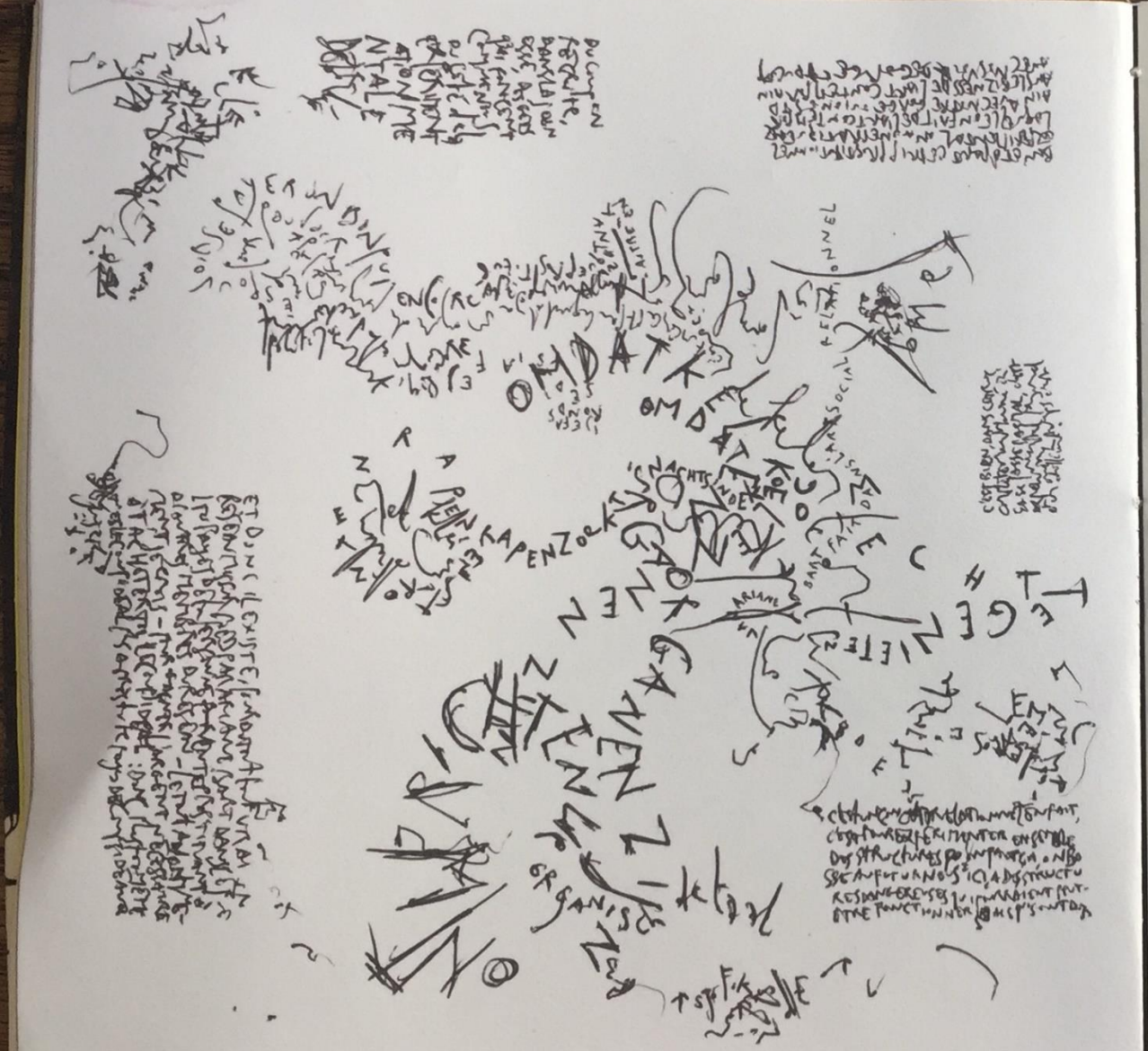

WHY ART IS NOT AN ADAPTATION BUT NONETHELESS A NECESSARY OUTCOME OF EVOLUTION

Art evolved

This is trivially evident when we accept the fact that we are living in a universe with a time dimension in which things necessarily change in continuous interaction with one another. First there was no life, then there was, then there was art. However, for many, since the enormous success of Darwin's evolutionary theory, Darwinism and the notion of evolution are quasi the same. But Darwinian evolution is of course a specific kind of evolution, characterized by particular mechanisms and conditions for those mechanisms to operate. It is almost universally agreed upon that the most important process in Darwinian evolution (from here referred to as "evolution") is natural selection.

