## 5.2 Creation of Culture

While *openness to experience* was not that present during the section on personality, it shows large effects in –and predicts the evolution of– preferences for many different aesthetic experiences (SEE FURNHAM & SWAMI, 2014), as well as interest in ideas. Being closely related to creativity and intellect, it does not take much to imagine it being one of the key mechanisms in which culture transforms or conserves. And much does point in this direction. Tan et al. (2016) finds that openness to experience is consistently and positively correlated with creativity (CONNER & SILVIA, 2015; FEIST, 1998; IVCEVIC & BRACKETT, 2015; VAN TILBURG ET AL. 2015), that it predicts intrinsic motivation (WATANABE ET AL. 2011) and that intrinsic motivation is conducive to creative performance (E.G., BODLA & NAEEM, 2014; CHOI, 2004; DE JESUS ET AL. 2013; ZHANG & BARTOL, 2010). As are factors like leadership skills, experience and knowledge (SHALLEY & GILSON, 2004).

With this in mind they propose that openness influences motivation, which influences creative engagement, which influences creativity. In their own experiment, they found significant predictive power in all of these relationships. Most significantly, openness to experience predicted creativity at 0.78 (0.5 when controlling for the other two variables), predicted Intrinsic Motivation at 0.63, and Creative Process Engagement at 0.44. The other relationships were in the range of 0.2-0.3. Moreover, in a meta-analysis, Ackerman and Heggestad (1997) found that openness positively correlated with general intelligence at 0.33 and Gignac et al. (2004) reported a correlation of 0.43.

Many of these relationships makes sense given that openness to experience measures tendency to imagine, aesthetic sensitivities, emotional self-awareness, novelty preference/tolerance, curiosity and preference for nontraditional values (MCCRAE & COSTA, 2003) (ADAPTED FROM HOGAN, 2012). The increased visual-spatial- and abstract-reasoning skills of intelligent individuals increases the speed at which they process stimuli. Coupled with the increase in information-retention, as well as the confidence and enjoyment such perceptive skills may bring, one might reasonably expect that intelligence influences one's preferences for novel stimuli, and further for the curiosity –and exploration– of new values. The positive affect related to the exploration and the expansion of imagination and self-awareness, could reasonably lead to an alteration in one's aesthetic preferences as well. Not least because aesthetics sometimes signals or represent values, which could create connections between attitude, representation, habituated affective/cognitive response, leading to specific preferences.

In any case, why is it that openness to experience is more of a variable than it is a feature of human cognition? Part of it might relate to it being dependent on environmental factors. That it is a trait that develops in response to certain stimuli. But probably more likely is that variation in the trait across a population is useful. The lack of predictability and ensuing instability that may come from wide-spread creativity, would likely become a problem for the effective functioning of a sociocultural structure. Not to mention how much of our attentive resources such activities cost. So, what is the opposite of this problem? If not precisely normative but diverse division of labor? Creating a frame that increases the predictability of communication and cooperation between individuals, as well as being a way in which one can store what creative people have made. (Granted that the creations are generally recognized as more valuable than they are costly by the individuals in the group.) In this way, openness to experience is probably a frequency dependent trait.

This also points to the (probably essential) flipside to creativity, like management and maintenance. The efficient functioning of both tasks being strongly restrictive in terms of practical feasibility and predictability. Also, considering that managers deal with how systems play out in practice, criticism of novelty naturally follows suit, particularly being sensitive to the potential and unintended negative consequences that a novel solution might bring. Since this consideration of the actual functioning of systems –and not only exploring potential and creating from it– is also complicated, general intelligence is also useful here, which might explain why the correlation between openness and intellect is not higher than it is.

To bring this point of functional duality home; there are several studies that find openness to experience to positively correlate with political liberalism, and to negatively correlate with political conservatism (E.G., SAUCIER, 2000; HEAVEN & BUCCI, 2001). As is there some relation between low agreeableness and high conscientiousness with conservatism, and high agreeableness to liberalism (CAPRARA & ZIMBARDO, 2004; VAN HIEL ET AL. 2004). Considering this point, and presuming that diversity in personality traits are beneficial to a society generally speaking, it also explains –and give some validity to– the presence of different political parties, and the necessity for public debate. Presumably because individuals within the population have different expertise and niches, leading to recognition of the usefulness of different values, leading to differences in preference and ultimately political leaning.

With that said, political views are not strictly determined by traits, but are also influenced by several other things, like ideological conviction, which is in turn influenced by in-group dynamics, and likely things like narrative identity. Furthermore, political parties do not consciously cater to FFM traits either (as far as I am aware). Instead, they are likely a product created at the intersection between situation and frame of reference. In any case, the duality of cultural change and conservation, among other tensions between individuals, brings us to a few of the largest cross-cultural institutions and what they do. As one might expect, when diversity within a population increases, various kinds of tensions may arise, or as people attain various expertise, that they might in turn use to gain unfair advantage. Both problems that call out for solutions.

### 5.3 Politics

As indicated, managing cooperation at scale require setting up some type of order, as well as the management and enforcement of the structure they bring. Contrary to what some assume, small, traditional human societies are in-fact generally egalitarian. There is cooperation within the group to make sure no-one becomes too powerful (BOEHM, 1999). Pointing to the importance of politics and the management of social norms, Cosmides (1989) found humans to be better at solving problems framed as violations of social rules than solved problems framed abstractly. And even if the problems were framed through other familiar content, indicating that we have specialized social intuitions.

Cosmides points out that this data is consistent with the idea that we are equipped with an innate mental organ for detecting cheaters. Observers might even punish perpetrators at a cost to themselves, whereas such things are not generally found among the other great apes (FEHR & FISCHBACHER, 2003, 2004; RIEDL ET AL. 2012). This also makes sense of terms like "cut down the tall poppies" from Australia and "the nail that sticks out get hammered down" from Japan (PETERSON & BUSS, 2022). Powerful human individuals generally obtain and retain power through demonstrating their ability to manage resources and by distributing more generously than others (MAUSS, 1954), and not through domination like the other apes.

In such societies (as for larger and industrialized ones) maintaining peace is not just a matter of retaliation, but is handled by third-party enforcement. A highly significant benefit of this, is that by externalizing the formulation-, implementation- and enforcement of law-and-order; we not only offload these responsibilities off everyone else, which frees them to busy themselves with other things, but we prevent the continuous –and often-times escalatory– retaliation processes found in some large-scale dysfunctional societies. Which can lead to adversarial groups forming, like the formation of gangster groups or a mafia.

The fact that we have externalized many of the processes surrounding normativity might have been resulted from a need to respond to very specific human phenotypes like aggression and retaliation. Which we solved by relying on our sophisticated social instincts to make the system not just more efficient, but also safer. As long as the implicit agreement of fairness between the group that has externalized its political management responsibilities, and the group that becomes specialized on the task, is honored, this likely makes the habitat function better. Though, this depends on whether the creation and enforcement of norms respond to psychological mechanisms in a way that is useful and stable, or which evolves towards improvement over time. The task is basically for political institutions to alter the cost-benefit analyses and dynamics between selfish actions on the one hand, with mutually beneficial collaborations on the other, in a way that works for a population with increasingly diverse niches (More under 6.3).

To the degree that it manages this, a resulting growth in the population might occur. As immoral behavior decreases, efficiency will in-turn increase, which extends the culture's carrying capacity. That is, as a society develops –through the effectivization of resource consumption and increased productivity, afforded by sociosexual stability and diversification– it affords a larger population. This larger population consumes more resources and is more difficult to manage, but gives access to a disproportionate number of brains and hands that can specialize. This affords a population to invest more resources in the



development of their society in return, creating positive feedback, until the increase in effectivization or production grinds to a halt, or the management cannot keep pace with the complexity.

Other consequences of a growing population are that the increased density, changing social order and physical environment (particularly in regards to hygiene) puts increased pressure on various sociosexual mechanisms. Of particular note, perhaps, is the problem of sanitation management (E.G., THEWORLD BANK, 2018; NIAGARA, 2018), the increased availability of mates (and rivals) leading to increased sexual selectiveness<sup>17</sup> (FISMAN ET AL. 2006) which arguably intensifies intrasexual competition, and a tension which arises from being surrounded by an ever-increasing amount of people that one is less personally involved with. This makes moral behaviors riskier, as exploitation becomes more salient. Increasing competition leading to decreasing altruism also makes sense of the association between inequality and social complexity (GIULIANO, 2016).

An example of how exploitation becomes salient is when society at large benefits from cooperation while the collaborators pay the cost. This gives rise to an increase in 'free-riding'. Free-riders are those who benefit from something that they have spent no effort on. As long as they are not pressured to pay a cost for it, such behavior would, generally speaking, increase their fitness. (Some benefit for no cost is a great bargain, evolutionarily speaking.) Another situation that can arise is when two people would be better off if they cooperated; but a lack of trust means that both parties are individually better off by betraying or exploiting the other; leading to an all-in-all suboptimal result. In either case, these are game-theoretic<sup>18</sup> problems, being that the (dis)incentives<sup>19</sup> are structured in such a way that the best option for the selfish and rational person is not the best option for the group, or that the ideal solution is prohibitive, because of the rule-set.

The effect of normativity might be expected to intensify in order to deal with this. Whether through the creation of new norms, making existing norms stricter or through more heavy-handed enforcement. However, as Uzzell & Rätzzel (2008) shows, heavy-handed behavior-change strategies are often suboptimal too. They can work, and are often supported when they are seen to be in the public good. But they may not be generalizable onto other behavior, meaning its effect is narrow in scope. (And likely to reverse the moment the norm is not enforced.) Neither does this particularly help those who struggle to keep themselves on their feet, or those who are still exploited regardless of the severity of the enforcement. Further, in the cases where people believe they are helpless, or not responsible for their actions, they might become cynical or critical of authority figures in particular. And such resistance and resentment can have unpredicted, unintended or counterproductive consequences (SEE UZZELL & RÄTHZEL, 2008).

But there are also other solutions at hand. Normativity might alternatively tap into our

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<sup>17</sup>Particularly in women.

<sup>18</sup> Game Theory (von Neumann, 1928) is the study of what rational agents will do in 'games' with various rules and (dis)incentives. The point is basically to discover how people are likely to (or should) respond strategically to a situation, and each other's strategies, given their set of motivations.

<sup>19</sup> Incentives are reasons to do something. It is like a desired affordance. A disincentive is an undesirable threat or cost.

moral instincts, and, for example, use kinship and in-group bias to our favor. By rallying behind a shared purpose, or by reinforcing the feeling of belonging, trust, or shared identity, these conflicts may be dealt with in part without punishment. Institutions of particular note that seem to have filled this role in the last (hundreds of) millennia (?), is organized religion. And across the last couple of centuries, with a rise of secular (political) ideologies too, which seems to manage to bring a similar kind of rallying power behind it.

## 5.4 Religion

I will not go into how the evolutionary origin of religion in this essay. Sufficient to say there is well reasoned disagreement about whether religion –and its components– are original adaptations or by-products of existing adaptations (SEE PYYSÄINEN, I. & HAUSER, M. 2009; BLOOM, P. 2012). What I will do is look at the role of religion, and particularly towards more recent times. Religion is generally argued to be related to morality, and more specifically something that can support cooperation in very large groups, precisely the context where reciprocity and reputation are insufficient mechanisms. It might do this through its institutionalism, similar to how a high trust towards secular institutions also encourage prosocial behavior (GIULIANO, 2016). Some even argue that it goes a long way to explain hyper-sociality (JOHNSON & BERING, 2006; JOHNSON & KRÜGER, 2004). A newer interpretation is that it works to detect free-riders, by forcing in-group members to engage in costly rituals and behaviors. It is the societal, civic and communal aspect we are most interested in for our purposes, as it also seems to be a newer part of organized religion, religious experiences and beliefs likely being with us for much longer.

