The Artful Mind: A Critical Review of the Evolutionary Psychological Study of Art

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Evolutionary psychology is among the various evolutionary and cognitive perspectives that have been used to account for the origins of art. It sets out to explain modern human psychology by means of the evolutionary history of the species, and by determining why and how our extant cognitive machinery evolved as adaptations to past environmental surroundings or by-products of such adaptations. In the case of art, evolutionary psychologists seek to track down its cognitive foundations and establish its evolutionary rationale, for instance by determining which function artistic behaviour as a whole might have performed. However, several methodological issues and gaps currently impede evolutionary psychological research on art: empirical support is often lacking, adaptationist claims are not adequately substantiated, and the definition and scope of basic aspects of evolutionary psychology often remain underspecified. This paper reviews the central themes that evolutionary psychology currently advances to account for the emergence of visual arts, music and fiction, addresses the most relevant methodological issues, and provides some suggestions that might help to develop evolutionary research on art.

1. Introduction

During the past decades, the study of art has been increasingly subject to naturalistic approaches such as cognitive science, neuroscience and evolutionary theory. One of these approaches is evolutionary psychology, which developed during the 1980s and integrates evolutionary biology, sociobiology and cognitive science. Evolutionary psychologists consider art to be a universal human behaviour, which comprises various artistic creations, such as visual arts, storytelling and music. In this paper, I will first briefly address the premises of evolutionary psychology, before describing the main focal points in its literature on art.[1] Evolutionary psychology is here taken to include not only authors at the centre of the discipline, but also others working in fields such as literary Darwinism, whose theoretical framework clearly incorporates evolutionary psychological ideas. Next, I will discuss the current state of affairs in the evolutionary psychological study of art, by looking at several methodological and conceptual issues characteristic of this discipline. With

1 The present overview does not include authors like Ellen Dissanayake (e.g. *Homo Aestheticus: Where Art Comes from and Why* (Seattle, WA: University of Washington Press, 1995)) and Steven Mithen (e.g. *The Singing Neanderthals: The Origins of Music, Language, Mind and Body* (London: Weidenfeld & Nicolson, 2005)). While they, and others, incorporate evolutionary psychological ideas in their work, their main disciplinary take (evolutionary ethology and cognitive archaeology, respectively) is different from the authors discussed here.

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this critical review of ongoing research, my aim is to advance evolutionary research on art by providing more clarity concerning these outstanding issues, as well as some possible approaches towards their solution.

2. Evolutionary Psychology and the Human Mind

Evolutionary psychology attempts to explain our current psychological make-up by referring to the evolutionary history of the human species. Researchers in this field look for an adaptive logic behind our cognitive machinery, probing into the relationship between our behaviour and the surrounding environment. Classical evolutionary psychology takes the mind to contain domain-specific, information-processing modules that originated through natural selection, as solutions to environmental problems faced by our human ancestors.[2] These innate reasoning circuits are said to make up our evolved human nature, and will produce behaviour in response to specific environmental cues.[3] Other scholars, also associated with evolutionary psychology, have modified this traditional conceptual framework. They place less emphasis on the presumed modularity of the mind, and advocate the inclusion of processes such as cultural learning.[4] In general, three major categories have been put forward to classify evolved traits: adaptations, by-products and random effects or noise.

An adaptation is an inherited trait that evolved by natural selection in response to a particular adaptive problem, consequently enhancing the survival and reproduction rates of the organism possessing the trait. In order to be transmissible, the trait requires a genetic basis, but it is also influenced by the surrounding environment through its ontogenetic development.[5] By-products are traits that are non-functional in themselves, but that emerged as side-effects of adaptations. Finally, random effects, sometimes referred to as noise, consist of neutral characteristics that, in contrast to by-products, are not related to an original

2 This view is endorsed by the Santa Barbara School, notably represented by scholars such as John Tooby, Leda Cosmides and Steven Pinker. This view on mental modularity strongly criticizes other approaches such as the idea that the mind is mostly a general processor with a few wide-ranging modules that are able to solve an immense variety of problems, or the Standard Social Science Model, which states that the mind is a blank slate at birth, lacking innate characteristics, and almost solely imprinted by experiences during life. For elegant discussions on different views of the mind, see, among others, Jerry Fodor, *The Modularity of Mind* (Cambridge, MA: MIT Press, 1983); Steven Pinker, *The Blank Slate: The Modern Denial of Human Nature* (London: Penguin Books, 2002); Edward Slingerland, *What Science Offers the Humanities: Integrating Body and Culture* (Cambridge: Cambridge University Press, 2008); Dan Sperber, 'The Modularity of Thought and the Epidemiology of Representations', in Lawrence Hirschfield and Susan A. Gelman (eds), *Mapping the Mind* (Cambridge: Cambridge University Press, 1994), 39–67; and Harvey Whitehouse, 'Introduction', in his *The Debated Mind: Evolutionary Psychology vs. Ethnography* (Oxford: Berg, 2001), 1–20.

3 John Tooby and Leda Cosmides, 'The Psychological Foundations of Culture', in Jerome H. Barkow, Leda Cosmides and John Tooby (eds), *The Adapted Mind: Evolutionary Psychology and the Generation of Culture* (Oxford: OUP, 1992), 19–136.

4 Robin I. M. Dunbar and Louise Barrett, 'Evolutionary Psychology in the Round', in Robin I. M. Dunbar and Louise Barrett (eds), *The Oxford Handbook of Evolutionary Psychology* (Oxford: OUP, 2007), 3–9.

5 David M. Buss et al., 'Adaptations, Exaptations, and Spandrels', *American Psychologist* 53 (1998), 533–548.

adaptation. These genetic changes or mutations can persist through evolution on the condition that they do not impair the organism's survival and reproductive opportunities.[6]

The causal engine of natural selection is differential reproductive success. If genes are to be transmitted into future generations, organisms need not only to survive at least until reproductive age, but they must also achieve greater reproductive success relative to others.[7] Sexual selection is a specific process of evolution by selection, with regard to traits that play a significant role in mate choice, courtship and other behaviours immediately relevant for reproduction, rather than survival in itself.[8]

Instead of using philosophical definitions, research into the psychological and evolutionary foundations of art often employs an operational distinction between three major categories.[9] Visual arts include painting, drawing, sculpture, body adornment, decorative applications to existing objects and so forth. Performance arts encompass a wide variety of time-based arts such as singing, dancing, instrumental music and theatre. Finally, storytelling involves fictional and non-fictional narratives, and poetry in both oral and written forms.[10] Some kinds of art fall within two categories, such as fiction being present in stories as well as in visual arts, or acting being a performative art, as well as bearing important features of storytelling. Some evolutionary hypotheses have been described by the philosopher Stephen Davies as 'general theories of art'.[11] These are theories that account for all manifestations of art—ranging from visual arts to storytelling and music—by using a general framework such as sexual selection, rather than allowing for different evolutionary trajectories and explanations for various kinds of art.

3. Evolutionary Psychology and Art

Evolutionary psychological research on art has explored several themes, two of which have been developed to a greater extent. These are sexual selection, and the elaboration of cognitive and social skills.

6 Tooby and Cosmides, 'The Psychological Foundations of Culture'.

7 Buss et al., 'Adaptations, Exaptations, and Spandrels'. This can happen either through actual reproduction (direct fitness benefits), or through altruistic behaviour towards other organisms with at least a partly shared genotype (indirect fitness benefits). These together make up inclusive fitness (William D. Hamilton, 'The Genetical Evolution of Social Behaviour. I & II', *Journal of Theoretical Biology* 7 (1964), 1–52). This concept also suggests that a more precise description of reproductive success involves not only the production of offspring by an organism, but specifically the production of fertile offspring that will in turn be able to reproduce themselves, as this will avoid the discontinuation of genetic material after one generation of offspring; see, for example, Tim H. Clutton-Brock (ed.), *Reproductive Success: Studies of Individual Variation in Contrasting Breeding Systems* (Chicago: University of Chicago Press, 1988).

8 Geoffrey Miller, *The Mating Mind: How Sexual Choice Shaped the Evolution of Human Nature* (London: Vintage, 2001).

9 Brian Boyd, *On the Origin of Stories: Evolution, Cognition and Fiction* (Cambridge, MA: Harvard University Press, 2009); Denis Dutton, *The Art Instinct: Beauty, Pleasure, and Human Evolution* (New York: Bloomsbury Press, 2009); Steven Pinker, *How the Mind Works* (London: Penguin, 1997).

10 Evolutionary explanations are not necessarily limited to kinds of art that were prevalent in ancestral times, and can also apply to more modern forms such as architecture in the case of visual arts, and film in the case of storytelling (Dutton, *The Art Instinct*). Evolutionary explanations are, however, mostly concerned with explaining art's origins, which is why they may be particularly suitable for accounting for ancestral kinds of art.

