Chapter 1

Ultimate explanations: Evolutionary psychology as a unifying framework and meta-theory

The term 'evolutionary psychology' (EP) was coined during "*lengthy and intensive debates about how to apply evolution to behavior*" (Tooby & Cosmides, 2005, p. 15) between Martin Daly, Margo Wilson, Don Symons, John Tooby, Leda Cosmides, and David Buss in the 1980s.

It is a relatively young and developing *way of thinking* in psychology that can serve as a meta-theoretical framework, as it builds directly on the foundations of biology. More specifically, EP is based on the only scientific explanation for the complexity of earthly life forms, namely evolution by natural selection. In the scientific community, it is largely acknowledged that humans are a product of evolution by natural selection too. We are mammals belonging to the branch of the tree of life called primates and our closest living relatives are the chimpanzees and bonobos, with whom we share a common ancestor that lived some 6 to 7 million years ago. Though such long time spans are beyond our 'natural' capacity to comprehend, consider this: the process of evolving from a light-sensitive cell to a human eye can happen in fewer than 400,000 years (Nilsson & Pelger, 1994).

Researchers named our species *homo sapiens* and contemporary researchers have determined our 'start date' to be at least 300,000 years ago, based on new homo sapiens findings in Morocco (Hublin et al., 2017). 'Start date' is a bit of a misleading term, as there is of course no 'sudden appearance,' but a very slow, invisible, and gradual change. Only after many generations can any difference be visibly noted. At a certain point, some features (such as the skull or eyebrows) become so 'typical' that scientists decide to give that species a different name, thus setting us apart from any other homo genus. This is best compared to continental drift. Once, the continents formed one big plate or one large land mass (Pangaea). The process of the continents drifting (called plate tectonics) is invisible to us, but it is still a fact that the continents have drifted apart for millions of years, meaning we now need planes or ships to travel between them. We now distinguish between Africa, North and South America, Europe, Oceania, and Asia, for example. Such large time scales can create enormous differences and variety. Think only of the variety of life that has developed on the different continents since they drifted apart, now separated by oceans. For this very reason there are no naturally occurring kangaroos in North-America.

What is EP about?

EP studies the **universal architecture of the human mind** based on four main premises:

1. Regardless of region or ethnicity,[1] human bodies are virtual identical: we have two legs, two arms, two eyes, two ears, one heart, one liver, etc., all working in the same functional way. The same is true of the brain, thus it can also be suspected that we have a 'universal' psychology.
2. Just like all our other organs and limbs, the brain must be the product of the process

[1] Ethnicity or ethnic group membership is transmitted through cultural markers such as dialect and clothing. People automatically self-identify by 'race' too (see the chapter on selection methods and the controversy surrounding race and intelligence), but that is based on morphological traits such as facial markers, skin color, etc.

of adaptation resulting from evolution by natural selection. As such, our brain contains pre-programmed, 'factory-equipped' knowledge about the world.[2] It has been 'designed' by natural selection to "*extract information from the environment and use that information to generate behavior and regulate physiology*" (Tooby & Cosmides, 2005, p. 16). Indeed, as Steven Pinker puts it more simply: "*Information is what gets accumulated in a genome in the course of evolution*" as well as through collection of information during an animal's lifetime (2018, p. 20). The sequence of bases in a DNA molecule are related to the amino acids in the proteins that make up our body.

3. The brain is a computational machine. Natural selection has systematically created a relationship between information and behavior (Tooby & Cosmides, 2005, p. 13). This process has resulted in an enormous set of heuristic rules (e.g. 'flee if you see a predator stalking you') and a mind that consists of several modules, each with a domain-specific specialization (e.g. vision).
4. Although male and female bodies are very similar in a number of ways, they are profoundly different in many ways as well: on average, men are 10% taller and 20% heavier, women have breasts and ovaries, men have a penis and testicles, men's upper body strength is, on average, twice that of women, men have more body hair and deeper voices, etc. (e.g. Miller, 1998). For that reason, EP hypothesized that there would be sex differences in the brain as well. Empirical research has indeed found differences in aspects such as spatial ability, mating strategies, differences in sexual jealousy, etc.

EP acknowledges that both inherited genes and environmental input are the basis for much of our behavior (e.g. Al-Shawaf et al., 2019). Our evolved brain architecture can generate an almost infinite number of responses to informational input, making our brain (and therefore us and our behavior) incredibly flexible.

EP thus is the unifying framework for psychology that Charles Darwin advocated back in 1859. The study of human nature is very scattered across disciplines[3] and research topics, many of which don't deserve the term 'scientific.' Most of the time they focus on immediate reasons or 'proximate' (superficial) explanations, not on the fundamental, 'ultimate' (deep) causes of why certain psychological mechanisms have been engineered by natural selection. In my view, Steven Pinker (2002), John Tooby, and Leda Cosmides (2002) were right when they wrote that a lot of assumptions in the scattered field of the social sciences (where many of the disciplines contradict each other) are plain wrong, because they simply can't be true from an evolutionary perspective. Too many people (including anthropologists, sociologists, and social psychologists) focus on the differences between individual people or cultures, whereas there is much more to be said for a universal human nature seen from an evolutionary perspective. As such, EP studies the universal architecture of the human brain and makes predictions about how humans will generally behave, depending on the context.

EP aspires to inform both the social sciences and the medical sciences (e.g. could there be a function for mild depression caused by external circumstances?). For the social sciences, it offers an entirely different framework than the erroneous one which tends to view the brain as a *blank slate* (0% genetic and 100% environmental influence) and a general-purpose

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[2] The more academic description is that our brain has "*a large number of expert systems that are domain specialized and content rich.*" This description has been used by Steven Pinker (2007, 2010) and Leda Cosmides and John Tooby (2001, 2010).

[3] Sociology, anthropology, economics, history, political science, neuropsychology, organizational and industrial psychology, clinical psychology, social psychology, interpersonal psychology, experimental psychology, and so on.

learning machine.[4] That's why EP often encounters so much opposition: a lot of fields will have to dismantle their erroneous framework and conduct a lot of work anew. Some disciplines, such as sociology and social psychology, see almost their entire theorizing threatened.

As in biology, where behavioral biology (the study of how natural selection acts on animal and human behavior) now dominates the theoretical and empirical work, empirical work will eventually lead to decisive empirical success for the EP framework.

Key words
Biology, evolutionary biology, behavioral biology, ethology, natural competences, ecology, natural selection.

■ **Executive Summary**
Theory
This high-level or meta-theory reflects Darwin's 'prophecy.' In *On the Origin of Species*, he wrote that one day the field of psychology would need to build on biology and evolutionary theory: "*Psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation*" (1859, p. 488). Although the vast majority of the medical world has accepted biology as the foundation for the field for many decades, various fields of psychology (e.g. social psychology), sociology, and anthropology lag behind. Many practitioners in these fields still consider human newborns to be 'blank slates.' This 'all is learned' view was mockingly dubbed the 'Standard Social Science Model' by John Tooby and Leda Cosmides in 1992. The SSSM assumes that all of the specific content of the human mind is derived from the environment and the social world. This denial of human nature and instincts was also criticized in Steven Pinker's seminal book *The Blank Slate. The Modern Denial of Human Nature.* Scholars of evolutionary psychology acknowledge that most of our behavior must be viewed from an evolutionary perspective. Humans are creatures that have been subject to the laws of evolution by natural selection just like any other animal species. Therefore, looking at our behavior from this perspective is theoretically very sound.

EP thus focuses on the species-typical 'architecture' of the human brain and on 'human universals' rather than individual differences. The theory predicts that evolved features in our brains (and the rest of our bodies) still have an impact on modern life. It posits that **genes and environment interact** (mainly through the brain). EP views nature *versus* nurture as an outdated, false dichotomy: it is nature *and* nurture. EP acknowledges the complex interaction between our inherited nature from our ancestors and our current environment. As Cosmides and Tooby put it: "*Every aspect of an organism's phenotype is the joint product of its genes and its environment*" (Cosmides & Tooby, 1997, p. 14). The brain should be viewed as an 'input-output' machine where the environment is the input, computed by the brain with built-in competences (and individual differences, think of our different personalities), resulting in behavior as output (which can sometimes be exactly the same, or independent of the individual, or sometimes radically different, dependent on the individual).

As a logical consequence, **culture is a product of human nature, not vice versa**, and thus reflects universal tendencies. Of course, the interaction between our evolved brains and different environments has created different kinds of cultural habits ('evoked culture'), a

[4] This was mockingly called the SSSM or the *Standard Social Science Model* by Tooby and Cosmides (1992).

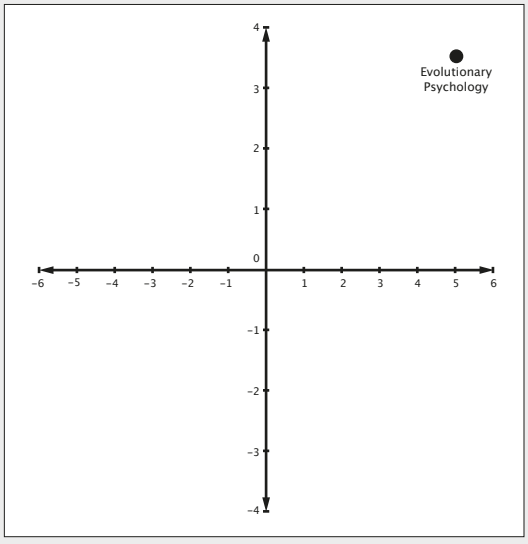
fact that is also acknowledged. A recent (and in my opinion exciting) theory is the idea of ***Cultural Genomics***: the idea that there are "*truly interactive processes between culture and genes*" (Chen & Moyzis, 2018, p. 780). If we look at *common* variants in the genome, all human populations look the same, but by studying *rare* variants, research has revealed many group variations in genomes. Part of this variation is the result of (1) adaptation to local environments (such as altitude adaptation, bitter taste adaptation, skin color, lactase persistence), (2) sexual selection, (3) epigenetic effects (e.g. methylation, earlier onset of female menarche), and (4) social selection (e.g. self-domestication resulting in lower aggression, assortative mating, education level) (Chen & Moyzis, 2018).

Empirical Data

It is too difficult to summarize which predictions and retrodictions have been successfully tested by evolutionary psychology research, so I will only name a few. One of the most important hypotheses advanced by EP is that our brains are 'modular'—containing a large number of information-processing modules that are 'specialized.' This modular brain hypothesis has amassed a large body of evidence from different lines of research: genetics, linguistics, brain imaging, brain surgery, etc. We have readiness modules with built-in natural competences for acquiring language, for social interaction, for altruism, for theory-of-mind, for cheater detection, and for facial recognition.

Just like other social animals, our lives are ruled by a limited set of large (meta) motives: in our struggle for survival and reproduction, **we both compete** (agentic motive to get ahead and to take care of ourselves and our relatives) **and collaborate** (communal motive). Our complex brain has expanded another motive: the need to predict and control our environment has resulted in a meta-motive to predict our future and make sense of things.

The theoretical/empirical grid



Conclusion
The theory is in line with evolutionary biology and offers testable hypotheses and retrodictions. EP has become a multidisciplinary research domain, gathering the brightest researchers from different fields of study, including biology, anthropology, medicine, and psychology. Evolutionary psychology provides new ways of thinking about literally every topic in psychology and thus can be used as a framework to serve as a first test for midlevel or mini theories.

Moral Assessment
If we really want to know how our psychology works, we need to study biology and the interaction of biology with our environment, just as biologists need to know chemistry and physics. Understanding human nature better will help us find strategies to counter phenomena we dislike such as warfare, racial or sexual discrimination, workplace bullying, unsound internal competition reducing the beneficial outputs of collaboration, etc.

Discussion

■ **Theoretical soundness**

Evolutionary psychology is the meta-theory that psychology needs. EP is the bridge between biology and the psychological sciences, which is currently a very scattered field (e.g. clinical psychology, consumer psychology, industrial and organizational psychology, experimental psychology).

Although EP focuses on human universals, it cannot ignore nor deny the many individual differences between people and even groups. For example, David Buss and Lars Penke acknowledged the existence of "*omnipresent, substantial and consequential*" individual differences (2015, p. 4). I will deal with those recognized differences in the chapters on the 5FM and 6FM of personality and in the chapter on recruitment. But there are also group-specific differences: evidence has been found for adaptations to local environments: think of altitude adaptation (e.g. people living on the Andean and Tibetan plateaus), skin color (lighter skin in the higher latitudes), lactase persistence, the balance between malaria resistance and sickle cell disease, etc. Sometimes these adaptations implicate different genes (genotype), but nevertheless have the same effect (i.e. the same phenotype, for example for malaria resistance). Sexual selection leads to assortative mating (e.g. females with a higher education select males with a higher education), and we have somewhat self-domesticated ourselves by creating systems such as judicial systems (laws and law enforcement) and education systems, which might explain the decline in aggression and violence (Chen & Moyzis, 2018).

There is a big difference between sociobiology and evolutionary psychology: sociobiology tries to explain human behavior based on the gene-environment interaction and within the rather limited perspective of the survival and reproduction of all animals. Evolutionary psychology on the other hand only studies human psychology, but looks at all aspects of human psychology, including the extraordinary role of the brain: how it serves as an 'interaction device' with our environment. EP acknowledges the creative capacities of the human brain.

Psychology cannot exist without biology, chemistry, and physics
In Part II, I explained the following figure:

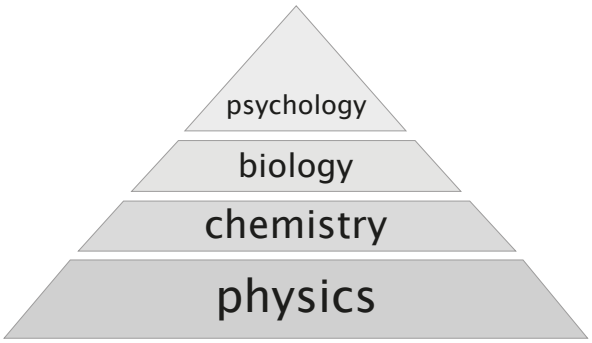


Figure V.1

I explained in Part II that this figure should be read from the bottom up and not top down, which would suggest a 'reductionist' view. A reductionist view implies that all of our psychology is 'only' physics, therefore reducing it to a simplicity that flies in the face of the complexity of the human organism and our incredible brain. On the contrary, this figure is meant to be read bottom up. Chemistry builds upon physics and simply wouldn't be possible without the fundamental building blocks of physics. Biology builds upon both physics and chemistry. Simply consider the fact that our bodies consist of 50 to 60% of water (Total Body Water), depending on age, sex, weight, etc. Not only is our blood a wonder of chemistry as anyone who has ever had their blood examined would know—but so is the brain. Our brain combines chemical processes (e.g. to transmit messages from one neuron or brain cell to another neuron using neurotransmitters) with electrical processes. I can't think of a simpler and better way to explain how physics and chemistry are the building blocks of the brain.

Biology adds complexity… and so does psychology
But this simplified view does not sufficiently account for how biology draws upon chemistry. Biology did not create new 'natural laws,' though it surely uses a lot of the physical forms of matter and demonstrates the laws of physics and the principles of chemistry in an unprecedented way (Raven et al., 2014). In fact, biological systems are probably the most complex chemical systems on earth. Moreover, the complex biology of our brain allows for intelligence. We are endowed with a kind of super intelligence, allowing us to think about ourselves, our lives, and even of the future of our planet and its other living inhabitants. Our own biology testifies to the immense complexity created by billions of years of evolutionary processes. Our psychology is at least as complex as our other organs, if not more so. I refer to Part II for more discussion on this topic.

A crude summary of the status of biological research
To make the case for the meta-theory of evolutionary psychology, I must first explain some aspects of our biology. It really is the science of Life. This science has progressed so much, and acquired so much knowledge, that it is truly closing in on 'the' description of the molecular workings of the cells that make up our entire body and the bodies of plants and animals. Single cells gave rise to the complex multicellular organisms that are so prevalent on our planet. Cells form tissues and tissues form organs, which are organized into living organ-

isms, such as plants, animals, and humans.[5] The sun has been the constant source of energy that allowed organisms such as plants to use photosynthesis to convert this energy and contribute to the earth's atmosphere. Other organisms, in turn, eat these organisms and so on. How could so many different organisms emerge? The answer is evolution. Charles Darwin is undoubtedly one of the greatest scientists of our modern times, who, after years of study and observation, advanced and documented the theory of evolution. Although refined and extended, his theory is now considered a *theorem* by the majority of scientists. A theorem is a theory that has been proven beyond any doubt, something researchers only do very rarely because they always want to leave open the possibility that there is a better explanation. However, we now have so much convergence of proof in other research fields that no one should cast doubt on this well-established fact (for an overview, see Jerry Coyne's *Why Evolution Is True* or Richard Dawkins' book *The Greatest Show on Earth*).