Natural selection leads to adaptation, modifications towards a better fit to a certain environment. These modifications need to be inheritable and inheritance is usually genetic (epigenetic inheritance and social transmission put aside for simplicity). One of the most interesting consequences of evolutionary theory is that it implies that we share a common ancestor with all living creatures on earth.

This means that animals and plants are literally our distant cousins; that the difference between us and other creatures is gradual instead of absolute. This also means that, at least in principle, the methods and concepts that biologists apply to investigate the evolution of life should also apply to humans – included human behavior.

This brings us back to a particular element of the human behavioral repertoire: art making and appreciating.

Thus, art evolved, but how and why?

The most obvious answer would be, seen our current Darwinized view of evolution, "because it is an adaptation". Hence, many scholars have argued as such in the past. It would imply that art as a trait, as a human behavioral trait, fulfills or fulfilled a particular biological function, increasing survival and/or reproduction probabilities.

Spandrels

Appropriately, the term is equally used in art as in physics. In art it means that artists will tend to fill up every empty spot, for example with ornaments.

Spandrels are no exception. The spandrels formed by the rounded arches supporting the great central dome of San Marco cathedral in Venice for example, are decorated with designs that perfectly fit the tapering triangular space. An evangelist sits in the upper part flanked by the heavenly cities. Below, a man representing one of the four biblical rivers pours water from a pitcher in the narrowing space below his feet. In physics it is identified that no volume of space can be perfectly empty, therefore real vacuum does not exist. This is practically so but it also follows theoretically from quantum theory. Therefore it follows that the spandrel being "filled up space" is a physical necessity albeit a nonfunctional byproduct.

This applies equally to architecture as to evolutionary systems. Returning to stone handling in macaques: once discovered this behavior turns out to be irresistible and becoming an inevitable part of this groups behavior based on pre-existing traits such as motivations, skills and social contact, all likely fulfilling important functions in other contexts. As a result, if you would want to select against stone handling you would have to select against some underlying traits that are highly useful. A trait that resists certain selective pressures is called a "constraint." Thus, even spandrels can be constraints.

All this brings us seamlessly to art. At least, that is the hypothesis I would like to exercise here. That art, just like stone handling in Japanese macaques, should be seen in the first place as a byproduct of pre-existing capacities and preferences. Now is the time to get a bit more concrete, since "art" is of course, a rather controversial term, with a very specific and narrow meaning for some and a more generally applicable meaning to others.

With a Eurocentric definition of art, that requires art to be experienced as art and as a result the invention of a concept of art, you obviously cannot work within the bio-evolutionary framework. Therefore, let us consider these western activities as locally and temporally restricted cases of a more commonly and broadly appearing phenomenon of "cognitive play with patterns." This is the description of artistic behavior Brain Boyd proposes in his recently published book with the ambitious title "On the origin of stories." There are objections to be made to the book, particularly to his statement that art is an adaptation and above all to the lack of scientific rigor in his defense of this statement, but it offers an excellent and very complete overview of relevant

Or that it thanks its existence to natural selection acting on genes for art. I think it is important to be critical of this popular assertion. "Comparative hypothesis appraisal" requires considering and testing it against non-adaptive alternatives. That is what I will do here. I will first present some evolutionary alternatives for adaptation by way of a few examples. Subsequently I will release these alternatives on art and inevitably I will thereby have to consider the controversial question of what art is, or, what is art and what not.

But first, to be sure: whether art is an adaptation or not has essentially no consequences for art practices, art organizations, or art lovers. The defense that art is not an adaptation isn't based on a judgment of value. Not because some trait is an adaptation that it is a requirement for humanity or for our biology (obviously two very distinct *things*), or that it is more resistant to changing times or the fickle pathways of evolutionary history. Contrary, something that is not an adaptation can be of vital importance. Therefore it is conceivable that art is an evolutionary byproduct without a biological function, but nevertheless exhibiting an almost physical inevitability, as I will argue here.

A classical example from evolutionary biology illustrates this matter. Mammals, and humans especially, must begin life with a tight squeeze-the passage of the relatively large fetal head through the narrow birth canal. The bones of the skull are not yet fully ossified or sutured together. Consequently, the nonrigid head can be "molded" as the bones alter their positions to allow this first essential adjustment to extrauterine life. If this molding could not occur, birth with such a large head would be impossible. Thus, we seem to have a prima facie case for a vitally important adaptation in this delayed ossification of skull bones.

Big heads

After all, big heads are a key to human success, and delayed ossification permits big heads. (With limited brain growth after birth, small neonatal heads and later expansion may not represent an option for an alternative pathway.) However delayed ossification cannot rank as a mammalian adaptation-for the excellent reason that "lower" vertebrates (and mammalian ancestors), which need only to break free from an egg, share this feature with us. And an adaptation is by definition a trait of which the underlying genes were altered by natural selection for a particular function. Since flexible babyskulls existed long before narrow birth canals, the latter cannot have exerted a selective pressure on the former, not with the existence of the aforementioned time dimension in our universe.