11 Stephen Davies, *The Artful Species: Aesthetics, Art, and Evolution* (Oxford: OUP, 2012), 121.

Sexual Selection

The evolutionary psychologist Geoffrey Miller takes an approach that is aligned with sexual selectionist explanations in evolutionary biology, through references to animal behaviour and the biological correlates of aesthetic choices. Artistic behaviour, in Miller's view, is a proper adaptation, with courtship signalling as the causal engine for its evolution.[12] Similar to physical characteristics, psychological and behavioural traits related to mate choice are often sexually dimorphic, i.e. they differ between male and female organisms within a species.[13] Common examples are the male peacock's tail and the bowers constructed by male bower birds as a mating device towards females. The latter's preference for elaborate bowers is at the same time a preference for overall health and physical strength, as only the most mature, experienced and physically apt males will produce the most impressive bowers.[14] Bower building skills are therefore an honest signal of a male's quality, as well as a costly signal: in many cases, spending vital energy on this or similar behaviours impedes the survival chances of the animal, a paradoxical outcome previously described as the handicap principle.[15]

According to Miller, we can extend this framework to human behavioural and mental abilities. Intelligence, creativity, art, humour, altruism and music are all thought to play an important role in mate choice, with males being the ones most likely to develop these traits under sexual selectionist pressure.[16] They are referred to as being part of

12 Geoffrey Miller, 'Sexual Selection for Cultural Displays', in Robin I. M. Dunbar, Chris Knight and Camilla Power (eds), *The Evolution of Culture* (Edinburgh: Edinburgh University Press, 1999), 71–91; 'Evolution of Music Through Sexual Selection', in Nils L. Wallin, Björn Merker and Steven Brown (eds), *The Origins of Music* (Cambridge, MA: MIT Press, 2000), 329–360; 'Aesthetic Fitness: How Sexual Choice Shaped Artistic Virtuosity as a Fitness Indicator and Aesthetic Preferences as Mate Choice Criteria', *Bulletin of Psychology and the Arts* 2 (2001), 20–25; *The Mating Mind*.

13 This apparent imbalance is explained by Trivers' parental investment theory, which states that females are more cautious in choosing a particular mate due to their much greater physical and metabolic investments in gestation and childcare. Males, on the other hand, generally obtain higher reproductive success by continuously looking for new mates to the detriment of paternal investment in earlier offspring. For this reason, they need to invest large amounts of time, energy and resources in attaining the best possible image towards future mates, whereas females require the ability to discriminate between males of different quality (Robert Trivers, 'Parental Investment and Sexual Selection', in Bernard Campbell (ed.), *Sexual Selection and the Descent of Man* (Chicago: Aldine, 1972), 136–179). However, not all instances of dimorphism are necessarily the result of sexual selection. For a discussion, see e.g. the chapters by Ernst Mayr and John Hurrell Crook in the same volume.

14 Gerald Borgia, 'Comparative Behavioural and Biochemical Studies of Bowerbirds and the Evolution of Bowerbuilding', in Marjorie L. Reaka-Kudla, Don E. Wilson and Edward O. Wilson (eds), *Biodiversity II* (Washington, DC: Joseph Henry Press, 1997), 263–276; Joah Madden, 'Sex, Bowers and Brains', *Proceedings of the Royal Society B* 268 (2001), 833–838.

15 Amotz Zahavi and Avishag Zahavi, *The Handicap Principle: A Missing Piece of Darwin's Puzzle* (Oxford: OUP, 1999).

16 Gil Greengross and Geoffrey Miller 'Humor Ability Reveals Intelligence, Predicts Mating Success, and is Higher in Males', *Intelligence* 39 (2011), 188–192.

the extended phenotype, a term coined by the evolutionary biologist Richard Dawkins.[17] In sum, Miller proposes that artmaking acts as an adaptive signalling system, aimed at attracting suitable mates. Aesthetic sensitivity towards art is the human equivalent of the female bowerbird's ability to assess impressive bowers:

> Applied to human art, beauty equals difficulty and high cost. We find attractive those things that could have been produced only by people with attractive, high-fitness qualities such as health, energy, endurance, hand-eye coordination, fine motor control, intelligence, creativity, access to rare materials, the ability to learn difficult skills, and lots of free time.[18]

Miller has applied the same line of reasoning to fictional storytelling, regarding it as a mating device through demonstrating cognitive creativity and higher-level skills such as counterfactual reasoning, but most notably to the origins of music.[19] Rhythm is thought to demonstrate cognitive control over complex movement sequences, dance and movement show physical strength, health and coordination, while melodic creativity is evidence of general cognitive fitness. Some components of music might additionally be explained as aesthetic displays, evolved through exploiting existing acoustic preferences. Given an original preference for complex auditory signals, an evolutionary feedback loop can emerge in which the producers create increasingly complex signals, while the receivers evaluate those signals ever more positively. This process is known as runaway sexual selection.[20] Musical features can be both indicator traits—containing features relevant for mate attraction — and aesthetic displays—products of runaway selection. In Miller's view, an adequate evolutionary analysis of music consists of a framework that includes both of these categories.

While not directly based on sexual selection, the evolutionary psychologist Steven Pinker has advocated similar ideas with regard to art fulfilling a social status signalling function. In his account, many traits we consider to be the most unique and striking features that make us human, such as art, religion, philosophy and humour, are in fact by-products of other cognitive abilities.[21] Engaging in visual arts and music might be partly sustained by the fact that their costliness in terms of time, energy and resources signals

17 Richard Dawkins, *The Extended Phenotype: The Gene as the Unit of Selection* (Oxford: W.H. Freeman, 1982); Miller, *The Mating Mind*. Similar ideas on art as an honest as well as a costly signal have been expressed by the biologist Eckart Voland, who states that works of art encapsulate honest signals concerning their makers. For example, costly materials used in the creation of artefacts provide valuable information about the resources available to the person who made the artefact. A phenomenon such as patronage is to be explained in the same manner: only those with abundant resources are able to employ others for creating, for example, status portraits (Eckart Voland, 'Aesthetic Preferences in the World of Artifacts—Adaptations for the Evaluation of Honest Signals?', in Eckart Voland and Karl Grammer (eds), *Evolutionary Aesthetics* (Berlin: Springer, 2003), 239–260).

18 Miller, *The Mating Mind*, 281.

19 Miller, 'Evolution of Music Through Sexual Selection'.

20 Ronald A. Fisher, *The Genetical Theory of Natural Selection* (Oxford: Clarendon Press, 1930).

21 Pinker, *How the Mind Works*; 'The Biology of Fiction', in Robin H. Wells and Johnjoe McFadden (eds), *Human Nature: Fact and Fiction* (London: Continuum, 2006), 27–39; 'Toward a Consilient Study of Literature', *Philosophy and Literature* 31 (2007), 162–178.

social status. Moreover, most of the arts make use of exisiting neural reward circuitry that originally evolved for other functional purposes. Stimuli that were beneficial for survival and reproduction gradually became associated with neural rewards producing positive emotions, whereas the reverse happened with stimuli that were likely to cause harm.[22] Co-opting these mechanisms enables us to draw pleasure from activities that are not in themselves useful for survival purposes and one of the most effective ways to do so is through the hyperstimulus called art.[23]

Elaboration of Cognitive and Social Skills

A second line of reasoning states that art contributes to the development of cognitive and social skills. This perspective generally focuses on fictional art, which is understood to include any kind of non-veridical representation across various kinds of art, such as literature and visual arts, although a focus on storytelling, and fictional stories in particular, is more common.[24] It sometimes tends to look for the roots of art in play behaviour, proposing that human artistic behaviour is a more advanced version of the exploratory behaviour found in a variety of other species.[25]

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22 Randy Thornhill, 'Darwinian Aesthetics Informs Traditional Aesthetics', in Voland and Grammer, *Evolutionary Aesthetics*, 9–35.

23 Pinker's ideas are closely related to the idea that our inclination to engage in art is due to the fact that it appeals to our constant need for pattern extraction from other organisms and the external world. Patterns can be generally understood as 'order or form in things, actions, ideas or situations' (Boyd, *On the Origin of Stories*, 87). They can involve visual data such as spatial features or physical characteristics of other individuals, but also more volatile information such as recurrent behaviours, intentions and mental states of conspecifics. The ability for pattern recognition is beneficial to humans due to the emergent potential for predicting future events. It has been argued that higher primates, including humans, have a preference for sophisticated patterns such as symmetrical or rhythmic displays (Boyd, *On the Origin of Stories*; Michael Gazzaniga, *Human: The Science Behind What Makes Your Brain Unique* (New York: Ecco, 2008)). Works of art could be considered to be supernormal stimuli: they contain a rush of these patterns, at much higher frequency and in greater intensity than we would normally encounter in real life (Boyd, *On the Origin of Stories*; Vilanayur S. Ramachandran and William Hirstein, 'The Science of Art: A Neurological Theory of Aesthetic Experience', *Journal of Consciousness Studies* 6 (1999), 15–51). This last paper, and the hyperstimulus conception of art in general, have been criticized for its rather limited scope of what art is; see, for example, comments by Ernst Gombrich and others in *Journal of Consciousness Studies* volumes 6 (1999) and 7 (2000), and a critical discussion of the peak shift principle in John Hyman, 'Art and Neuroscience', in Roman Frigg and Matthew C. Hunter (eds), *Beyond Mimesis and Convention* (Dordrecht: Springer, 2010), 245–261.