Evolution is the outcome of *at least* five general, evolutionary forces:

1. First of all, in order for things to evolve and adapt, **genetic mutation** is key: in passing on genes to the next generation, random changes in our DNA occur (sometimes pedagogically called *DNA copying errors*),[6] and this process creates **variation**. Each human cell contains forty-six DNA molecules (each DNA molecule is composed of two strands twisted around each other—the double helix), each forming a chromosome. Each molecule also carries genetic information in the sequence of bases A, C, G, and T.[7] It is in these sequences that 'copying errors' or mutations occur.
2. **Genetic drift** is the second random process. By chance, certain allele frequencies change from one generation to the next. Genetic drift does not produce adaptation, but it can produce nonadaptive (neither useful nor harmful) features in DNA—hence it is sometimes called **neutral selection**. This has been empirically confirmed for some bits of DNA. It can sometimes overpower natural selection, especially in small populations, where certain alleles can rise to 100% frequency and others might get lost entirely (e.g. if certain individuals that carry those alleles do not reproduce). For example, this can explain the incidence of genetically based diseases in small human populations (nobility, for example) as it tends to decrease genetic variance in a population (e.g. Coyne, 2009, Lynch et al., 2016).
3. The most well-known force by the general public is **nonrandom natural selection** (most people forget the nonrandom part, hence the many misunderstandings that evolution is an entirely random or blind process). **Positive selection** increases the frequency of beneficial alleles, whereas **negative selection** eliminates detrimental alleles. It is the most important force and for pedagogical reasons it is often referred to as the 'natural designer' as it can adapt organisms to the challenges in their environments (which is why it is not random). Positive selection can result in **fixation:**[8] when an allele has a frequency of 100% in a population.
4. **Social selection** is a subtype of natural selection in which the resource at stake is social exchange with nonrelated people. We compete for social partners (e.g. to have friendships, to work together, to form a coalition, etc.). In social selection, "*the em-*

[5] Beyond any doubt, we are animals too—more specifically, mammals belonging to the branch of primates. Thanks to our high intelligence, our effective communication, and our dexterity, we are one of the most successful living organisms on the planet. Now let's hope we are also wise enough not to destroy it.

[6] Most mutations are deleterious and thus weeded out. Different species also have different mutation rates (e.g. Lynch et al. 2016). It is estimated that each individual per generation has an average of 70 new mutations (Keightley, 2012), but because some harmful mutations are not weeded out when they arise, we carry a number of deleterious mutations, resulting in at least 500 brain-disruptive mutations (Keller & Miller, 2006).

[7] The bases or nucleotides are A (adenine), C (cytosine), G (guanine), and T (thymine).

[8] This can be the result of a '**complete sweep,**' which is a reduction in genetic variation because of positive selection of advantageous alleles, leading to a 100% frequency of these alleles.

phasis is on forces of selection that arise from choices about relationship partners and group membership" (Nesse, 2007, p. 145). If an individual possesses certain traits, that individual will be given a selective advantage. Social selection could offer a partial explanation for our coalitional psychology (see later) as well as for the shaping of extreme (costly) traits, signaling our capacity and willingness to collaborate.

5. **Sexual selection**[9] is the force that selects for traits because members of the opposite sex feel attracted to them. Sexual selection often comes with *costly signaling* of fitness (think of the male peacock's tail or conspicuous human spending). The resource at stake are sexual mates.
6. **Gene flow** is the process in which genes move from one population to another, because they sexually mix.

There are other conceptual definitions that I will also use in this part of the book:

1. **Balancing selection** is the term referring to the genotype:[10] it is a process by which multiple alleles (these are different versions of a gene) are actively maintained at a certain locus in the genome of a population. For example, having one copy of the variant gene hemoglobin beta HBB^{SC} results in malaria resistance, but two copies result in sickle cell disease, leading to death. Both alleles HBB and HBB^{SC} are kept in the gene pool (**incomplete sweep**).
2. **Stabilizing selection** is the term referring to the phenotype or the observable: it is a process that reduces or weeds out individuals at either extreme end (pole) of a phenotypic range or distribution, thus reducing the variance in the population. Research has demonstrated for several traits that individuals at either extreme end of the phenotypic distribution have less fitness. For example, the birth weight of human babies falls under stabilizing selection. This is the most common form of natural selection (e.g. Sanjak et al., 2018).
3. **Directional selection** refers to the process that favors one phenotype over another, causing allele frequencies to shift in one direction. This kind of selection is usually observed in environments that have changed over time.
4. **Disruptive selection** refers to the process that selects against the average individual in a population. It results in disappearance of the mean of a phenotype range, and the appearance of more phenotypes at both extremes. It is the rarest type of natural selection and can lead to two or more new species forming.
5. **Purifying selection** is the result of ongoing negative selection, causing the removal of deleterious alleles as they arise.

Of course, humans have used **artificial selection** as well, as humans selectively breed plants or animals to choose desirable traits.

All organisms have evolved adaptations to their environments that help them survive and procreate. Evolutionary theory in itself is the grand meta-theory that consists of several sub-theories: *descent with modification* from a common ancestor (Charles Darwin, 1859) powered by the mechanisms of *natural selection* (Charles Darwin, 1859), *sexual selection* (Charles Darwin, 1871), *kin altruism* and *inclusive fitness* (William Hamilton, 1964a, b), and *reciprocal altruism* (Robert Trivers, 1971), *parental investment* (Robert Trivers, 1972), and *parent-offspring conflict* (Robert Trivers, 1974).

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[9] Some authors consider sexual selection to be a subtype of natural selection and even of social selection (e.g. Nesse, 2007).

[10] Genotype is part of who we are, as the result of our set of genes or our unique genome. Our phenotype however is the expression of these traits, or in other words, your observable physical and psychological appearance.

It is clear that we are also the product of evolution: humans are not extraterrestrials. It suffices to look at our DNA and see how much we share with other animals and living organisms to understand that we too are inevitably the product of evolution by natural selection. We share[11] up to an astonishing 98.8% of our DNA with chimpanzees and bonobos. That's why we sometimes laughingly call them our 'cousins.'[12] We also share about 80% of our genome with cows, 75-80% with mice (although 99% of mouse genes seem to have human analogues). Because of the similarities between human and animal genes, researchers often use animals for medical purposes in biomedical research (e.g. Elsik et al., 2009). A long-standing myth is that we share 50% of our genes with bananas, but even if we look at homologs, it is highly unlikely that a banana could outdo fruit flies (40–50% gene match, still). However, even **these** numbers lead to the inevitable fact that **all life is related**. On a cellular level, there is a lot in common between all living organisms, indeed pointing to the common ancestor Darwin once retrodicted. **Today, biologists have reached a very large consensus that all organisms, including humans, have descended from the same cellular structure.** Sometimes this common evolutionary past is very visible, since the same bones are present in many types of vertebrates. The diversity and complexity of life can be explained by evolutionary change over billions of years.

Biologists not only study how cells work, or how DNA codes for certain features, but they also study animal behavior. This topic encompasses fields such as ethology, animal cognition, behavioral genetics, behavioral ecology, sexual selection, and learning. Animal behavior is not only shaped by natural selection (for example, instincts), it is also controlled by internal processes such as brain processes and hormones. In the biologists' view, it is beyond doubt that a lot of behavior can be traced back to its evolutionary origin. The adaptive value of male lions fighting each other to gain control over the pride is that the winner manages to add his genes to the gene pool or next generation (this is called 'reproductive success'). Of course, just like in humans, input from the environment shapes their behavior as well. Besides our instincts, animals can also learn from environmental input.

Ethology studies the behavior that is the result of an animal's innate instincts, or *programmed* behaviors. If you look closely at the behavior of pets or other domesticated animals, you will soon find that these animals perform behaviors that they did not learn from their parents or other adults. Some behaviors come quite naturally because they are programmed into the content that is enshrined in the DNA. For example, I am sure my dog never saw her parents digging a den or covering up their excrement because the parents never had the chance to perform such an act, having lived on a concrete floor. Our dog, however, has instinctively displayed this behavior (to my regret she has dug many a den in our garden). Take an example from the wild: fish and birds can swarm in a highly synchronized manner thanks to fast instinctive neural circuits. Or consider the species of ant that can close its jaws in only 33 milliseconds by following an impulse. There is often no time for thinking when it comes to survival. That's why evolution has 'designed' fast and frugal heuristics in our and other animal brains that are often very efficient in the natural environ-

[11] Depending on what you compare. The figures used are based on *protein orthology comparison*. This comparison does not tell the whole story of course. Just look at the differences between chimps and humans. Not all animal genomes have been sequenced yet. If you use another 'measure,' the differences become larger: e.g. if biologists look at the number of *amino acid differences* in the *hemoglobin polypeptide*, for example, it becomes clear that some animals (such as frogs) are very distantly related to humans—though still related). A common mistake is to not distinguish between genes and DNA, although they are related. Genes are a small section of the DNA string that contains the instructions for making a particular protein.

[12] See, for example, the website of the American Museum of Natural History (www.amnh.org).

ment. The fact that the nervous network involved in this fast behavior is often made up of few neurons is why they are called frugal.

Behavioral genetics studies the contribution of heredity to behavior. Beyond the old and fruitless *nature versus nurture*[13] debate, **we now know that behavior is the result of a complex interplay of internal mechanisms and contextual input**.[14] Human interpersonal behavior too, for example, is the result of personality interacting with the environment in a complex fashion. Behavioral geneticists try to determine the exact percentage of a behavior that is solely attributable to genes. One method is to breed animals by using artificial selection and making hybrid (crossbred) animals. For human behavior, twin studies[15] have long dominated research efforts. Animal research has definitely demonstrated how genes impact behavior. For example, hybrid birds[16] changed their nest building and courtship behaviors in a way that was intermediate between those of their parents. Another example: male birds who were only exposed to songs of other bird species failed to sing a structured song. Only hearing songs from males of their own species resulted in good singing. The previous studies could not identify which genes played a role in behavior, but thanks to new research methodologies such as *Molecular Biology* and *Genome-Wide Association* studies, researchers are now unriddling ever more functions of single genes or combinations of genes (called *poly*genetic influences). Using animal research, biologists found out how learning was dependent on genes: song acquisition in birds depends on learning, but only from members of their own species, for example. Learning does not happen if the right set of genes are not in place. The most striking example of course is the cuckoo: all adults sing the song of their biological parents (the cuckoos) instead of the song of their foster parents. These examples demonstrate the complex interplay of environment and genes, and how genes are ultimately a necessary condition.

Some of the most important findings, concepts, and sub-theories in evolutionary biology and ethology are the following:

- **Survival and reproduction** are the drivers for life on earth.
- **Nonrandom natural selection:** natural selection leads to the survival and reproduction of the fittest or the most adapted to the current environment. It is nonrandom because it increases the frequency of *certain* alleles[17] (and thus traits) in a population because the mutations in the alleles offer a reproductive advantage in the *current* environment. It also gets rids of harmful alleles. Environmental pressures can be things like an (1) arms race between prey and predator, or (2) the harshness of environments (e.g. regions with cold climates or droughts), etc.
- Besides *nonrandom* natural selection, there is another major evolutionary mechanism that can create genetic change that is called (random/neutral) **genetic drift**.

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[13] The defenders of *nature* insisted that the behavior of an individual animal or human was mostly determined by the genes inherited from its parents, whereas the defenders of *nurture* maintained behavior was influenced mostly by learning and experience.

[14] The starting point for the research of evolutionary psychologists is that the development of an individual is the result of a complex interaction between its genes and the environments (biological, social…) it experiences during development (Tooby, Cosmides, & Barrett, 2003).

[15] Although twin studies have the enormous advantage of capturing all genetic effects, they are mainly based on twins of European ancestry. Future research will hopefully reveal whether or not this poses problems for the current heritability estimates. For example, African populations have up to 33% more genetic variation (see chapter on recruitment).

[16] Hybrid birds are birds that have two different species as parents.

[17] An allele is a variant of a gene: each gene has two copies—one from each parent—at a specific location on a chromosome (called a locus). Remember that a dominant allele will result in observable differences, called phenotypes.

This involves random changes in the frequency of alleles in a population caused by the capriciousness of reproduction.

- Natural selection favors strategies that maximize lifetime reproductive success. **Life History Theory** (LHT) is the theory about the complete life cycle of an organism (growth, maintenance, and reproduction). An important aspect of LHT is the trade-off between the quantity and quality of reproduction. Every species has a kind of trade-off 'strategy.' Basically speaking, organisms can either invest in fertility (r-strategy—'live fast and die young'—emphasis on quantity) or in survival and growth (K-strategy—emphasis on quality).[18] The timing of reproduction may vary—for example depending on the available food in the environment—as well as the quality and quantity of the offspring itself. Some animals mature rapidly, live relatively short adult lives, make large efforts to reproduce at a very early age, have a large number of offspring (with high mortality rates), and have low parental investment. These species are called 'r-selected organisms' or r-strategists. *r-selection* is defined as selection pressures from the environment that favor rapid reproduction. Environments that are dangerous, have low food availability, or are otherwise unpredictable, favor fast reproductive strategies. Other species mature more slowly, delay reproduction, have a very limited number of offspring, and invest more in parenting. Safe and predictable environments generally favor slow reproductive strategies. These species are called 'K-selected organisms' and include humans.[19] K-selection is defined as selection in saturated environments, which favor the ability to compete and avoid predation (see Dobzhansky, 1950; Wilson & MacArthur, 1967; Stearns, 1976). Even within species there is some variation depending on the environmental input. For example, whereas humans as a species have a very late reproductive age, we still see the impact of poverty on menarche and reproduction timing: think of teenage pregnancies in poor countries and neighborhoods. Life history strategies also have an impact on behavior such as risk-taking, mating, (in)fidelity, caregiving, cooperation, etc. (Del Giudice et al., 2005).
- **Intersexual selection** is the active choice of a mate. In most species, the female chooses her mate because she often has the largest gametes, leading to more selective mating and higher parental investment.[20] This is the origin of the following witticisms: *the male hunts, the female chooses* and *maternity is a matter of fact, paternity a matter of opinion.*[21]
- **Kin selection** results in behavior favoring closely genetically related individuals over less genetically related or non-related individuals.
- Social species (or group living species) both **compete** (often intrasexual competition occurs, for example males competing for territory, status, or females) *and* **collabo-**

[18] r/K selection are drawn from standard ecological algebra, where **r represents the growth rate** and **K the carrying capacity** or the maximum number of individuals that an environment can support. The Belgian mathematician Pierre François Verhulst published a logistic function that was later adapted by Raymond Pearl and Lowell Reed.

[19] The fast-slow LHS continuum is useful for understanding human variation as well, but there are other factors that impact LHT variation, such as parental harshness and childhood unpredictability (e.g. review by Richardson et al., 2017).

[20] Gametes are sexual reproductive cells such as pollen, sperm, and eggs (most of the time the egg is larger than the sperm). In most sexually reproducing species, including humans, females have larger gametes and a higher metabolic cost and parental investment (e.g. women's single reproductive cycles are about 28 days, pregnancy lasts nine months, and in our ancestors' and contemporary hunter-gatherers' lives, breast feeding could last up to four years) than males (sperm cells are produced constantly). However, in some species, males are the choosier sex and invest more in parenthood. This has been documented for the Mormon cricket, pipefish seahorse, and Australian cassowary. See, for example, Buss, 2005.

[21] In humans, some monkeys, and many birds, female ovulation is concealed, so a male can never be certain of his fatherhood.

rate. Both motivated behaviors help to survive and flourish and to produce offspring that reach adulthood and can reproduce in turn.

- **Emotions** are physiological changes in the brains of animals and humans. Emotions are often followed by three responses: (1) an autonomic response facilitates (2) the behavioral response (e.g. by directing blood from the digestive system to the muscles) and emotions are also followed by (3) a hormonal response that serves to reinforce the autonomic responses.
- **Sexism** is the inclination of a *portion* of male animals,[22] including human males, to control the sexuality of the female. The main reason is that males, not females, are susceptible to cuckoldry, i.e. males are deceived into raising the offspring of other males. As such, males have a genetic incentive to not only pursue mating with several females, but also to control the sexual behavior of 'their' females, particularly their short-term mating strategies. Human males therefore have a biological tendency to control females in many aspects: their sexuality, freedom, and labor (Pinker, 2011 & 2018, Schmitt, 2005; Wilson & Daly, 1992). That's why some traditional cultures and religions value the chastity of daughters so highly. The relevance for a work environment is, for example, that (a) cultural norms such as equal rights must be deployed against male sexist discrimination against women, particularly in leadership positions, and (b) that hierarchical abuse, i.e. sexual exploitation, should be investigated and punished.
- **Altruism** is reflected in behavior that benefits another individual at a cost to the actor and either a lack of or delayed *repayment* or reciprocation. Cheating behavior in many species is prevented by reciprocal altruism: if I do this for you now, I expect you to do this for me (later). Some species like primates also use punishment to force conspecifics into fair collaboration.

Evolutionary psychology as a subfield of biology

Since we are an evolved species like all others, it logically follows that many of these findings also apply to humans. Indeed, the goal of research in evolutionary psychology "***is to discover and understand the design of the human mind***" (Cosmides & Tooby, 1997, p. 1). EP takes into consideration that our biology, and thus also our brain, is the product of billions of years of evolution. It draws heavily on knowledge and principles from evolutionary biology or ethology **and acknowledges there is a genetic basis that is universal and human species-typical.**[23] EP studies those universal features and leaves the study of individual differences mainly to behavior genetics research (this field of study tries to find how much of the differences between people can be accounted for by their genes).

John Tooby and Leda Cosmides, generally considered the founders of evolutionary psychology, frame the entire field of psychology as follows: "*Psychology is that branch of biology that studies (1) brains, (2) how brains process information, and (3) how the brain's information processing information generate behavior*" (1997, p 3). They advance five principles drawn from biology that serve as 'thinking tools'—the fifth is very relevant for the workplace too:[24]

> ***"Principle 1.*** *The brain is a physical system. It functions as a computer. Its circuits are designed to generate behavior that is appropriate to your environmental circumstances.*

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[22] For an overview, see Chapter 13 (Malamuth, Huppin & Paul) of *The Handbook of Evolutionary Psychology* by David Buss.

[23] This should reassure people on the far left and Platonic Idealists, but surprisingly most are hostile towards EP.

[24] I highly recommend reading this seminal paper by visiting the *Center for Evolutionary Psychology* website. (http://www.cep.ucsb.edu/primer.html).

