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Evolution and Human Migration

Policy implications of anthropological evidence

Considering the overwhelming evidence that our behavior is deeply rooted in our evolutionary past, an understanding of the principles of evolutionary biology is necessary to comprehend human behavior. In particular, applying these findings to the study of migration and reflecting upon the migration of Homo sapiens around the globe allows a more rational analysis of the implications of contemporary migration flows.

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1. THE CONCEPTS OF EVOLUTIONARY BIOLOGY

1.1 Adaptation

In the many years since Charles Darwin, the principles of evolutionary biology have been tested on a great variety of living species and fossils, dating back to the origins of life on Earth 3.5 billion years ago. Evolution shaped not only our bodies but also our minds, our cognition and our personality. This makes it fair to say that we carry the inheritance of roughly 200,000 years of evolution of Homo sapiens, several 100,000 years of evolution of the genus Homo, and about 30 million years of primate evolution in our bodies and minds. The fundamental principle of evolutionary biology is adaptation, the very process whereby an organism becomes better able to live in its habitat (Dobzhansky 1968). Accordingly, the better adapted will have more offspring and – if such a characteristic is at least partly inherited – the genetic information that is associated with that characteristic will spread in a population. Humans have moved through different ecological environments (Jobling et al. 2013; Jeong/Rienzo 2014), making human migration always also a process of adaptation to new environments. Interestingly, the species Homo sapiens is increasingly able to shape the environment in such a way that this new "self-generated environment" in turn influences genetics and leads to adaptation; this process is referred to as cultural-genetic co-evolution. An impressive example is lactose tolerance: Humans in the Neolithic Age started to keep cattle for meat production, but they were lactose intolerant until someone had the mutations that allowed him or her to drink milk as adults. Lactose tolerance offered such a genetic advantage that those lactose tolerant individuals had more children, leading to a spread of lactose tolerance (Mathieson et al. 2015). Today, the majority of adult Europeans are lactose tolerant (fewer in southern Europe, more in the northern parts of Europe). The cultural advance of keeping cattle for meat production has thus shaped our genetics in a previously unpredictable manner.

Recently, many other adaptations have been discovered, e.g. that Europeans relatively recently "lost" their darker skin color due to the ability to produce Vitamin D in higher latitudes with lesser sunshine (Izagirre et a. 2006).

1.2 The "selfish gene"

From the perspective of evolutionary biology, it is evident that any organism that did not reproduce is not in the line of ancestors. Accordingly, mechanisms that make us reproduce have been programmed into our minds. It does not matter what makes us a parent (such as a desire for sex); the consequence is that we have children and therefore pass our genes to the next generations (roughly 50 % of the genes from the mother and 50 % of the father). The concept that we aim to pass our genes to future generations is a fundamental concept of socio-biology (Wilson 2000) and has been popularized by Richard Dawkins (Dawkins 2016). Although it seems trivial, the drive to pass genes to the next generation is essential to explain human behavior. Based on this principle of gene transfer, William Hamilton formulated the "rule" of kin cooperation in 1964: we share 50 % of our genes with our children, and also 50 % with our full-siblings, while we share only 25 % of our genes with the children of our siblings and 0.125 % with the children of the children of our siblings – the same amount of genetic share that great-grandparents share with their great-grandchildren. It has been demonstrated that help among kin typically decreases with decreasing relatedness (this is defined as "inclusive fitness or kin selection"). Despite remaining childless, someone could be biologically successful if his or her siblings did reproduce successfully: the genetic material of this person is transferred – if only indirectly via his or her siblings – to the next generation. Accordingly, caring for your relatives is only superficially altruistic but genetically selfish. This is, of course, not a simple linear concept, as conflicts also arise among members of families and relatives (Trivers 1974). On average, however, help and support among kin is comparably high and seems to be rooted in our genes.