24 John Tooby and Leda Cosmides, 'Does Beauty Build Adapted Minds? Toward an Evolutionary Theory of Aesthetics, Fiction and the Arts', *SubStance* 30 (2001), 6–27.

25 See, for example, Boyd, *On the Origin of Stories*. Among the crucial differences between human artistic and animal exploratory behaviour are shared attention in the former, as well as a variety of abilities such as language and relevant motor skills that enable particular kinds of art such as storytelling and drawing, while not doing so in non-human animals. It is possible, however, that art and play behaviour are phylogenetically linked; see, for example, Dissanayake, *Homo Aestheticus.* Common elements are, among other things, creativity, imagination and intelligence (Davies, *The Artful Species*).

The evolutionary psychologists John Tooby and Leda Cosmides' hypothesis involves linking art to the organization of sensory input and knowledge. The enjoyment of art is regarded as an adaptive neurocognitive process, instrumental in the development of the mind. They provide the example of natural phenomena such as stars, landscapes and the sound of running water, which often capture our attention and are experienced as beautiful. This is because the brain uses their constant properties as a means to finetune its perceptual machinery: 'The brain, because it "knows" in advance what these cross-generationally invariant signals should be like, can compare the actual input with its innate model of the expected input, and use the difference as a corrective feedback signal.'[26] The specific contribution of fictional art and non-veridical imagery is that it increases our mental catalogue of representations to such a significant extent that it greatly enhances our ability to venture into imagined worlds. Fiction therefore implies 'simulated or imagined experience': it allows for processes like mental time travel, engaging in imaginary social interactions or conversations, mapping out different action strategies in response to a potential real life situation or threat and so forth.[27] This enables the practice of skills necessary for everyday life, while at the same time avoiding the risk of having such practice take place amid the perils of Pleistocene life.

Several authors extend the more general idea that art enables cognitive elaboration into the domain of social skills. According to the literary scholar Brian Boyd, art can be regarded as a form of cognitive play saturated with pattern. He considers both art, in general, and fictional storytelling, in particular, to be adaptations. The latter provides us with patterns of strategic social information relevant for immediate action, as well as with general principles concerning character traits and reasoning tools for grasping the depth of social interaction. Fiction also endows us with the abilities to contemplate social situations from different perspectives, to make mental shifts between characters and to increase the speed of social information processing by stocking our memory with a range of compelling examples.[28]

Pinker similarly argues that stories allow for a form of case-based reasoning, as generic strategies are less useful in specific circumstances. Contrary to visual arts and music, he considers fiction to be a combination of an adaptation—realized through its instructive function—and a by-product—referring to its pleasurable effects. Its main function is that it provides us with a virtual reality where thought experiments can be done so as to explore different options in social interaction. In addition, stories where complex social scenarios are absent can help us to acquire sociocultural norms.[29]

The literary scholar Joseph Carroll states that literature and the arts in general 'fulfill the specifically and uniquely human need to produce an emotionally and aesthetically

26 Tooby and Cosmides, 'Does Beauty Build Adapted Minds?', 17, original emphasis.

27 Ibid., 23.

28 Boyd, *On the Origin of Stories*.

29 Pinker, 'Toward a Consilient Study of Literature'. For a psychological perspective on the simulation hypothesis, see Raymond A. Mar and Keith Oatley, 'The Function of Fiction is the Abstraction and Simulation of Social Experience', *Perspectives on Psychological Science* 3 (2008), 173–192.

saturated cognitive order'.[30] Elsewhere, he argues that 'the primary adaptive function of art is to provide the mind with subjectively weighted models of reality in such a way as to help organize the complex human motivational system. … It provides an emotionally saturated simulation of experience'.[31] This enables those who engage in art to be immersed in particular emotions while at the same time keeping cognitive distance.

Aside from increasing our social skills, stories have also been said to elevate our moral consciousness.[32] Moral emotions, dilemmas and choices make up a considerable part of the content of stories worldwide, and repeatedly experiencing and contemplating them is thought to help us make good moral choices, and to develop prosocial behaviour as well as feelings of empathy towards others. According to the literary scholar Jonathan Gottschall, this is particularly evident in nationalist and religious stories, whose aims are to boost cooperation and diminish the importance of individual benefit seeking. The medium of fiction, often characterized by emotionally saturated content and unexpected twists and turns, is particularly successful in capturing and maintaining attention, and eventually in altering our cognitive and neural make-up.[33] This means that fictional content, rather than, for example, a fact-based historical narrative, is much more effective in achieving goals such as moral education and cooperation. Similarly, religious teachings would probably be far less compelling if their content was merely listed as a set of guidelines, rather than being cast in elaborate stories of a mythological or imaginative nature.

4. Methodological Issues in the Evolutionary Psychological Study of Art

Since its establishment as a scientific discipline in the early 1990s, evolutionary psychology has received a significant amount of criticism from outsiders to the evolutionary study of human behaviour, who argue that evolution holds little relevance for understanding modern behaviour and culture, given how different these are from the hunting and gathering conditions thought to be characteristic of human ancestors. In addition to this, insiders to this framework have criticized evolutionary psychology in favour of other perspectives

30 Joseph Carroll, 'Literature and Evolutionary Psychology', in David M. Buss (ed.), *The Handbook of Evolutionary Psychology* (Hoboken, NJ: John Wiley, 2005), 931–952, at 938; see also Joseph Carroll, *Reading Human Nature: Literary Darwinism in Theory and Practice* (Albany, NY: State University of New York Press, 2011). While the achievement of cognitive order in the surrounding environment is likely not exclusive to humans, the vast social complexity in human groups and societies does warrant a more refined understanding of such order and structures, which, in Carroll's view, can be achieved through the simulation mechanisms present in storytelling. In the specific cases where animal societies rival humans' in their complexity, the absence of art (but the common presence of play) may be due to the corresponding absence of relevant psychological and behavioural adaptations involved in human artmaking.

31 Carroll, 'Literature and Evolutionary Psychology', 940.

32 Boyd, *On the Origin of Stories*; Jonathan Gottschall, *The Storytelling Animal: How Stories Make Us Human* (New York: Houghton Mifflin Harcourt, 2012); David Sloan Wilson, 'Evolutionary Social Constructivism', in Jonathan Gottschall and David Sloan Wilson (eds), *The Literary Animal: Evolution and the Nature of Narrative* (Evanston, IL: Northwestern University Press, 2005), 20–37.

33 Gottschall, *The Storytelling Animal*.

such as gene-culture co-evolution and human behavioural ecology.[34] Within evolutionary psychology, art has been studied to a relatively small extent, and its limited representation in this scientific literature makes for considerable gaps and methodological issues. While accepting evolutionary psychology as a valid approach for studying art, I will address four issues: the complex debate on adaptationism and how it is reflected in research on art, the current scarcity of empirical studies testing existing hypotheses, disagreement on the nature of modules or psychological mechanisms, and evolutionary psychology's one-directional perspective on culture. The first two matters concern the current theoretical and empirical setup of this literature, whereas the third point involves an issue that is of a more conceptual nature, specific to evolutionary psychology. The last topic discusses how this discipline might expand its methodological framework in relation to other evolutionary perspectives on human behaviour.

The Adaptationist-By-Product Debate

The matter of defining adaptations is in itself the subject of numerous publications in fields such as evolutionary biology and ethology, where it has encouraged complex meta-discussions. The evolutionary psychologist David Buss has argued that three important questions need to be asked, and should receive an affirmative answer, for a trait to be designated as an adaptation:

> Does the mechanism regularly develop in most or all members of the species across all 'normal' environments, and perform dependably in the contexts in which it is designed to function (reliability)? Does the mechanism solve a particular adaptive problem well (efficiency)? Does the mechanism solve the adaptive problem without extorting huge costs from the organism (economy)?[35]

Most importantly, these features must be unified in a particular trait through special design: 'The decision as to the purpose of a mechanism must be based on an examination of the machinery and an argument as to the appropriateness of the means to the end.'[36] Confusion concerning the evolutionary origins of art often stems from a misunderstanding between adaptive function and function in general. Art has been credited with many different benefits, such as providing us with comfort and consolation, with insight into the human psyche, or with an increased appreciation of nature.[37] However, it does not suffice to claim that art is an adaptation, for example, because it unites people, even though such a beneficial effect may have been demonstrated empirically. Unless an adaptive problem can be identified and linked to the trait as its solution evolved through natural

34 Kevin Laland and Gillian Brown Contrary to what I wrote in this version, they are the authors instead of the editors of this book, *Sense and Nonsense: Evolutionary Perspectives on Human Behaviour* (Oxford: OUP, 2002).

35 David M. Buss, *Evolutionary Psychology: The New Science of the Mind* (Boston: Pearson Education, 2008), 16.

36 George Williams, *Adaptation and Natural Selection: A Critique of Some Current Evolutionary Thought* (Princeton, NJ: Princeton University Press, 1966), 12.