According to Bellah (2011), religion is a system of beliefs and practices related to the sacred (an extraordinary, but shared reality), that unite adherents in a moral community. Early religions were closely tied to the environment, often through worship of natural forces, nature spirits, animal powers, and other entities. Much of the religious activity were devoted to maintaining the environment and keeping in good faith with it. The recent, larger religions continued this focus on the natural, but 'disenchanted' it. One of the biggest changes in this shift was movement towards universalist messaging. Bellah sees this process as a result of the maturation of our cognition towards an increasingly complex world. Supporting this is the observation that modern religions seem to be becoming more secular, and civic in that they move away from the supernatural and move towards a civic moral education (BELLAH ET AL. 1985; BELLAH AND TIPTON 2006). Today, most people engage in religious practices and beliefs, which can be a big source of day-to-day pleasure (BLOOM 2010). Religion is also highly relevant to many people's lives (SHERMER 2003), as are many public debates affected by people's religious views.

Religious beliefs, like a belief in an all-seeing entity could support morality, through thinking that one is being watched and will be rewarded or punished according to one's actions. (JOHNSON & BERING, 2006; BULBULIA, 2014; BERING & JOHNSON, 2005) Adults who were told that there is a ghost in the room were less likely to cheat on a task. As were 5-9-year-olds that are told there is an invisible agent with them (BERING ET AL. 2005). When the skeptical children were removed from the analysis, the effect of this invisible agent became as strong as the presence of an actual adult (PIAZZA ET AL. 2011). In another study, people had

the choice to write down book titles or religious primers<sup>20</sup>. Writing down the religious primers made people less likely to cheat (MAZAR ET AL. 2008). Religious priming made people more generous in a game (SHARIFF & NORENZAYAN, 2007), more interested in helping distribution information about charities (PICHON ET AL. 2007), and even subliminal priming made subjects less likely to cheat (RANDOLPH-SENG & NIELSEN, 2007).

What causes these effects? It could be that primers make people subconsciously believe that they are being watched, since even subtle cues of the presence of others affect moral behavior. People were more generous in a game when exposed to "eye spots" in their visual field (HALEY & FESSLER 2005). As does the presence of posters with eyes on them make people less likely to take coffee without paying (BATESON ET AL. 2006) and less likely to litter (ERNEST-JONES ET AL. 2010). You can also get the same kinds of effects with secular moral primes (SHARIFF & NORENZAYAN, 2007; MAZAR ET AL. 2008). In any case, being primed in these ways might make people nicer to each other. Whether through beliefs in a supernatural entity (BERING 2006, 2011; NORENZAYAN & SHARIFF 2008) or arguably, a belief in heaven and hell (JOHNSON 2005; JOHNSON & BERING 2006). Punishment might be also be more effective than reward in causing prosocial behavior. There is more crime in places where people believe in heaven, and less crime where they believe in hell (GIULIANO, 2016).

It is difficult to know what effects religion and culture has on morality, and what is innate. As de Waal (2010) put it: "It is impossible to know what morality would look like without religion. It would require a visit to a human culture that is not now and never was religious." So, research focuses on what one might call more or less religious people. Controlling for several factors, religious people donate more money (including nonreligious charities); more likely to volunteer, donate blood, and give to the homeless. (BROOKS, 2006). Frequent churchgoers particularly, donate much to others (PUTNAM & CAMPBELL, 2010). This suggests that the moral boost of religion is not necessarily limited to one's in-group (BLOOM, 2012). People with religious backgrounds were also more likely to think they should sacrifice their own lives in order to save others (HUEBNER & HAUSER, 2011).

Despite this, some find believers to be no nicer in laboratory conditions (NORENZAYAN & SHARIFF, 2008; REFERRING TO BATSON ET AL. 1989, 1993). And other studies, also controlling for several factors, showed that patterns of moral judgements made by religious people were not significantly different (HUEBNER ET AL. 2011; HUEBNER & HAUSER, 2011, HAUSER ET AL. 2007, BANERJEE ET AL. 2010) Also, while the Danes and Swedes are among the least religious in the world, they are nice to one another (ZUCKERMAN, 2008). Less religious societies are actually better off with regard to several objective measures of societal health (PAUL, 2005), although this research is criticized for being highly selection-biased (JENSEN 2006). It could also be that a rise in prosperity and health of social communities can cause abandonment or rejection of religious beliefs or ideals (PAUL, 2005). However, to the degree that supernatural beliefs and drive towards shared purposes are biologically ingrained, we might expect something else to fill these roles. It has been argued, for example, that this might be behind the 20-21st century rise in political ideologies (HARRIS & PETERSON, 2018b).

Costly beliefs and rituals (e.g., circumcision and fasting) could also serve as signals of group commitment (WILSON, 2002; SOSIS, 2006; BULBULIA 2014). Freeriders would be recognized if they do not engage in these ways, which could increase in-group cooperation by building

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<sup>20</sup> In this case, either ten books they had read previously, or the ten commandments.

trust (SEE PYYSÄINEN & HAUSER, 2009). It is also a case of *sunken cost*, which is when someone has already sacrificed or committed something to a cause, that they will feel incentivized to continue this behavior. (To avoid feeling like one has sacrificed something for nothing.) This explanation bodes well with the findings that religious groups with many costly rituals tend to outlast those that have fewer, which in-turn outlasts non-religious groups (SOSIS & BRESSLER 2003). Other religious activities can also build emotional bonds between unrelated people, decreasing likelihood of defection or betrayal, or be used to reinforce commitment. Furthermore, religions might create fictive kinships, which might co-opt and extend kinship-bias to others (SEE GIULIANO, 2016). Some rituals also generate 'synchronicity' (e.g., dancing, chanting) which laboratory studies find to be prosocial effects. (WILTERMUTH & HEATH 2009). Indeed, even mimicry can increase empathy (CHARTRAND & BARGH 1999).

Religion might turn up empathy, caring and love. It might also increase one's prejudice and intolerance toward out-groups. Most research in this field looks at religiosity's effects on racial prejudice (SEE BATSON & STOCKS 2005 FOR REVIEW). In the 1940-50's, personal interpretation of the influence of religion in their upbringing, correlated with prejudicial attitudes towards out-groups (ALLPORT 1954). In the 1970s, white Christians, compared to less religious people, were more likely to disapprove of interracial marriage, and more likely to agree that blacks had less innate capacity to learn (PUTNAM & CAMPBELL 2010). Johnson et al. (2010) found that subliminal exposure to religious words increases prejudice by whites toward African Americans on a range of measures.

A recent meta-analysis (HALL ET AL. 2010) found a relationship between racial prejudice, and "extrinsic religiosity<sup>21</sup>" and "religious fundamentalism<sup>22</sup>". While greater "intrinsic religiosity<sup>23</sup>" and "readiness to face existential questions, acknowledge religious doubts, and accept change" was negatively associated with it. In any case, the relationship between religion and prejudice has declined since 1964. There is also a correlation between religiosity (particularly fundamentalism) and political conservatism and authoritarianism. Both of which correlate with racial prejudice (JOST ET AL. 2008, NAPIER & JOST 2008). So, since earlier studies rarely controlled for these factors, it could be that less religious individuals in those studies had more liberal attitudes and experiences, and that this was the thing that led them to being less prejudiced.

Similarly, a series of studies by Ginges et al. (2009) used cross-cultural and cross-religious survey data to explore the relationship between various religious actions and attitudes. They found that frequency of mosque attendance predicted support for suicide bombings, while frequency of prayer did not. (In fact, students who attended mosque more than once a day were over three times more likely to believe that Islam requires suicide attacks.) Israeli Jews, when primed with thoughts about synagogue attendance, were more likely to describe a suicide attack as "heroic" than when primed with thoughts about prayer. The same prediction pattern was also generally found for negative feelings toward other groups.

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<sup>21</sup> An instrumental approach to religion, motivated by things like social status, -security and -acceptance. (ALLPORT & ROSS 1967)

<sup>22</sup> "An unquestioning, unwavering certainty in basic religious truths" (ALTEMEYER & HUNSBERGER 1992, p. 127)

<sup>23</sup> Being "committed to religion as an end in itself" (ALTEMEYER & HUNSBERGER 1992, p. 128)

Indicating that religion exerts many of its effects, good and bad, through its force as a social glue. It may primarily be the community associated with religion that drive its effects, not the belief system (GRAHAM & HAIDT, 2010). When measured by religious attendance, the religious are happier and more generous than the secular (BROOKS, 2006). Through extensive data analysis, Putnam and Campbell (2010) showed that none of the beliefs –afterlife, creation, God as source of morals– correlate with volunteering and charitable giving. “In fact, the statistics suggest that even an atheist who happened to become involved in the social life of the congregation is much more likely to volunteer in a soup kitchen than the most fervent believer who prays alone. It is religious belongingness that matters for neighborliness, not religious believing” (p. 473).

This is also reflected in the Scandinavian countries. Christians there are somewhat secularized in belief and practice, but have strong communal feelings and tend to be well behaved (ZUCKERMAN, 2008). Community can also explain the uglier side of religion, as in Ginges et al. (2009). It is commitment to the social group that matters, reflected in participation in group activities and rituals. Furthermore, even though religion can exclude other groups, it can also include them through fictive kinships. Much of this is consistent with the hypothesis that religion is a solution to the free-rider problem, and a mechanism to bring people together, which affords the society to expand and diversify further.

## 5.5 Technology

Large societies, with their large and diversified populations, produce a great variety and quantity of wisdom and value. This is stored in various cultural products, ranging from ideas, to literature and art, monuments, architecture and even urban structure. Some of these products are very fluid and individualized, like beliefs, values and habits. Aggregation of individuals makes up relationship networks and hierarchies. These networks make up larger sociocultural patterns and products, manifest in taxation schemes, speaking-, writing-, and accounting systems, management of law & order, healthcare, intertribal/international politics and warfare, and so on. Which need spaces to unfold their varied range of activities, for communal or spiritual rituals, building and maintaining sociosexual relationships, acquiring goods and services, to sport-, artistic-, economic-, political-events and so on. These patterns of movement, communication, and collaboration are gradually given physical manifestation through architectural and urban form. To house them and represent them, and to connect them and afford their existence through various infrastructure projects. The commonality through the various scales of products is that they are created through cultural processes, and serve as tools for various purposes.

The fact that they are created also means they can be improved, and we would call those improvements technological advancements or innovations. Technological advancement is made possible almost entirely from our ability to store and transfer wisdom socially and through objects. Without the possibility of accumulating wisdom, we might not even have spears, as every person would have to reinvent the very first solutions over and over. Conversely, without imagination and creation processes, there would be very little wisdom to store in the first place (SEE GIULIANO 2016; RICHERSON & CHRISTIANSEN, 2013). Given its primacy it makes sense of why we see that technology is generally, across many different countries, transmitted persistently over long periods of time (COMIN ET AL. 2010).

An advancement in technology generally means that the new product can do more for less. Whether it means it is first to solve an existing problem, or it is more efficient than a previous technology at a narrow task, or it is increasingly generalizable and can improve a broad set of products. In Coccia & Watt's (2020) hypothesis of the evolution of technology, they point out that "Technological host (or master) systems with many parasitic technologies generate a rapid stepwise evolution of technological host-parasite systems not seen in technologies with fewer associated parasitic technologies and a low level of technological interaction." (p. 14).

Host systems are technologies that other technologies (parasites) can latch on to and benefit from. This can form symbiotic and positively coevolutionary phenomena which quickly leads to a system accruing complexity. The increasing complexity is what makes the system progress, generally speaking<sup>24</sup>, and how far it progresses depend on the ability of the original system to continuously attract and maintain interaction with parasites. (To achieve that, it must essentially be able to provide an answer to a diverse set of problems. This means that the host system must be broad and generalizable, indicating in-turn that it is in line with something fundamental.) They also argue that technological evolution follows the principles of biological evolution, which of course makes sense on a first-principles basis.

This accumulative and hierarchical host-parasite dynamic is found in all kinds of places, like the complexity in genotype/phenotype, in evolution of behavior and imitation (BOYD & RICHERSON, 1996), in the individualistic hierarchy of goals and values (PETERSON, 2017; PETERSON & HARRIS, 2022), all the way out to scientific models and computer algorithms. Arguably in any adaptive evolutionary system. By a basic analogy: the taller the building, the stronger its foundations must be. The ability to continuously improve upon our cultural products, then store our wisdom passively inside of them (and inside our own minds and muscles) in-turn become the difference between throwing rocks at the intruders of our small jungle territory, and the hyper-complex web of habituated and technologically boosted interactions that take place in the modern mega-cities of the current day.