In the course of evolution we cooperated strongly within tribes of at most 150 individuals (Dunbar's number, Dunbar 1993), i.e. to some extent with genetically related individuals. Accordingly, support and cooperation during our evolution can be explained to a certain degree by inclusive fitness and kin selection. This is important because support and cooperation are fundamental to all human societies and help explain why we are so inclined to cooperate within our most nuclear groups: families and relatives. Despite cooperation among relatives, however, mechanisms of cooperation among non-kin have also evolved. Robert Trivers introduced the concept of reciprocal altruism, explaining cooperation among non-relatives. Numerous experiments have been conducted on forms of reciprocal altruism and the sustainability of reciprocal altruism. The results showed two important prerequisites for cooperative behavior to spread in a population: 1. Individuals must interact more than once (Mesterton-Gibbons/Dugatkin 1992). 2. There has to be some form of punishment for individuals who violate common rules (Fehr/Gächter 2002). This is referred to as "altruistic punishment": individuals in cooperation experiments punished individuals who behaved unfairly. While it is important to avoid simplification, the assumption is that the rules of cooperation originating in our evolutionary past are the basis for our complex societies. This system of rules supports cooperation by positive reinforcement, but also by punishment if rules are violated. Steven Pinker demonstrated in his book "The Better Angels of Our Nature – Why Violence Has Declined" (Pinker 2011) how a system of rules and their execution has made us a far less violent civilization compared to our highly violent tribal ancestors.

1.3 Religion

Based on the agglomeration of more individuals in larger structures (such as villages and cities) during our more "recent" evolution (~ last 10,000 years), it has been speculated that religion evolved from "small animistic gods" – that only marginally enforced moral behavior – to "big watchful and punishing gods" (Noreyenzan et al. 2016), strongly enforcing pro-social and cooperative behavior. In those larger units, individual control and punishment of defectors was rather difficult. Accordingly, the concept of the watchful and punishing god may have evolved – "god sees everything" – to ensure behavior in line with norms and to foster cooperation and cohesion. Particularly good examples for such a development are the three monotheistic religions: Judaism, Christianity and Islam. Group cohesion by religion should thus never be underestimated. In many religions, relations "within the own group" are preferred. This is also valid for marriage rules, e.g. that individuals should marry within their own religious group. Thus, religious homogamy has a worldwide prevalence of 95 %, and individuals have more children if they marry within their own religious community (Fieder/Huber 2016). Generally, religiousness is associated with an increase in fertility (Blume 2009; Fieder/Huber 2016), hinting at the potential evolutionary adaptive character of religions. Moreover, religions may have helped to overcome tribal/ethnic boundaries during the agglomeration in urban structures, starting in the Neolithic, as suggested by the "big god theory" (Huber/Fieder 2017). Although religions clearly tend to include all their members and therefore shift borders from smaller communities to much larger communities, borders still exist between religious denominations.

Cooperation among groups along with the exchange of resources and cultural goods between groups (e.g. cultural inventions by diffusion of ideas, Fu et al. 2016) no doubt had many benefits for the interacting individuals and groups. At the same time, these processes may also have entailed the risk of hostile interactions that could seriously harm the cooperating entities. Therefore, individuals and groups may have benefited from two types of personalities: "open individuals" who appreciated the contact to other groups and helped their own group to gain access to new resources and cultural goods, and more cautious individuals who avoided contact to members of other groups and demanded more protection of their own group. Both personalities would be important for survival and complement each other within a group of humans. This hypothesis is also in line with archeological evidence: the fast transfer of new technology over long distances in a short time as well as the many records of lethal human interactions (Curry 2016).

1.4 Mating

In most animal species the investment in reproduction largely determines the different mating strategies of males and females. Bateman (Bateman 1948) was the first to discover this fundamental biological principle based on the fruit fly. Bateman's principle is easily explained. In the case of sexual reproduction, evolution ended up with an asymmetric investment for reproduction: the females of all species usually directly invest more energy, time and resources in reproduction – the production of eggs, pregnancy and lactation – than males do in producing small sperm cells. Accordingly, women can have only a limited number of progeny. Men, in contrast, can theoretically have a nearly endless number of children. The consequence of these investment differentials is that females are the choosier sex. It has been argued that this has little relevance in modern societies, which provide child care facilities, kindergartens etc. Nonetheless, women still have to invest more in direct reproduction compared to men. Correspondingly, women still search for men with higher social status (Buss 1989) and, in turn, men with a low education level and income have a higher risk of remaining single (irrespective whether marriage or co-habitation is investigated). Thus, men of low education and income also have a higher risk of remaining unmarried and childless or ending up with fewer children (Fieder et al. 2005; Fieder/Huber 2007; Hopcroft 2006; id. 2015; Nettle/Pollet 2008; Fieder et al. 2011; Barthold et al. 2012). This remains highly relevant in modern societies and in times of increased global migration flows: young men lacking resources and social status will still have difficulty finding a wife. If young men are unable to offer enough status and resources, they will end up single (Fieder et al. 2017).