37 Dutton, *The Art Instinct*.

selection, the label of adaptation is not to be attributed. This touches upon a common issue in adaptationist explanations of art: as the available empirical studies show, evidence often supports different explanations. With regard to music, for example, links have been established with its value as an instrument for mate attraction and assessment, but other research points towards its cooperative and prosocial effects. Different functions for one behavioural trait are not mutually exclusive, as such a trait may have originated for one particular effect and may have later taken on another function. As Davies notes, this possibly applies to some of the functional explanations that are now put forward as reflecting selection pressures. Mating display, for instance, is a strong candidate for explaining several kinds of art, but may comprise a secondary, co-opted function, rather than a primary adaptive one.[38] In order to trace the evolutionary roots of music as a possible adaptation, one should be able to identify an ultimate function that yielded survival value, rather than merely raising a number of different uses. This requires further thought on what constitutes an adaptation in the context of art.

Several approaches have been enlisted to demonstrate that adaptation is a suitable category for explaining various kinds of art.[39] Adaptationist claims are sometimes substantiated by referring to a number of characteristics that, taken together, point in the direction of functional, adaptive value. For example, with regard to the visual arts, Miller argues first that art is universal in time and space.[40] While this is presumably true, this does not automatically constitute proof for an adaptation. The fact that artistic behaviour appears to be species-specific and universal merely warrants us to consider it as a stable feature of human nature, which makes evolution an obvious candidate for its explanation.[41] Conversely, a trait does not even have to be universal in order to be adaptive, such as in the case of negative frequency dependent selection, where fitness increase derived from this trait depends on it *not* being a property of all individuals in a population.[42] Next, Miller points out that art provides pleasure. However, Pinker's by-product account also succeeds in explaining the pleasurable effects of art and its aesthetic features by arguing that we might be enjoying the separate components of art, such as visual primitives and symmetrical patterns, while it appears to our conscious experience that we draw pleasure from art as a whole. The argument of art's costliness does appear to be supported

38 Davies, *The Artful Species*, 125.

39 Categorizing art as an adaptation in principle requires the assumption that it has a genetic basis. However, the current state of research does not allow for much speculation about these genetics, as there is very little clarity about which traits are supposedly adaptive. Different kinds of art such as fictional storytelling might be instruments in adaptive traits such as social learning mechanisms. This would allow for a strongly cultural explanation of storytelling in itself, with genetic analysis focussing on the basis of these mechanisms. In addition, mechanisms such as social and cultural learning often play an important role, contradicting the idea that a behaviour such as art is predominantly determined by genes. Understanding the level of heritability in artmaking is nonetheless important for investigating interindividual variation in this trait; see, for example, Davies, *The Artful Species*, 49–50.

40 Miller, 'Aesthetic Fitness'; *The Mating Mind*.

41 Merlin Donald, 'Art and Cognitive Evolution', in Mark Turner (ed.), *The Artful Mind: Cognitive Science and the Riddle of Human Creativity* (Oxford: OUP, 2006), 3–20.

42 Davies, *The Artful Species*.

by Zahavi's aforementioned handicap principle, which states that a costly signalling trait is positively correlated with higher fitness levels, indicating that costliness does indeed point towards adaptiveness. Miller's last remark that artistic skill is a typical human trait that we can acquire relatively easily, mainly points out that art is part of the cultural niche of humans: it evolved as a species-specific trait through the unique interaction of human ancestors with their physical and social environment, which does not make it an adaptive function. A similar argument to Miller's, also including the complex cognitive processing engaged by art and its apparent necessity for individual and cultural identification, has been put forward by Carroll.[43]

An approach such as this one attempts to address the burden of evidence for an adaptationist explanation, but lacks further elaboration as to whether art is uniquely suited to fulfil its various proclaimed functions, such as its being a mating device shaped and sustained via sexual selection. According to Davies, this is a significant deficit of the aforementioned general theories of art: 'art-general theories should identify an evolutionarily significant function performed not only by *all* the arts but also by *only* the arts'.[44]

Several issues arise here: using one explanation for all kinds of art, ranging from fictional storytelling to body decoration, and from individual crafting to collective song and dance, surpasses the immense complexity of these different practices. Furthermore, as is evident from Davies's remark, using a general explanation such as sexual selection also leaves unanswered the question of whether art is truly unique in fulfilling this function. If works of art are considered parts of the extended phenotype reflecting highly elaborate cognition, as is argued by Miller, one might question whether it is in fact the mating mind itself, rather than its products such as art, that should be the central focus of this adaptationist explanation.[45] In order to preserve the focus on art, it seems that sufficient support should be gathered in evidence of any exceptional or unique properties of this behaviour that are much more efficient in communicating mental abilities than other parts of the extended phenotype as it is mapped by Miller, such as humour.[46] This would make art, in Carroll's words, a 'primary adaptation', and would attribute an irreducible adaptive function that is different from the associated benefits argued for in 'secondary adaptation' explanations.[47]

A promising approach, which corresponds more to the evolutionary biologist George Williams's plea for mapping the evolutionary history of a trait through connecting its structural properties to a particular evolutionary function, is reverse engineering. Critical

43 Carroll, 'Literature and Evolutionary Psychology'.

44 Davies, *The Artful Species*, 123, original emphasis.

45 Davies, *The Artful Species*; Miller, *The Mating Mind.*

46 Davies, *The Artful Species*; Greengross and Miller, 'Humor Ability Reveals Intelligence, Predicts Mating Success, and is Higher in Males'.

47 Carroll, 'Literature and Evolutionary Psychology', 939. A related issue is the question whether different functions might have played a role in the emergence of one trait, and if so, how these relate to each other. Suggestions in this regard have been made for all kinds of art: see, for example, Boyd, *On the Origin of Stories*; Edward H. Hagen and Gregory A. Bryant, 'Music and Dance as a Coalition Signaling System', *Human Nature* 14 (2003), 21–51; Sebastian Kirschner and Michael Tomasello, 'Joint Music Making Promotes Prosocial Behavior in 4-Year-Old Children', *Evolution and Human Behavior* 31 (2010), 354–364.

of the common tendency in the evolutionary study of art in general to attribute the label of adaptation to art, Pinker claims that

> one has to show—*independently of anything we know about the human behavior in question*—that X, by its intrinsic design, is capable of causing a reproduction-enhancing outcome in an environment like the one in which humans evolved. This analysis can't be a kind of psychology; it must be a kind of engineering … With these design specs in hand, one can then compare the specs against the facts of the human drive or talent we are trying to explain. The closer the design specs match the empirical facts about human beings, the more confidence we have that the trait in question is an adaptation.[48]

This approach has not been thoroughly explored with regard to art. The evolutionary psychologist Michelle Sugiyama has pointed out that reverse engineering—'that is, inferring the function of the whole by examining the operation of its parts'—might be a useful avenue for explaining the origins of narrative.[49] This analysis involves identifying the structural properties of narrative, such as action, character and conflict, and subsequently explaining why these features might be relevant. According to Sugiyama, narrative is an information storage and transmission system that enables the simulation of actual experiences. However, as she rightly argues, this reverse engineering approach only clarifies that narrative appears to meet the adaptationist criterion of special design, but does not allow for integrating narrative, adaptive cognition and functional value, nor for determining whether narrative might have increased the survival and reproduction opportunities of those who practised it. In order to determine whether narrative or other kinds of art are adaptations, more extensive analysis along the lines of Pinker's suggestion is necessary.

Insufficient support for the adaptationist claims often made does not, however, validate a by-product account. For example, if Pinker is right in arguing that art increases social status, it is likely that this effect entails differential reproductive success, favouring those possessing artistic skills or abundant resources to invest in art. This violates the non-functional nature of by-products, but more importantly, designating art as linked to signalling implies that artmaking will be accompanied by costs to the individual that engages in this behaviour. Several authors have argued that these costs would have caused non-functional traits that did not yield any benefits, such as the creation of music and visual arts according to Pinker, to be selected against and quickly removed from the behavioural repertoire of human ancestors.[50]

According to Davies, this critique does not allow for the possibility that by-products can indeed be costly traits and points out that there might not be a comparative disadvantage towards other individuals. If music making, for example, is a universal behaviour imposing

48 Pinker, 'Toward a Consilient Study of Literature', 170, original emphasis.

49 Michelle S. Sugiyama, 'Reverse-Engineering Narrative: Evidence of Special Design', in Gottschall and Wilson, *The Literary Animal*, 177–196, at 178.

50 See, for example, Joseph Carroll, 'Pinker's Cheesecake for the Mind', *Philosophy and Literature* 22 (1998), 478–485; Boyd, *On the Origin of Stories*; and Daniel J. Levitin, *This is your Brain on Music: The Science of a Human Obsession* (New York: Dutton, 2006).

costs on everybody, this erases the relative disadvantage of individuals that devote their time, energy and resources to a non-functional occupation.[51] However, this remark does not take into account that music making would probably never have become a universal behaviour if it entailed costs that surpassed any benefits stemming from its practice. As a consequence, its mere universality either suggests the relative absence of costs, or their compensation by benefits such as increased social status. Whether this argument is sufficient to gravitate towards an adaptationist explanation remains an important point of debate. It again raises the aforementioned issue that art might be a secondary means for communicating, in this case, a notable social status, rather than being the primary locus of selection.