Darwin, who we may arguably call a moderate Darwinist, mentioned the case in a cautionary note on overindulgence in adaptationist explanation. He proposed that this structure had arisen from the laws of growth, instead of from natural selection. This case illustrates that a trait that is vital does not need to be an adaptation and that more specifically it is important not to conflate evolutionary genesis and current utility. It therefore follows that we should not just assume that behavioral traits of which survival and reproductive advantages are much less evident then those of a large and flexible baby head, such as art making and appreciating, are adaptations. Paleontologist and evolutionary biologist Stephen Jay Gould proposed a new term for traits that have advantageous effects in certain contexts without them having been molded by selection for these effects: "exaptation."

Exaptation

For example, our capacity to drive cars is an exaptation of numerous motor and cognitive skills that of course were not selected by the act of driving with cars, but that were part of the human repertoire long before any kind of driving existed. Or consider tool use in orangutans. Until recently it was assumed that orangutans did not use tools in the wild. That changed when Dutch primatologist Carel van Schaik found a group that did, somewhere in a Sumatran swamp: they used little twigs to get at the highly nutritious seeds of the Neesia fruit. Remarkably, another group of orangutans, not so far away, did not. Yet advantages are considerable – especially in times of food scarceness – and both groups live in the same forest with the same fruits. van Schaik and his colleagues discovered that a higher social tolerance in the tool using community was the underlying cause of the difference. Young orangutans in the tool-using group did not only interact with their mothers but also with other individuals in their group. As a result they could learn from other potentially interesting role models in the group besides their mommies, contrary to little ones in other orangutan communities who only get to learn from them.

An initial spark of tool use behavior by a clever individual will not extinguish after death of the inventor, but is copied by multiple inquisitive individuals, driven by their sweet tooth. As a result a cultural tradition emerges without the need for underlying genetic modifications and therefore it should not be classified as an adaptation.

It is however an exaptation: although natural selection acting on genes did not create orangutan tool use, the tradition does increase chances of survival through enhanced energy intake, as van Schaik and colleagues have identified.

It is indeed possible that in the long run certain genmutations that further improve the efficiency of this tool use tradition and that as a result increase chances for survival and reproduction are selected. In that particular case the tradition would become an adaptation, more specifically a so-called secondary adaptation. In that case that would thus result from the fact that the Neesia fruit is not only tasteful but also nutritious.

But what if some behavior is psychologically attractive without providing any direct advantages? In that case you would assume that the behavior will spread over the population of socially interacting individuals as long as it does not impose all too high costs in terms of survival. "Stone handling" behavior in one group of Japanese Macaques seems an example thereof. Basically it is picking up suitable stones to repetitively smash them against each other.

Researchers have had the honor of witnessing the birth of this cultural tradition. They observed who first one female of the group started and how it slowly but steadily spread over the population by imitation. So far no function of this behavior has been discovered and it seems unlikely that it ever will be. Apparently they handle stones because they copy it from group members and because they are somehow motivated to keep doing it. Maybe it is pleasurable (perhaps they like the sound, sometimes they seem to turn their ears towards the sound the smashing produces)? Or maybe they engage in it compulsively.

Horror vacui

Fact is that the behavior does not need to be functional and that it can persist in their local culture as long as it does not impose heavy costs. Also for this kind of non-functional traits Gould proposed in an article with Richard Lewontin a new term: "spandrel." It is a term borrowed from architecture for the tapering triangular space formed by the intersection of two rounded arches and a dome mounted on top of the rounded arches. Thus the spandrel does not serve any function. It is however a necessary concomittant of the primary loadbearing function of the two rounded arches. That the spandrel is physically necessary results from the horror vacui, the fear for voids.

For instance, there's the fine-tuned hand-eye coordination elemental for creating a decent painting.

The selection pressures responsible for its evolution are much more likely ecological and other conditions that exert a much more significant impact on survival and reproduction, such as use and manufacture of tools (note that the example of the oranges illustrates that a certain level of manual skill, yet dormant, preceded the emergence of permanent tool behavior in our Hominid ancestors).

The view on evolution that Gould advocates is somewhat the opposite to the view with which most lay people are confronted through books by authors such as Richard Dawkins, Geoffrey Miller, and Steven Pinker. "Opposite" in the sense that in the words of these popular authors the emergence and evolution of new traits result almost exclusively from natural (and sexual) selection on genes, whereas Gould points to the importance of spandrel, exaptation and constraint, as alternative explanations for traits without negating that natural selection is an important evolutionary force.

But she is given a different role in the creation and design of a trait.