Principle 2. *Our neural circuits were designed by natural selection to solve problems that our ancestors faced during our species' evolutionary history.*
Principle 3. *Consciousness is just the tip of the iceberg; most of what goes on in your mind is hidden from you. As a result, your conscious experience can mislead you into thinking that our circuitry is simpler that it really is. Most problems that you experience as easy to solve are very difficult to solve—they require very complicated neural circuitry.*
Principle 4. *Different neural circuits are specialized for solving different adaptive problems.*
Principle 5. *Our modern skulls house a stone age mind."*

This means that most evolutionary processes are very slow, often spanning several hundreds of thousands of years, and most of our evolutionary history took place when our ancestors were hunter-gatherers.[25] The agricultural revolution (some 12,000 years ago) or the industrial revolution (150 years ago) mean nothing on the timescale required for evolution to select for new complex cognitive brain programs. Some call this the '**mismatch hypothesis**': a lot of our preprogrammed behavior was selected for when our ancestors lived as hunter-gatherers in archaic environments. Some of this behavior is not always very productive in modern Western societies (physical violence at work is rarely, if ever, productive, for example). But evolution cannot anticipate the future, so selection favored only those 'brain programs' that were beneficial to adaptive problems faced by our ancestors thousands of generations ago. Evolution certainly did not program us to thrive in what is our current modern environment.

In general, EP tries to explain **WHY** we do certain things, not *how* our brain performs the functions such as vision, hearing, or cognition. These are fields or topics of research, whereas EP is not a field nor topic, but a *way of thinking* about our psychology.

Furthermore, EP serves as **the necessary meta-theoretical framework** to partially respond to the strong criticism of psychology as a research domain. Scholars from other domains (such as biology and philosophy), as well as scholars from within the psychology community, have criticized psychology research for its lack of theory. According to them, too many research efforts focus on mini-aspects of human life and fail to include theories that could explain the observed phenomena. Replication efforts have painfully demonstrated that without a good explanation (theory), there is a significant risk of publishing 'first studies' and marketing 'small' research results that are untenable (false positive findings). According to Jesse Marczyk, "*Without theory, all you have is a grab bag of findings, some positive, some negative, and no idea what to do with them or how they are to be understood.*"[26] Indeed, **replication failures** have been noted in experiments concerning priming effects (e.g. flag priming conservatism, currency priming influencing system justification, brief exposure to physical warmth on interpersonal warmth and prosocial behavior), embodied cognition effects, the effect of cleanliness on moral judgments, the moral licensing effect (if you write about positive traits, you donate less to charity and cooperate less), the ego-depletion effect (if you are tired, you have less self-control and become more racist, violent, risk-taking, and addicted), or facial feedback theory (does putting a pencil between your teeth really result in more positive affect?).[27]

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[25] There is evidence of rapid or punctuated change as well: for example, lactase tolerance in adults and resistance to malaria in certain populations.

[26] See this blog: http://popsych.org/i-find-your-lack-of-theory-and-replications-disturbing/.

[27] Most of these replication studies were published in a 2014 special issue (volume 45) of the magazine *Social Psychology* (Hogrefe Publishing). I also include some notable failures in my list of consulted sources.

Relying on EP as a theoretical guideline in psychological research could prevent false positive results from too easily finding their way to the many magazines that are eager to publish. Together with some other measures such as (1) preregistration of research hypotheses and methodology, i.e. prior to the actual data gathering for research, and (2) the obligation that the research must be reproducible (replication of results), including EP as a theoretical guideline could contribute to avoiding the many scandals that have plagued the field of psychological research over the last decade. After all, as the researchers from the Open Science Collaboration wrote: "*Scientific progress is a cumulative process of uncertainty reduction that can only succeed if science itself remains the greatest skeptic of its explanatory claims*" (2015, p. 950).

In the next paragraphs, I will discuss some aspects or findings of EP, since they are relevant to the chapters to come.

Specialized brain circuits

William James was one of the first 'psychologists' to assume that the brain has multiple specialized neural circuits that are the product of our evolutionary past. He called those specialized neural circuits instincts. He was right: the human brain is modular and consists of several networks or specialized areas. These 'modules' are sometimes 'spatially located' (they can be found in the same areas in our brains), but very often the specialized neurons are distributed over networks. Both the spatially localized and the distributed networks have functional specification. **There is no such thing as one big brain or a 'general purpose machine.'** Many psychologists oppose the modularity idea because they found a statistical factor for intelligence called the *g*-factor. This statistical finding, in their view, is evidence that the brain is not really modular, but a kind of general device. To refute the idea of brain modularity, they often refer to early speculations, such as the writings of philosopher Jerry Fodor (1983), and often misquote him as someone who viewed brain modules as *only* pre-programmed, fast, and quite closed entities. This is a bad case of selective reading. As you know from previous chapters, I will deal with the empirical evidence in the section on the empirical findings.

It is a bit of a shame that so many psychologists still oppose the idea of (massive) modularity, as this terminology is widely accepted in **evolutionary biology**. Indeed, modularity is the term that evolutionary biologists use "*to describe the decomposition of phenotypes into underlying components and processes*" (Barrett, 2015, p. 39). This modularity is most likely a prerequisite for all complex organisms as Craig Nelson notes: "*Modularity pervades every level of biological organization. From proteins to populations, larger biological units are built of smaller, quasi-autonomous parts*" (2004, p. 17). Of course, as in any truly scientific field, there is a lot of debate going on, but the consensus arising from both theoretical and empirical work is that modules can be *nested*, i.e. they can be part of one (larger) module on one level and be part of others on another level. Consensus is growing about the *hierarchical nature* of modularity too: at the broadest level, a large brain module regulates our limbs (arms and legs), but this is broken down into smaller functional regions or modules; at the sublevel there are modules for our arms (left and right); at a lower sublevel there is a module for our hands; at still a lower hierarchical level we find the neural tissue commanding our thumbs and the neural tissue for other fingers. This has been confirmed using **fMRI studies**. It is highly likely that this hierarchy applies to all features of the brain, thus explaining, for example, why psychologists find one *g*-factor (*general intelligence*)—at least *statistically*.[28]

[28] For an in-depth discussion of g, see the chapter on selection methods.

Open, closed, and readiness modules

The view of contemporary evolutionary psychologists such as Robert Kurzban, John Tooby, Leda Cosmides, or Clark Barret is that we have both *closed* and *open* modules. Closed modules are modules that 'do what they are designed for' (a domain-specific function) with no or almost no input from the environment, although different inputs do lead to different behaviors as each evolved module is 'designed' to deal with environmental input. Closed modules "*are much less forgiving of mistakes*" "*(for example avoiding toxic foods and deadly predators)*" as "*in many cases (it) would be too hard, too costly, or too dangerous to relearn from scratch in each new generation."* Open modules "*admit a large amount of trial and error-learning*" "(*for example mating and courtship*)" (citations from Del Giudice, 2019, p. 26). Rather they are designed by evolution to interact with our environment and to learn. A very good example is our language module: the language we speak depends on the language community into which we are born.

Moreover, several modules have *multiple* domain-specific functions. Indeed, many of these modules have pre-programmed instincts or heuristics, and they work so well and require so little effort that researchers have ignored or been blind to these *natural competences*. Producing sight, hearing music, and being able to 'see' other people's intentions based on eye gaze are such automatic and effortless computations that we take them for granted. But many modules have also evolved in such a manner that they allow us to adjust to our environments, whether they are natural settings (e.g. finding clues to find food and water) or social settings (e.g. making social decisions depending on the situation). The human brain consists of both modules that are rather intuitive (fast and frugal) and modules that allow us to reason (slow and effortful).

Ignorant views of modularity	Views of biologists and evolutionary psychologists
Modules are only non-conscious or automatic.	There are both conscious/volitional and non-conscious/automatic modules. There are both modules involving automaticity (e.g. hearing) as well as modules requiring effort (e.g. reasoning).
Modules would require their own set of genes.	Modules share genes and are likely hierarchically related. Although they are all subcomponents of the nervous system, they contain some unique features and specialized functions.
Modules must have their own unique set of neurons.	Most brain cells are part of several neural networks or modules and can 'serve' different functions. e.g. the amygdalae are involved in both processing fear and memory tasks.
Genetically, we differ only 2% from chimpanzees and bonobos, yet we are radically smarter and physically different (phenotype), so genes cannot explain the human brain.	Although we share many genes with most other animals, the endless combinatorial possibilities of genes, gene sequences, and gene expression result in an astonishing diversity in phenotype. Evolution had plenty of time to turn us into very different beings despite sharing many building blocks (genes). The same building blocks can result in radically different buildings.

Ignorant views of modularity	Views of biologists and evolutionary psychologists
Modules stand on their own and are rigid and fixed.	Most modules evolved to flexibly adjust to our environments/contexts/situations. Some of these (open) modules are even highly learning-dependent.
Modules must be spatially located.	Modules are functionally organized, not necessarily spatially enshrined. Most modules are not isolated but are spread out over the brain in networks. Some are spatially located as medical cases and brain surgery have demonstrated.
We cannot have an evolved module to drive a car.	A lot of (open) modules allow us to learn and to adapt to new situations.
Modules would have to be independent from other modules.	Most modules interact with other modules and there is probably a hierarchical ordering. It can be compared to the composition of a car. The car is a whole, but it can be broken down into different parts that interact with each other.
Modules necessarily must be narrow (a very narrow, specific function).	There are many broad modules.
The findings about brain plasticity rule out modularity or specialization.	Brain plasticity is an expected feature of an evolved brain because selection shaped our brain to flexibly adapt to the environment. Brain plasticity is also not without its limits, in adults it is mostly restricted to neighboring areas.

From an evolutionary perspective, we can retrodict why this modularity was useful: one explanation is that functional specificity can result in a faster brain, which may have been useful to our ancestors who often needed to respond a quick fashion, e.g. to the imminent threat of a predator such as a lion. Another explanation (both can be true at the same time) is that it promoted greater resilience: if one part of the brain is damaged, this does not mean that the whole brain is dysfunctional. A brain like a general-purpose machine without compartmentalization would break down entirely. Other explanations are of course also possible or compatible: for example, the fact that there are quite a lot of spatially located brain modules could be the result of selection pressures. This would have led to reducing the (energy) cost of connections in the neural networks.

Quite a lot of these modules are called **'readiness' modules** because they need to be activated through interaction with the environment. If the eyes of rhesus monkeys were covered for a period of 6 months, for example, the animals would never see.

It is important to understand that it is not because our brain is modular that it would be fixed, static, or inflexible. It is now relatively uncontroversial that most functions are the result of the complex interaction between innateness (genetic inheritance) and the environment. Take for example our innate language module. It is 'ready' to absorb language: what language is absorbed or learned depends on the environmental input: the language

your innate language module learns will depend on where you live as a child. You can safely say that our biology (readiness module for language) and the environment (input of language from others) are equally important.

I would like to offer some examples that clarify how some modules have preprogrammed, natural competences. Few people seem to realize how complex human vision is. It requires a complex organ like the eye and a connection to the brain. When light hits the retina, photoreceptors communicate through synapses with different kinds of cells (bipolar cells, ganglion cells, amacrine cells…). Several regions of the brain such as the visual cortex, the hypothalamus, and the tectum receive visual information. This seemingly easy and effortless task is in fact not easy at all. It is thanks to millions of years of evolution that we experience this ultra-complex process as something easy. In other words, a brain is 'engineered,' 'tinkered,' or 'designed' by natural selection so that it 'comes with content' or 'factory-equipped knowledge about the world.' These specialized functions feel so obvious or self-evident that they were overlooked by most lay people and researchers. Other self-evident programs in our brain include love for our children, fear of predators, courtship behavior, coalitional decision-making, etc.

To name but a few specialized modules or specialized networks that have been identified so far:[29]

- our theory of mind (our capacity to understand the minds of other people, thus developing a theory about them), sometimes called empathy;
- an innate language module[30] (including a set of grammatical rules found in every language studied thus far), making it 'easy' for young children to learn the grammar of a language (compared to the difficulties most children experience with math);
- the visual centers (most are spatially located in the occipital lobe in the back of the brain);
- centers for hearing, taste, and memory;
- a module for numbers;
- a gaze detecting module;
- a sexual orientation module;
- a module to regulate reciprocity (also called our intuitive economy);
- a spatial orientation module;
- a cheater detection system;
- a kin detection system;
- a face recognition module;
- several emotion systems.

The clash between blank-slatism or the SSSM and EP

Many anthropologists, sociologists, social psychologists, and Platonic Idealists still deny that human nature exists. According to their view, humans are born as blank slates: with no pre-knowledge of the world, no readiness modules, no instincts, and no genes that affect our brain and hence our psychology. They are still angry with Barkow, Tooby, and Cosmides for their book *The Adapted Mind* that shunned their outdated view of the human mind.

They accused EP of something EP researchers never said or wrote: genetic determinism. They accuse EP of viewing genes as deterministic, meaning our genes would control 100% of our behavior and other features. We would not have the slightest grain of free will.

[29] An overview is provided in Barrett and Kurzban, 2006.

[30] The core of this module is topographically located in two areas in the left side of the brain: the areas of Broca and Wernicke, named after their discoverers.

Contrary to their accusations, both biologists and evolutionary psychologists view genetic determinism as indefensible. Rather, EP holds an interactionist view or a systems perspective: our brain is an input-output device, so to say. The input we get from our environment makes us react differently (output). Our brain (which hosts our intelligence and personality traits) is the result of endless tinkering by evolutionary processes like random mutation, genetic drift, gene flow, sexual selection, and natural selection.

Not only does the field of EP fully support the importance of environmental input for behavior, as it leads to different behaviors due to environmental variation, it also dedicates a lot of effort to studying psychological differences across societies (or cultural differences). One such framework is called **behavioral ecology** (Davies et al., 2012), which studies how environmental pressures lead to variation in animal and human behavior, even if the underlying genes are identical. So far, this field of research, as well as many related theories and subtheories, has already found a number of environmental features that can elicit different behaviors, habits, and cultures: population density (e.g. high density can lead to slower reproduction and fewer offspring—something that is also found in human populations); genetic relatedness (e.g. there is higher collaboration among genetically related individuals); sex ratios (e.g. both in modern, large-scale societies and small-scale hunter-gatherer societies, if there are more males than females, then men are more monogamous,[31] marry more, and divorce less); resource ecology (e.g. is sufficient food available, without too much effort & time, and not much fluctuation? If this is not the case, it can lead to increased boldness and aggression); mortality likelihood (e.g. if life expectancy is low, reproduction speeds up, with humans having their first children at earlier ages); pathogen[32] prevalence (e.g. if the environment contains a lot of parasites, this can lead to earlier reproduction and increased preference for physical attractiveness, as this signals a performant immune system); and cultural ecology (Sng et al., 2018).

What is the relevance for the workplace?
Hear me out when I say it is hugely relevant. We can't brush off millions of years of evolution, nor can we ignore our human nature with its upsides and downsides. Let's see what evolutionary psychology can tell us about organizational life.

The impact of our pre-programmed brain modules on modern organizational life can be seen in the following phenomena:

- Social exchange is still a pervasive and central part of human social life; this is true for aspects such as learning (probably the reason why learning social skills without human interaction is very difficult), leadership, collaboration, etc. Ignoring the fact that humans are **social animals** with needs and guiding principles (such as fairness) will result in a dysfunctional organization.
- Our brains evolved over millions of years, allowing us to live in bands of 20 to 100 people (some put the maximum at 150), which causes a lot of **coordination problems for big organizations** nowadays.
- **Leadership** as a coordination effort is a feature of human life that took millions of years to evolve (promoting in-group collaboration, preventing and solving in-group conflict, coordinating competition, or fighting with out-groups). It is highly unlikely humans could suddenly do without leadership and become self-organized without any leadership.

[31] There is evidence of a universal transcriptomic mechanism that determines the degree of monogamy across vertebrates, including humans (Young et al., 2019).

[32] Pathogens are microorganisms such as viruses and bacteria that can cause disease.

- The tendency for males to try to **dominate others and gain power or status** (admiration) from their functions and jobs. This also results in derogation of competitors through a variety of strategies such as (physical) aggression, gossip, coalition building, and networking. Dark Tetrad traits and behaviors are displayed significantly more by men.
- The **underrepresentation of female leaders** in top positions and the wage gap can be *partially* explained by sex differences such as male risk-taking, the male need for dominance, the higher rate of narcissism in males, their larger body size and physical strength, but is also as the result of evolved sexual divisions of labor,[33] female preferences, and women's obviously larger parental investment in children (9 months of pregnancy and subsequent lactation). Of course, this doesn't imply that we should ignore or downplay other *partial* explanations, such as discrimination and other prejudices, for example the misled notion that women who have given birth are less emotionally stable (e.g. Gatrell et al., 2017).
- The abusive use of power positions, including **inappropriate sexual behavior** by (mostly top) leaders.
- The **greed and desire for power** that some top level leaders display.
- The difficult balance between **(internal) competition and collaboration**—and the resulting 'ideological' views: some leaders believe in 'healthy internal competition' including creating incentives such as 'employee of the month,' awarding individual bonuses, etc., whereas others believe in common goals, collaborative efforts, participative methods, etc.
- The problematic and **unproductive competition between departments or teams** caused by our coalitional nature, or what is known in the scientific literature as in-group versus out-group negative stereotyping, which leads to unproductive competition.
- Regarding some natural phenomena, our brains are extremely fit and rarely make mistakes. For other human-created and complex aspects, such as financial markets, our brains make mistakes rather often. These mistakes are well-known in the **bias**-literature.
- Our need to reproduce and our parental capacity to love our children influence our views on of **work-life balance**.