Davies has rightly pointed out that a by-product explanation should not be regarded as an easy way out of the apparent demands of more complex argumentation needed when attempting to characterize a trait as a true adaptation. Stating that a trait is a by-product, requires identifying one or more adaptations the trait makes use of, as well as how they gave rise to the by-product itself.[52] Moreover, Davies argues that it is unlikely that a newly arising behaviour, even though it might have originally been non-functional, would remain a by-product if it contained signalling potential. If engaging in art and expressing views of expertise about its quality are costly signals, these behaviours will soon start playing a role in our assessment of other individuals in terms of their mate quality, and will therefore increase differential reproductive success.[53] The foundation of this idea is the fact that evolution can only construct new traits out of building blocks that are already present. Adaptations too cannot simply emerge out of nowhere, so linking a new trait to previously existing adaptations should therefore not be equated to its categorization as a by-product.[54]

In this regard, it might be useful to extend the adaptationist-by-product debate to include other categories such as exaptation and secondary adaptation. While an adaptation emerges through a history of selection in order to solve an adaptive problem, an exaptation corresponds to an already present adaptation and gains a new function without subsequent selection. A secondary adaptation is characterized as the result of a primary adaptation undergoing additional phenotypic modification for a new, fitness-enhancing effect.[55] Based on this conceptual distinction, it might be useful to regard the eventual adaptationist outcome proposed by Davies as a secondary one in order to maintain an analytic distinction with other authors that have developed their hypotheses as primary adaptive explanations.

Insufficient Empirical Support

While theoretical reasoning is necessary to develop a hypothesis, no research programme on human behaviour is complete without rigorous empirical testing, so as to avoid the

51 Davies, *The Artful Species*.

52 Ibid., 139.

53 Davies, 'Why Art Is Not a Spandrel', *BJA* 50 (2010), 333–341; *The Artful Species*.

54 Davies, 'Why Art is Not a Spandrel'; *The Artful Species*.

55 Paul W. Andrews, Steven W. Gangestad and Dan Matthews, 'Adaptationism—How to Carry Out an Exaptationist Program', *Behavioral and Brain Sciences* 25 (2002), 489–553; Stephen Jay Gould and Elisabeth S. Vrba, 'Exaptation—A Missing Term in the Science of Form', *Paleobiology* 8 (1982), 4–15; Stephen Jay Gould and Richard C. Lewontin, 'The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme', *Proceedings of the Royal Society B* 205 (1979), 581–598.

conjectural reasoning characteristic of 'just so stories'.[56] Evolutionary psychological research on art currently lacks a sufficient body of empirical research that thoroughly scrutinizes the existing hypotheses and, as a consequence, only a limited and inconclusive set of data is available.

In order to support his concept of the psychology of aesthetics, Pinker argues that we enjoy certain figurative representations, such as 'safe, food-rich, explorable, learnable habitats, and fertile, healthy dates, mates, and babies', because they are artificial signals of 'adaptively valuable objects'.[57] Such ideas have been addressed in applied environmental aesthetics research, where it is proposed that the search for an adequate habitat was one of the major adaptive problems faced by human ancestors. [58] This allows for predictions as to what features of habitats we find attractive in landscape painting, as has been empirically investigated.[59] Yet the remaining claims about aesthetic preferences for content elements remain hypothetical. The pleasure buttons Pinker refers to can perhaps be more easily activated by abstract and geometric patterns that correspond to the structure of the visual cortex. So-called 'graphic or visual primitives' can be indications of artificial or natural structures and thus regularity and predictability in the environment, recognition of which was beneficial for our ancestors.[60] Clear patterns and vivid colours also ease information processing, which explains the persistent preference for these elements still characteristic of present-day humans.[61] But despite cognitive neuroscientific evidence in its favour, the psychology of aesthetics does not appear to be suitable for clarifying the full range of our aesthetic preferences in art.

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56 John Tooby and Leda Cosmides, 'Evolutionary Psychology and the Generation of Culture, Part I: Theoretical Considerations', *Ethology and Sociobiology* 10 (1989), 29–49.

57 Pinker, *How the Mind Works*, 526.

58 Jay Appleton, *The Symbolism of Habitat* (Seattle, WA: University of Washington Press, 1990); Stephen Kaplan, 'Aesthetics, Affect, and Cognition: Environmental Preference from an Evolutionary Perspective', *Environment and Behavior* 19 (1987), 3–32; Gordon H. Orians and Judith Heerwagen, 'Evolved Responses to Landscapes', in Barkow, Cosmides and Tooby, *The Adapted Mind*, 555–579; Gordon H. Orians, 'An Evolutionary Perspective on Aesthetics', *Bulletin of Psychology and the Arts*. 2 (2001), 25–29.

59 Judith Heerwagen and Gordon H. Orians, 'Humans, Habitats, and Aesthetics', in Stephen R. Kellert and Edward O. Wilson (eds), *The Biophilia Hypothesis* (Washington, DC: Island Press, 1993), 138–172. The genre of ideal landscapes—based on intuitive liking rather than actual resemblance—commonly displays the features that would have been highly sought after during the Pleistocene, such as the presence of water, animals, green vegetation and shelter, views of the horizon, and a calm sky. See also, for example, Christa Sütterlin, 'From Sign and Schema to Iconic Representation: Evolutionary Aesthetics of Pictorial Art', in Voland and Crammer, *Evolutionary Aesthetics*, 131–170.

60 Pinker, *How the Mind Works*, 526–528; Derek Hodgson, 'Graphic Primitives and the Embedded Figure in 20th-Century Art: Insights From Neuroscience, Ethology and Perception', *Leonardo* 38 (2005), 55–58.

61 Ramachandran and Hirstein, 'The Science of Art'; Vilayanur S. Ramachandran, *The Artful Brain*, BBC Reith Lectures 2003: The Emerging Mind. The psychologist Nicholas Humphrey similarly remarks: 'Beautiful "structures" in nature or art are those which facilitate the task of classification by presenting evidence of the "taxonomic" relations between things in a way which is informative and easy to grasp.' (The Illusion of Beauty', *Perception* 2 (1973), 429–439, at 432).

In other instances, experimental studies have been published, but they often remain inconclusive. This is the case of the courtship hypothesis by Miller.[62] Proponents of sexual selectionist explanations often draw evidence from animal examples, acknowledging that humans are animals occupying an extraordinary cognitive, social and cultural niche. Experimental support has additionally been produced for creativity being a good genes indicator through an investigation of female preferences for short-term and long-term mating in relation to creative capacities.[63] A more general study by Miller analysed the production demographics of items of culture such as paintings, music albums and books, and found that these patterns correspond to predictions made by the courtship model: male output is on average ten times bigger than the amount of female cultural products—in accordance with the idea that males must compete for female attention—and their production peaks during young adulthood, the period when sexual competition is strongest.[64] A similar pattern of age distribution was found for the career peaks of scientists. Not only were the majority of scientists male, in accordance with the sexual dimorphism expected for courtship traits, their productivity was also greatest during early and middle adulthood, consistent with the pattern predicted by Miller. If science is regarded as an expression of cognitive creativity, these results can be interpreted as supporting the courtship hypothesis.[65]

Such findings have been criticized for not adequately taking into account the social and historical influences that have created a male bias in different canons of art, or products of creativity in general.[66] Two studies by the psychologists Chris McManus and Adrian Furnham attempted to map the potential influence of education, personality, social class, age and sex on the involvement in artistic activities from a broad consumer perspective. The results did not yield a bias towards greater participation in the arts by males, nor was the pattern of male artistic engagement of a more active nature than that of females, contradicting what might be expected based on Miller's work. Differences do appear when particular kinds of artistic activity are compared across the sexes, with females overall

62 See, for example, Helen Clegg, Daniel Nettle and Dorothy Miell, 'Status and Mating Success Amongst Visual Artists', *Frontiers in Psychology* 2 (2011), doi:10.3389/fpsyg.2011.00310.

63 Martie G. Haselton and Geoffrey Miller, 'Women's Fertility Across the Cycle Increases the Short-Term Attractiveness of Creative Intelligence', *Human Nature* 17 (2005), 50–73.

64 Miller, 'Sexual Selection for Cultural Displays'. The cultural courtship model does not state that female cultural production should be absent, but that it will be exercised in a less public manner, most often following the establishment of a relationship in order to maintain the pairbond. Furthermore, while cultural production equally indicates desirable qualities such as creativity and overall fitness in women, public advertisement during mate choice could comprise risks in the form of harassment by males, also explaining its less outspoken appearance. While creativity is thought to be only moderately heritable (Davies, *The Artful Species*; Miller, *The Mating Mind*), the potential genetic correlates of this and other capacities involved in artmaking, such as imagination, manual skill, etc., suggest that female offspring of highly talented males may possess a similar array of artistic abilities. Its proposed relative absence in display contexts therefore does not necessarily imply the overall absence of the relevant talents and skills in females.