Local culture or legal regulations may also lead to a surplus of men, for example up until recently in China due to the "one child policy": because of local customs (such as bride dowry), parents preferred male progeny and therefore frequently performed abortion on female fetuses (Junhong 2001). This led to a significant surplus of men in China (Hesketh/Xing 2006). Albeit India does not have a "one child policy", the practice of girl abortion is also common (Arnold et al. 2002). Whatever the reasons, in both countries sex selection in fetuses skews the sex ratio: more men than women. In some parts of India the ratio is over 110 men to 100 women (Jha et al. 2006). This leaves many young men of low social status marginalized, never having the chance of getting married (Hesketh/Xing 2006). Muslim societies usually do not practice female fetus abortion, but in some countries a culture of polygyny is practiced, allowing a man to have up to four wives. Henrich et al. (Henrich et al. 2012) used a theoretical model to document what only a moderate rate of polygyny would mean for a large percentage of men: if 25 % of the men took a second wife and 2 % a third wife, a pool of 40 % of the male population would be shut out of the marriage market.

A high proportion of unmarried men can mean trouble: it increases the risk of violence, war and crime (Henrich et al. 2012; The Economist 2016). Marriage seems to very well prevent men from becoming violent and criminal (Horney et al. 1995; Farrington/West 1995). Data from the US suggest that marriage reduces the likelihood of committing a crime by 35 % (Sampson et al. 2006). China is an example where the excess of unmarried young men resulted in a substantial increase in crime rates (Hudson/Den Boer 2004; Edlund et al. 2007; Henrich et al. 2012). This leads to the assumption that the risk for violence and crime is higher in populations in which a considerable proportion of men is excluded from the marriage market because of a lack of women, or because men do not meet the requirements to enter marriage (such as a lack of social status, education or employment) (Sampson et al. 2006).

2. ARCHEOLOGICAL AND GENETIC EVIDENCE OF HUMAN MIGRATION

As fossil evidence at several sites in Africa suggests, the ancestors of humans split from our closest relatives about 5–7 million years ago. Our first upright-walking ancestor was the genus Australopithecus, dating back 2–4 million years. The first species of Homo, namely Homo erectus, appeared 1.9 million years ago and was, in fact, the first true long-distance migrant. Homo erectus and its early descendants (such as Homo Heidelbergensis) – dating back 200,000 to 600,000 years – started to populate the world outside Africa, with the exception of the Americas and Australia. The descendants of Homo Heidelbergensis, the Neanderthals and the Denisovia people played an important role in the evolution of Europeans and Asians. The migration of Homo Erectus, its descendants and later Homo Sapiens has to be understood as a "generational project": each generation moved a certain distance – mostly along coastlines – settled and the descendants of these individuals then moved on. Considering that the "modern human", Homo Sapiens, first appeared in the Omo river valley in southern Ethiopia 200,000 years ago, we do in fact all stem from Africa. There is evidence that the "out of Africa" migration occurred in one wave. The aboriginal Australians and the inhabitants of Papua New Guinea separated from Eurasians 50,000–70,000 years ago and moved to the Far East, as Europeans moved to the North and North-West. East Asians later split from the ancestors of European and Asian populations. The Americas were populated much later, around 15,000 years ago, but the current data on the migration waves are still under debate.

The populations of what we now call Europeans met with the Neanderthals (probably in the Levant) during their journey to the North-West. Neanderthals are the descendants of Homo Heidelbergensis and therefore stem from a much earlier migration wave out of Africa. Neanderthals were adapted to the colder northern climates. It was long thought that the Neanderthals had died out, but genetic evidence shows that they mated with the newly arriving Homo sapiens (Gree et al. 2010) and successfully reproduced with our ancestors. Accordingly, all Europeans and Asians contain a small genetic legacy (about 2 %) of Neanderthals. The genes inherited from the Neanderthals helped us adapt more quickly to the new and cold environment of Europe (Vernot/Akey 2014). In biology, however, nothing comes without a cost: the genetic inheritance that helped us survive the European climate seems to have made us more prone to depression, for example (Simonti et al. 2016). Since the arrival of Homo sapiens in Europe (~45,000 years ago), continuous migration and admixture has taken place. Meanwhile, we know that the individuals who first arrived in Europe did not contribute substantially to the current gene pool of Europeans (Fu et al. 2016). All individuals living between ~45,000 and ~14,000 years ago were the descendants of a single founder population. Approximately 9,000 years ago, however, a new genetic component from the Near East spread across Europe (Fu et al. 2016). This more recent "Neolithic spread" brought agriculture from Anatolia to Europe. This Anatolian migration lacks any evidence for a sex-specific admixture (no disproportion of men or women). An equal number of men and women migrated and admixed with the local population of hunters and gatherers and spread agriculture across Europe (Goldberg et al. 2017). In contrast, the later Neolithic and early Bronze Age migration was heavily male dominated, and sex-specific admixture thus took place. Genetic data indicate that the ratio of men to women ranged from 5:1 to 14:1. This male-biased migration wave (using horses) may have had totally different implications. The assumption is that the large segment of migrating males led to a less peaceful and rather violent process (Goldberg et al. 2017).