Richerson & Christiansen's (2013) argue that the evolution of technology is dependent on the history of technology and of the population it develops in. This view of the history of technology makes sense in terms of what underlying host-parasite systems exists within the population to being with. If the population is not sufficiently technologically advanced, a parasite has nothing to latch on to, and a host system has nothing to interact with. We might also consider the population itself to be a technological system of sorts; where beliefs, habits, and relationship-structures themselves functions as a host system, whose ability to attract, implement and alter these other technologies largely shape their evolutionary future. This is in-fact directly reflective of a kind of nature-culture coevolution as well.

Further, Spolaore and Romain (2012) finds that populations that share more traits over several generations tend to be better off technologically. This is presumably because they find it easier to copy and build upon each other's innovations. Indicating that the

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<sup>24</sup>Innovations that lead to more specific (and less complex) tools are still enabled by them being nested within a larger technological system that is complex enough to enable it to serve its narrow purpose.

flow of information –through connectedness– is an essential part of the development and spread of technology. In this analogy, their communication and cooperation technology, which is stored in their brains and social relationships, is the generalized host system that affords synergy with several types of physical technological parasites. Furthermore, as the previous subchapter suggested: sharing traits, might relate to sharing beliefs, purposes or a communal identity, which is potentially a key influence in the ability to cooperate in the first place.

Richerson & Christiansen (2013) show that the history of a population is generally a much stronger predictor of economic outcomes than the history of a given geographical location (PUTTERMAN AND WEIL 2010; COMIN ET AL. 2010; SPOLAORE AND ROMAIN 2009, 2012, 2013). They argue that differences in intergenerational cultural transmission have led to divergence among populations, which created barriers between societies preventing the spread of technologies. Consider also that technologies are tools developed by a niche, intended to solve a niche-related problem. As niche-structures are different in different cultures, the technologies of one culture might prove a rougher fit in another, even potentially requiring the niche to adapt before it can be utilized<sup>25</sup>.

These barriers might partially explain the differences in income across populations over time. Reversals of economic success are also much less prevalent when considering a populations' history, rather than the history of geographic locations. Modern determinants of economic prosperity are, according to Giuliano (2016), the quality of institutions (education, healthcare, economic and political) and economic policies, violence and instability. (Not that geographic location is insignificant either. At least in terms of international trade and warfare relations and access to various natural resources. While modernization and globalization are changing the dynamics of this picture –including industrial inventions exploiting resources like coal, oil and solar power– it should come as no surprise that some environments have typically afforded larger populations than others. E.g., most large settlements are centered around rivers, lakes or oceans, and both very hot and very cold climates typically have lower carrying capacities. More under 6.1.1.) We will look at the final institution, before getting to the discussion.

## 5.6 The Built Environment

The built environment (hereafter: TBE) is the last institution/cultural product that we will look at. As indicated, TBE (at least in its modern forms) is one of the more recent steps in the cultural creation process, and it should conceptually be considered the environmental manifestation of culture. (The cultural niche-structure is our extended community, and TBE is our extended environment.) That makes TBE the physical properties of a place that –together with the cultural community– make up the affordances of our extended habitat. Being that a niche is a set of affordances, any change within TBE or the cultural niche structure will lead to a change in the niches that operate within them, and vice versa. Similarly, the carrying capacity of the extended habitat plateaus at the point at which no species can further expand its own niche.

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<sup>25</sup> Granted, this is a little unintuitive, as a problem is the same regardless of who is appointed to solve it. However, the relationships between individuals and their competences, which manage the niches closest to the problem, might not be well equipped to adopt it, even if they had access to it.

Since the affordances of a niche is not just dependent on its surroundings, but its ability to perceive it, and act on it, it means that the affordances of TBE is also dependent on their perceptibility. This makes the built environment partially determine how our cultural niche-structure is both organized, as well as perceived<sup>26</sup>. Since TBE does not just influence our cultural niche-structure, but alters and manifests itself environmentally, it becomes the new foundation of our selective pressure structure. This does not just influence how our physiology interacts with the ecological habitat, but the effects of these new interactions redefine what fitness means at its core. This change in selective pressure then travel upwards through the selective pressure structure, ultimately influencing the sexual-, social- and cultural pressures and mechanisms in return. To which degree this alteration matters is uncertain, however, it surely depends on which time-horizon one uses to measure its effects.

Yet it does not stop there. Through altering the way in which we relate to each other both visually and spatially, it also directly affects the fitness and functionality of our other adapted mechanisms. This in-turn creates ripple effects in-and-between all of these pressures and mechanisms. Since TBE manifests at the base of the selective pressure structure, it is further the most permanent and immutable of them. (E.g., the community is generally more dependent and influence by their environment, than the environment is on the community.) This suggests that changes which occur in the pressure dynamic, will generally travel more upwards than they will downwards. Further, in this way, and given enough time that; TBE would be expected to shape our future evolutionary trajectory. (As the physical environment ultimately did before it.) This bias in directional movement of adaptations is also hinted at earlier. The first stage at which cultural evolution occurs is through our minds, our beliefs, values and habits. This then influences our relationship-structures and our systems. Once sufficiently manifest in this soft type of culture, it starts shaping and storing itself in the (built) environment itself.

However, TBE is the last to arrive. Caused –and continuously affected by– all of the previous pressures and mechanisms. In some way, this makes TBE the least impactful on the human genotype. The older pressures have shaped us for much, much longer, and therefore by far more significantly. Particularly in the ways that we are affective towards them, and respond to them instinctually (that is: beyond culture). Since our history with TBE is so brief, it is highly unlikely that we are as affected by buildings, neighborhoods, districts and cities as we might have been if we had had time to adapt towards them<sup>27</sup>. With the said though, TBE does still interface directly with our adaptations towards the physical environment, as does it to both emerge out of and influence the other pressures and mechanisms.

In summary, as is my thesis, TBE is the extended phenotype of humankind. Or more specifically, the environmental manifestation of human's extended community. It is a tool which can be used to transcend or circumvent trade-offs. It does this through shaping our environmental affordances, as well as partially determine how our cultural

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<sup>26</sup> Unfortunately, aesthetics is a significant part of TBE which is missing from this essay. More on this under 6.4.

<sup>27</sup> Since we have not had time to evolve specific intuitions and motivations about the significance of TBE, it suggests that it holds less affective or instinctual power over us than it otherwise would have.



community is organized in space, as well as how it is perceived. In this role, it feeds back into the foundation of the selective pressure structure that shapes our future evolutionary trajectory.

## 6.0 Discussion

We have now gone through the selective pressure structure, and defined the built environment. While there is certainly much more research and theory that is relevant to this essay, it is hopefully sufficient as it is to outline the broader picture. Which is what this discussion-section will be about. It has three parts: what is, what should be, and how do we get there? In the first part, I will summarize what I think is significant about the research that has been presented. What I think it suggests about the problems we face at large and what it suggests about what some of the solutions might look like<sup>28</sup>. This is divided into human universals and -diversity (which is just a restructuring of what we have already covered above). I will then lay out how I think this relates to the built environment.

In the second section, I will discuss how I think what *is*, relates to what *could* be, and by extension, what *should* be? I will set a moral goalpost that I believe is broad enough to afford cooperation at large. I will then discuss the implications of such a goal, to which I will use concepts from evolutionary theory (See 1.2-5). Then, in the third and last section, I will discuss how I think we could move from *what is*, to *what should be*. That is, how do we manage to steer selective pressures and our adapted selves in a way that makes the world better? What does this imply about the field of architecture and urbanism as cultural niches? Finally, we will conclude this essay with a brief summary and by pointing our attention towards future research.

### 6.1 What is?

#### 6.1.1 Universals & Diversity

The physical environment sets the frame in which the ecological community continuously evolves, which greatly impact its carrying capacity. Its material affordances (the building blocks for organic matter), and physical properties like radiation, wind and water currents, topology and precipitation, strongly influence what its niche-structure will look like. It is not the only factor, but is also influenced by pseudo-random events, which through time, alter which pathways different niches can take and will therefore evolve in. Up until the most recent part of human history, the material conditions, local climate and ecological opportunities of the place had tremendously large effects on how humans lived, and furthermore, how TBE was constructed. E.g., like for building techniques, but also for spatial compositions and properties like heights of ceilings (e.g., managing temperature) and widths of streets and buildings (e.g., managing radiation broadly), as well as aesthetic considerations. Of course, the ecological habitat also influenced the culture

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<sup>28</sup> I am not an expert and hold not pretensions about the accuracy of my understanding. The discussion is strictly about starting to engage in the type of conversation that I believe is becoming more important to have across the scientific- and design-disciplines.

that developed, which had countless indirect effects on TBE as well.

Our relationship towards the ecological habitat is otherwise highly managed and habituated in the modern circumstance. We treat bacterial infections with antibiotics, and we have vaccines for some of the deadliest viruses we face. Most people live in places relatively free from predators, and when we do not, we can usually protect ourselves from them with things like buildings, fences or some kind of weapon or deterrence. We have set up complicated systems for growing, harvesting, transporting and selling food, which, –for most of the world most of the time– mean that we do not starve. We do not either, generally speaking, freeze to death or die from heat stroke. Many other illnesses or serious accidents are manageable through modern medicines and surgery. While there are still many diseases we do not know how to cure, and some people still live in abject poverty, these pressures are generally well responded to, compared to the other pressures. On the flipside, some modern physiological dangers have emerged, which we are not particularly well-adapted to, like cars, sugar, and cigarettes. Although they are usually –compared to the challenge of surviving in our past environments– trivial. Although not always so, which we will expand upon under 6.3.1.

Moving on, it seems that some sexual/familial dynamics are of high impact to population-wide outcomes. Of primary importance, I think, is the context in which children are raised. The literature is quite clear on the negative consequences of single parenthood, for example. Most of the negative effects of these situations might be mediated by the lack of access the children have to economic-, affective-, and attentional resources. This effect also seems particularly significant in early life. If the point on mediation is indeed the case, it suggests that the issue of single parenthood could plausibly be rectified by other-than-parents investing some of their resources in the children as well. This might be a bit tricky though, granted that biological parents are biased towards their children in a way that others usually are not (kinship bias). Which also shows up in the statistics around step- and foster-parents as well.

Another –and perhaps more natural– solution is to try to make sure that people’s long-term romantic relationships stay healthy. Or at the very least, that there is an expectation of commitment to one’s romantic relationship until one’s shared kids are of a certain age, which greatly reduce the damage caused by a divorce or a breakup, since the child(ren) are already mostly developed. Arguably, also that remarriage or a new cohabitation arrangement should be expected to delay by a significant portion, given the highly worrying data surrounding it. The arguments so far do not apply equally to every situation, although I strongly suspect them to be part of why we have had norms around both sex and family throughout deep time and across the globe.

I think it is reasonable to imagine that marriage was a religious or civic norm that originated for just this purpose. This is also suggested by the fact that marriage is a highly cross-cultural phenomenon. The research on personality also suggested the positive effects that serious romantic relationship, including marriage, had on individual’s personalities. I would therefore suggest that the more recent increase in divorce rates and decrease in marriage rate might therefore be more caused by a cultural change, than it is about the fitness of marriages in the modern circumstance. Of course, relationships and marriages can also be abusive, or otherwise unhealthy, to such extents that it is better to part ways, both for the partners and their kid(s). In any case, it seems to me that serious romantic relationship, probably marriage included, is of value both

personally and societally; although it might really be of less importance once the kids are grown up, as should there be reasonable exceptions to the 'rule'.

Point of order: Having said these things; what does my interpretation of these topics have to do with TBE? While we will answer this later in some more detail, for now we will point out that; since TBE is a manifestation of culture, and culture is our way to respond to natural pressures; and responding to natural pressures is the exact for our modern successes, it means that the success of a culture is therefore vital to the success of TBE. Furthermore, since culture is blind without reference to what it aims to manage, understanding the mechanisms which have adapted to the natural pressures are key to culture's success. Another consideration is that culture's manifestation through TBE shapes the bottom of the selective pressure dynamic, which influences itself from the bottom-up, so understand this process also requires an understanding of the mechanisms and pressures it will move through.

Since it affects itself through both co-evolutionary processes, and feedback loops, these considerations are also relevant to its long-term trajectory. I think it is important that there are individuals in or around the niche-structure that affects the culture and its expression through TBE that takes these considerations into account. While I do not pretend to know precisely what the truth of the matter is, it appears to me that there are not enough people considering these things in our niche, so I figured I would start to grapple with these topics myself through this essay. While I am aware that I am no expert, I think that it is better to initiate an imprecise conversation, than it is to have no conversation at all. And in that spirit, we will continue on.