65 Satoshi Kanazawa, 'Scientific Discoveries as Cultural Displays: A Further Test of Miller's Courtship Model', *Evolution and Human Behavior* 21 (2000), 317–321.

66 See, for example, Mithen, *The Singing Neanderthals*.

being more interested in watching and taking part in different kinds of dance, listening to classical music, reading novels and poetry, and drawing and painting, while males tend to be inclined towards photography and cinema, reading non-fiction and going to pop concerts. Overall, personality traits do not account for these differences.[67] As the current state of research remains inconclusive, additional research, and cross-cultural testing in particular, is sorely needed.

Studies such as those undertaken by McManus and Furnham illustrate an important point not commonly addressed in evolutionary research. Considering historical and social influences on artmaking raises the question of what extent the art currently discussed in evolutionary psychological writings involves 'high art', which will naturally show up in some anthologies used as sources of empirical data, such as the cultural demographics datasets. Miller has countered this, with music as an example, by referring to research indicating that the demographics of extremely creative, cultural production appear to correspond to patterns found in ordinary cultural production, which suggests that we can make inferences from the first to discuss the second.[68] Yet the consumer perspective of McManus and Furnham indicates that artistic behaviour as a human universal is much broader than the mere production of, for example, visual artworks within a mating context. This has also been noted by Davies, who points out that adequately investigating the link between art and evolution requires first and foremost considering the width of the subject matter. While art in itself should be thought of as 'encompassing domestic, folk, decorative, popular, and mass art',[69] it is additionally suggested that 'art-behavioral competence'[70] rather than mere artmaking should be the unit of analysis. Given how much time and mental investment goes into experiencing different kinds of art, and how many individuals worldwide frequently engage and acquire competence in one or more art forms, it seems sensible to regard artistry not as the possession of a small, highly trained elite.[71]

Naturally, modifying the concept of art discussed also affects the extent to which the proposed hypotheses correspond to their subject. A view of art that also includes practices such as, for example, domestic applications of decorative patterns on utility objects when considering visual art, invites questions concerning the nature of its makers and thus the nature of the proposed explanations.[72] The aesthetic fitness indicator hypothesis, for instance, is

67 I. Chris McManus and Adrian Furnham, 'Aesthetic Activities and Aesthetic Attitudes: Influences of Education, Background and Personality on Interest and Involvement in the Arts', *British Journal of Psychology* 97 (2006), 555–587. See also I. Chris McManus et al., 'Vocation and Avocation: Leisure Activities Correlate with Professional Engagement, but not Burnout, in a Cross-Sectional Survey of UK Doctors', *BMC Medicine* 9 (2011), doi:10.1186/1741-7015-9-100.

68 Miller, 'Evolution of Music Through Sexual Selection'.

69 Davies, *The Artful Species*, 51.

70 Ibid. 52.

71 'Most people are expert in sub-forms of art—think how knowledgeable many people are about movies or popular music—and most people plainly reach a medium level of competence in many of their culture's art forms. Moreover, so extensive is the active participation of amateurs in art-creative behaviors that many achieve executive low-level competence in their favored art form and can be counted as artists to that extent' (ibid. 54).

72 This objection has been raised from the evolutionary ethological perspective by both Ellen Dissanayake and Kathryn Coe, who, interestingly, make extensive use of ethnographic data (Dissanayake, *Homo Aestheticus*; Kathryn Coe, *The Ancestress Hypothesis* (New Brunswick, NJ: Rutgers University Press, 2003)).

heavily dependent on a particular conception of art, and the proposed strong bias towards males in artistic production should be revised in accordance with both western popular culture and ethnographic findings, such as the common presence of female artists, especially when 'art-behavioural competence' is said to include the most daily and worldly kinds of art.

As for music, it has been argued that the courtship hypothesis does not sufficiently explain the apparent fact that music was, and still is, a typical group activity.[73] Indeed, empirical evidence for the sexual selectionist explanation is scarce. Some authors suggest that rhythm might play a role in assessing mate quality, while others have found that hunter-gatherer females prefer lower pitched voices—correlated with higher testosterone levels—when seeking mates, and higher pitched voices—associated with less testosterone, and thus with paternal investment behaviour and resource provision—when infants are cared for.[74] A study investigating a possible female preference for musical complexity as indicative of male quality did find an overall liking for complex acoustic displays, but apparently not in relation to current states of fertility, opposing the sexual selectionist idea that a bias towards higher complexity might be present around ovulation.[75]

Clearer empirical evidence has been produced in favour of hypotheses that link the emergence of music to the importance of in- or between-group cooperation. For example, the evolutionary anthropologist Ed Hagen discusses music as a reliable signal of group cohesion and quality, relevant for the establishment of intergroup coalitions, while others have proposed causal effects of music for cooperation, prosociality and social bonding.[76] Group singing appears to increase both levels of trust and the tendency to cooperate, compared with passive listening or engaging in other kinds of art.[77] A significant increase in prosocial behaviour and cooperation was also found among four-year-old children after joint singing and dancing, which led the authors to hypothesize that these activities help envision collective goals.[78]

More comprehensive evidence seems to be available for hypotheses such as the proposal that fictional art might contribute to our cognitive development or the elaboration of social skills. Long term acting classes, compared with other kinds of arts training, have been shown to increase empathy scores in children and both empathy and theory of mind in adults.[79] Children with more sophisticated pretend play and imaginative skills also

73 Hagen and Bryant, 'Music and Dance as a Coalition Signaling System'.

74 Eva M.F. van den Broeck and Peter M. Todd, 'Evolution of Rhythm as an Indicator of Mate Quality', *Musicae Scientiae* 13 (2 Suppl) (2009), 369–386; Coren L. Apicella and David R. Feinberg, 'Voice Pitch Alters Mate-Choice-Relevant Perception in Hunter-Gatherers', *Proceedings of the Royal Society B* 276 (2009), 1077–1082. The latter study does not immediately apply to music, so the evidence is circumstantial.

75 Benjamin D. Charlton, Piera Filippi and W. Tecumseh Fitch, 'Do Women Prefer More Complex Music Around Ovulation?', *PLoS ONE* 7 (2012), e35626.

76 Hagen and Bryant, 'Music and Dance as a Coalition Signaling System'; Edward H. Hagen and Peter Hammerstein, 'Did Neanderthals and Other Early Humans Sing? Seeking the Biological Roots of Music in the Loud Calls of Primates, Lions, Hyenas, and Wolves', *Musicae Scientiae* 13 (2 Suppl) (2009), 291–320; Juan Roederer, 'The Search for a Survival Value of Music', *Music Perception* 1 (1984), 350–356.

77 Anat Anshel and David A. Kipper, 'The Influence of Group Singing on Trust and Cooperation', *Journal of Music Therapy* 25 (1988), 145–155.

78 Kirschner and Tomasello, 'Joint Music Making Promotes Prosocial Behavior in 4-Year-Old Children'.

79 Thalia R. Goldstein and Ellen Winner, 'Enhancing Empathy and Theory of Mind', *Journal of Cognition and Development* 13 (2012), 19–37.

perform better on theory of mind tasks, with general verbal intelligence controlled for.[80] A study analysing the different effects of reading narrative fiction and expository non-fiction—the main difference being that fictional stories depict the actual world with agents operating in it—found that reading fiction was positively correlated with social abilities and empathy, while a negative correlation was observed for non-fiction.[81] A follow-up study clarified that individual differences in personality traits that might explain readers' attraction to fiction do not account for the enhanced social skills measure compared with non-fiction readers, suggesting that there might indeed be a formative effect of fiction.[82] Applying fiction to visual representations, the psychologists Fiona Scott and Simon Baron-Cohen found that, compared with matched controls, children with impaired theory of mind abilities due to autism were significantly less able to introduce unreal, imagined features into their drawings, or even to produce fictional images upon specific instruction.[83]

Emotional and moral content in stories, put forward as a crucial feature of storytelling by authors such as Gottschall, has been the subject of a large-scale empirical study, testing reader's attitudes to various characters in a sample of Victorian novels. Among the findings were the attribution of clear agonistic structures when perceiving and classifying individual characters as protagonists, antagonists or associates of either one. Protagonists were generally judged as being of a cooperative nature, whereas antagonists were often rated to display dominance behaviour that threatened social stability. The authors regard novels as reservoirs of prosocial norms and conventions, the adoption and maintenance of which will eventually benefit all those engaging in storytelling.[84]

While the above-mentioned studies provide convincing support for the link between imaginative abilities and theory of mind, numerous questions still remain unanswered. The psychologist Raymond Mar and his colleagues broadly equate fiction with narrative that deals with social situations, and non-fiction with an expository style.[85] This distinction fails to address non-fictional content that is also phrased in a narrative style and contains socially relevant themes. Do the characteristics of fiction make these stories instrumental, or rather the features of narrative style? What are the cognitive implications of fictional narratives that do not contain socially relevant information?

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80 Marjorie Taylor and Stephanie M. Carlson, 'The Relation Between Individual Differences in Fantasy and Theory of Mind', *Child Development* 68 (1997), 436–455.