A trait may first emerge as a nonfunctional spandrel, a necessary concomitant of other traits, subsequently it may exert positive effects and become an exaptation, and as a result of which it may be further molded by natural selection as a secondary adaptation.

Therefore, defending that art should rather be considered a spandrel or an exaptation, meaning that the cognitive capacities required for fiction were exapted to fiction, I am assuming that these capacities haven't been further molded by natural selection for fiction. If one would like to proof that fiction or art is an adaptation, one would need to show that the emergence of art has brought about particular beneficial genetic modifications, that would not have taken place in the absence of art. Until today there hasn't been found any such evidence.

As long as this evidence is not produced we should favor the more simple and parsimonious spandrel-exaptation hypothesis.

Hand-eye

Furthermore, even if the presence of works of art or fiction has contributed to particular genetic modifications, chances are that these modifications are of minor importance to art. It seems much more plausible that art, since it emergence, above all has caused cultural modifications, and that these modifications in turn impacted the culturally transmitted aspects of art. Contrary to other animals are humans specialists in the accumulation of cultural innovations: building one invention upon the other. I believe that many aspects of the evolution of art are explained by this capacity for cumulative culture.

In a recent article with Mark Nelissen I elaborated on this in relation to the evolution of iconic or figurative art. Our argument builds on two striking observations.

Delay

First, there is a considerable delay between the emergence of human anatomical modernity, a 200 - 160 thousand years ago and the consistent appearance in the archaeological record of unambiguous figurative art, by 35 thousand years ago. Think of the compelling paintings of cave of Chauvet and of the younger Lascaux cave and the hundreds of Venus figurines that have been found from the Pyrenees to Siberia. Since our Homo sapiens of 150 thousand years ago are anatomically indistinguishable from us today, one wonders why they did not engage in art behavior, while we do. Genetically speaking they possessed the same dispositions and cognitive abilities as we have now. Why then did they wait another 100 thousand year to become figurative artists? Second observation is that this time lag does not apply to abstract art, of which much older pieces have been found.

The archaeologist Derek Hodgson observed in this respect that abstract art requires much less social learning then figurative art. The latter for example requires the knowledge of how to translate three dimensions to a two-dimensional surface or how to create depth in the case of painting. One individual cannot invent all required insights and techniques in one lifetime.

This knowledge arose from gradual accumulation of one innovation upon the other over the generations passed on from teachers to students and between peers.

This has led us to the hypothesis that the "creative explosion" as the consistent appearance of art used to be called, was not the result of genmutations leading to neurocogntive changes that opened up the possibility for art as many researchers assumed, but that it were demographic changes, such as the increase in size of

Social web

populations, but also increased density of populations on the landscape and the emergence of long-distance exchange through trade contacts. As a consequence of these demographic changes, many more individuals came directly and indirectly in contact with one another's knowledge in an expanding social web.

The expansion of this social web made it more likely that certain innovations required for art, such as the winning, processing and the use of pigments, persisted by being maintained by social transmission. Being maintained in the population, one innovation could build on another.

Driven by the emotional and perceptual effects visual art obviously has on us humans, and our interest for the reality where the compelling fictions represented refer too, innovations spontaneously accumulated and iconic art traditions naturally emerged.

The latter illustrates again the idea that art, albeit not an adaptation in the sense of a trait that arose by natural selection on genes, is nonetheless a necessary outcome of evolution and an integral part of the biology of the cultural animals human are.

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LITERATURE

BOYD B (2009) ON THE ORIGIN OF STORIES: EVOLUTION, COGNITION, AND FICTION. THE BELKNAP PRESS OF HARVARD UNIVERSITY PRESS.
GOULD SJ (1991) EXAPTATION: A CRUCIAL TOOL FOR AN EVOLUTIONARY PSYCHOLOGY. JOURNAL OF SOCIAL ISSUES 47 (3) : 43-65.
GOULD SJ, LEWONTIN RC (1979) THE SPANDRELS OF SAN MARCO AND THE PANGLOSSIAN PARADIGM: A CRITIQUE OF THE ADAPTATIONIS PROGRAMME. PROC. R. SOC. LOND. B 205 (1161): 581-98.
VAN SCHAIK CP, KNOTT CD (2001) GEOGRAPHIC VARIATION IN TOOL USE ON NEESIA FRUITS IN ORANGUTANS. AM J PHYS ANTHROPOL 114: 331-342.
VERPOOTEN J, NELISSEN M (2010) SENSORY EXPLOITATION AND CULTURAL TRANSMISSION: THE LATE EMERGENCE OF ICONIC REPRESENTATIONS IN HUMAN EVOLUTION. THEORY IN BIOSCIENCES 129(2-3): 211-221.