This list is not exhaustive. For example, some researchers are looking into lower-level aspects of organizational life. Margaret Lee and colleagues hypothesized that men sometimes display higher levels of unethical behavior in negotiations because of evolved sex differences. They indeed found that unethical behavior was most pronounced "*when their mating motivation was activated, and when they negotiated with attractive men,*" thus providing evidential support for their hypothesis that "*the greater level of unethical behavior among men, compared to women, is a consequence of an evolved male intrasexual competition strategy*" (Lee et al., 2017, pp. 2036 and 2037). Others found by following ecological logic that if employees with physically demanding jobs perceive job scarcity through the media or internal communication, they reduce their level of effort (Pietesa et al., 2017). As these two examples are first studies, much more research and replications are needed. My position is that I/O research should really take more of an evolutionary perspective as it could help resolve longstanding questions and debates.

[33] Male hunting, fishing, and fighting versus female gathering of plants and seeds and caregiving.

Misconceptions about EP

As the founders of EP predicted, EP is not without criticism, much like how ethology, sociobiology, and evolutionary biology were heavily criticized before it. An initial problem is that quite a lot of people do not criticize EP for scientific reasons, but because of **biased ideological reasons**. With regard to EP, the Platonic Idealists and politically far-left leaning people are well-represented among the critics. Before you accuse me of being right-leaning, let me say this: I think both sides are problematic with regards to science. I consider both a far-left and a far-right leaning tendency for scientists problematic, because science is supposed to be neutral and objective, not biased or ideological. Yet bias is indeed prevalent. A recent meta-analysis of effect sizes reported in 51 experimental studies conducted in the United States involving 18,815 participants showed that both U.S. liberals and conservatives had the same mean levels of bias regarding political topics such as gun control, global warning, capital punishment, education policy, etc. This meta-analysis settled (or should have settled) the debate as to whether conservative people are more biased than liberals ('the asymmetry hypothesis') or whether people from both partisan parties would show the same bias ('the symmetry hypothesis'). The researchers convincingly argued that the results clearly show support for the symmetry hypothesis in the article on the meta-analysis as well as in a response to a critique (Ditto et al., 2018 and 2019). Participants from both sides of the political spectrum showed a tendency "*to find otherwise identical information more valid and compelling when it confirmed rather than challenged their political affinities*" (in press, p. 2). This tendency was present regardless of the sample: students, adults, or a representative sample of U.S. citizens. It also occurred regardless of topic: scientific and nonscientific information and politically charged topics.

The findings of this study are entirely in line with the vast body of research into confirmation bias and motivated reasoning, as well as the literature on coalitional psychology or in-group versus out-group bias. However, the researchers expected that, depending on the topic, either liberals or conservatives would be more biased. In a direct test of this expectation, Bo Winegard, Cory Clark, Connor Hasty, and Roy Baumeister hypothesized that U.S. liberals would have more bias towards perceived victim groups such as blacks, women, and Muslims. They hypothesized that there would be a personality trait to explain this tendency, which they called equalitarianism. They conducted seven experiments involving 3,274 people. They found that liberals consistently showed "*bias against information that portrays a perceived privileged group more favorably than a perceived victims' group*" (in press, p. 1) on two topics, namely IQ differences between black people and white people or between men and women. The higher the score on the equalitarian measure they developed and validated, the more bias among liberals (Winegard et al., 2018).

In the U.S., liberals are probably over-represented in social research, especially sociology and social psychology. Although several researchers such as Jonathan Haidt (well-known for his research on morality) and Philip Tetlock (well-known for his research on politics and expert-bias) raised this hypothesis earlier, Yoel Inbar and Joris Lammers (2012) were the first to empirically examine it. They found that 85% of social psychologists from a discussion list[34] identified as *socially liberal* (or in other words, on the political left) and almost consider **equality to be a *sacred moral value*** (Duarte et al., 2015). **Biased thinking because of a left-leaning tendency in the social sciences has been documented on several occasions.** This tendency is called **equalitarianism**, stemming from an aversion to inequality. For example, researchers found that **most sociologists deny nature** as a cause for differences

[34] SPSP = the Society for Personality and Social Psychology.

between male and female humans and even… nonhumans (I kid you not) (Geher and Gambacorta 2010; Horowitz et al., 2014; Martin, 2015; Winegard et al., 2014).

In the **physical and biological sciences**, a few professors fall in 'the middle of the road' (2.4%), there are fewer far-left leaning individuals (11%), and liberals (48.8%) still outnumber conservatives (12.1%) by a large number (HERI survey, Eagon et al., 2014). Of course, as confirmation bias and motivated reasoning are pervasive, they do not regard their in-group ideology as a bias, but as a truth. That causes problems in the peer review process: research articles investigating hypotheses that deviate from the sacred equality norm are often refused.

Sam Abrams (2016) explored a database from the *Higher Education Research Institute* (HERI) at UCLA containing data of tens of thousands of professors who were surveyed triennially. This survey included a question that asked the professors to score themselves on a five-point ideology scale (far left, liberal, moderate, conservative, far right). His data analysis showed that since the 1990s, a lot of left-leaning U.S. academics leaned even farther to the left, whereas the distribution of moderates, conservatives, and liberals has changed little in the U.S. population as a whole. This 'left-leaning' tendency of academics is even more problematic, if you consider this fact: out of 335 social scientists surveyed by William von Hippel and David Buss in 2015, only one (!) identified as far right, and only 5 as right (1.5%), whereas the mean score was within two points of the liberal end of an 11-point scale (Buss & Von Hippel, 2018; Von Hippel & Buss, 2017).

In *The Blank Slate*, Steven Pinker has convincingly demonstrated how leftist politics has posed a problem for the study of human nature and even compromised the quality of research. Both far sides of the political spectrum have regularly attempted to curb free speech, under the (often false) pretext of (cultural) racism. In the first half of 2017, academics like the sociologist Charles Murray, biologist Bret Weinstein, and evolutionary biologist Richard Dawkins—a member of my Champions League—were intimidated and silenced in the United States. The number of attempts at **disinvitation** from the left is rising faster than on the right.[35] But it's not only the political left that has problems with science, far right-wing leaning politicians and their voters have also shown a high degree of disrespect for science lately, particularly in the United States.

Another interesting finding from the Von Hippel & Buss survey was that, although 88% of respondents answered that evolutionary theory was likely to be true, the endorsement dropped to 55% when it came to evolutionary social psychology. Left-leaning students and academics, as well as Platonic Idealists, don't like the study of sex differences (I refuse to use the word 'gender,' although I know that it refers to psychological feelings rather than our biology). If differences in 'tendencies' between the sexes are reported (e.g. such as differences in jealousy, differences in preference for sexual variety), these critics **commit the reasoning error that tendency implies inevitability**. Of course, not all heterosexual male humans cheat on their girlfriends or wives or become violent if their girlfriends or wives cheat on them. Another reasoning error is the belief that finding sex differences might lead to justification of unequal treatment of women and men. That would be a serious misuse of scientific findings, but why should such objective findings inevitably lead to misuse? They err.
Von Hippel and Buss see another possible explanation for people's discomfort with evolutionary psychology: the *natural fallacy*, or the erroneous belief that *all that is present in nature is good*. It is a clear fallacy if one only considers the atrocities committed by animals

[35] https://heterodoxacademy.org/the-skeptics-are-wrong-part-3-intolerance-levels-are-high/

and nature; for example, killing the offspring of competitors, poisonous plants and parasites that slowly yet brutally kill their hosts, diseases that have decimated entire populations, etc. Nature isn't good or bad. According to human notions of good and bad, it contains both. Be sure to read the paragraphs on our coalitional psychology further on in this chapter, because as John Tooby wrote on edge.org (2017):

> "*Forming coalitions around scientific or factual questions is disastrous, because it pits our urge for scientific truth-seeking against the nearly insuperable human appetite to be a good coalition member. Once scientific propositions are moralized, the scientific process is wounded, often fatally. No one is behaving either ethically or scientifically who does not make the best case possible for rival theories with which one disagrees.*"

Other criticism of EP is raised by some psychologists themselves, for example by wild speculation from the 'lesser gods' in the field of psychology. Sadly enough, some psychologists do not understand EP, yet still claim to be evolutionary psychologists. Some psychologists who call themselves evolutionary psychologists have indeed made the fatal mistake of believing their theories without generating and testing several hypotheses. Some of them (like Satoshi Kanazawa[36]) are highly controversial and have been criticized by serious evolutionary psychologists such as Steven Pinker or biologists like Jerry Coyne. Thanks to the scientific rigor of EP researchers such as Leda Cosmides, John Tooby, David Buss, Steven Pinker, and many others I surely forgot to mention, EP is now considered a mature science by biologists like Jerry Coyne and Richard Dawkins and by philosophers of mind like Daniel Dennett. But it is a hard-fought status.

Some people refer to EP as '**just-so stories**' (mere speculation), and ask '*how can you know the past without fossils? Behavior does not fossilize!*' First of all, this is not entirely true, as hard evidence of past behavior *has* been found. For example, **fossils and human remains** have been found that are the result of human behavior such as fighting (leaving cutting tracks on bones), eating habits (the study of ancestral teeth reveals a lot about eating habits and the origins of cooking food, for example) or taking care of disabled co-humans (individuals who reached an age that they could not have reached without the helping behavior of others). A lot is known about the conditions in which our ancestors and our non-human cousins lived, thus enabling the development of plausible and testable hypotheses. Moreover, multidisciplinary EP researchers have been finding a number of ways to test EP hypotheses about human life. These **diverse research methods** encompass the study of clinical populations with developmental disorders or brain lesions, have performed cross-cultural tests, and have studied biological effects such as uterine effects and methylation systems to study the Gene x Environment interactions, etc. (I provide a more extensive overview in the following paragraphs). Second, new theories within EP have also allowed for **retrodictions**: some phenomena can be better and more parsimoniously explained by EP than by previous theories. There is nothing wrong with explaining facts: it is what scientists in many fields, including the hardest science (physics), do: take gravity, for example, or the Big Bang that happened about 13.5 billion years ago. Just because science has difficulties to explain the past doesn't mean it isn't possible**. Just as scientists like Albert Einstein or Charles Darwin had to find explanations 'after the fact,' evolutionary biology and evolutionary psychology do the same, and the best scientists do this with the academic rigor and integrity that is to be expected of them.** EP can 'retrodict' how the mind might have evolved and make predictions that can be tested by conducting experiments. Third and last, a lot of EP research isn't just based on observations only, in fact, a very large proportion

[36] A group of 68 evolutionary psychologists issued an open letter on May 27, 2011 in which they rejected his views. Another article was published by Penke and colleagues (2011) in *American Psychologist*.

of the research is theory driven and hypotheses are launched to find out facts that were previously unknown. EP is no more prone to just-so stories than a lot of other research domains, such as geology (you can't see the continents drifting), astrophysics, or cosmology.

Another criticism is that EP would imply that behavior is solely determined by our genes, disregarding any influence from the environment, and thus our behavior would be genetically determined and inflexible. Contrary to what some critics say, **EP refutes genetic determinism and focuses on interactionism.** The fact that our brain is 'packed' with hundreds of specialized circuits makes it an incredibly flexible *device* for interacting with our environment. Indeed, our brain serves as an 'interaction' instrument with the environment, meaning **our genes and the environment interact all the time via our brain**. In other words, our behavior is the output generated by our brain after it is fed environmental input. This interaction is extremely dynamic. Even though the architecture of the human brain is universal, our behavior is not, because people live in different environments. For example, people in different cultures express status in different fashions: some use cars or diamonds (e.g. in some Western countries), others use penis gourds (e.g. traditionally worn by some ethnic groups in Papua New Guinea), or neck rings (e.g. women of the Kayan tribes in Myanmar and Thailand).

Another example of behavior elicited by the environment is when food sources like meat are scarce due to ecological (environmental) circumstances, people communally share food to reduce the problematic variability of a high calorie food supply, as the !Kung San in the Kalahari Desert of northwest Botswana do, for example. The //Gana San who live in northeastern regions of the Kalahari desert, on the other hand, have a relatively abundant food supply and, as a consequence, don't share meat but gain status from hunting success (Cosmides & Tooby, 1992).[37] EP assumes an evolutionary, hereditarian position, on average attributing 50% of differences to genetics and 50% to environmental etiology, whereas the SSSM views all human differences as 0% genetic and 100% environmental. In conclusion, people who accuse EP of genetic determinism simply aren't familiar with its basic tenets. Humans, like other animals, are equipped to respond flexibly to different environments. Different 'input' from the environment will lead to different behaviors, sometimes because of epigenetic effects, i.e. some genes will be silenced while others will be activated (or 'expressed'), leading to different 'output' in the form of attitudes, values, and behavior.

Other common misconceptions are that EP could have negative implications for gender equality (when in fact EP describes sex differences and their origins, but does not offer 'prescriptive' advice) or racial equality (when in fact EP considers the notion of race rather irrelevant to the field, as it studies the universal features of the human brain), or that it has limited ecological validity (when in fact EP uses cross-cultural research to find human universals across cultures).

Finally, I also want to point to the mistaken and falsely attributed to EP idea that *all* of our behavior must be functional and serve survival and reproduction. Many properties are not adaptations. Sometimes, they are merely (1) by-products of adaptations, called

[37] The mechanism of sharing has been confirmed by computer simulations studying the conditions that promote cooperation in hunter-gatherer societies (Pereda et al., 2017).

exaptations,[38] or (2) simply '**noise**' (properties that have no negative impact on survival or reproduction, such as the white color of our bones). Our capacity to do math (some of us can understand and practice incredibly complex math) is one of the best examples of such an exaptation. Another nice example is our ability to learn to read and write, which are to be considered by-products of our evolved adaptation of spoken language. Lastly, let's also remind ourselves that reproduction is not perfect: every organism also possesses gene variants that can sometimes cause problems (e.g. gene variants that cause dyslexia).

In conclusion, it's only fair to say that we cannot ignore our incredibly long past and evolution. Physics, chemistry, biology, and psychology made us who we are today, though it took billions of years. **Understanding who we are and why we are inclined towards certain behaviors is an absolute necessity**, especially as our human nature won't change that fast. That doesn't mean that evolution had stopped by the time of the agricultural revolution, as EP researchers previously assumed. Genetic drift and even positive and negative natural selection have occurred over the past thousand years, and evolution is even fast with regard to some mutations (e.g. Harris & Pritchard, 2017).

■ Empirical findings

Traditional psychological research not only focused on rather small or trivial phenomena, it relied heavily on unreliable methods such as self-reports (notoriously unreliable for some research topics), interviews, and correlational methods that are unable to detect causality. Because of this, and because EP has received a lot of criticism, EP practitioners have strived to make their findings as robust and reliable as possible. To this end, they combined multiple research methods to limit the problems of those 'traditional' methods. Some of the current research strategies and methodologies at the disposal of EP researchers include (for an overview, see Simpson & Campbell, 2005):

- **formal theorizing**, including a detailed description (with very specific and refined hypotheses) of how natural selection could have resulted in 'special design,' e.g. color vision in humans and other primates. The appropriate strategies for testing these hypotheses must then be selected and combined;
- **comparison** with other species;
- studying **clinical populations** and individual cases (e.g. developmental disorders, brain damage to certain localized brain modules, etc.);
- **DNA research** and **molecular genetic research**. Our DNA contains historical information about our evolution: we can calculate when a feature arose or disappeared, thus answering questions such as *when did our tails disappear?* (Or *how come children are sometimes still born with tails or with fur or at least a lot of body hair?*[39]);
- setting up **experiments** to distinguish between traits that are the product of evolution by natural selection (adaptations) or are merely by-products (exaptations, spandrels, co-opted functions) or noise. For example, if traits develop or skills are "*learned very easily, quickly and reliably,*" (p. 127) this is a strong indicator it is an adaptation. The capacity to learn a spoken language and its grammar is such an adaptation, whereas learning to read is a much slower and painstaking process, so this

[38] As I explained in a footnote in Part I, there is much debate about whether exaptation is really a good name for gradually evolved functions. For example, although feathers probably first served as insulators (to keep warm), selection pressures 'tinkered' them into wings, allowing birds to fly. Lately, the term is used less and less and almost all evolutionary biologists have abandoned the term (e.g. Larson et al., 2013, who present a graph illustrating the declining use of the terms 'exapt' or 'exaptation'). I will further reserve the term for 'an intentional reassignment of function.'

[39] This is called an atavism: a sporadically expressed remnant of ancestral features that is a testimony to and reminder of our evolutionary past.

would be viewed as an exaptation. We can thank the co-opting of certain brain capacities for our hard-fought ability to do math and statistics, though it requires intelligence, focus, and effort;
- testing **which theories offer the best fit** with the empirical findings: for example, can the hypothesis that spatial orientation is learned ('socially constructed'[40]) outcompete the EP hypothesis positing that this is an evolved function? The superior spatial location memory of women, for example, is more accurately and parsimoniously explained by EP;
- **ecological validity testing**: testing whether effects occur under typical or common conditions for a population and how robust these findings are. Are the findings present across different settings, different cultures, and historical contexts?
- the **multitrait-multimethod matrix** approach: for example, measuring a trait with different measurement instruments (self-reports, other reports, observations, etc.);
- laboratory experiments;
- experimental simulations;
- field experiments;
- field observations;
- **cross-cultural studies** (e.g. in 1989, David Buss studied human mate-preference criteria in 37 different societies, whereas most researchers typically use a small sample of WEIRD undergraduate students);
- **brain imaging studies**;
- computer simulations to model and test evolutionary hypotheses before using other research methods;
- using advanced statistical techniques;
- diary studies (people report at fixed times what they are doing, thinking, or feeling; e.g. after receiving a text-message prompt on their cellphones);
- using **public records** (e.g. in 1988, Daly and Wilson analyzed homicide rates to test the evolutionary hypothesis that young men around the age of 25 were most at risk of committing murder);
- comparing the alternative explanations for non-evolutionary theories with the predictions from evolutionary theory;
- etc.