There is also some question to what degree different kinds of arrangements of romantic relationships work, and what effect they have on society. The vast majority of the non-monogamous societies of the past (and the present) have been polygynous societies, which are in turn correlated with a series of highly undesirable outcomes (e.g., increased violence, domestic abuse, poorer educational- and economic outcomes.) This is in line with what one would expect granted the connection between sex, competition, and violence. And polygyny particularly, since men having several women mates leads to fewer single women, which increases the intrasexual competition among men, which are, in turn, more likely to resolve such competition with physical violence. However, it is unclear what the effects of an equivalent rise in polyandry would be. It is also unclear what would happen in a society where polyandry and polygyny is balanced in such a way that the normal proportion of available mates are relatively balanced. Granted that the civility within polygamous households can be maintained, then children might benefit from having more adults around. Considering sexual jealousy and kinship bias though, there is a question to what degree this is stable (however, I am not well-read on this topic).

For what sociality is concerned, it seems as if we have deeply ingrained moral intuitions tied to things like sharing, helping, and distributing resources. It further seems to me as if we distinguish how resources should be distributed depending on context, whether it should be equal, based on earning, or based on need. Since these moral intuitions have proved its adaptive utility, one could therefore argue that their complexity should be reflected in national and regional politics to some degree. Conveniently for this argument, is the observation that many of the most economically successful nations in the world have a rather mixed bag of capitalistic and social-welfare policies. That is, ideally, a balance of incentive to work to earn, and a response to need, which helps others escape

negative spiraling. I think that both of these outcomes are clearly desirable for societies at large. In fact, it might be that it is the only stable way, as societies can arguably not be too benevolent, if we are to manage the problem of free-riding. And abuse of political power and a large degree of economic inequality threatens the stability of the culture as well. The same culture that is responsible for creating and managing the gains we retrieve from the increasing sociocultural complexity.

The same sociocultural complexity in turn makes altruism less fit, and competition more intense. It also blows a few of our useful mechanisms out from below our feet. Being surrounded by strangers, the effects of both kinship bias and in-group bias lose hold, and it becomes more tenable to exploit others. Whether it is the political apparatus, groups, or individuals that can rest on the gains of other's work, or it is the lack of trust that exists between strangers, leading to scenarios where the optimal solution to various situations is not generally speaking the best solution. Or for those situations where public goods come at personal cost to only some of the individuals in the population. This might have been part of the reason for why organized religion during more recent times might have taken on more universal messaging and playing an increasingly civic role. With the growth of atheism and agnosticism, there is a question of how we maintain a shared communal unity powerful enough for the biggest scales of our large societies.

Managing communication and cooperation seems to be largely affected by normativity, and institutions by extension. Normativity simplifies various situations, as well as saves the wisdom of those situations through various cultural products. This storage is found in all kinds of place, ranging from; short-term storage, like habits, skills or beliefs; through societal institutions like social and sexual roles, patterns of communication and relationships; through longer term storage, like objects, buildings, infrastructure and urban form. Norms go from the bottom up, from being stored temporarily in human brains, to being stored in patterns of communication, to being manifest in semi-permanent structures like the environment. The second part of social cohesion is found through shared goals and identities, often created and maintained through religious activities and communities, but also through civic institutions, or subcultural groups or movements. Likely including things like voluntary work, political engagement, sexual-niche groups (e.g., soccer moms), social-niche groups (hobbies or vocations), and so on.

There are many similar kinds of considerations that apply across human diversity, although it becomes complicated very rapidly. The complexity is present regardless of whether it is ethnic-, sexual-, or personality differences. Personally, I think the latter is by far of highest interest to us, as I am not sure to what the degree the two formers are significant to TBE, particularly in the medium-to-long term. There are also other types of human diversity that I have not presented thoroughly, or at all, in this essay. Some that are broadly relevant to TBE, like life stage and physical and mental disability, while some are narrower, like very uncommon birth defects or things like niche hobbies, or certain experiences.

For what ethnic diversity<sup>29</sup> is concerned there are some physiological differences (on average), and some of which have some effect on our relationship to the ecological habitat. Like lactose intolerance, sun protection or vitamin D production, average height, and

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<sup>29</sup> Do keep in mind that ethnicity and race are not precise terms. There are no clear boundaries here, but a shared and highly intertwined phylogenetic tree.

strength of muscles or amount of fat. However, as we will see with the sexes, most of these variations exist within the categories as much as they exist between the categories. For those that do not (sun protection and vitamin D production) could be solved by simple things like shading devices, sun cream or D-vitamin supplements. However, since ethnic diversity is also usually much less prevalent than diversity in both sex and personality in a population, there is a question of whether even this difference would be significant enough to have a perceptible effect within a given geographical place.

Height might arguably have some effect across different geographic locations. Where national averages across the planet spans from 159 to 184 cm for men, and from 151 to 170 cm for women (NCD-RisC, 2020). A 20-25 cm average height difference arguably makes a difference in some circumstances, although again, this difference exists within ethnicities in the same way it does between. There are indirect ways in which ethnic diversity could impact the built environment, which we will touch on later. However, that it is not a consequence of intrinsic differences, but effects that probably stem from personality traits, in-group and kinship bias, and the fact that ethnic diversity is simply more visible than many of the other kinds of diversity. In other words, any such effects would be about managing bias rather than responding to specific phenotypic differences.

I do not find it clear either, how sexual diversity would affect TBE. While sexual dimorphism is common across species and useful in principle (because of the synergy between niches that specialize differently), it is not clear that this effect is currently particularly impactful -nor that it will be in the future. Primary sex characteristics (and reproduction) aside, there is not much obvious advantage left in male and female diversity, nor are the differences particularly large. Differences in interest are quite substantial, as are the differences in sexual attraction and strategies. These are also likely biological, as the interest divide increases as social and political gender equality increases, implying that these differences might be suppressed in cultures where the sexes are otherwise less equal. There might be some effect where different vocational choices between the sexes, for example, may make sense of some effects that could apply to TBE.

Some sex differences in personality have also been claimed, women being more agreeable, more orderly, more enthusiastic, and slightly more neurotic. While men are less agreeable, more industrious, more assertive and slightly less neurotic. There is also a difference in physical aggression/reputation destruction. There are some physiological differences, hip and shoulder ratios, height, fat and muscle-mass, bone density, sanitary needs. Perhaps most significant is overall size difference and the immoral male mating strategy that is sexual assault. This difference and the problem in itself might be responded to with the design of safer streets, and safer sexualized places, like clubs, for example. This would also conveniently help men, which are in turn more likely to be physically assaulted in these kinds of places.

Some differences indicate that there could be some differences in spaces that are heavily geared towards the different sexes. The increase importance that women put on aesthetics, for example, might be reflected in women-dominant spaces. Although, considering the substantial intrasexual variation too, it is unclear to me whether these kinds of differences in TBE would be positive, or only draw unnecessary distinctions between the sexes. I for one, much enjoy aesthetics, and would think it a shame if male-dominated spaces were robbed of aesthetic quality as a consequence, for example. With that said, if

some sociosexual niches are overwhelmingly of one sex, then some type of specific aesthetic representation or pragmatic consideration for that sex would clearly make sense. E.g., if a work place is 95% female employees and customers, then there is clearly less need for urinals than there are in sex-balanced places.

Moving on, I think differences in personality is generally the most significant for the built environment. Given that we are as diverse as we are in terms of personality suggests its general adaptive utility, although it might be that some of these traits are under movement as well (more below). These traits are likely around 30-40% genetic, the rest presumably being a result of environmental/experiential factors. We did also see that various situations have an effect on traits, even long term. Cognitive ability is also highly likely to be adaptive, being the strongest predictor of typical measures of life success, although it does not appear mutable. Finally, we saw that motivations change as goals are achieved, or as one's circumstance change.

The research on personality suggests a few things to me. First, genetic variance in personality traits might be a useful thing to take advantage of. It seems highly likely that different types of work are best carried out by individuals with natural predispositions towards different kinds of personalities. E.g., very extroverted people might generally function better and be happier working in customer service, while introverted people might generally function better and be more content with vocations like accounting, while other vocations might benefit from having relatively diverse individuals, such as teachers (kids probably benefit from a diverse set of role models), or actors (each having their natural inkling for acting out different roles). If this is the case, and people are also happier at doing jobs that suit them better, then it seems like trying to match up jobs and personality might be a fruitful endeavor.

I also think it is likely that the more complicated a culture gets, the more specific niches it must fill, and the more diversity, and atypical people become beneficial. As stated earlier though, this can also create a lot of friction. There are at least three ways that solving this conflict of interest might be approached. The first strategy is to segment the population in some way to prevent different people from creating friction in the first place. This sounds harsh, but might be exactly why subcultures exist to do. This also clearly happens in some cities, where whole districts may have a distinct character like "business", "art", or "leisure". Another strategy is to build a strong cultural identity. To create something to bind people together, whether it is based in entertainment, art, shared role models, national or regional identity, shared language, a common sense of humor, shared religious beliefs, or other things of this nature. That said, managing to find something –or enough of some-things– that can bind vastly different people together is difficult.

The final strategy is to incentivize people to cultivate their personality traits and skills. As the section on personality showed us, both clinical, non-clinical and other practices had a relatively long-term effect on people's personality traits. This indicates to me, that people can develop their character in a way that makes them better understand and interact with others across increasingly large differences. E.g., people who have gone through tough times may better understand others who have gone through tough times, or people who have tasted bliss, may better understand people who are currently blissful, and so on. By growing people's repertoire of experiences, one could hypothetically afford individuals to specialize in what they do, while maintaining their ability to communicate

across differences. Of course, this does not come for free either, but costs both time and energy from the people themselves. It is further unlikely that we should or even could force anyone to expand their character. Instead, likely the best we can do is give people the option to build themselves up, and make the step towards it easier. In any case, all of these strategies come with both upsides and downsides, as one might expect. And they are useful in different ways and is therefore probably best applied to different circumstances.

Having boasted of the value of diversity in personality, I think there will be some generally desirable trends in its evolution moving forward (and plausibly some unfortunate). While I think trends are good, I think that the way in which the changes occur, has a significant effect on people's well-being, and that this should be taken into account along the way. The traits that are of particular interest is; neuroticism, related to several negative outcomes; and conscientiousness and extroversion, which are related to several positive outcomes. Openness to experience and agreeableness is a bit more complicated. Openness plausibly being highly frequency dependent, and the utility of agreeableness might depend on the situation. It is connected to living longer and having better relationships on one side, but earning less money on the other (PSYCHOLOGYTODAY, 2022B).

Also, worth mentioning here is that research in psychology is often carried out in the WEIRD<sup>30</sup> world (E.G., BROOKSHIRE, 2013). It might very well be, for example, that some of the positive or negative outcomes of these traits are dependent on the WEIRD way of life. Although I think there's a strong argument to be made regardless. The world has been steadily migrating to the cities for a while now, and the simplest explanation for this I believe is in affordances. The city simply has more opportunities in it, more potential mates, many more people and opportunities for social connections, more things to do with one's time, more people with similarly odd interests and personalities, better and more options for careers, and generally more money to earn. The density, and the amount of people makes the city much more efficient at spending resources, and there are more people with diverse knowledge-bases that can collaborate, as is there more intense competition which generally improves productiveness.

With that said, I think that the intensity of the population density; following competition in the job and dating 'market'; and constant stream of audio-visual noise would create additional selective pressures for some traits over others. Extroversion is probably generally useful in managing the intensity. Conscientiousness is clearly useful in a highly competitive and productive job market. And both of these traits are useful for work, which improves social status, in turn, dating prospects, and on it goes. Neuroticism grabs the short end of this stick. It may have adapted particular sensitivities to cues that signal danger (See 2.5), and have other effects in the individual's reaction to these cues, leading to behavior that generally proved fit in the past. However, these sensitivities might be overstimulated in the city, with cues like loud noises, fast moving objects, and chaotic or unpredictable situations constantly signaling danger where there is none, or little. This might lead to the trait become overactivated, likely causing pathological effects over a population.