Comparable effects are also documented for the largely male immigration to the Americas 500 years ago. It led to the extinction of Native American lineages (not only due to violence, but also because of infections). As disastrous as the "export" of men to the Americas was for the Native Americans, without this "export", European history might have been even more violent than it has.

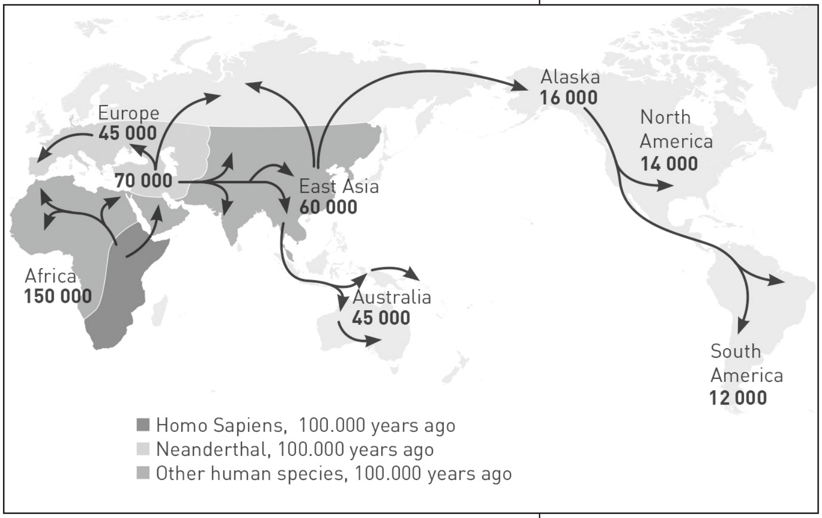
3. IMPLICATIONS FOR MIGRATION POLICY

Examining the dispersion of Homo sapiens around the globe reveals that human history is also a history of migration. At one point or another, someone in everybody's lineage was a migrant – it is merely a question of how far back to look. Migration thus always was in the nature of humankind. At the same time, migration itself does not have a nature: it is never just good or bad, peaceful or violent, beneficial or detrimental. As part of the evolutionary process it can be all of these things, but – as in many other regards – evolution does not care about the side effects such as the stability of states, the state of the economy or individual happiness. It cares only about reproduction and adaptation.

The frameworks that define our lives and the governance structures that Homo Sapiens has created are largely based on ideas, mental constructs and myths. Be it nations, religions, laws or money: they do not exist because they are a part of nature, but because we have chosen to believe in them (Harari 2015, 41). Migration flows, however, are something very real – they consist of people on the move and they create a reality that has to be reckoned with. The challenge of migration policies is hence to merge these realities with the myths that organize societies.