As an example of researchers combining methods, let's briefly discuss what Öhman et al. (2001, 2003) did. They used comparative methods, interviews, field observations, primate observations, and experimental laboratory studies to test the carefully constructed hypothesis that we have a specially designed program for fearing snakes. They indeed found that our fear of snakes is an evolved feature or adaptation, and their experiments ruled out a culturally mediated conditioning process (i.e. fear of snakes is easily and readily learned from observing others).

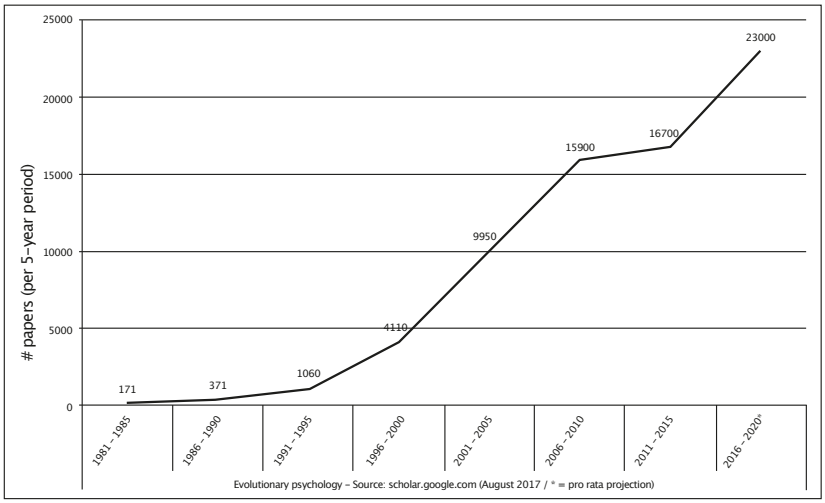
In general, the sequence of evolutionary psychology research efforts follows, or should follow, the sequence below:
Context of Discovery:
- Observations from the 'real' world in different kinds of societies (including modern hunter-gatherers).

[40] There are people, even psychologists, who deny reality. Some think that even "*human beings as a species may be a social construction*." This is at least what some people claim, James Averill did in an interview with Andrea Scarantion in July 2017. I will not waste my energy on such ridiculous thinking, as I know that 'what can be asserted without evidence, can also be dismissed without evidence' (by now you will recognize this famous quote from the late Christopher Hitchens. It is often called *Hitchens' razor*).

- Theorize about the adaptive challenges our ancestors might have faced using a variety of techniques such as evolutionary game theory, observations of hunter-gatherer societies, primate studies, etc.
- Formulate hypotheses about evolved brain programs.

Context of Proof:
- Test the hypotheses using different methodologies, including brain research (to find the spatially located or neurological network circuits or modules).
- Test this cross-culturally.

What is the level of evidence?
Due to the vast breadth of the research domains that EP spans, I will mostly summarize the findings and refer the reader to accessible papers and books that contain most of the descriptions of the empirical findings. Since the late 1990s, EP research has experienced quite a boom, which is a strong indication it is considered a very fruitful research area by psychologists:



Graph V.1*: evolution of research papers on evolutionary psychology.*

I will also limit myself to relevant research topics, although topics or middle-level theories such as parental investment theory, parent-offspring conflict, reciprocal altruism, sexual jealousy, or the shift in women's mate preferences across the hormonal cycle have received incredible amounts of empirical support. I will rather focus on those research findings that have an impact on organizational life, briefly stating what are the risks and offering advice whenever possible.

In the following paragraphs, I will first deal with the issue of our brain modularity, then describe several risks that organizations face, discuss the trade-off between collaboration and competition, and briefly discuss the need for hierarchy and conclude with some recommendations.

Evidence for the modular brain
Historically, the modularity of our brain was discovered gradually, mainly through **human medical cases**. One of the first discoveries was that damage to one spatially localized

area—the Broca area, named for the researcher who discovered it—resulted in the inability to form words. Lesions in another part of the brain (Wernicke's area, idem) resulted in the inability to comprehend other people, despite the person still being able to form words. Other medical cases have also revealed the modularity of the brain: when the hippocampus is damaged, people have problems forming memories; if the corpus callosum (the 'bridge' between the two neocortical hemispheres) is cut, people have difficulty recognizing objects when shown to the right hemisphere (left eye). Most infamous perhaps is the case of Phineas Cage, a railroad worker whose brain was pierced through by steel spike and whose personality changed, albeit temporarily, or that of H.M., a man who lost most of his hippocampus and surrounding parts of his brain during an epilepsy surgery. Although he lost the ability to store new experiences, he could still learn other things. These individual cases pointed to specialized areas in the brain. This was further demonstrated by Roger Sperry's and Michael Gazzaniga's brain research on 'splitting' the brain by cutting the corpus callosum between the two hemispheres in an attempt to treat epilepsy.
These medical cases offered the first compelling evidence that our brain consists of several functional areas or modules. These cases[41] contradicted the up to then dominant idea that *everything* can be conditioned through learning by offering frequent stimuli. This idea was based on the experiments conducted by Pavlov (his dogs salivated upon hearing a sound that they associated with meat powder—classical conditioning) and Skinner (pigeons that pushed a button to obtain food—operant conditioning). Because of new research findings, this simple idea had to be abandoned, even with regard to conditioning. For example, some animals can only be conditioned using sight, whereas others can only be conditioned using smell. Put simply, Skinner was wrong to consider the brain a general-purpose machine with only one simple learning process governed by reward and punishment (Tooby & Cosmides, 2005). The problems with **animal conditioning** also point towards modularity for different senses such as hearing, smell, taste, touch, sight, etc. Indeed, a lot of innate, built-in mechanisms have been found, and sometimes even their spatial location in the brain. Researchers have found programs for vision, sexual orientation, kin detection, grammar acquisition, heart rate regulation, predator vigilance, and threat of exclusion.

Optical illusions[42] such as the checkerboard 'same color illusion' are a nice way to experience the modularity of the brain for yourself. A part of your brain is *convinced* it sees different colors, when in fact the colors are exactly the same. If you cover up parts of the figure, another part of your brain suddenly sees it as the same colors. But if you look at the whole picture again, you will see identical colors again, even if you now rationally know this is false.

Animal research was the second line of research to demonstrate modularity. In biology and medicine, it is a widely accepted fact that we are evolutionarily related to other species. We share many of our genes *and* our traits with nonhuman animals. This phenomenon is called homology. In animal research, more techniques are used than in human research, of course, as ethical considerations often limit experiments with human subjects. Both invasive and non-invasive techniques have demonstrated modularity in animals, logically following that the same must be true for the human animal. For ethical reasons, human brain networks are studied noninvasively, mostly using **(f)MRI technology**. Although less accurate, what these studies have demonstrated is that many of the same networks can be found in humans and in animals.

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41 There are many other patient cases, such as people with *blindsight* who report being completely blind, but still dodge if you throw something at them or make above average guesses if you show them objects or emotional faces.

42 Check out this website: http://www.michaelbach.de/ot/. Be sure to look at the Müller-Lyer illusion and Edward H. Adelsons same color illusion.

However current research efforts no longer focus on the question '*is our brain modular?*' The notion that our brain is modular can be considered proven because virtually all research methodologies in both animal and human research point to the same conclusion (for a review, see Sporns and Betzel, 2016). The question now at hand are '*where are the networks?*' '*are they spatially located in relatively limited areas of the brain or are they distributed circuits?*' and '*which modules are flexible and which are not?*' **Brain surgeons** too are faced daily with the modularity of our brains, so opposing the idea of brain modularity is… well, silly. That is why I follow the recommendations of experienced evolutionary psychologists to continue using the words module and modularity.

The risks of our modular brain

The problem arising from this modularity is that we are far from consistent, as there is an internal struggle between the modules. Heterosexual men might feel sexually attracted to a woman and fantasize about having sex with her, but another part of their brain might tell them to restrain themselves and think of their family and children and the damage that cheating could do. Most people preach integrity but are less honest when it comes to their own tax declaration or buying services or goods on the black market (paying for a part of your newly constructed or renovated house without paying tax is very popular in Europe, for example). We might be pro-environment, but still won't give up traveling by plane when taking a vacation. We are in favor of moral rules and apply them to others, but less so to ourselves. We advocate freedom of speech, but if someone uses that right, he might be fired (think of engineer James Damore who was fired for his fact-based opinion of diversity and inclusion at Google). Some people take a strict position on hard drugs, yet they still drink alcohol (a drug) or smoke (an even more addictive drug). That's why evolutionary psychologist Robert Kurzban wrote the serious book with the funny title *Why Everyone (Else) Is a Hypocrite.*

The lesson to be learned is that at some point, **people will inevitably be inconsistent and sometimes very emotional and irrational**, for example defending views that are untenable in the light of facts. To my regret, I have no solution to offer organizations in this regard. Having realistic expectations will have to be enough.

It should also be noted that social exchange follows a set of rules created by evolution by natural selection, and these rules do not follow formal logic as (some) humans have developed. Indeed, these social exchange rules are not always rational. Take the classic experiment in which two children/adolescents/adults toss a coin to decide who can distribute an amount of candy or money. In this setup, the winner gets the chance to decide how to distribute the candy or money, but the loser of the toss holds a veto right. If such a veto right is used, neither of the two receives anything. As it turns out, if the winner of the toss proposes a distribution of 80 dollars for himself and 20 dollars for the other person, and if the other person holds a veto right, he or she will almost certainly use said veto, resulting in no one receiving any money (or in the case of children, candy). This is by no means a logical choice, as no one gets anything: accepting the proposal would be more logical from a purely economic point of view, as both get something instead of nothing.
However, human social exchange has a rule that programs us for 'fairness.' If our instinctive social rules tell us that the winner of the coin toss proposes an unfair distribution, we punish him or her, even if we have to punish ourselves. This happens quite often in daily life: for example, people are prepared to incur high costs of paying lawyers to take someone to court if they have a chance of inflicting an even higher cost on their adversary. I have witnessed companies go bankrupt because both the board of directors and the unions failed to see their common interests and were willing to play a high-stakes game of poker, resulting in the total destruction of the company. So, companies would be better off con-

sidering these inconsistencies and social exchange rules that we inherited from our ancestors. Trying to reframe large pay gaps using the argument that one should not envy others, for example, simply will not work.

The risks of our coalitional psychology—Us versus Them

It is quite undisputed that people categorize themselves and others into various groups, for example according to gender, religious affiliation, etc. Multiple competing explanations have been theorized to explain this phenomenon. Back in 1985, Henri Tajfel and John Turner developed *Social Identity Theory* (SIT), one of the most famous theories in social psychology. They thought that this classification served two functions, namely (1) ordering the social environment, which made life less complicated, and (2) defining oneself in this social environment. They were uninformed by evolutionary psychology or biology, however, and biologists had another explanation: by banding together, our ancestors who mainly lived in nomadic tribes could defend or attack rivaling tribes (e.g. for resources). Biologist Ed Wilson (1975, p. 120) argued that if cooperation was so beneficial for ancestral human groups, natural selection would have favored psychological programs to spot and punish cheaters and to be wary of strangers.

Krebs and Denton (1997) suggested that forming enduring coalitions probably was critical to our ancestors' survival. Belonging to a group and maintaining coherence between group members was necessary for cooperating and competing for resources with other animals and competing out-groups (other tribes). Both biologists, anthropologists, and psychologists reached the conclusion that our ancestors, hunter-gatherers, lived in bands and often came into conflict with other bands, although archeological evidence shows that intergroup trade also has a long history in human evolution (e.g. overview in Robinson & Barker, 2017). Within larger bands, sub-coalitions formed, as was found in human and related primate studies (for an overview, see Cosmides, Tooby & Kurzban, 2003). This led researchers to the hypothesis that **humans would have an evolved brain program (a module or neural circuit) for detecting coalitions**. Therefore, the single best and parsimonious explanation is that humans seek power by forming coalitions and alliances with similarly-minded others, especially in conflicts with other coalitions or out-groups.

Whereas dress and dialect probably emerged as some of the first markers in this cognitive system, it is likely that other cues would also have been in place early, and some may have developed as a by-product of this adaptive coalitional machinery. Other early cues in the adapted coalition (or alliance) detection system could have been *X works together with Y, X defends the views of Y, X fights together with Y against an enemy,* etc. (e.g. Pietraszewski et al., 2014). Years of research has revealed "*that people spontaneously categorize newly encountered individuals by their sex, age and race,*" (p. 2)[43] but recent research strongly suggests that implicit conversational cues as well as behavioral cues lead to **spontaneous categorization**; moreover, these cues have stronger effects than visual cues such as dress or race. This should not surprise us, some evolutionary psychologists say, because if we look at the differentiation of skin color, it is only a relatively new feature if you compare the last 60,000 years with the millions of years since we shared a common ancestor with chimpanzees and bonobos. Based on experimental research, they argue that the fact that people categorize

[43] There is still a heated debate as to whether use of the term 'race' is 'allowed'—people on the extreme left of the political spectrum can't stand if other people (even scientists) use the word. In the biological sciences, it means that a population is (1) statistically significantly genetically distinct from another population, (2) found within more or less localized territory, and (3) can still interbreed with neighboring populations (Cliquet, 2010). Using these scientific criteria, there is no reason to oppose the use of the term 'race' for the human species too. Moreover, people of all skin colors automatically identify with people of their skin color. I will deal with this issue more in depth in the chapter on recruitment.

themselves and others into races is merely **a by-product** of our categorization and coalitional psychology. For example, if basketball teams were composed of 50% black and 50% white players and they all wore the same color of jersey for their team, the team members self-identified as a team and the categorization into race disappeared (near zero). The same effect was found when a strong verbal identification was given to the own group (a charity group membership, cues of political party support). By contrast, the categorization into sex and age did not disappear in such experiments (Kurzban et al., 2001; Pietraszewsky et al., 2014, 2015). The researchers interpret this pattern to mean that race. just like nationality, is a social rather than a biological construct, whereas sex and age are biological facts that do not trigger our coalitional psychology.
I do not entirely agree with this view, however. In the extensive chapter on recruitment methods, I explain how GWA studies can reveal biological patterns and track people's ancestry. Moreover, humans tend to think in terms of 'essences.' **Essentialism** implies that we tend to label species, using different discrete names for them. Children as well as adults expect species-specific properties: we view members of a category as sharing a deep, underlying, inherent nature (Rhodes et al., 2012). Thus far, our inclination towards essentialism has been found in every culture studied so far (Gelman, 2004; Henrich et al., 2010b). It is *probably* an evolved mind module that harbors a kind of folk biology. It was probably very helpful to our ancestors' survival and food gathering practices. Francisco Gil-White (1999, 2001) provided a more elaborate hypothesis about essentialism: he proposed that we have innate knowledge about several species (just as other animals do) and that entails a belief in essences. This innate essentialism is an alternative explanation for why we tend to label people into races as well as ethnicities: ethnicities are characterized by clothing, rituals individuals use to display membership, language, and other behavioral norms. People tend to do label other humans too, whether they truly 'belong' to another species (Neanderthals, Denisovans, Australophitecus, etc.) or whether we sub-divide our own homo sapiens species into races. Essentialists erroneously see races as *inherently* lazy, shrewd, smart, superior, etc. And, as Richard Dawkins noted on edge.org: "*Essentialism rears its ugly head in racial terminology.*"

This essentialism might have resulted in a "*cheap learning strategy*" (Machery & Faucher, 2017, p. 1161) or a kind of heuristic: if you interact with people of other ethnicities that share the same behaviors, you might feel safer interacting with them. In a review of four competing hypotheses,[44] Edouard Machery and Luc Faucher (2017) agree that there must be an evolved, domain-specific, *coalitional cognitive* system. The fact that so many similarities in the classification of phenotypic properties can be found across cultures points to a universal cognitive system. But they conclude that the empirical evidence lends more support to the Gill-White hypothesis for explaining *racialism,*[45] although they don't agree with all its aspects (e.g. essentialism) and are of the opinion that the jury is still out. The precise cognitive mechanism needs further specification.

In the previous paragraph, I wrote that I partially disagree with the idea that race has no biological roots. This also implies that I partially agree; indeed, GWA studies using ancient DNA have also demonstrated that **a lot of admixture happened over the past few thousand years and before**, **making the primeval division of race untenable**. Most people are of mixed race, although that is not always visible in skin color. But saying that biology isn't involved at all has been proven wrong by DNA findings. In my opinion, it is more likely that age and sex were always obviously present in our evolutionary past. It is therefore logical

[44] Theories that view race as a 'social construct.'

[45] Racialism is the value-free term to describe the fact that people automatically classify humans on the basis of physical properties such as skin color, facial features, height, etc.

that these categories never disappear. The concept of race is newer (our ancestors didn't have a lot of opportunities to meet people of other skin color), which is probably why it can be replaced so quickly with another arbitrary set. Nevertheless, what is important is that our coalitional detection system makes us interpret cues like skin color or facial features as cues for social interaction, thus leading us to categorize people by race, but **the good news is that this can easily be overcome**. This coalitional categorization system seems to be dynamic and can be 'updated.' In humans, group membership is often fluid and can be defined by many axes (e.g. religion, region, language, political views) (e.g. Moya & Scelza, 2015; Pietraszewski, et al., 2014, 2015).