As we mentioned above, there are also fewer dangers in our modern habitat, generally speaking, so the trait may also have fewer use-cases than it used to, further tipping the

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<sup>30</sup> Western, Educated, Industrialized, Rich and Democratic.

cost/benefit equation against its utility. In some sense, this is a good thing. Since negative emotions (highly correlated with neuroticism) feel bad; if we did not need them to persist over time, it would probably be a good thing to get rid of them. This is true on the flipside as well, if Extroversion is correlated with positive emotions and general well-being, it would be a good thing for that trait to be fit, and selected for, all things considered. Although the way that these traits slowly fade in or out of the picture matters. If we can avoid the worst of the overstimulation of neuroticism in the city, for example, the trait might still slowly fade away with time, but the people along the way will be less bothered by it, which would be a good thing. In any case, while *good* and *fit* are tied together in the above statements, they are surely not the same, which we will get to under 6.2. First though, we will continue the discussion of how TBE might relate to this.

### 6.1.2 The Built Environment

While the relationships are undoubtedly complicated and not always strong, TBE will have some effect on all of the pressures and mechanisms mentioned above. We will use some examples to illustrate, but we cannot cover all of it. First, family arrangements (singles and couples without kids included) have a significant effect on how the cultural niche structure is composed –and how its individuals interrelate– and TBE is a manifestation of that. Although it is not always clear in what way, for what reason, or exactly what it is that becomes manifest; TBE can and will, in return, influence how these various arrangements are afforded, selected against, and even perceived among the population. What types and sizes of living units exist within a certain place is of great consequence, for example. The number of rooms and their sizes directly influences which family arrangements or socioeconomic niches will end up living there. As does the cost of the habitation, which sometimes moves beyond mere influence, and becomes a dividing line between those who can afford it, with those who cannot.

In this way, although TBE as it is rarely forces anyone to live in any particular place, it may yet determine where some sociosexual niches will be able to live, as well as influence where those with sufficient means end up settling. In turn, this effect influences which relationships form between which niches, and in which places, in-turn influencing the niches themselves. (Again, niches evolve dependent on the affordances of their habitat.) Because places, like people, can also become reputable, where one lives may even have an effect on how one is perceived by strangers. Where the person takes on the associations that one has with a place. E.g., if you live in a generally well-off area, people may assume you are well-off.

These types of relationships between TBE and human networks are present not just at the level of living unit, but at the level of building, street, neighborhood, district and city. Even country and continents, to some degree. Although, the strength and type of our attachments to place are not the same across different scales (SEE LEWICKA, 2011). Probably similarly to the way that we do not have the same relationship with our family, as we do with our friends, -colleagues, -neighbors, -acquaintances and strangers. These ties do not simply exist on a scale from unknown-to-known either, but respond to different needs and wants in our lives. Through that, we also use different measurements for what is considered good in these various relationships. Others have also pointed at this kind of similarity (E.G., SHIN, 2016).



That being the case, one would therefore expect that some types of social arrangements map better onto some spatial arrangements than others, and that the success of this mapping has an effect on the relationships between the individuals that are mapped, so to speak. Whether we live in private houses with our own yards, or multi-unit housing with a shared yard, or an apartment block surrounded by open space; it will influence the way in which we relate to each other. It will likely also affect us in different ways for different reasons, not simply because we might expect or be familiar with different environments, but because things like our personality likely also influences the way in which we relate to the world around us, of which TBE is increasingly the key part.

These factors, as one might expect, do in-fact show up in research on how and why we are attached to a place. However, the problem as I see it, is that our current scientific understanding of still runs quite short. The field of environmental psychology is of particular interest, yet are also particularly lacking in regards to *place* and *process*<sup>31</sup> (LEWICKA, 2011) (what one might expect the field to be strongest at). And for what *person* is concerned, it does not appear that the research factor in personality or culture that often either (SEE TAM & MILFONT, 2020). One problem of the present moment that may prevent its further expansion, could be the climate crisis. Giuliani & Scopelliti (2009) showed that; while TBE used to be the focus of the field; ecological sustainability and its related concerns became the main focus as of 'recent'. We will get back to this in 6.3.2.

This is particularly unfortunate, considering that we are living in times of rapid technological advancements and cultural changes. Also, together with the ongoing global population growth, and following expansion of our built-up areas. In Lewicka's (2011) review on place attachment, she pointed out that "The world has changed compared to the 1970s and 1980s. Considering the increased mobility, globalization, growing homogeneity of places and loss of their cultural specificity" (p. 209); yet concluded with "little empirical progress has been made compared to what was known 30 or 40 years ago." (p. 226). While place-attachment seem to be a relatively well studied facet of the person-environment interaction –and point to what seems like rather clear relationships– it is clearly more complicated than our understanding of it is. We do not even know which ways the relationships point. As Lewicka states:

*because all studies that explore associations between place attachment and other variables are correlational, it is uncertain whether attachment causes these beneficial outcomes, or perhaps it is their consequence, [...] One may easily imagine that people who are generally satisfied with their life also tend to have more friends, develop better relations with neighbors, and have a more positive attitude towards their residence place. It is also possible that some personality constructs [...] may contribute to strong emotional bonds with places on one hand, and to life satisfaction and strong social ties, on the other. Without more attention paid to psychological mechanisms of place attachment, these questions cannot be answered. (p. 218)*

And this is only in regards to individual-level place attachment, not in terms of actual

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<sup>31</sup> Part of the tripartite model: Person-Place-Process. (SCANNELL & GIFFORD, 2010)

effect that TBE has on natural and cultural processes, and, by extension, the evolution of society at large. E.g., while place attachment is usually related to positive outcomes, there are also dangers to it. It can cause decreased mobility, which can restrict life opportunities (FRIED, 2000), or unwillingness to move even in the face of natural disasters (DRUZHININA & PALMA-OLIVEIRA, 2004). Even, in some types of communities, an overly strong sense of community can negatively affect children's development (BRODSKY, 1996). This begs the question: to what degree can professionals working within the design-fields even be confident that such markers as attachment would be expected to reflect a positive outcome of their projects?

It does not appear to me either, that we have a great grasp of how things that are desirable in the moment, relate to outcomes over time. This is, of course, very significant to the picture that this essay is trying to paint. It could very well be, for example, that a rise in material living standards generally causes people to become less engaged in their local communities, which in-turn trap their well-being in a local optimum. Or that a lack of challenging situations can make people poorly equipped to deal with unforeseen problems (SEE ANTIFRAGILITY: TALEB, 2012), essentially leading to the same kind of problem. This means, for example, that it is not clear that we should even strive to make the world perfectly safe for the moment being, or at least not free from challenge. Instead, it might be that we should gradually challenge the population to expand upon their interpersonal and other skills, if they have the capacity for it (be it affective or cognitive). Even that this could and should start early. I think TBE could be a great tool for these kinds of purposes as well. (FOR AN EXAMPLE, SEE VOX, 2019)

It could also be that some urban divisions (or gradations) between niches, are generally more functional and preferable over diverse groups being equally present everywhere. The economic success of Silicon Valley is an example of the potential benefit of having many individuals with similar traits-, vocations- or interests- in close proximity to each other. The flipside is also relevant, as indicated, where diversity can cause tension. In the US, for example, creating borders between different communities increased feelings of security and attachment for both sides of the border -if the sociodemographic composition of the communities were very different. While, where the differences were not large, open borders were preferred (BILLIG & CHURCHMAN, 2003). Others have also found diversity within neighborhoods to cause a decrease in place attachment (TAYLOR ET AL. 1985). Which negatively affects collective actions, number of close friends, and general happiness (STOLLE ET AL. 2008). Particularly diversity of language decreased trust in neighbors (LEIGH, 2006).

With that said, diverse neighborhoods had higher mutual tolerance, despite the decreased place attachment (OLIVER, 2010) and the negative relationship between diversity and trust was not found in those who regularly talked to their neighbors (STOLLE ET AL. 2008). Which also suggests the importance of things like personality and culture as well. Extroversion and openness might be of particular interest in this situation, as do certain habits and social norms around neighborly relationships in a culture. Furthermore, TBE forms the environment in which we see each other, and cross paths in, and the types of spaces and structure it brings no doubt has an effect on the ease at which we communicate, or the degree to which a friendly exchange feels intuitive or 'natural'.

While diversity on the neighborhood level comes with caveats, people value diversity on bigger scales, like the city (LEWICKA, 2011). Multicultural cities attract tourists and the creative class (FLORIDA, 2002), and internally homogeneous regions are more legible (LYNCH, 1960). I think the way Alexander et al. (1977) framed the latter point is rather interesting. They stated that: "a great variety of subcultures in a city is not a racist pattern which forms ghettos, but a pattern of opportunity which allows a city to contain a multitude of different ways of life with the greatest possible intensity." And that subcultures "can only live at full intensity, unhampered by their neighbors, if they are physically separated by physical boundaries" (p. 76). Now, whether that last point is true (or if much of the research presented above can be explained through various mediating factors), I do not know. What it does indicate however, is that these considerations matter, since a gesture that was meant to bring different people together in harmony, might cause the exact opposite and therefore counterproductive effect. It also clearly points to both the value and the tension that comes with diversity, as I have suggested throughout this essay, and that the both the place and the person matters in these questions.

So, how do we begin sorting out questions and conflicts like these? Not only are several of the topics quite contentious, but they are also highly complex. Furthermore, since the world is changing rapidly, we are subjected to a large set of novel situations that are either difficult to parse out intellectually, or are socially and mentally destabilizing. On the flipside, we have also gotten hold of powerful communication-technologies, we have access to much talent in many specialized niches, we have more resources than ever, and have both highly advanced and rapidly progressing computing software and hardware. How do we thread the water then? Personally, I think the answer lies in how we have solved our problems previously, which is through cultural processes and products, enabled by communication and cooperation. Simply put: as complexity increases, so must our collaborative efforts and sophistications, and the next subchapter is about how to afford this.

## 6.2 What should be?

### 6.2.1 What do we aim for?

I think the most important thing to have for collaboration is shared goals. That there is a future out there that we would all be satisfied living in, if we knew what it was that we really wanted. Furthermore, that the bigger the goals, the more specialized the niches must generally be, and the stronger the frame for cooperation, and in turn, the more the ambition and following payoff must be broadly applicable. We will start the discussion on this topic by setting some terms straight. All things aside, we might say that regardless of what *good* actually *is*, or would look like, it is by definition preferable to *evil*<sup>32</sup>. Conversely, we might say that moving towards good is better than moving towards evil. With this in mind, we might further agree that if we do not know what good and evil is, then we should therefore figure it out, granted knowing what it is will help us to move towards the good. While some people hold very strong moral convictions, it is difficult to argue disagreement and lack of communication in itself helps anybody, and so if their position could be maintained while the problems that come from the disagreements absorb, then at least we can establish that as a shared baseline. (Furthermore, I think an

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<sup>32</sup>Good and evil here takes the place of moral and immoral, as used earlier.

agreement to the pursuit of truth achieves a similar thing.)

Some might protest for a different reason, namely arguing that good and evil does not exist; or that even if it exists, it is entirely subjective. However, subjective morality is difficult to argue, because there is always *some* reason why someone will find something good or bad. So, one might expect that if we can parse out the various elements that constitute this sense of good or bad, that we might be able to capture the shared elements of different subjective moral notions. (Therefore, still managing to form a solid ground, even if it has abstract qualities.) It is also difficult to argue that good and evil does not exist in any form, since we are always doing *something*. And doing something requires having some motivation. Which we can extrapolate to mean that we have in some way considered *some-thing* to be better than some *other-thing*. (Since we do not do that thing instead.)

One can even protest this, with the argument that we are simply machines carrying out a task dependent on automated processes. And that while the actions and their effects are describable in terms of attaining value, it does not imply that the things that are attained have intrinsic value. While that is certainly a reasonable response, it is also entirely inconsequential from a pragmatic point of view. Whether something has intrinsic value, or it is just our intellectual, affective or reflexive tendencies that makes it appear to have value, it does not change the fact that it is experienced as valuable. That is; an enjoyable experience is enjoyable regardless of whether the cause of the experience is intrinsically valuable, or relativistic in some way.