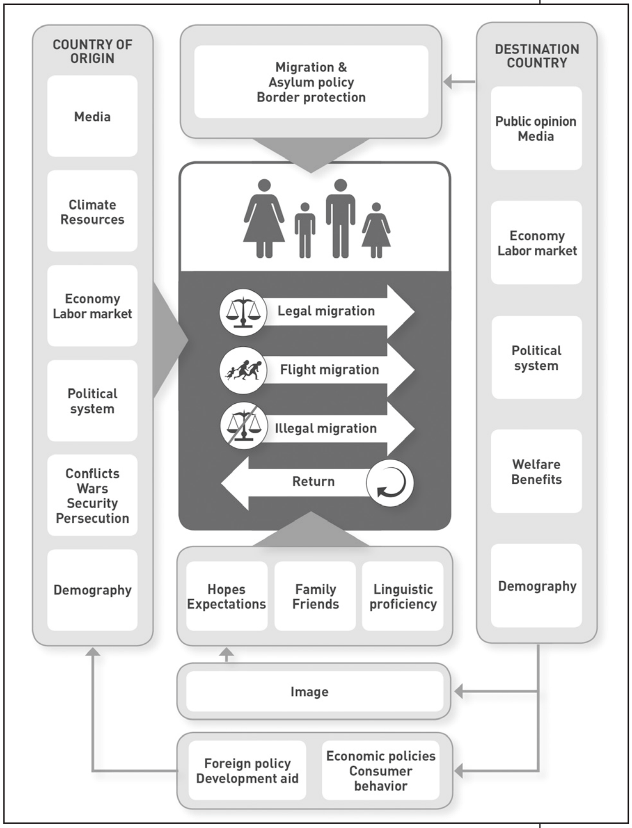
Migration is indeed an inherently complex matter and there is no simple narrative that explains it all. Numerous factors impact the source and destination countries, influence the decision-making process and regulate migration. These factors are

Source: Schahbasi/Fieder



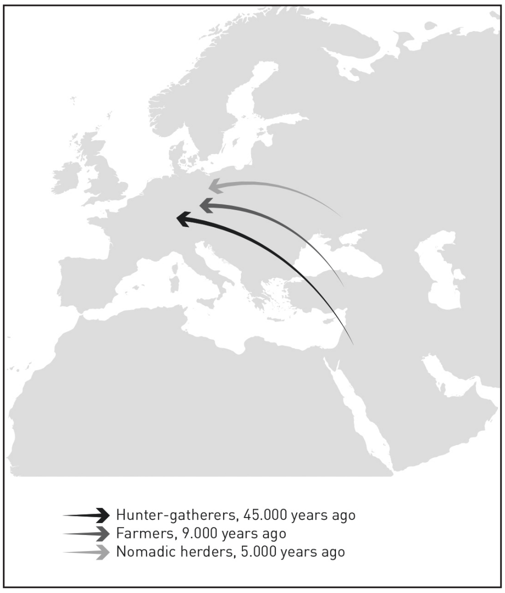
The distribution of human species and the migration of Homo sapiens[1]

Source: Schahbasi/Fieder



The complexity of migration[2]

Source: Schahbasi/Fieder



Major prehistoric migration flows[3]

largely interdependent, creating a complex web that defines the direction and scale of migration flows.

Accordingly, the anthropological aspects of human evolution also fail to provide an overarching theory of migration, but they do uncover some underlying truths with implications for governance. Drawing on the fundamental principles of evolutionary biology yields points of reference for migration policy makers to consider.

- Examining the diverging nature of the prehistoric migration flows that shaped the genomes of modern Europeans underlines that migration flows can be peaceful endeavors (e.g. the migration of farmers from Anatolia to Europe approximately 9.000 years ago) or lead to rather violent periods (e.g. the migration of nomadic herders from Ukraine/Russia to Europe approximately 5.000 years ago).
- Historically, inter-group interactions have had positive and negative effects: positive effects were the exchange of resources, cultures and information, whereas negative effects were hostile interactions with very detrimental outcomes for certain groups. For societies to thrive, both aspects need to be appreciated: openness as well as wariness.
- Skewed sex-ratios, leading to a disproportionate number of males vs. females, may lead to higher crime rates. Research suggests (Hudson/Den Boer 2004) that a sex ratio above 120 to 100 may impact stability. In particular, a bulge of young, unmarried men – due to a lack of women and/or a lack of social status – pose a risk to social cohesion.
- From an evolutionary point of view, integration takes place when groups intermarry and reproduce. Considering the rule of kin cooperation, this is fundamental to maintain and increase social cohesion over the long term.
- “Big states”, the bureaucratic nation states and their inherent, all-encompassing set of rules and regulations, have led to more peaceful societies by enforcing cooperative behavior, for instance through “altruistic punishment”. This approach – effective state governance and enforcement of rules – is equally necessary to ensure that migration movements remain peaceful endeavors.[4]

[1] *Harari 2015, 24.*

[2] *Spindelegger/Webinger 2017, 13.*

[3] *Jobling et al. 2013; Goldberg et al. 2017.*

[4] *Acknowledgments: Michael Stachowitsch for proof-reading.*

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