No matter which one is considered the best evolutionary hypothesis, the proposition that our coalitional psychology results in different behavior towards members of the own group (in-group) than towards members of the other group (out-group) has been tested and confirmed many times. We are more cooperative towards our in-group and more hostile towards members of the out-group (e.g. Burkart et al., 2009). There is some strong evidence for the **biological foundations of our coalitional psychology**. First of all, our coalitional psychology is regulated by hormones: **oxytocin** produces kind behavior towards in-group members and hostile behavior towards out-group members. These hormones only have an effect on people who are already prosocial (see for example Sapolsky, 2017, p. 116 and p. 258). Second, functional neuroimaging studies have found differences in **neural development**. Children pay more attention to out-group faces (probably to anticipate threat), whereas adolescents show relatively greater activation in a number of brain regions, such as the amygdala and the orbitofrontal cortex, to in-group faces—probably because fitting in becomes very important to them (Guassi Moreira et al., 2017). Competing explanations, such as the SSSM of social psychology, can be ruled out (Pietraszewski, Cosmides, & Tooby, 2014; Bailliet et al., 2014). This also means that **this evolved, inherited, and innate coalition detection mechanism cannot be 'stopped.'** We only need to find and use smart ways to avoid the negative effects in organizations (as well as between nations, of course, but that is beyond the scope of this book).

Barack Obama's rough encounter with coalitional psychology.
At the beginning of his first term as President of the United States, Obama often appealed to both Republicans and Democrats to overcome their differences. History made it clear that his hope and ambition was futile. The tribal instincts of both the Republicans and the Democrats did not allow for any approach or cross-party collaboration, not even for the greater goal of the welfare and well-being of the United States as a country.

But did Obama really propose collaboration over competition? Not really, as his own coalitional psychology also emerged. In an interview with Science Debate in 2012, this is what he said:

> *"My 'Educate to Innovate' campaign is bringing together leading businesses, foundations, non-profits, and professional societies to improve STEM[46] teaching and learning. Recently, I outlined a plan to launch a new national STEM Master Teacher Corps that will be established in 100 sites across the country and be expanded over the next four years to support 10,000 of the best STEM teachers in the nation. These investments would improve the quality of STEM education at all levels, ensuring the next generation of Americans has the tools* ***to out-innovate and out-compete the rest of the world.*****"** (bold emphasis my own)

Not so different from 'Make America Great Again' and 'America First,' although more elegantly formulated, if I may say so.

[46] STEM = Science, Technology, Engineering, and Mathematics.

Coalitional psychology—or in simpler words, in-group versus out-group feelings, impacts organizational life because it can impede collaboration or can lead to discrimination and a loss of energy and resources. In a perfect world, employees would identify themselves with the organization as a whole and consider the organization their in-group. If people feel alienated from their companies because of policies, abusive supervision, or workplace harassment, their motivation and productivity dwindle. However, most organizations are too big (bigger than n= 150) to keep everyone 'mentally on board.' In an attempt to overcome problems of coordinating large groups, big organizations are structured into neat entities (sometimes called silos), unwantedly creating subgroups that are smaller in size and with which it is easier to identify.
It is not difficult to understand then, why the production department in-group quickly views the marketing department as the out-group and sees it as *disorganized, doesn't know what it wants, cannot plan ahead, has no clue how difficult it is to switch production,* etc. Not to mention the sales department out-group which *overpromises so that the company will underdeliver*. **It takes tremendous effort by the leaders to communicate and convince members of the common organizational goals because the 'departmental' silos are so prevalent, and it is so easy to create feelings of in-group superiority and out-group inferiority.** Research has demonstrated that even the slightest clues can make people classify themselves into in-groups and out-groups (union, lunch group, age cohort, even t-shirt colors if this marks group membership) (Brewer, 1979; Tajfel, 1982; Locksley, Ortiz, & Hepburn, 1980; Pietraszewski et al., 2014). As such, it is probably unavoidable that people identify themselves with multiple in-groups, though the negative effects can be reduced if leaders insist on and highlight the similarities and downplay the disparities between groups. We should not forget that intergroup competition can be stimulated very easily and reinforce the in-group identification with the smaller unit, thus reinforcing out-group negative evaluations (e.g. Ashforth & Mael, 1989).

The risks of nepotism

William Hamilton (1964a, b) introduced the notion of **kin altruism** as an explanation for the altruistic acts that some animals[47] and humans perform. Hamilton proposed the formula $c < rb$, in which c is the cost to the individual being altruistic, r is the coefficient of genetic relatedness, and b is the benefit to the recipient. According to this theory, which is supported by a vast amount of empirical data, altruism evolved from the initial care given to offspring. The more genetically related someone is to another person, the more often altruistic acts are performed towards that person. When relatedness diminishes, altruism diminishes too. Kin altruism could also explain the eusociality found in bees and ants, where some sterile workers cannot reproduce, which at first glance is a purely altruistic act. Kin altruism explains how this is not the case however, as the seemingly 'self-sacrificing' behavior of bees and ants promotes their own genes too—for example, because female worker bees share so many of their genes (up to 75%) with their *sisters*, they self-sacrifice.

Following the thinking of Haldane (1955) and Hamilton, John Maynard Smith introduced the notion of **kin selection,** explaining that parents would try to favor relatives. Hamilton summarized these phenomena as **inclusive fitness theory**. A series of experiments conducted by Burnstein and colleagues involving hypothetical decisions to offer help demonstrated that all of the participants followed the predictions made by Hamilton's inclusive fitness theory: "*In life-or-death situations, people chose to aid close kin over distant kin, the*

[47] This has been documented in wild dogs of Africa (Schaller, 1972), ants (Wilson, 1975), dwarf mongooses (Rood, 1986), vampire bats (Wilkinson, 1984, 1990), and naked mole rats (Sherman et al., 1995).

young over the old, the healthy over the sick, the wealthy over the poor, and the premenopausal woman over the postmenopausal woman" (1994, p. 773).

Choosing close kin over distant kin and over non-related individuals is what we call nepotism. Although people give less weight to kinship and often turn to non-kin for everyday favors, when it comes to important decisions—such as providing a job—most people tend to favor close kin. The French politician François Fillon became the object of public and media scorn in 2017 when the presidential candidate was found guilty of giving paid jobs to his wife Penelope and children Charles and Marie, perhaps without them actually having done any work. If this is true, it is a clear case of nepotism. There is a 'rational' case to be made for nepotism if you like, as research has shown over and over that relatedness leads to increased cooperation and decreased conflict in most cases (Kurzban et al., 2015). Some family-owned and family-managed companies have thrived thanks to this connectedness: think of the family-first policies adopted by Ford Motors, Walgreens, or Southwest Airlines. Moreover, the anecdotal stories about incompetent children are not confirmed by the quantitative empirical evidence (e.g. Jones & Stout, 2015).

Of course, quite a few negative effects have been found as well, such as infighting in family-based organizations that often leads to splitting the organization to restore the peace within the family or resulting in more autocratic leadership and dissatisfied employees. Other negative effects that have been found include lower employee commitment, heightened stress by family pressures, and diminished organizational performance (e.g. Pearce, 2015).

Especially in smaller, family owned companies, this risk is still prevalent. In some countries, laws have been passed to prevent leaders of companies and especially public organizations from favoring their relatives. Even if objective hiring procedures are in place, when a relative or close social connection of a leader is hired, employee perceptions of nepotism can be damaging to morale and motivation. However, excluding good candidates solely on the basis of family ties is also discriminatory. In my opinion, organizations should try to avoid both extremes: anti-nepotism policies that preclude all family ties are unfair and discriminatory, whereas the opposite is also true. If family members always get an advantage over others, this is unfair and discriminatory. Using scientifically valid hiring tools (and promotion tools) is of course the logical answer to this dilemma. A risk analysis of likely future relationships could add extra perspective.

A comparable vice is that leaders often surround themselves with trustees and friends at work. Authoritarian and autocratic leaders in particular prefer yes-men as collaborators. It needs no further explanation how damaging this can be and how demotivating to other employees.

The risks of dominance, aggression, and boasting

Although women can of course be openly aggressive too, physical aggression is more of a male problem across countries (e.g. Nivette et al., 2019). It is well documented that men use aggression and dominance to get to the top more often than women, who prefer to rely more on respect, prestige, and building coalitions. Men use tactics to deceive or manipulate more often than women, including denigrating others, boasting, aggressing, excluding others, impressing others, claiming leadership capacities, etc. Women use social displays and networking more often than men, for example engaging in helping others, conforming to others, or cultivating friendships (Hays & Bendersky, 2015; Lund et al., 2007; Semenya & Honey, 2015).

Aggression can have several problematic effects in organizations. Decisions made with dominance or power are often poorer choices because different viewpoints are ignored or oppressed, and afterwards people feel less motivated to execute the decision. These dominance decisions sometimes involve risk-taking that can lead to dramatically negative effects, including bankruptcy (e.g. Nutt, 2002). Nor does aggression provide the necessary psychological safety for employees to speak up or to put forward new ideas that might lead to innovation.

Organizations should try to avoid having such leaders on board as much as possible. Prevention and monitoring can be made easier by using selection tools that maximize predicting dominance and lack of integrity, for example. I recommend regularly conducting scientifically developed 360° assessments to identify bad leadership and to try to remedy it (a coaching period with competent coaches or preferably trained psychologists can sometimes help, but getting rid of such leaders might be unavoidable if this does not provide the desired behavioral change).

A meta-analysis conducted by Corinne Post and Kris Byron in 2015 strongly suggests that having women on boards does indeed have a beneficial effect on financial returns, namely accounting returns. This could be due to two things that boards are typically responsible for: monitoring and strategy involvement; female board representation shows positive correlations with these two responsibilities—although more research is needed as correlation does not automatically imply causation. Still, the fact remains that female representation seems to have positive effects on firm performance. It may be the case that this is because women were likely 'designed by evolution' to adopt a longer view than men due to the historic conditions in which maternal care of children was of utmost importance to safely bring their children into adulthood (Campbell 1999; Daly & Wilson, 2005). This sex difference can be seen in a number of phenomena, such as men preferring instant reward over later rewards more than women, higher risk taking, and risk taking in decision-making. If organizations value the same set of traits and characteristics in selecting for leadership positions, then females are at a disadvantage because the pool of females with such traits and characteristics is much smaller than that of males. Research has revealed that both male and female C-level executives have a common, rather agentic profile: they are higher on extraversion, conscientiousness, and emotional stability. This is much less so in the general population, where women score lower on these traits (Wille et al., 2018).

The risks of failing to acknowledge sex differences

For a long time, and still today, some people, including a large group of social scientists, are deeply convinced that the sex differences we perceive and the resulting underrepresentation of females in some occupations are only due to 'socialization and bias.' In this view, the sex differences are only 'socially constructed' and exaggerated. This is the paradigm of the SSSM or 'blank slatism' model. Confirmation bias is very pervasive in people who believe in this SSSM (such as Alice Eagly, who stubbornly sticks to her *social role theory* in spite of the evidence refuting her theory). Despite this blank slatism view having been convincingly disconfirmed by scientific research, it has nevertheless become mainstream thinking among the general public. Evidence points to the fact that although some stereotypes about sex differences are actually accurate, **people have come to underestimate gender differences, rather than exaggerate them** (Jussim, 2018; Jussim et al., 2016).

On rare occasions, people are prepared to take a hard look at the data and change their opinion. It took quite a bit of courage for professor Diane Halpern[48] to change her views. She admitted that "*biological sex differences play a role in establishing and maintaining cognitive sex differences,*" a conclusion that she "*wasn't prepared to make when I began reviewing the relevant literature*" (Halpern, 2008, Edge.org and in the preface of her book). Although back in 1973 anthropologists George Murdock and Caterina Provost studied 50 activities in 185 preindustrial societies and showed that many crafts were assigned to one gender or the other, WEIRD[49] scientists still maintained that the *Western* societies had created discrimination against females and that *all* division of labor and roles should be viewed in that light. The idea that the habit of labor division could have an origin in biological differences was simply unacceptable to them. Not wanting to investigate a hypothesis or look at the facts has nothing to do with science, but quite a bit to do with ideology. So, what did the research tell us? Depending on the culture, crafts were sometimes made by men and sometimes by women. This means that the division of all labor is not universal, but for some specific crafts, there seems to be a universal division: hunting, woodcarving, and metalworking are almost entirely male occupations in both traditional and modern societies. In traditional societies, the gathering of mainly plant foods is mostly done by women.

EP researchers do not agree with the SSSM paradigm, but their rebuttal of the SSSM is often thwarted and misrepresented by those who state that EP says it's *all* biology (or 'nature'). As I explained before, EP acknowledges and studies how biology interacts with environment. EP also acknowledges the biological basis for *some* differences and this biological basis offers at least a *partial* explanation. For example, as with many species, human males show more variability than females. There is more variance (as can be seen in the 'tails' of a normal distribution—the extreme ends) among men in intelligence[50] (at the extremes, there are more males than females that are either very stupid or very smart), and of course in body height. When discussing sex differences, I do not only mean the obvious morphological differences such as height, size, muscular strength, or ratio of index (2D) to ring (4D) finger lengths.[51] For example, 98% of men have a stronger grip strength and have a stronger throwing ability than the *average* woman, which also implies that *not* all men outperform all women (Schmitt, 2017).

As evolutionary biologist Jerry Coyne argues, **6 million years is ample time for differences in the brain and behavior to have evolved**. A lot of people resist that fact, not because of empirical findings, but for ideological reasons: they simply cannot accept this idea because they fear it will lead to discrimination or sexism. As Coyne reasons, "*we can accept evolved differences without turning them into social policy.*"[52] Complementarity of the coevolved yet different skills is a different way to look at these differences, a way I prefer. Equality does not always mean equal—equality of choices and opportunities is not the

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[48] Although rather irrelevant, the fact that she was elected president of the American Psychological Association in 2002 shows she is a well-respected scholar.

[49] WEIRD = an acronym for Western, Educated, Industrialized, Rich, and Democratic. 96% of the research findings in psychology journals are based on WEIRD subjects, who represent about 13% of the world population (Henrich, Heine & Norenzayan, 2010a). Most of them are university students who mainly have these features in common. Psychology research receives a great deal of criticism for this.

[50] This finding is consistent across countries and has been replicated successfully (Lohman & Lakin, 2009).

[51] This is thought to be caused by the levels of prenatal testosterone and prenatal estrogen, with males typically having lower values of 2D:4D than females. A lower 2D:4D ratio is associated with a lot of things, including dominant behavior, and even shows correlations with gender inequalities across nations (e.g. Manning, Fink, & Trivers, 2014).

[52] See his post "*The sociological religion of no biological differences between the sexes*" on his website whyevolutionistrue.wordpress.com.

same as being biologically equal. Anyway, whether you like the differences or not, you cannot wipe out millions of years of evolution. Differences have been found both in brain structures and in behavior. Of course, the most urgent matter is the translation of our knowledge of sex differences into the development of drugs and therapeutic interventions, because **the denial of sex differences has resulted in "*increased adverse events and reduced efficacy in females for some drugs*"** (Khramtsova et al., 2018, p. 14).

Although men and women are very much alike regarding many topics, there are a number of evolved sexual differences that are likely to have an impact in the work environment. Although we have thousands of features in common, we also have hundreds of differences. Let me first point to **some obvious commonalities** among the average man and average woman:

- we both have two arms, two legs, two eyes, one nose, one backbone, one heart, etc.;
- neuroanatomists cannot distinguish between a male and female brain 'by sight';
- even though girls get better school grades in almost every topic (including mathematics!), boys and girls do equally well on standardized tests (Lindberg et al., 2010);
- we are equally strong in basic categories of cognition (object recognition);
- men and women do equally well in leadership roles (except in task leadership); smiling, helping behavior, interpersonal relations, and communication and leadership effectiveness are other examples.[53]

I will now name but a few of the empirically established differences between the 'average' female and the 'average' male that are found in all cultures studied:[54,55]

- the sexual orientation of a fetus is programmed during the second half of pregnancy. Several structural differences between homosexual and heterosexual males and females have been found (e.g. in the hypothalamus and in the bed nucleus of the stria terminalis). Our sexual orientation is not a choice but is to a large extent biologically determined as the result of natural variance;
- women score better on mathematical calculation, though men are better at mathematical word problems and mathematical reasoning. Still, the fact is that women often do not choose to pursue careers in math (more on that later). These findings hold across cultures;

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[53] Regrettably, these kinds of similarities have been used to claim that there are almost no sex differences (e.g. Hyde, 2005). However, this study found moderate to large differences in sensitivity, aggressiveness, spatial orientation, mechanical ability, computer skills, etc. These differences were downplayed, when in fact they have an impact on education and career choices. Scott Alexander wrote the following about the study: *"I think Hyde's article is a gimmick which buries very real differences under a heap of meaningless similarities."* (www.slatestardcodex.com, posted August 7, 2017)

[54] It is important to realize that I speak of the 'average,' meaning it is really the 'midpoint' of the Gaussian curve we need to consider. I use the statistical generalization despite individuals differing greatly between one another, and these differences are larger than the differences between these statistically generalized men and women. Of course, anyone can find examples of boys or girls that deviate a lot from the average and that seem to contradict general statements about boys and girls or men or women. But differences between men and women cannot be studied at the individual level, because all features or characteristics of animals and humans show variation (although within boundaries; nobody has three eyes for example…). Again, this also does not imply 'biological determinism': our brain is 'engineered' by natural selection to interact with the environment and to learn from it and from our co-humans. Overviews can be found on the website of the *Center for Evolutionary Psychology*, or in articles such as Schmitt's 2014 paper in *Psychological Bulletin*, or in the easy-to read brief overview of EP theory and findings written by Shackelford and Liddle (2014).