This does not at all mean that what we do will always end in the attainment of value. Or that the value attained is the best possible outcome. Nor does it mean that we always do what we think we *should* do, or that what we desire or deem to be good in the moment, is the same as what we *would* or *should* want if we were omniscient or omnipotent. What I think it implies, however, is that we have an intrinsic sense –and drive towards– value more generally, and that this is universal. Furthermore, that what we experience as good can hypothetically be analyzed objectively, and in terms that makes sense of any disagreements of what good is, or could be. Unfortunately, this essay is lacking in research on the mind. There are several topics to cover across both neuroscience and “spirituality” (such as experience, consciousness and state of mind) that would be helpful in breaking this down.

Because there is a problem with speaking of value strictly from the evolutionary perspective; just because something evolved in response to a situation, does not make it good in moral terms. And it does not make it optimal either, as it can get stuck in a local optimum. In the same way, something that is desirable and experienced as good in the moment, is not necessarily conducive to the persistence of goodness over time. In other words, while fitness is not necessarily good, movement towards a better future is dependent on fitness. This suggests that momentary displeasure can be good thing if it leads to less displeasure in the future. This kind of positive reframing of momentary sacrifice, can even cause otherwise uncomfortable sensations to become enjoyable (E.G., HARRIS, 2012) (Like the burning sensation that comes with exercise). Conversely, that momentary pleasure can be bad if it leads to less pleasure in the future. So, by combining fitness and pleasure, one might set the standard for a universal kind of morality, summarized in the question: How can we create a world that affords the most positive (and

least negative) experiences over the longest amount of time?

Such a framing is angled towards –and compromising of– both perspectives. On the one side, it asks what we should strive to move towards instead of what our current pressures and mechanisms suggests that we do. On the other side, it frames positive experiences neutrally and allows the possibility of a ceiling in momentary pleasure so that it can afford its own sustainability (See Carrying Capacity under 1.4). (e.g., the most positive experience possible might not be sustainable.) I think this interpretation of goodness is also implicit in the actions of human beings, and visibly expressed throughout human history. Even though violence and immorality are in it as well, I think we are slowly but clearly moving away from it. If this interpretation holds water, it could potentially lay the foundation of an objective morality<sup>33</sup> (SEE HARRIS, 2010). Which could afford us the shared purpose necessary to cooperate at a large enough scale that we can answer the most difficult questions we face.

Now, there will always be someone that finds a way to disagree, and that is a part of the process. However, I think that a disagreement on this very topic is logically and definitionally absurd, based on what above statements. Truth and the pursuit of good morality is cross-culturally present in religions after all, and so the cause of disagreements on that basis might be because of a lack of trust, not because one actually has different goals in mind on the broadest terms. After all, what is heaven if it is not encapsulated in *the best possible thing for the longest time?* Or Hell, if not *the worst thing for the longest time?* (C.F., HARRIS & PETERSON, 2018A) and how could anyone reasonably argue that moving towards heaven would not be good, whatever heaven actually is?

Granted that we could generally agree to this, how could we go about answering it? Surely, we would have wildly different ideas about what the answer to such a question would be. While the question is probably too vague for some to be motivated by, or know how to apply their actions or beliefs to, it is only intended to form the lowest foundation at which things are built upon, similarly to the host-system conception of Coccia & Watt's (2020). Which is why –despite the details– I have tried to keep this essay as broad as I can. Given that we have an incomplete understanding, it means that both the goal, and the way to get there must be sufficiently flexible. Since we will undoubtedly keep discovering new truths along the way, they will need to be implementable in both our 'answer' and the questions we pose.

Knowing that the person you are talking to want the best possible thing to happen, seem to me to be an excellent starting point for a good-faith conversation or disagreement. And this is essential, because there is, and will be much disagreement over any such matters. E.g., some might argue that in order to maximize positive experiences, we might simply put our *brains in a vat* (HARMAN, 1973) and pump it full of pleasure chemicals. And that the continuation of this process should be ensured by a sufficiently sophisticated and efficient artificial intelligence. However, many of us would reflexively object to such a proposal. And many of us would find such a thing to be dystopic, or even nightmarish. It seems like many of us imagine the good things about life to be about much more than chemical pleasure alone. Now why is that the case, and is it the right response? Regardless, whatever the ideal future would look like specifically, I will not

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<sup>33</sup> Objective, here also, an objective. (As in: a goal.)

speculate. It is just to say that disagreements on such matters are valid and necessarily up for consideration.

What I will suggest, however, is that since the question is framed partially in terms of fitness, it is grounded to reality in such a way that using evolutionary- and complex systems concepts will not just be useful, but essential. And that it must respond to the current circumstance in a way that is plausible to being with, and so our human adaptive pressures and mechanisms must still be managed. In this regard, a good starting point might be to ask: How do we get as many goods out of as few resources as possible? That is, how could we technically approach the question of maximizing the carrying capacity of goodness?

### **6.2.2 Maximizing Carrying Capacity**

As with the ecological community, the carrying capacity of a cultural community is considered as the point at which none of its niches can individually increase resource production or effectivization. Since immoral behaviors<sup>34</sup> spends resources without contributing any, it negatively affects carrying capacity, and close to every tool that allow us to cooperate, invent and improve can also be used to exploit, corrupt and destroy. This means, that if immorality is not selected against in a culture, then it will necessarily at some point trap the population in a local optimum, in relation to the actual degree that that is allowed. (Not to mention the negative experiences directly associated with exploitation, and the other negative consequences that usually follow such negative experiences.)

Immoral strategies and mechanisms, whether behavioral or through tool-use are passed down generations and evolve over time, in the same way, and in response to, moral mechanisms. The pressures caused by exploitation and destruction behavior increases selective pressures, which can trigger rapid coevolution on one side, and can therefore hypothetically be useful. E.g., leading to more rapidly evolving socio-cognitive mechanisms to detect other's intentions. However, it can also –and might usually– result in mechanisms that are not strictly necessary if not for the adversity itself (e.g., detecting deception), or to mechanisms that directly hinder cooperation (e.g., distrust towards strangers). These hypothetical inefficiencies or counterproductive mechanisms are not easy to get rid of, since getting rid of them in some of us, would make those same people easier to exploit, which in-turn increases the fitness of immorality. This in turn implies that we need to make cultural products that makes immorality less fit, independent of the existence of human physiological/cognitive mechanisms. Not an easy task.

This all leads to other tricky considerations too. Since culture is a cooperative process, and most –if not all– people have the capacity for being intentionally immoral, how could we even start making systems that select against it? Being selected against is not exactly a pleasant thing, and turning up the selective pressure might instead select for more sophisticated immorality. My best guess, is that to manage and gradually escape the dangers of immoral mechanisms or traits a couple of things must be achieved: First, the culture must make it more beneficial to cooperate than it is to exploit others or destroy systems. Second, since cooperative and exploitative strategies coevolve and there

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<sup>34</sup> Previously defined as behaviors that lead to unfair distributions or which damages more than it benefits. Also; morality's main function is to regulate social interactions in the general direction of cooperation.

might therefore be loop-holes continuously discovered or created, it could be that this can only be solved through the exaptation of immoral traits. That is, to redirect their functionality in such a way that it becomes –albeit unintentionally– cooperative.

It is not uncommon in nature for a species' cognitive or physiological traits to gradually morph to fulfill a different purpose as its niche evolves. A benefit of this approach is that one might be able to maintain useful pressures in a culture along the way. In our case, that might be to turn exploitation into competitiveness. Briefly explained, competition would be actions motivated by personal gain performed within a game-theoretical state that only affords such gains through advantaging others. In other words, we will allow each other to get ourselves ahead as long as we also make the world better in the process. This might overrule any benefit that immorality holds without directly adding pressure to it.

Before we continue, I want to make something clear. At some point, expressions such as 'maximizing carrying capacity' and 'population fitness' might be interpreted to mean that we should apply simple utilitarian calculations to public policy, or even something more drastic. That is not what I suggest. Fitness and optimization are much more difficult (and much less sexy) than such things like pop-flavored utilitarianism, or other utopic idealisms. But in return for those weaknesses, it is also significantly more difficult to refute when probably developed. Let's illustrate the contrast with an example from utilitarianism. There are five people who need organ transplants to survive. They all need different organs. If they got the organs, they would move forward to lead otherwise good lives. Does this situation therefore suggest that we should kidnap a healthy person (also with a good future), kill them, and harvest their organs, in order to save the other five's lives? Since 5 is bigger than 1, and we want to maximize positive experiences does it not indicate that such a thing should be done?

Well, not exactly. And it is precisely the lack of context that makes it seem like that. Instead, one might ask the question: what would happen if a political power decided that such a thing should be implemented into law? Would not the possibility of any healthy person, at any point, being murdered for such a purpose, spread fear and anger through the population? Even to such a degree it would lead to distrust, seeding into conflict, and finally revolt? Does this cost not far outweigh any benefit? If only for its potentially devastating effects? Yes, you could save a few people who need an organ transplant, but you might risk the stability of the whole of society in return. And even if such dramatic events did not transpire, the sheer amount of negative affect produced –and following decrease in life quality and negative consequences of said affect, would likely far exceed the benefit still. When all is said and done, it was not exactly a mechanism leading to betterment, or even a particularly utilitarian intervention.

If we were completely rational beings though, perhaps we would collectively conclude that this kind of altruistic sacrifice should be required of every citizen when necessary (including their family, friends and community, who would bear the loss). If that was indeed the case, maybe we would not even resist if we were asked to sacrifice ourselves in this situation. Perhaps we would even be happy that we got the privilege and opportunity to give our own life for a worthy cause. However, since it is not the case that we are completely rational beings –nor that it is obvious that we should strive to be– such a consideration makes no difference for the time being. Furthermore, one might wonder whether these kind of moral-dilemma type of questions are valid to begin with. Perhaps

they need some additional context to make any actual sense. Like asking whether the dilemma could be solved technologically instead. E.g., will we be able to figure out how to print new organs, saving everyone at next to no cost? What would it take/what investments are necessary to make that happen? Is that a worthwhile pursuit compared to other possible investments?

Another consideration of this is that, as fitness is about persistence, one might imagine that populations move towards more functional cultures over time, as instable ones tend to topple over, or be recognized as dysfunctional and therefore altered. Meaning, in turn, that if there has been little change in a culture over a very long time, then there is a high likelihood that the culture has hit some kind of equilibrium. (It is probably also stuck in a local optimum, as most things are, but we will leave that for now.) The fact that the hypothetical utilitarian scenario does not tend to appear in stable cultures, gives us another clue that it is not a particularly functional way to run a society. (Although, of course, it does not prove that it could not be functional either.) Another thing this indicates is that cultures that have lasted for a long time might have developed highly functional cultural products, regardless of which form they come in. And that the total composition of cultural products, coupled with the circumstances of their ecological habitat has proved to be stable across time, and might therefore be worth studying carefully.

Another thing this suggests, to the credit of the conservative temperament, is that we should be cautious about altering long-standing traditions if we do not understand what their purpose has been (SEE CHESTERTON'S FENCE, CHESTERTON, 1929). In all likelihood, it has fulfilled some purpose, otherwise it would likely have been selected against at some point. It is likely that in many cases, such as with various religious practices, it has selected against immoral behaviors, or altered the incentives that drive such behaviors. It could alternatively be the opposite, where some cultural niches have managed to carve themselves out a space in which they can consistently exploit others. Understanding culture as it works in the moment, and across space and time, it therefore very fruitful, even essential in moving towards a better future.

It seems to me that the more one digs into how complex systems work, as well as the optimization of them, it quickly becomes clear that simplistic notions can hardly be expected to be broadly applicable. Especially if one factors in sources of variation in the system, as is the case with adaptive evolutionary systems like us and our societies. That is, unless that simplistic notion manages to describe something so fundamental that one can be confident it will apply to a broad set of problems. Mathematics and logics are just such genres of disciplines that often seem to manage this. Although they too on occasional struggle with paradoxes.

In any case, I think it is safe to say that we do not appear to understand how culture works or how it feeds into natural selection, or how ecologies, or interpopulation –or even intrapopulation– dynamics really work. To suggest then that we know the best way that human societies should be structured would indeed seem quite foolish, and why I want to make it clear that we do not know what the best future is, nor do we know how to get there. However, I do think that we can recognize that some tools and some mechanisms will likely to work better than others, and that there are principles that do a decent job at breaking the problems down into manageable pieces for us.