81 Raymond A. Mar et al., 'Bookworms Versus Nerds: Exposure to Fiction Versus Non-Fiction, Divergent Associations with Social Ability, and the Simulation of Fictional Social Worlds', *Journal of Research in Personality* 40 (2006), 694–712.

82 Raymond A. Mar, Keith Oatley and Jordan B. Peterson, 'Exploring the Link Between Reading Fiction and Empathy: Ruling Out Individual Differences and Examining Outcomes', *Communications* 34 (2009), 407–428.

83 Fiona J. Scott and Simon Baron-Cohen, 'Imagining Real and Unreal Things: Evidence of a Dissociation in Autism', *Journal of Cognitive Neuroscience* 8 (1996), 371–382.

84 Joseph Carroll et al., *Graphing Jane Austen: The Evolutionary Basis of Literary Meaning* (New York: Palgrave Macmillan, 2012); John A. Johnson et al., 'Hierarchy in the Library: Egalitarian Dynamics in Victorian Novels', *Evolutionary Psychology* 6 (2008), 715–738; Joseph Carroll et al., 'Graphing Jane Austen: Agonistic Structure in British Novels of the Nineteenth Century', *Scientific Study of Literature* 2 (2012), 1–24.

85 Mar et al., 'Bookworms Versus Nerds'; Mar, Oatley and Peterson, 'Exploring the Link Between Reading Fiction and Empathy'.

The moral influence that supposedly radiates from stories is supported by a positive influence on empathy skills, as well as by the commonly addressed subject of group values and norms. However, this does not equate to normative power. While religious stories are often taken as a clear example of this, additional enforcement mechanisms of religion, such as supernatural punishment, might be overlooked. This means that some, rather than all stories, can exert a normative influence. Still other questions arise when the concept of fiction is extended to include other kinds of art, such as visual art. Do the same laws of social elaboration apply when the medium of literary narrative is absent?

In addition to the specific issues concerning the above-mentioned studies, a gap remains between the empirical support often found for various functions, and discussions of whether these functions were adaptive, and therefore crucial for these traits to evolve.[86] According to Carroll, the hypothesis that fictional storytelling aids in the development of cognitive and social skills is the sole example of a primary adaptationist explanation, which refers to properties of stories that are uniquely suited to fulfil this proclaimed function. However, neither of the above-mentioned studies provides empirical support that exceeds the ascribed function, lacking a foundation for the adaptationist claim itself. The possibility that the elaboration of social skills is achieved in other ways can therefore not be excluded, nor should the option be overlooked that our mechanisms for social learning might be the true adaptations, in which case storytelling would solely be a means towards this end.[87]

One approach to the issue would be to elaborate empirical studies so as to incorporate the question of whether the behaviour discussed enhances the differential reproductive success of those who practise it. Interestingly, the aforementioned study by Haselton and Miller takes steps in this direction. The possession of creative intelligence is a preferred trait in short-term mates over the ability for resource provision, which means that males possessing the former trait will achieve greater reproductive success. Not only do males receive fitness benefits, females choosing these males will increase their chances, through the assocation with good genes, of offspring survival.[88]

The Nature of Psychological Mechanisms

Evolutionary psychologists tend to focus on our psychological make-up, which ties our brains and behaviour together.[89] Our evolved psychology is thought to be constructed

86 Davies, *The Artful Species*.

87 Additionally, the afore-mentioned studies rarely if ever address the question of whether advanced cognitive and social skills such as empathy and theory of mind are not already necessary for storytelling to become possible in the first place (ibid.). Yet this should not be a major pitfall of these studies, given that the authors concerned do not state that stories are responsible for the *emergence* of these capacities, but rather for their practice and further development.

88 Haselton and Miller, 'Women's Fertility Across the Cycle Increases the Short-Term Attractiveness of Creative Intelligence'.

89 Leda Cosmides and John Tooby, 'From Evolution to Behavior: Evolutionary Psychology as the Missing Link', in John Dupré (ed.), *The Latest on the Best: Essays on Evolution and Optimality* (Cambridge, MA: MIT Press, 1987), 277–306.

of a range of modules or psychological mechanisms, but significant disagreement exists as to what is meant by this. Authors such as Tooby and Cosmides argue that the mind is to be regarded as a collection of special-purpose or domain-specific modules or mechanisms. These modules are supposed to have evolved in response to adaptive pressures, and together constitute human nature: 'the evolved, reliably developing, species-typical computational and neural architecture of the human mind and brain'.[90]

While Cosmides and Tooby maintain a strong focus on the internal organization of the mind, therein echoed by Pinker, Buss presents a broader concept of modules being context-specific predispositions and emotions.[91] According to him, the mind must possess hundreds or even thousands of mechanisms to solve problems ranging from survival and mating to parenting, kin investments and social mapping. Miller has argued that we should consider art as a module in itself, and along with other human capacities such as language and music, it supposedly makes up the set of adaptations or modules that together constitute human culture. Despite being interrelated, each of these modules can have a different evolutionary history, a different life history development, different contributions to human survival and reproductive success, as well as being built upon different psychological principles.[92]

These various views have considerable implications for applying the evolutionary psychological focus at the level of cognition to the study of art. One possibility, endorsed by Miller, is that artistic behaviour is centred in one mechanism or module. Other views suggest that it would be more feasible to look for a number of different cognitive abilities that together enable artmaking and the aesthetic appreciation of its emerging results. For example, Pinker employs the mental toolbox metaphor to indicate that the mind contains numerous building blocks that can be variously assembled in order to obtain different behavioural outcomes.[93] This argument is sometimes supported by referring to cognitive neuroscience, where an increasing amount of studies shows that mental features incorporated in artistic behaviour are scattered across the brain. Even the basics of visual art, such as areas responsible for processing formal properties and content features, are widely distributed.[94]

Neuroimaging studies on different kinds of art also seem to suggest that they should not be regarded as psychological primitives in themselves, i.e. they are not reducible to a

90 Leda Cosmides and John Tooby, 'Evolutionary Psychology and the Emotions', in Michael Lewis and Jeannette M. Haviland-Jones (eds), *Handbook of Emotions* (New York: Guilford, 2000), 91–115.

91 Leda Cosmides and John Tooby, 'Consider the Source: The Evolution of Adaptations for Decoupling and Metarepresentation', in Dan Sperber (ed.), *Metarepresentations: A Multidisciplinary Perspective* (Oxford: OUP, 2000), 53–115; Pinker, *How the Mind Works*; Buss, *Evolutionary Psychology*.

92 Miller, 'Sexual Selection for Cultural Displays'.

93 Ibid.; Pinker, *How the Mind Works*.

94 M. Dorothee Augustin et al., 'The Neural Time Course of Art Perception: An ERP Study on the Processing of Style Versus Content in Art', *Neuropsychologia* 49 (2011), 2071–2081; Thomas Jacobsen et al., 'Brain Correlates of Aesthetic Judgements of Beauty', *NeuroImage* 29 (2006), 276–285; Hideaki Kawabata and Semir Zeki, 'Neural Correlates of Beauty', *Journal of Neurophysiology* 91 (2004), 1699–1705; Ulrich Kirk et al., 'Brain Correlates of Aesthetic Expertise: A Parametric fMRI Study', *Brain and Cognition* 69 (2009), 306–315; Semir Zeki, *Inner Vision: An Exploration of Art and the Brain* (Oxford: OUP, 1999).

particular neurocognitive pattern that is activated across a wide range of tasks.[95] Instead, art seems to make use of various other psychological primitives such as theory of mind, with those primitives being more basic building blocks of human cognition. Assuming current research does indeed point in the direction of several abilities being co-opted by art, this seems to support the idea that we are dealing with a by-product, rather than an adaptation. Nevertheless, the question still remains which mental capacities or neural networks make for a cognitive blueprint of art. A limited number of attempts to elaborate on this have been made.[96] The variety in these replies, ranging from symbol-mindedness and metarepresentational ability to different memory systems and an intuitive design stance, is indicative of the indistinctness surrounding psychological mechanisms or modules.

Moreover, questions have been raised as to whether neuroimaging research can be used to support the modular nature of cognitive abilities proposed by many evolutionary psychologists. Properties located in the mind do not necessarily correspond to well-defined areas in the brain, but even if this were so, it is unlikely that they would be static features, given the constant interaction between organisms and their environment.[97]

Aside from the amount of ongoing discussion about the nature of psychological mechanisms, criticisms have been levelled against these mechanisms being the primary and sometimes only concern of evolutionary psychology. For example, in his analysis of music, Miller writes:

> Adaptationist analysis does not worry very much about origins, precursors, or stages of evolutionary development; it worries much more about the current design features of a biological trait, its fitness costs and benefits, and its manifest biological function. This is good news for theories of music evolution. It is just not very important whether music evolved two hundred thousand years ago or two million years ago, or whether language evolved as a precursor to music. The adaptationist's job is to look at the adaptation as it is now, to document its features and distribution within and across species, and to test hypotheses concerning its biological function against this evidence.[98]

Miller's statement that it does not matter very much when music evolved, eliminates a range of other relevant perspectives that might shed light on the origins of music or art in general. Relevant archaeological findings often generate new ideas and hypotheses on, for example, the cognitive machinery that must have been necessary to make a particular artefact, while research into the relation between music and language might help identify

95 Johan De Smedt and Helen De Cruz, 'Toward an Integrative Approach of Cognitive Neuroscientific and Evolutionary Psychological Studies of Art', *Evolutionary Psychology* 8 (2010), 695–719.