[55] It is simply impossible for me to quote all the relevant research as literally more than one thousand research papers have been published on this topic, so I only point to a few that offer striking evidence. Most of these are based on meta-analyses from enormous data sets.

- although the sexual dimorphic features in humans are smaller than many other animals, on average adult men have more than twice the muscle strength of adult women;
- in adults, eye contact leads to better collaboration among females but forms a risk for conflict between men;
- men slightly prefer younger women, and younger women slightly prefer older men—this led to increased numbers and survival of offspring in the ancestral environment;
- across cultures, on average men display a higher sex drive than women and are more interested in casual sex (the effect size is large; $d = +0.80$). Dopaminergic responses to sexually arousing visual stimuli are greater in men than in women in both monkeys and humans (Sapolsky, 2017, p. 66) (you probably didn't need science to find this out);
- although both sexes experience jealousy if they suspect or observe sexual infidelity, men tend to be more upset by sexual infidelity, whereas women tend to be more upset by emotional infidelity (forming an emotional attachment to another female);
- heterosexual men compete with each other based on their biology (muscle strength, athletic capacity, left-right symmetry in the face and muscles, body height) and certain behaviors such as excelling in a domain, showing intelligence, or displaying wealth and power (e.g. Hennighausen et al., 2016). Heterosexual women compete based on their biology too, although in a different manner (hip-to-waist ratio, smooth skin, symmetry in the face), as well as in their behavior: they pay more attention to their appearance than men (clothes, jewelry, make-up…). Women might not like to read this, but quite a large amount of research found that women's spending on beauty products increases during recessions, despite consumer spending generally declining during economic recessions. This so-called 'lipstick-effect' is a remnant of our evolved psychology, as studies have shown that women do so to attract mates with resources (e.g. Hill et al., 2012). But a portion of men, on the other hand, are not free from 'sin': men who have a low parental investment strategy (see the explanation on LHT) are known to buy premium or expensive versions of consumer products and conspicuously display them in an effort to attract females for short-term mating[56] purposes (though women interpret these signals accurately unless they are at peak fertility near ovulation) (Lens et al., 2012; Sundie et al., 2010) or for young single people as a general mating effort (Miller, 2012);
- males—whether children or adults—engage in more risk taking than females, both in everyday situations (such as crossing a busy road) and in (corporate) decision-making. Numerous meta-analyses have confirmed this (one of the largest was Byrnes, Miller & Schafer in 1999), as has recent research (Josef et al., 2016);
- independent of culture or region, men kill people more than women, especially young men between the ages of 20 and 24;
- males are at greater risk of severe autism and females are at greater risk of depression—the effect sizes are around +0.80;
- women outlive men because men's higher testosterone levels make them overconfident, which results in taking more risks, though it is problematic for the circulatory system too (Sapolsky, 2017);
- using more powerful computers allowed for a better analysis of the dataset that originally resulted in the Five Factor Model of Personality (also called Big Five). The new analysis revealed a six-factor structure (HEXACO) rather than a five-factor structure. Because of new rotation (see the chapter on 5FM and 6FM), emotionality emerged as one of the six factors. This is the factor that shows a difference of more than one

[56] Short-term mating is characterized by a sexual strategy involving frequent partner switching and low parental investment. Of course, not all conspicuous spending is linked to this strategy.

standard deviation between the average score of men and women. Perhaps unsurprisingly, women score higher on emotionality than men, which means that the 'statistically generalized woman' is more afraid, more caring, and more empathetic than the average man;
- across cultures, women value ambition, high social status, and good financial prospects in men;
- men expect coalition partners to show courage, to be able to defend themselves, and to offer protection. Women expect more conscientiousness and social sensitivity.

A very interesting meta-analysis was conducted by top experts in the field Sven Stringer, Tinca Polderman, and Danielle Posthuma (2017). They used data from 2,235,920 twin pairs studied between 1958 and 2012 to test sex differences in genetic and environmental contributions to variation in 2,608 previously reported traits, clustered in 50 trait categories. They found significant sex-specific genetic factors in 25% of the 36 trait categories (only 36 trait categories could be tested): food, disorders of puberty, eating disorders, height, specific personality disorders, weigh maintenance functions, recurrent depressive disorders, and functions of the brain. They also found significant different genetic contributions between males and females for 3% of 1,922 traits. Not surprisingly, they also found trait categories where the relative environmental contribution was bigger than the genetic contribution: this was the case for (1) mental and behavioral disorders due to tobacco use and (2) looking after one's health.

Let me point out **the largest sex differences in the brain** that have been demonstrated by empirical research:

- the biggest difference is the '**people versus thing'** orientation. The effect size[57] of this difference is around +0.80, meaning that 79% of men are more interested in things, whereas about 79% of women are more interested in people:
  - from the day they can see, baby girls look at faces than more baby boys do, who look at moving and mechanical objects more, this was even tested in neonatal babies (e.g. Connellan et al., 2000). This phenomenon is often referred to as the 'People versus Things' difference and is best explained by prenatal hormonal exposure (e.g. Beltz, Swanson & Berenbaum, 2011);
  - across cultures, male and female children have different toy preferences and actually play with different toys. This finding is robust, and the evidence is piling up that biological factors are more important than socialization by adults and peers. Moreover, male babies from primates prefer balls and wheeled toy cars over dolls: this has been found in humans, vervet and rhesus monkeys, and chimpanzees (e.g. Kahlenberg & Wrangham, 2010). In baby girls, it is the other way around. This is an innate, evolved preference (Alexander & Hines, 2002; Berenbaum & Hines, 1992; Hassett et al., 2008; Kimura, 1999; meta-analysis by Puts et al., 2008);
  - boys engage more than girls do in rough-and-tumble play such as wrestling or fighting, which reflects the biological predisposition to establish a (social) dominance hierarchy (e.g. Else-Quest et al., 2006). This finding is also related to aggression: adult males show more aggression than females (d ranges from +0.89 to 1.01) (Del Giudice, 2009), regardless of country or culture (Nivette et al., 2018);[58]

[57] Some studies have found up to 1.2 SD, e.g. Lippa, 2010.

[58] These researchers looked into the sex differences in 63 countries: "*males were twice as likely to report frequent fighting in the last 12 months than females*" (p. 82), but also "*sex differences in physical aggression decreased as societal gender inequality increased*" (p. 82)—a finding that contradicts *social role theory*.

  - girls like to draw human figures, boys prefer to draw objects, weapons, and fight scenes;
  - the "people versus things" difference is still present in adults: the difference is larger than one standard deviation, so yes, this difference is very large ($d = 1.18$) (e.g. Browne, 2002; Lippa, 2010);
  - it is safe to say that this "people versus things" difference contributes to sex differences in occupational preferences (e.g. Su et al., 2009) and the occupations ultimately chosen (Lubinski et al., 2014; Su & Rounds, 2015). Remember, both sexes score equally well on tests such as the SAT scores in the United States. Lubinski and colleagues studied the careers of 1,600 mathematically gifted people who were identified as such in the 1970s. Guess what? Four decades later the gifted men were more represented in positions as leaders in IT and STEM occupations, whereas the gifted women were more likely to be found in education, finance, medicine, and law. Our natural sex preferences seem hardwired. Cultural or social interventions might be able close the gap, but to what extent? I am very skeptical that the gap can be wiped out entirely without 'forcing' girls into occupations they don't like. And what effect would that have on their motivation and well-being?
  - research using a large dataset (10 million messages from over 52,000 Facebook users) revealed that women write more about topics like friends, family, and social life, whereas men discussed objects more than people (Park et al., 2015);
  - finally, although the difference in intelligence between men and women is almost insignificant, adult males outperform adult women on three ASVAB[59] subtests: (1) auto and shop info, (2) mechanical comprehension, and (3) electronics info (Meisenberg, 2017). Damn, it seems James Damore from Google got it right on many occasions in his internal memo. Luckily, women outperform men on verbal skills, speed of processing, and accuracy, so neither sex can claim superiority;
- a second large and consistent finding of male-female differences is **spatial cognition and navigation** (e.g. meta-analysis by Voyer et al., 1995). The effect size is around +0.50, meaning that 69% of one sex is higher on these aspects than the other sex. Men outperform women in navigation and mental rotation, but women outperform men on other spatial tasks (such as remembering *plant object* location). EP reasons that these differences in the architecture of the minds of men and women can only be explained by environmental pressures over a very long evolutionary period. Different habits don't change brain structures (that is old-fashioned Lamarckian reasoning— Lamarck believed giraffes had long necks because they stretched for the leaves in the trees, for example). Only random mutations in combination with natural selection ultimately lead to adaptations; they were 'selected' because they 'fit the environment.' These adaptations (at the gene level) then spread to future generations. It was advantageous for our male ancestors to navigate the environment in a different way because animals move, whereas plants do not. The nice thing is that these hypotheses were tested and confirmed in modern, non-traditional living people (such as experiments in a food market). What is really striking is that both sexes are highly accurate in pointing out the location of foods with… higher calories. Maybe not so surprising if you consider how our ancestors faced scarcity all the time. These sex differences in spatial abilities are stable across age regardless of culture. This can only mean that our brain *is biologically embedded with content* (Cosmides & Tooby, 2013);
- The nail in the coffin for people who defend the 'nurture only' or 'environment only' claim is a very recent study using resting-state fMRI on 70 male and 48 female human

[59] Armed Services Vocational Aptitude Battery. The results were obtained from complete test results from 5,975 males and 5,939 females.

> fetuses, which confirmed for the first time that network functional connectivity differs with sex in utero. **The sex differences already emerge during human gestation**, which of course provides another piece of strong evidence for biological differences, as evolutionary biology and psychology cited previously (Wheelock et al., 2019).

It needs to be noted that these findings are not only found in research based on self-reports (the classical way to conduct psychological research). So far, literally hundreds of sex differences in the brain have been found by **brain researchers**.[60] In an interview in a Belgian newspaper, neurosurgeon Dirk De Ridder sums up some of these differences: in men, brain connections are anatomically organized from front to back, whereas in women, they go from left to right. The brain connections men use for intelligence are fewer but thicker, whereas women use more, but narrower connections. The effect of neurotransmitters can be totally different too: if vasopressin arrives in the hypothalamus, it makes men more aggressive, whereas it makes women less aggressive. The reverse is true for serotonin.[61]

Although these effects are small to medium in effect size, they do have an impact. Though let me be clear: NOT on talent and intelligence, but mainly on preferences (what kind of education I prefer, what kind of job I like or gives me satisfaction). A strange fact is that people across cultures see men and women as having different natures (e.g. anthropologist Donald E. Brown's Human Universals list, 1991), but in politics and academia, a lot of people cannot accept this. Admittedly, some of the old stereotypes were wrong: the idea that boys are better at math than girls are is wrong, but the stereotype could be the result of preferences rather than abilities.

As many evolutionary biologists and psychologists[62] have pointed out for many years, it is highly unlikely that the differences that we perceive, and that are confirmed by empirical research, are due to some humans who started this 'social construction of sex differences' at some arbitrary starting point at the dawn of time, and ever since then biased thinking towards men and women has been perpetuated in all cultures. It actually sounds like a global conspiracy theory. It simply isn't true, as the differences and resulting stereotypes (which are underestimated, remember!) do have their origins in biological differences. **Such biological sex differences that impact behavior can be found in all living animals, and humans are no exception.**

It is necessary to acknowledge male-female differences and to either use them or curb them to the advantage of both the individuals and the group. For example, unequal representation in certain professions, particularly STEM occupations (chemistry, mechanical, electrical and civil engineering, computer sciences, etc.), is at least *in part* the result of biological differences and preferences, *not only* of sex discrimination. Not a single serious evolutionary psychologist I know denies discrimination, they only point out that in some cases, biological differences—mainly in preference—also play a role.

In Western societies, where barriers against women have been removed, women now make up the majority in some professions, whereas in the past these jobs were almost strictly reserved for men clearly for discriminatory reasons. Such is the case for positions in the helping professions (medical doctor, veterinarians, psychologists, etc.), the humanities, and the social sciences. Women also express that these jobs give them the most satisfaction. So basically, even if women have the *opportunity and the capacity*, a majority still

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60 e.g. an overview provided by the Dutch brain researcher Dick Swaab.

61 De Standaard, July 7, 2018 (translated: 'We are NOT born with gender neutral brains').

62 See for example Steven Pinker in his reply to Susan Spelke on Edge.org

prefers other educational paths and occupations than math and STEM. These are the facts in the United States:

- Female students outnumber males in the following fields: linguistics (60%), journalism (60%), psychology (75%), biology (60%).
- Female and male students have an almost equal representation in math (45%) and medicine (49.8%).
- Males outnumber females in engineering (20% female).

It is clear that in Western countries, women are now choosing educational paths and professional careers that were once reserved for men. This is **clear evidence of greatly reduced discrimination**, though it doesn't mean we don't need to stay vigilant. **In some professions however, removing the barriers has not resulted in equal levels of representation**, and women are still underrepresented, and this is a worldwide phenomenon (Stoet & Geary, 2018). Such is the case in technical jobs like math and IT. Women who studied math choose more 'people'-related jobs such as teaching than 'things'-related jobs such as technical fields and IT.[63] 75% of pediatricians are women, as are 80% of new veterinarians, and both are jobs that are better paid than the average computer programmer.[64] So, although research shows men and women are at least equally good at them (although girls do tend to do better in math), it seems women don't choose these professions.

What is striking is that in the countries considered to have the most equality between the sexes, where women really have free choice, such as the Netherlands and Sweden, women choose even more 'typically female' professions such as caregiving and working part-time than in countries with not as much equality. Even in the most egalitarian countries such as Sweden, Canada, and New Zealand, the percent of women in computing is only 30%, 24%, and 20%, respectively (Galpin, 2002; Schmitt et al., 2008). It sounds counterintuitive, but the more egalitarian environments show increasing heritability for this 'people versus things' orientation; the difference between female and male preferences must be due to genetic differences.[65] Regrettably, too many social scientists still won't even consider biological differences in their explanations (e.g. O'Dea et al., 2018).

It is safe to conclude from the available data that if men and women have true freedom of choice, they tend to follow their biological preferences even more. These findings are in line with hypotheses from evolutionary psychology and totally contradict the SSSM (and the *social role theory* by Alice Eagly in particular) (e.g. Falk & Hermle, 2018; Lippa, 2010; Nivette et al., 2019; Stoet & Geary, 2018).

Sometimes the underrepresentation of women in certain professions is a negative thing for organizations and for society. For example, although EP offers strong evidence that men pursue leadership positions more competitively, research also shows that this is not beneficial to modern, large-scale societies. After all, most of us are not engaged in tribal

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63 https://datausa.io/story/06-16-2016_math-teachers/

64 For an excellent summary see psychiatrist Scott Alexander's summary here: http://slatestarcodex.com/2017/08/07/contra-grant-on-exaggerated-differences/

65 Heritability (h^2) is explained in detail in Plomin, DeFries, McClearn, and McGuffin (2001) as well as in Rushton and Jensen (2005). *Heritability* refers to the genetic contribution to individual differences or variance among people in a particular group *in a particular environment*. **This implies that if the environment changes, the heritability coefficient can change too**. A heritability of 1.00 would mean that all observed differences in a group are due to genetic differences. A heritability of 0.50 means that the observed variation is equally the result of genetic and environmental differences. And yes, $h^2 = +0.80$ can be read as 80% heritability.

warfare anymore, where leadership by large, strong males with the support of a strong coalition were the logical choice for both our female and male ancestors. A good balance between men and women reduces risk-taking and aggression and adds interesting perspectives in joint decision-making. **Embracing the complementarity of men and women is the best argument to striving for a 50:50 ratio in employment and leadership positions.** But imposing the 50:50 ratio in all occupations, for example in STEM, is likely to exact a toll in terms of individual happiness (Stewart-Williams & Halsey, 2019).

The risks of change programs

People continuously (and often non-consciously) make **Welfare Trade-Offs**. In this situation, personal welfare is compared to the welfare of others. For example, when deciding whether to support a proposed change in the company, employees will, among other things, quickly make trade-off calculations: what are the costs and what are the benefits? Leaders must be able to predict what employees will value and experience as a fair share of outcomes. But remember, social exchange rules often don't follow formal logic. For example, the *perceived* benefit for top management and shareholders is much higher than the perceived benefits for the employees, and as a result, our built-in circuitry for fairness might make employees oppose the envisioned change. However, even if all goes well and both parties perceive balanced benefits for all, the work is not yet done: after these valued outcomes have been anticipated or perceived, a leader must be able to charismatically persuade employees of the mutual benefits of the change (e.g. Tooby, Cosmides, & Price, 2006; Tooby, Cosmides, Sell et al., 2008). For further discussion on evidence-based paths to successful change programs, I refer to the chapters devoted to change in this book.

Collaborate or compete?

The findings from several research domains and a wide variety of methods lead to one conclusion: our *predisposition* to collaborate *within our group* is a human universal which has contributed enormously to our success as a species (e.g. Silk, 2014). There is evidence across cultures that people have increased social vigilance towards collaboration or communion. Not only is the vast majority of Brown's 372 human universals related to communion (or collaboration), people think more about traits and behaviors related to communion rather than to agency and are more vigilant towards those traits too (Ybarra et al., 2008). Compared to other species, our level of cooperation is unusually high, whether at the family level or within larger groups (Bowles & Gintis, 2011). Cooperation or collaboration has its origins in *kin altruism,* or our actions that benefit genetic relatives (Hamilton, 1964), and *reciprocal altruism,* which explains our capacity to collaborate with nonrelatives in a 'give and take' manner (Trivers, 1971); it may also have origins in social selection, or our drive to be viewed as a reliable social partner, which resulted in extreme traits such as ultrasociality (West-Eberhard, 1979; Nesse, 2007).