## 6.3 How do we get there?

### 6.3.1 Shared Intentions

If we could trust each other with taking all the things we care about into sufficient consideration, in the formulation and re-formulation of such an important, expensive, and long-term ambition, then we might just be able to get there in the end. Besides, undertaking goals in collaborations could be incredibly invigorating. It would provide an overarching moral context to one's life. A context in which what one does is no longer just performing a job, but partaking in the most meaningful collective effort one could possibly imagine. Regardless of whether that means partaking in the imagination of what it could be like, hypothesizing what it should be like, making experiments to test what might actually work, criticizing any or all of the niches above, implementing what we have learnt into society, or managing what has been implemented.

In any case it puts into focus what it is that we are trying to achieve. It gives a common frame of reference, that as we progress towards it, may slowly crystallize into clearer principles. It may then become generally well understood and accepted as a consequence of the fact that it would be gradually revealing the truth to us. This is basically what much of science does today, as it might have been part of what religion has done for social stability over millennia. Although they have worked through largely different means and 'truths' (SEE HARRIS & PETERSON, 2017). Which is also why I think the shared intention is so important. As scientific knowledge and thinking is slowly replacing our view of reality, it may, in the process, take out religion or at least, some of its constituent parts. Which, considering what is said above about the adaptiveness of long-lasting cultures, might indicate that we are in the process of eliminating some of the mechanisms of which our cultures are founded upon (SEE HARRIS & PETERSON, 2018B), which perhaps needless to say, can have significant negative consequences.

This is perhaps the most important reason for setting a shared goal, and learning and sorting out some of the moral questions and cultural mechanisms along the way. Because if we don't, we run the risk of potentially devastating effects. This is because 'Sucker's Folly' (Described under "Trade-offs") also applies to culture. There exist scenarios in which the adaptive evolution of culture can drive a population in a direction that becomes dysfunctional over time, even potentially to the point of extinction. In other words, what works in the moment, will in some circumstances also continue to work until the problem grows to a sufficiently large size and scope that it suddenly malfunctions and causes incredible destruction. E.g., one might be able to add a floor to a building, and that would expand its capacity. One might even be able to add one or several more floors to the building. But at some point, if it continues, the structure will inevitably cave in, causing the collapse of the entire system.

This can happen to society at large or even the global order. Whereby our ecological or cultural habitat is altered in such a way that it becomes inhospitable to us. It could be rapid environmental change, ecological-, nuclear-, or cultural collapse, creation of a super-virus, artificial general intelligence and the list goes on. As mentioned, many, if not most, of the mechanisms and tools brought up in this essay afford immorality as well as cooperation. As our technology, systematic and otherwise, become increasingly sophisticated and effectful, so does their potentially destructive utility. This could reasonably be counteracted if we could set foundations for wider scale trust, as the section on religion

(and civic institutions) indicate is possible. If the intention is generally speaking to create a better future, then one might dare to ask the biggest questions, and start to think about how one might go about solving them too.

Furthermore, as we develop cultural products, without considering the context in which our species developed –or we are unconcerned with measuring its effects– we are ever more likely to create an increasingly inhospitable habitat for another reason. Given that we are still very much biologically adapted to the habitat and lifestyle of the hunter-gatherers, one should not be surprised to find that there are elements of TBE –and our cultures more generally– that we are not in-fact well suited for, or which can even be very harmful to us. This situation is generally termed maladaptation and could be very common in the modern world. The basic argument to this effect is that since there are fewer ways to make a complex system work than there are ways to break it, one should be on the lookout for unintended consequences. I.e., if we carelessly create solutions to problems without understanding the broader mechanisms it works on, or implement them at scale without carefully observing or collecting data on its effect, we might run into these problems.

And there are many examples of problems we have discovered in TBE, which we have already reacted to. The problem of sanitation in large cities goes far back in time. Lack of sunlight and clean air particularly during the early aftermath of the industrial evolution as well. Using lead in pipelines for drinking water, and using arsenic in wallpapers in the Victorian era. Or even the problems cause by simplistic functionalist notions in urban planning and housing, or using asbestos as a building material during the last century. And the question is as present as ever, what are the problems that we are not even aware of? Or, that we do not understand, know how to solve, or even care to solve?

There are some that come to mind. Like the link between mental illness (anxiety, mood disorders and schizophrenia) and city living (LEDERBOGEN ET AL. 2011), black soot (that comes from fossil-fueled transportation) and various health problems (APTE ET AL. 2015), noise in the neighborhood and dementia and other cognitive decline (WEUVE ET AL. 2020), the link between the naturalness of perceptual stimuli (particularly sound) and mood (SEE JIANG ET AL. 2021 FOR REVIEW), or a lack of exposure to allergens or pathogens causing an increase in allergies (LYNCH ET AL. 2014). Other potential problems include light pollution at night, sedentary lifestyles, lack of access to nature or “gently-stimulating” environments, and so on. And these are only links from the ecological domain, which, from my impression, we seem to understand relatively well, despite the shortcomings. At least in comparison to the sexual-, social-, and cultural effects and dynamics of TBE.

And there is no shortage of questions one might want to ask in those regards either. Like how do streets and their interrelations (e.g., how they turn, intersect, or relate to places of interest) influence us? Where are schools located and can children get there on their own, and should they even? Is it safe and enjoyable to be a pedestrian (e.g., is there life in the streets)? Are social meeting places attractive, and how does that influence the way in which we perceive ourselves, our relationships, and our world more generally? How does the institutions that our cultures provide relate to the niches they serve, in terms of location and appearance? How do these products (buildings) that house them relate to the other products in relative proximity, and how does this influence the way in which we perceive the institutions themselves and their role in society? How do the ways

we perceive the institutions reflect back upon the way we interact with them, and what does that do to the institutions over time? Et cetera.

With that said, and luckily, there is a fantastic upshot. As our societies develop, and various selective pressures are responded to in an increasingly effective and efficient way; we will have more attentional resources available. Meaning we will be able to gradually care about solving less and less impactful issues. While soot may be bad, it is not as bad as lead in our drinking water was, and yet, we will solve that issue too eventually. An argument to this effect was also found in the personality research, where personal motivations changed as goals were achieved, or one's circumstance was altered. This further makes it likely that mismatches in the modern built environment will be solved at some point, although it does demand attention and effort.

Arguably the primary way in which we can be confident that we are progressing –and that we are not risking fatal 'sucker's-folly' events in the process– is that we build into society various safety mechanisms and incentive structures to prevent it, and that these are stored passively within culture at different levels. Which is basically what we seem to have done for a few hundred thousand years already. Only difference now is that we are significantly more technologically advanced, which raises the stakes in both directions. To create good and functional products and incentive structures I think it is essential that we share the intentions of figuring out what the truth is, then using it for what is good over bad, whatever that may in-fact be.

### **6.3.2 Theory & Technology**

Given that not everyone will agree to even such a basic moral proposition, there are other useful tools that we can use as well. In particular, we could, through political bodies, alter the affordances within various niche-structures in order to incentivize more of the things we recognize as good, and disincentivize the things that we recognize as bad. Eventually, we might be able to record the results of our adjustments to the structure, to build up a data-base of interventions and their effects. Later to be analyzed to extract general principles of political governance and their relation to various outcomes. This is very long-term thinking though, as the level of complexity involved in these questions might still be much above our degree of understanding, nor do we have the computing technology to process all of the necessary data, nor do we have the data itself.

What we could do, however, is to start by analyzing what different niches within some sections of the economy are trying to accomplish, and how the niches trade values between themselves. Through that we could analyze the system of interactions and responsibilities; and where it appears that some perverse incentive connects to some observed negative consequence. We may then use the findings to construct a game theoretical scenario, and try to adjust the rules in such a way that we maintain or elevate the benefits, while we limit the costs or destruction of value. We could hypothetically even create evolutionary computer algorithms that run experiments with various possible game states, and sort out which ones are expected to work the best, given we know what the judgement criteria for its proper functioning is, and their relative degrees of importance to various outcomes. We could then potentially run those results through a neural net (pre-trained to solve such tasks) to strike some balance between optimal results on one side and the simplicity of the rule-set of the game on the other.

While that is hypothetically possible, and we are likely close (if we are not there already) to have the kind of computer algorithms that could sort these things out, we do not in fact have the substance, the data, necessary for the algorithms to process in the first place. Nor do we –to my knowledge– have the game theoretical understanding necessary to break down the various niche-structures into their constituent relationship and affordances. Nor do we know how these interact or which way they *should* interact to produce outcomes that would be good for society at large. And what is more, over time.

However, again, what we can do, is start to identify some of the problems, make hypotheses about how they might work, perform some of the relevant research or experiments, and collect some of the relevant data. During this process, we would no doubt start gaining the knowledge and understanding necessary to begin constructing the kind of complex theoretical models we would need to develop and manage a better 'game state'. While it is not easy to parse out what is good and what is bad; some cases will be more obvious than others, and it would make sense to start with these, of course. Speaking from my own field, which is architecture, I think there are relatively clear problems in the game theoretical state of the affordance/niche structures surrounding it. (Do take the following section with a pinch of salt though, as I have not worked professionally yet, meaning that these observations are all second-hand. Although I have heard several sources belay the same kind of things, also across different countries.)

The public are those who deals with the most with the effects of TBE, as are they the only ones with close to no influence on the way it develops, generally speaking. They may choose a living unit over another, but if there is more demand than supply, then their choices have little consequence for the economy. When it comes to public spaces, they also have next to no influence, nor are they asked for their opinions either before, during or after construction. Further, politicians do not stay in office long enough to benefit from long-term investments into various public goods. Given the way their reputation is key to their success, and they benefit from simplifying their job, actions and outcomes when speaking about it publicly, they are incentivized to accept projects that can give them simple statistics to present to others. E.g., "under our rule, this-and-that many living units were built". This of course, speaks nothing of the actual quality of the things made, or their effect on society at large. Nor what people actually think about the projects that were built.

This works out well for the developers, who are more than happy to supply simple numbers in their pursuit of maximal returns on their investments. This is because smaller apartments and bigger buildings bode well with both profits to the developer and the kind of numbers the politician can and want to present to the public. As an understanding of 'diminishing returns' (1.4) tells us, the maximization of one trait leads to the minimization of all others. And while no niches are completely single-minded in this way (e.g., profits), many of them are continuously and competitively driven towards just that.

To the degree that they are competent at that task, and to the degree that such strategies are permissible within the game-theoretical state of the niche-structure, the product of their niche will in-turn be accordingly bad. Housing is in a particularly odd position here, since we by any reasonable standard should call it a basic life utility. It is certainly

one of the things that are very difficult to forego in the modern world, and so have fewer tools available to change this course. In any case, while there are more problems with the developer (like how they influence politics and banking, how a few companies run most of the show, and how they are legally allowed to run price-competitions) this will have to do for now.

The architects, while they have control over the execution of the designs in many respects are also pressured constantly by the developer to push the costs down. This may result in spaces that are more cramped than they should be, or the use of designs or materials of low aesthetic or functional quality. Architects in this position are rarely organized enough within their discipline to muster significant resistance to these pressures, although the hypothetically have that option available. Furthermore, while architects are certainly the most competent on the questions of architectural quality, they are also incentivized to create buildings that are judged positively by the niches surrounding them, because it influences how much work they will get in the future. While some architecture offices may cave in to the developer's pressures and go about designing buildings as cheaply as possible, others may compete to get the high-status projects, and increase their own reputation and following access to clients in this way. (Some may also forego these situations entirely, and specialize in things like singly family housing.)

Several other issues come into play here. First, it is rarely the public that asks for their buildings to be planned or designed, and they rarely have a voice in the process either. While some cities have urban designers or 'city architects', and some large cities have significant urban planning and design departments, most do not, and particularly not smaller places. This sometimes leaves decisions around state-funded public projects up to various state employees and politicians, which often have little relevant design competence. The rest of the decisions are up to the architects, and the way they think and the incentives they respond to. Architects are generally taught architecture by other architects, and so may not have much connection to the world outside of the design and engineering fields. The architects' incentives are also partially bound-up in the world of architecture criticisms and prices, which have their own ways of measuring the quality of a project.