96 Boyd, *On the Origin of Stories*; Johan De Smedt and Helen De Cruz, 'A Cognitive Approach to the Earliest Art', *Journal of Aesthetics and Art Criticism* 69 (2011), 379–389.

97 Davies, *The Artful Species*. For a critical discussion of these and other subjects, see, for example, Johan J. Bolhuis et al., 'Darwin in Mind: New Opportunities for Evolutionary Psychology', *PLoS Biology* 9 (2011), e1001109.

98 Miller, 'Evolution of Music Through Sexual Selection', 337.

the particular evolutionary pathways, relevant neural networks, and the eventual structural outcome of music.[99]

Furthermore, Miller's approach only partially meets the four questions framework famously argued for by the ethologist Niko Tinbergen, developed with the aim of gaining a complete understanding of the nature and evolution of behavioural traits. In Tinbergen's view, behaviour is to be understood by means of four dimensions, clustered into two levels of explanation. The proximate level—the how-questions—includes the ontogenetic development of an individual (1), and the immediate mechanisms responsible for the manifestation of a trait (2), such as social and cultural influence. The ultimate level—the why-questions—involves both phylogenetic structures (3)—the relationships between various species—and adaptive explanations for why a trait originated, focusing on its function (4).[100] Although Miller is right in stating that adaptationist explanations are mostly concerned with the fourth of these explanatory dimensions, disregarding the relevance of evolutionary precursors such as language in relation to music, or the time frames during which various kinds of art developed, will fragment a full evolutionary understanding of art.

A One-Directional Perspective on Culture

Evolutionary psychology tends to regard culture as an outcome of psychological evolution, although opinions differ as to which level of autonomy should be attributed to culture.[101] Culture in this sense is not understood to be limited to behaviours such as artmaking, but is often conceptualized in a broad anthropological sense as 'information capable of affecting individuals' behaviour that they acquire from other members of their species through teaching, imitation, and other forms of social transmission'.[102] If the basic, traditional premise of evolutionary psychology is taken into account—evolution produces an adapted mind with domain-specific psychological mechanisms neatly suited to solve specific environmental problems—this means culture must be subject to this process as well, and be the product of evolved, innate cognitive machinery. In line with this, Pinker has written:

> A complex meme does not arise from the retention of copying errors. It arises because some person knuckles down, racks his brain, musters his ingenuity, and composes or writes or paints or invents something. Granted the fabricator is influenced by ideas in the air, and may polish draft after draft, but neither projection is like natural selection.[103]

In his view, something like a work of art does not arise because an artist has been through a process of ever new attempts at creating a painting or sculpture while retaining and further elaborating on the best ones, which would be the process predicted by cultural evolution

99 Steven Mithen, *The Prehistory of the Mind: A Search for the Origins of Art, Religion and Science* (London: Thames and Hudson, 1996); Mithen, *The Singing Neanderthals*; Thomas Wynn, 'Archaeology and Cognitive Evolution', *Behavioral and Brain Sciences* 25 (2002), 389–438.

100 Nikolaas Tinbergen, 'On Aims and Methods of Ethology', *Zeitschrift für Tierpsychologie* 20 (1963), 410–433.

101 Robin I. M. Dunbar and Louise Barrett, 'Evolutionary Psychology in the Round'.

102 Peter J. Richerson and Robert Boyd, *Not By Genes Alone: How Culture Transformed Human Evolution* (Chicago: University of Chicago Press, 2005), 5.

103 Pinker, *How the Mind Works*, 209.

parallel to natural selection on genes. Instead, Pinker states that improvements and changes originate from the mind's computational power to redirect inventions: 'the striking features of cultural products, namely their ingenuity, beauty, and truth (analogous to organisms's complex adaptive design), come from mental computations that "direct"—that is, invent—the "mutations", and that "acquire"—that is, understand—the "characteristics"'.[104]

As the biologist Peter Richerson and the anthropologist Robert Boyd argue, this reasoning assigns culture to the proximate level, as it is not thought to be an evolutionary driving force in itself. The perspective of gene-culture co-evolution, notably elaborated and developed by Richerson and Boyd, attempts to modify this view by recognizing that culture can be an ultimate cause in itself: it can significantly alter the evolutionary path of individuals, and more importantly, social groups, as many cultural traits are located at group level.[105] Proponents of this view argue that genes and culture develop throughout evolutionary history in a constant feedback loop. Evolutionary psychology has been criticized for failing to take into account the importance of culture as a solid, powerful and at least a partly autonomous feature in human evolution, and for not considering that cultural behaviours such as art might significantly influence their own evolutionary trajectory.

Richerson and Boyd have themselves explored the possibility that such a co-evolutionary process occurred during the evolution of art. They make use of the aforementioned process of runaway selection, except that this time the process involves cultural traits rather than phenotypic traits and corresponding preferences.[106] Culture is transmitted in various ways, notably through social learning, but also through transmission biases such as indirect bias.[107] This means that successful individuals will be imitated more than others because those who imitate might draw fitness benefits from copying a relevant indicator trait that signals prestige or status. Boyd and Richerson provide the example of colourful versus plain clothes. An existing preference for colourful clothes, even though these might be less practical, will influence the prevalence of these clothes in a population, which in turn will influence the frequency of people with this preference, as they will likely adopt the colourful clothing style. A model such as this one explores the possibility that art and aesthetic displays might have evolved as products of a co-evolutionary process, rather than as one-directional outcomes of psychological evolution.

Considering the potential of an active role for art in human evolution seems particularly relevant in the light of suggestions already made in this direction, such as Brian Boyd's proposal that recurrent engagement with art can significantly reconfigure our neural wiring and improve perceptual skills and social cognition, or the finding that neurocognitive structures can be altered through exposure to music and visual arts.[108] Although ontogenetic changes in individuals should not be assumed to be heritable, cultural processes in

104 Ibid., 209, original emphasis.

105 Richerson and Boyd, *Not By Genes Alone*; Robert Boyd and Peter J. Richerson, *Culture and the Evolutionary Process* (Chicago: University of Chicago Press, 1985).

106 Fisher, *The Genetical Theory of Natural Selection*.

107 Boyd and Richerson, *Culture and the Evolutionary Process*.

108 Christian Gaser and Gottfried Schlaug, 'Brain Structures Differ Between Musicians and Non-Musicians', *Journal of Neuroscience* 23 (2003), 9240–9245; Kirk et al., 'Brain Correlates of Aesthetic Expertise'; see also, for example, Jan Verpooten, 'Extending Literary Darwinism: Culture and Alternatives to Adaptation', *Scientific Study of Literature* 3 (2013), 19–27.

themselves can spark large-scale changes, including at a genetic level. This suggests that culture merits to be taken out of the proximate realm in order to be integrated among the ultimate causes of art's evolution.

5. Conclusion

In this article, I have reviewed present evolutionary psychological research into art, and provided critical remarks on its current state of progress. Within the broader movement of applying naturalist perspectives to humanities subjects, art—ranging from visual arts to storytelling and music—has been tackled by authors either working at the epicentre of evolutionary psychology, or in related fields such as literary Darwinism.

The lack of empirical studies is among the issues that I have explored here. Further research in this direction is needed to test existing hypotheses, as well as to address the problem concerning the fact that the current state of research does not provide an answer as to whether art is an adaptation. In order to provide support for an adaptive value, empirical studies should not only demonstrate a particular function for art, but also added survival or reproductive opportunities for an organism, which would indicate the value of art for differential reproductive success. The debate on any adaptive functions associated with art in turn should be improved by considering categories such as secondary adaptation and exaptation, and other evolutionary processes such as cultural evolution.

Other issues are to be found at the level of evolutionary psychology's conceptual framework, such as the nature of psychological mechanisms. Although a focus on these mechanisms is one of the hallmark features of evolutionary psychology, significant differences of opinion exist as to their precise nature, which in turn complicates attempts to produce a comprehensive overview of the mechanisms at the basis of art. As for the relative role of culture in human evolution, several ideas in this direction are already being explored with regard to art, which underlines the importance of considering this possibility. It also suggests that evolutionary psychology in general might benefit from doing so as well.

Despite the criticisms put forward here, evolutionary psychology has many merits. It has drawn attention to the evolved psychological foundations of human behaviour in general and art in particular, and has made clear that universal patterns underlie what seems to be boundless cultural variation. Nevertheless, only a thorough exploration of these and other methodological issues, as well as a full integration with other fields such as cognitive neuroscience, archaeology, and developmental psychology, will thoroughly reform our evolutionary thinking on art.[109]

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