There is a general consensus among the members of my Champions League and academic experts regarding this conclusion (e.g. Salas et al., 2018). What sets us most apart from other species is the combination of (a) our creative capacity to invent tools, (b) our dexterity, (c) our natural curiosity which helped us understand and control our natural environment in an unprecedented manner, and (d) *in-group collaboration.* Our species, homo sapiens, has

escaped extinction a number of times as research on mitochondrial DNA (mtDNA)[66] variation (e.g. Wilson et. Al 1985) and ancient Y chromosome (aY) variation (e.g. Lippold et al., 2014) has revealed. Maternal lineage can be studied using maternally-inherited DNA, whereas the study of paternal lineage can be done using non-recombining Y chromosome (NRY) variation. This research makes it possible to investigate the history of populations because DNA can be extracted relatively easily from the remains of long-dead animals and humans. Comparisons of maternally-inherited mtDNA and paternally-inherited non-recombining Y chromosome (NRY) variation have revealed that many human populations were very small in size. For example, the out-of-Africa migration most probably was initiated by fewer than 100 individuals: research suggests about only 25 females and 15 males. This migration is now dated to some 75,000 years ago (Li & Durbin, 2011; Lippold et al., 2014). Some scientists relate this near-extinction to the massive eruption of the Toba volcano in North Sumatra about 75,000 years ago. It is also quite astonishing to realize that the 'founding' population for all current human population groups living outside of Africa consisted of about 60 females and 30 males. This is difficult to comprehend in light of the more recent population boom, which started some 20,000 years ago and has resulted in the number of human inhabitants on this earth reaching more than 7 billion.

Because all animals compete with others species and even within their own species for scarce resources, competition is important in human life as well (before the agricultural and industrial revolution, resources were scarce for humans too, which is why most human populations developed a preference for sugar, fat, and high calorie foods[67]). Nevertheless, **the balance clearly tilts towards collaboration**, as was already demonstrated by the game-theoretical approach used by Robert Axelrod. The importance of collaboration is often forgotten, even by many scholars (think of tournament theory applied to salary structures). Of course, collaboration has faced a number of challenges, I address in this chapter:

- in-group challenges: coalitional psychology (in-group competition and conflict), conditional collaboration, cheater detection and punishment, toxic leaders and selfish leaders, nepotism, etc.;
- out-group challenges: coalitional psychology (in-group superiority, intergroup competition and conflict, including warfare);
- agentic motives (individual competition, striving for status and power, greed, etc.)
- the size of our societies and our work environments: our society has become a 'mass society,' whereas our cooperative skills evolved in small scale societies.

Some modules have been *designed by natural selection* for *social exchange*—or cooperation for mutual benefit. Cooperation with multiple other people is not easy, nor was it for our ancestors. Evolution was given ample time (billions of years) to evolve specialized brain modules that shape our current cooperation. Besides our capacity to form and detect coali-

[66] Some of our DNA is inherited from only one parent and can be found in so-called uniparental markers. mtDNA is the abbreviation for mitochondrial DNA, which is only maternally inherited in humans and many other species. It contains 37 genes, but each cell contains around one thousand copies of mitochondrial DNA (Reich, 2018). mtDNA however is not very helpful for tracing our origins further back than some 160,000 years, as this is the limit restricting the possibilities of genome comparison. Technological advances have made it possible to study ancient male Y chromosome (aY) variation in human populations too (Kivisild, 2017). Other parts of the genome allow researchers to go back millions of years however (***paleogenomics***) (e.g. Larmuseau & Ottoni, 2018). In the chapter on recruitment, I discuss how ancient DNA studies revealed migration patterns that were undetectable through uniparental markers.

[67] Because this preference developed during the EEA—the Environment of Evolutionary Adaptedness, or the period of evolution that produced a certain adaptation—with the abundance of high calorie foods today, many nations worldwide face the problem of obesity.

tions and our aversion to free riding and other forms of cheating, Tooby and colleagues (2006) hypothesized and tested whether we developed a strategy of conditional cooperation combined with punitive sentiments towards free riders. They argued that cooperation within the in-group could not have evolved without **a mechanism to identify cheaters and punish them**. As it turned out, people are indeed **conditional collaborators**. Game theoretical approaches have demonstrated that unconditional helping or unconditional cooperation is not an evolutionary stable strategy (ESS). In populations of unconditional helpers, cheaters who do not reciprocate would quickly outcompete them. Research has shown that people have evolved a brain module that carefully monitors how much effort other group members put in to a collaborative effort and how many benefits they get out of it. Conditional helping or conditional collaboration is indeed an ESS (See for example Tooby & Cosmides, 2005, chapter 20; Smith et al., 2018). The mechanism of punishment has now been confirmed by experiments from other researchers as well. Their research revealed that the use of punishment results in only 20% of participants failing to cooperate, whereas in the no punishment condition 73% failed to cooperate (Fehr and Schmidt, 1999; Fehr and Gächter, 2002). If people cannot punish defectors, then they withdraw from cooperation. These findings are also important for organizations to bear in mind.

Game theory, a branch of mathematics, was also used to model the behavior in social decision-making. One scenario is called the prisoner's dilemma and asks players in several rounds to make decisions about cooperation and defection. The famous tit-for-tat strategy seems to be the most successful and evolutionarily stable option (an ESS): you try to cooperate as much as possible and if the other person cooperates, you reciprocate by cooperating: if the other person defects, you immediately defect too, until the other person cooperates. It was recently found that tit-for-tat with forgiveness (you forgive a first defection) also turned out to be an ESS.
Different lines of research produce convergent evidence that, for the human species, **cooperation is better than competition in modern day organizations as well** (Hruschka & Silk, 2015). There is growing consensus among researchers from these various fields. I briefly refer to a few studies about collaboration in organizations:

- Research by social psychologists Claudio Toma and Frabrizio Butera (2015) suggests that cooperative goals are needed for effective group decision-making. If people are more motivated by competitive incentives (goals, rewards), they tend to withhold information, lie about, distort or exploit information for their own interests, and information processing is impaired.
- David Johnson and other psychologists have researched the effects of cooperation versus competition and found that people in cooperative settings outperformed people in competitive or individualistic situations and were more supportive of each other (e.g. review in 2003). He considers the following to be key elements for collaborative success: interdependence, feeling responsible for others, helping behavior and assistance, exchanging information and materials, using social skills, periodically reflecting in a group setting on how well they are doing as a group and how they might improve. There are conditions under which competition can be positive: when winning is relatively unimportant, when everyone has a fair chance at winning, and when the task is unitary and relatively simple and clear.
- A meta-analysis conducted by Kleingeld and colleagues (2011) revealed that group-centric goals increased performance, whereas egocentric goals (meant to maximize individual performance) reduced group performance.
- If the performance of a team, department, or an organization highly depends on cooperation, then a cooperative reward structure (equality in pay, team-based rewards, etc.) is needed (e.g. Beersma et al., 2003; Kramer et al., 2013; Nyberg et al., 2018).

- One particular research field within psychology has studied the effects of collaboration versus competition in modern organizational contexts: *Social Interdependence Theory* (Deutsch, 1949). I refer to the chapter on goal setting for a more thorough discussion of this theory.

Do we need hierarchy?
Although I already dealt with this question extensively in the *partial truths* section, I briefly come back to this question here.

Social status (or dominance) hierarchies are the result of competition for scarce resources (food, territory, and other goods) and sexual mates. For most westerners, it is difficult to imagine that for most of human existence, our ancestors faced many difficulties just to meet their daily caloric needs. Our ancestors had to compete with both conspecifics from other groups and other animals. Competition/agency results in a social hierarchy among humans, and humans display their dominance in a number of ways: facial expressions showing anger, erecting the upper body, sitting straight, using expansive gestures, speaking in a loud voice, the visual dominance ratio (VDR, or who looks longer at the other), head position, and nodding (e.g. Gallaher 1992; Gifford, 1994).

Almost all mammals, but certainly all primates, also have dominance hierarchies. Some reach the top spot through brute force (e.g. male lions), but many primates combine brute force with social skills (e.g. chimpanzees). Humans on the other hand largely use intelligence and social skills. Humans evolved to have **social hierarchies** where social dominance and status are very important. All human groups have social hierarchies, whether they are casual (cliques, bands) or formal groups, such as in business or the military (Lund et al., 2006). Humans are not unique in this sense, as status hierarchies are common among most animals, though particularly so in our closest primate relatives, the chimpanzee.

Nevertheless, just because it occurs naturally does not mean it is also 'good.' But leadership in social species does have some serious advantages for survival and reproduction. There are at least three evolved functions of leadership: in-group coordination, in-group prevention, and reduction of conflict and coordination when facing a hostile out-group. Of course, some people gain status from leadership positions and can climb the social and economic ladders thanks to the financial incentives linked to this role. As with animals, reaching the top of the social ladder offers many benefits, such as access to more food, better health care, and more access to desired sexual partners (even in modern times). Thus, leadership has both an individualistic benefit and a group benefit. However, assigned leadership is still needed, and in contemporary organizations as well.

I will now repeat some of the arguments I discussed extensively in Near Myth 11 (on self-managing teams and leaderless organizations).
It is only fair to say that academic research provides ample evidence that allows us to conclude that it is simply impossible for organizations to work entirely without leaders. Even if some work designs allow for teams up to 20 people to be self-managing, they are still 'supported' (whatever that vague term means) by leaders. Sometimes leaders need to be highly inspirational or directive, especially with less experienced individuals or teams, and probably with less cohesive teams as well. In crisis situations, a central assigned leader is even crucial to solving a crisis quickly. Sometimes effectiveness and popularity don't go hand in hand: crises require strong and swift leadership. Different leadership styles (e.g. directive, inspirational, coaching, or participative) and even forms (e.g. assigned versus shared) are needed, contingent upon the context (environment, economic situation, internal variables such as employee level of expertise, etc.).

Indeed, I found **no proof** of the existence of successful **leaderless organizations**, in neither the popular literature nor the academic literature. The research on **self-managing teams** offers **no solid evidence** for beneficial outcomes such as well-being, performance, or financial health, as literature reviews since 2010 have consistently shown (Mathieu et al., 2008; Maynard et al., 2012; Parker et al., 2017; Van Mierlo et al., 2005).[68] Literature reviews (e.g. a meta-analysis by Wang et al., 2014) on **shared leadership** found no relationship with subjective and objective performance outcomes (what companies are interested in) but did show some correlations with other outcomes such as attitudinal or behavioral outcomes—although causality could not be demonstrated (Dust and Ziegert, 2015). In which circumstances shared leadership should be applied is controversial, as studies find opposite effects: some find it is beneficial for complex tasks, yet others don't.
In times of crisis, assigned leadership is needed. Almost all research points to the **need for leadership** and humans assign this leadership to several individuals within an organization. The research on charismatic leadership, for example, has found many benefits of this kind of leadership style. Leadership among human groups is prevalent in both small-scale societies (e.g. contemporary hunter-gatherers) and large-scale societies (e.g. Western democracies, multinationals). It is safe to conclude that the leaderless organization is a myth. People always organize themselves in ways to achieve better coordination for their tasks and to achieve their goals. In certain contexts, such as stressful events (crisis, accidents), leadership is even very much needed. The research thus supports leaders adopting different styles and adapting themselves to contextual inputs.

Of course, what we don't need are authoritarian, abusive, self-serving, and free riding managers at the top. But that doesn't mean people have no need for social hierarchies. I repeat that no leadership is not a substitute for bad leadership, good leadership is.
On a final note, research has indicated that when teams are allowed to internally allocate rewards on their own, this generates outcomes for women that fall below their actual productivity level, whereas men are consistently overcompensated though they did not offer higher productivity, which the researchers attribute to the "*combination of higher prosociality and lower bargaining power in women*" (Pierce et al., 2018). I would hazard a guess that this is not what we want.

Finally, I want to write a last word on a relatively new theory that I briefly explained in the paragraphs on the theoretical considerations. To my regret, the empirical evidence for **Cultural Genomics** is still mainly indirect (Chen & Moyzis, 2018). However, it should be noted that this theory offers some strong retrodictions: much of the evidence collected thus far fits this model extremely well. I recommend that you read the article for yourself (it is in the recommended reading list).

What does my Champions League say?

There is a broad consensus among the following members: Leda Cosmides, Jerry Coyne, Daniel Dennett, Steven Pinker, Michael Shermer, Dirk De Ridder, Sarah Blaffer Hrdy, Judith Rich Harris…, literally all agree that the nature versus nurture notion is completely outdated. There exists an interaction between genes and environment, meaning almost noth-

[68] For the full references of the articles, see Chapter 11 in the Partial Truths section.

ing is exclusively genetic (except personality disorders according to Dirk De Ridder[69]) and surely nothing is exclusively environmental. Human nature cannot be denied; we are not born as blank slates, but as species with genes. Lastly, the differences found between the sexes are fully acknowledged by this league.

■ **How can organizations apply the findings of EP?**

In other books, I have already described exhaustively **what organizations can do to prevent unproductive subunit identification and to maximize collaboration**, so I will only briefly summarize the most important topics:

- create an **attractive company identity**, create collective ambition instead of a classical *top down* vision story, include values, a mission statement that goes beyond the classical economic motives, etc. In short: your company should be attractive (in words and in practice);
- outside threats can increase the likelihood of collaboration between groups, so insisting that **outside competition is a threat** (at least for commercial organizations) *can* reduce inter-group competition within the organization. If such a narrative is not possible, it is important to insist on the benefits of resource sharing or exchanging (e.g. Robinson & Barker, 2017);
- **reduce internal competition** or cues that could lead to internal competition such as individual performance goals, social comparison (no 'employee of the month'), individual bonuses, stack-rankings, etc. Instead, use common goals, pro-social goals, team performance goals, quality, process and learning goals—and have people participate in the goal setting process;
- be sure to have **enough female leaders** on your board;
- ensure **good leadership**:
  - o as a general rule, select leaders with high levels of integrity and who place common interests and goals above their personal goals and interests (or at least look for alignment between personal and organizational goals); take a look at extraversion: it is a very good predictor of leadership emergence as well as leadership effectiveness;
  - o have leaders reflect on their mission and the common good of the company, train them to formulate common goals and communicate with inclusive language—train them to intervene at an early stage when team members are disrespectful towards each other or other teams;
  - o have leaders align with and repeat the company values, identity, etc.;
  - o punish or remove leaders who are obviously selfish, denigrating, disrespectful, etc.;
- have people **physically work together** in small groups on common, cross-team, or cross-departmental projects so that they become familiar with one another;
- ensure a **fair distribution** of resources and keep large salary gaps to a strict minimum. Too high of wages for top management or mid-level management are detrimental to collaboration as the beneficiaries will be perceived as cheaters;

[69] One of the newest developments in behavioral-genetic research are Genome-Wide Association Studies (GWAS), a methodological approach to identifying genetic variants at loci that are associated with trait or behavior variation among humans. Using this methodology, researchers have found multiple genes related to personality disorders such as schizophrenia (e.g. Pardiñas et al., 2018; Tansey & Hill, 2018) or depression (e.g. Coleman et al., 2018). The cause of personality disorders is not one gene but multiple genes, hence it is called a polygenic risk. Moreover, the diathesis-stress model of psychiatric disorders proposes that exposure to trauma activates an underlying genetic liability. Again, our genes and environments interact, with the environment serving as input. For a review of important GWAS discoveries, see the article "10 Years of GWAS Discovery: Biology, Function, and Translation" by Peter Vischer et al., 2017.

- establish a minimum **set of rules and procedures, including modest punishment**. Preventing and punishing free-riding (though not always, the threat will usually be sufficient; see Hoffman & Goldsmith, 2003; Krasnow et al., 2015) and other forms of cheating is one of the tasks of a leader. If they fail follow through with this, employees who perceive an imbalance of input (effort) and/or output (e.g. salary) will gradually reduce their efforts too. Punish only when necessary, but don't refrain from doing so if truly needed. Perhaps consider using an independent, third-party committee to choose the punishment, as this makes it more acceptable for the punished (think of independent judges in truly democratic countries);
- Imitate the ancestral environment (in some aspects). The last few decades have shed light on why poorly lit work premises (mostly designed by architects with a mission to be 'efficient' but who were uninformed about human psychology) might make people feel unhappy and even depressed. Indeed, we seem to have a kind of factory-equipped appreciation and longing for **natural environments and landscapes**. Ensuring enough **sunlight** enters the building, placing **greenery** in the office space (greenery, potted plants, even images of landscapes), purchasing desks that alter positions to induce physical movement, providing napping opportunities, and **offering spaces that facilitate informal social interaction** (yes, coffee corners aren't a bad idea if they are pleasant to dwell in) are measures that imitate the ancestral environment (overview in Fitzgerald & Danner, 2012). Some companies take this one step further (e.g. Gore and Associates) and create company units with a maximum of 150 people in order to not exceed the average group size of our ancestors, which was indeed around 150 people (e.g. Hill & Dunbar, 2002);
- Truly follow up and do something about **chronic stress**. The deleterious effects of chronic stress are well-documented, and middle management is particularly at risk because their jobs are often highly demanding, yet low in autonomy as most decisions are made at levels above them (for a detailed discussion of the effects of stress, see the chapter on emotions, this part);
- Give priority to rational and participatory decision-making processes. Use tools (such as cost-benefit analysis) and involve lots of different parties. We must be aware that many decisions are still made through dominance (tall and strong men do so in particular), by relying on past experience or competence (the current situation might make the experience irrelevant), or eloquence.

■ Recommended further reading:

First and foremost, check out the free available resources on the website of the Center for Evolutionary Psychology.

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