Since the public is rarely asked either before, during or after the project is completed, these critics have no basis on which to judge the effect of the projects from a public point of view, and must therefore rely on their own intuition or the commonly accepted views within their own niche. My impression is that this leads projects to often be judged on their artistic or novel quality (more below), over the actual effect it has on the people that will stay in or around them. Another, and more recent development that adds to the distance between the architect, critic and the public, is that the field of architecture are becoming increasingly international, as a consequences of convenient high bandwidth communication technologies, and computerized site-data and other technical- or design drawings. This might to a large degree disconnect these niches from the habitat that their products impact, in some less than desirable ways. Generally speaking, it removes these niches from the environmental-, natural- and cultural- context in which they create or criticize projects. (Although some certainly work to counteract this.)

It removes them not just from all of the small things that they would consider if they were to design a building in their own city, but it removes them from some of the consequences that the project has on the place and its population too. I think any architect

has distinctly different thoughts and emotions running through them if they design a building for themselves, a family member, a friend or a neighbor, or if they are one of ten people working on an apartment block for a city half-way across the world. Point being that the external and personal factors of the niches also come into play in these situations, and that the depersonalized aspect of some of the modern field of architecture may be problematic in and of itself. But I digress.

I think there are three primary issues for TBE at the current moment, that if dealt with, would have the most significant effects. First is that design professionals have little competence on what the fields they are working in actually do, outside of common-sense practical reasoning, and the various aesthetic influences and movements of the day. While many have a lot of work experience, and some have highly significant expertise, the quality of arguments that connect the modern design fields to the reality of human experiences appears somewhat lacking. Oftentimes big words and poetic language is used to this effect, that is, to convince others of the quality of their projects.

And while this might work well in professional communication, where reputation and appearance are important, it falls flat in other situations. I think this makes the design niches' claim to competence and influence much weakened. If they knew what effects various design decisions have on society or individuals more broadly or in-fact more specifically, and this was backed up by science, they would be in a great position to argue that their competence should not just be taken seriously, but that it should have broader impact on both the niche-structure and on projects across various scales. This would be good, because they are, in the end, the most competent at what they do. This leads to another –and arguably the more important– consequence, which is that an increase in this kind of competence would also improve the quality of what they produce.

The second problem is that the relevant fields of research are largely lacking in their relevant amount of output and in their theoretical sophistications. This might be related to a lack of research in general, but is also a technological/methodological challenge which may be largely resolvable. Today most people have powerful computers in their pockets, or on their wrists, and so it might be possible to garner large amounts of data very cheaply –with the right apps and with some public awareness and engagement. The field of computer science is also expanding at an incredible pace, and the power of the data-processing tools that come out of it might be of consequences beyond what we can even currently imagine.

The third problem, which is related to both of the previous ones, is that the niches adjacent to TBE are not sufficiently diverse, nor appears to be particularly well-connected. This may start to resolve itself starting soon, since the scientific sphere seems to be gradually moving towards interdisciplinary collaborations and diversification of their fields. This is of great effect, and presumably just what design professionals need to engage in for our field to progress further. TBE is in just such a place where it has broad overlaps with many other fields, and so would benefit –perhaps disproportionately– from partaking and playing a significant role in these kinds of collaborations.

Since TBE is very complex and highly significant<sup>35</sup>, it also further suggests that the

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<sup>35</sup> Being one of most recent cultural products, and partially determining the way in which the cultural niches are organized, perceived, and will evolve as a consequence.

niches that manage it in our societies should be equally diverse in their specialized competencies. E.g., to create a truly good spatial arrangement in a home for a specific family (whose individuals have different interests, personalities and so on) requires a different set of competencies than it takes to create a truly good spatial arrangement for an airport. These are both further significantly different from what it would take to design a great façade in a specific place and culture, or how one should go about designing a small café in a highly competitive area. Furthermore, how a city should plan their streets, infrastructure, what zoning laws in which areas, and on and on. This has implication for education as well as for architecture criticism of course.

With that said, it is not surprising that we have not grappled with many of the intricacies and effects of TBE yet either. After all, it is one the –if not *the*– slowest moving cultural product, arguably the most complex, as well as one of the newest –relatively speaking. TBE is also one of the fields in which a niche can gain a lot by taking just a little bit from many others. And as we are not particularly well-suited to notice or care about such things, any immorality or incompetence within these niches might not catch our attention like other things do. Although, I think we are starting to notice the consequences more broadly as our societies are running shorter on the more serious problems. Or at least, the problems that we understand well enough to start suggesting answers to. Personally, I believe this is one of the reasons for the growth of various ‘Architectural Uprising’ groups throughout Europe, with Scandinavia seemingly at the forefront. Furthermore, they are probably, more specifically, caused by TBE hurriedly responding to instability resulting from rapid societal change over the last couple of centuries.

I think the instability has very likely originated from the everyday technologies of the recent past, and the societal/cultural changes that have proceeded them. From the industrial revolution and its impact on material wealth and physical and repetitive labor; to the social, political and philosophical advancements transforming our political and economic structures, roles, rights and responsibilities; to the birth control pill and advances in sanitary technology and their effects on dating, sex and family; to electricity, the transistor, and the internet and their effects on the work life and communication more broadly. It seems to me that there have been several highly significant changes to the sexual-, social-, and cultural pressures we face in our lives today, compared to a few handfuls of decades ago, and that this necessarily will had had implications on both what cultures must hurried to manage, which has naturally had effects on TBE by extension. Furthermore, that TBE has been even more pressured –as well as enabled, by two world wars causing mass urban destruction, and a global population increase not before seen in human history. Not that surprising then that economic efficiency has been a major influence on the field in recent times.

We seem to generally think that technology’s relation to the built environment relates to advances in infrastructure, material science, construction techniques, and ecological sustainability, and that has certainly been the case recently. It seems to me as if we have spent much of the effort in TBE of modern times to sort out many of the environmental pressures that we have faced. Modern materials, like reinforced concrete, high strength steel and glass, had large implications on what we could make. Couple that with the history of problems with air quality, sunlight and hygiene during the industrial revolution, towards improvement after improvement in production techniques and in indoor-environment-technologies, and it makes sense of why we have focused on the physical domain.

Then we have the global climate movements which put the sustainability of the ecological habitats into question. This explains many of the other technologies –or attempt at technologies– that have since followed, like green roofs, insulation technologies, wildlife corridors, innovations in material science, urban farming, etc. With that said, there might be a question of how long significant progress is going to continue to be made in these domains though. Once we have expanded our solar and wind power harvesting, laid large power cables between countries and built significant power storage facilities, what then? The houses we build are generally well insulated, farming is generally easier and more cost-effective outside the cities, et cetera. Then if we capture and sequester carbon from the atmosphere it seems like we have solved most of these issues and that it is only a question of implementing and managing the technologies. Once we hit nuclear fission power plant production at scale, all of our energy problems may even be flat out solved without any of the above technologies even being strictly necessary.

In the rush to solve these questions, it seems to me as if the other domains at the higher levels of emergence have been lagging behind, even occasionally being attacked outright. Like the recent and sudden contention surrounding well-established concepts like human sexual dimorphism, how human hierarchies work, and whether or not culture is fundamentally an oppressive force. To me, this signals not just an issue that we should seek to resolve for interpersonal harmony and person well-being, but something that could provide us with great opportunities for technological advancement. As does it let our societies continue to progress if we do end up meeting a roadblock in the development of physical and ecological technologies. Suggesting perhaps, that is a good time to start researching and diversifying our competence around sexual-, social-, and cultural pressures and mechanisms.

And it is not even that the Modern movement has not and are not responding to some of these questions as well. Particularly, it responded to changes in sociosexual and economic niches through many, many experiments with spatial composition; as did it reject the old ideas of style and ornamentation, at least partially in response to a cultural longing for a Modern identity. This progressive and experimental mentality, is actually its strength, in my opinion. However, it is also connected to its weakness. In this process of renewal, I think the design fields made the mistake of matching their desire for novelty with an equally intense rejection of the past it emerged from. Which, considering the topics of mismatch and sucker's folly mentioned previously, is just the kind of thing that is dangerous to do. Not only are things evolving towards something new, which is destabilizing in itself, but the problem and potential dangers intensifies if the old world is simultaneously and rapidly blown apart under one's feet.

The artistic impulse itself, is in principle fine –great even– given the right situation. Which, in this case, I think would be that the continuous experimentation we perform across the world, would be counteracted by specialized niches that seek to discriminate its useful innovations from its suboptimal ones; as well as niches that seek to implement its gains into systems that afford more directed and sophisticated experimentation in the future. Being able to discern good from bad likely requires design professional to involve themselves more with various research fields, and likely that the fields responsible for planning, experimenting, implementing and maintaining TBE should diversify further. The universities could even be key players in some of these pursuits as well.



The result from these practical research efforts, coupled with the connection of the design fields with other scientific fields, could form a solid design theoretical understanding grounded in human nature and culture, which we could use to evaluate design projects and briefs at various scales and across various contexts. The growing competence could further enable us to increase the specificity of the design experiments we run, in turn, increasing our understanding of the effects of TBE. We could then save this competence in various cultural products, which would afford us the incredibly significant advantage of accumulating benefits. Not only is the potential significance in terms carrying capacity and well-being immense, but the direction of our own evolutionary trajectory would further slip out of nature's hands and into ours. (Which is likely a good thing, considering the commonality of brutality in nature.) It would potentially afford us to further externalize what we do not desire to carry on ourselves into our ecological and extended habitats, bettering our lives in the process, and ensuring our collective movement towards a better future.

## 6.4 Summary & Future Research

In this essay we have looked at the built environment from the evolutionary lens. We described various concepts from evolutionary theory and complex systems. We then used these concepts to look at various aspects of our deep evolutionary past, primarily through the topics of physiology, sexuality, family, violence, sociality, personality, and culture. Further, we looked at some of culture's most significant products, like the built environment. We then used this research to discuss: what is (human universals and -diversity, and the built environment); what could be (a universal morality that drives us towards a maximally good future); and how we could get there (through shared intentions, and game-theoretical and technological/scientific advancement.)

The range of subjects that this essay brings up is –perhaps mildly speaking– vast, so this section on future research could probably go on for 20 pages. (It won't, don't worry.) However, there were a few things that came up in particular during the reading and writing from this semester. First is that I think that this essay's structure would work well with the aesthetic aspect of TBE as well. I came across a significant amount of research that I found both interesting and relevant, which surely feels like the missing second half of this essay. There seems to be some clear links between ecological affordances and sexual/physiological signaling, the extension of our socio-cognitive mechanisms onto objects (anthropomorphism), as is it clear that religious and other cultural phenomenon rely on symbolism to transmit ideas that are too complex for basic impressions like "this fruit looks good to eat". Aesthetics also likely works similarly with some of the concepts presented during this essay, like normativity, universality, diversity, trade-offs, and so on.

It would also be interesting to look more specifically at the mind. At consciousness, state of being, emotions and experiences. How do we experience the environment and various situations, or how does it affect us? Further, from a developmental psychologist perspective– what do the various life-stages suggest about familial and social niche structure, and what should TBE aim to achieve in these regards? I also think sociology is somewhat missing from this essay, although I have a suspicion that it would pair up well with some of the game theoretical considerations presented towards the end. I also think that modern maladaptation could and should be expanded on, and that it is a promising place to look for easier-to-fix problems than the ones presented above.

In a very different style of thought, I think it would be interesting to consider how evolutionary and ecological concepts may apply directly to various scales of TBE. The sheer amount –and fit of– analogies are rather astounding, like trade-offs, traits, physiology, morphology, phenotype, niches and species. One could consider the fractal and nested state of human-made reality, and through which means variations between these objects are created and transmitted across ‘populations’, and which selective pressures function on them. One may even be able to think about human made objects as creatures in their own right, albeit not living in the typical sense of the term.

Lastly, of course there is much future research potential that would emerge as various interdisciplinary research collaborations may start to gain traction. Particularly in response to the rapidly advancing world of computer science. Dall-E 2, for example, recently showed that algorithms can now create novel pictures from text input at close to comparable levels that human graphic designers can. Once computer scientists start mixing with other scientists it is difficult to predict what may even happen. There could certainly be many large-scale transformations across and between the disciplines, and there is no reason to expect that architecture and urbanism will be any different. It may even be a prime candidate, given the complex nature of the field, and the fact that much of it is already significantly digitalized. In any case, thank you for reading!

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