The Development of Boxing: Origins in Biomechanics and Social Mechanics; The Ancient World (Prehistory)

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Abstract

We survey the prehistorical and historical development of boxing as a tradition of upright hand-to-hand combat. The sociological origins of conspecific violence in primates and hominids is discussed, and comparison with precedents in other animal species is made. Boxing is defined as a family of related orthograde agonistics. We speculate on the motivation behind boxing's perennial popularity among humans, and lay the groundwork for a thorough historical examination.

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1 Introduction

Modern sport boxing (in both its combat-performative and exercise-oriented forms) descends from a rich tradition of unarmed upright hand-to-hand combat. Contemporary boxing has solidified a number of conventions and technologies of interpersonal combat articulated during two active periods of development in the West: a long childhood in the ancient world and an adolescence from the seventeenth through twentieth centuries. Many of the features we associate indelibly with boxing are modern innovations: time-limited rounds, the neutral corner, the hook, the count, the seconds. Others are ancient when not aboriginal: gloves, the ring, the referee, the cutman. Ancient boxing and early modern boxing as preserved in the received and discovered record also present many features no longer present due to the evolution of rules, safety protocols, and perhaps spectator taste: for example, injurious strikes, kicks, chancery, weaponized gloves, and throws. In this article, we survey the prehistorical and historical development of boxing as a tradition of upright hand-to-hand combat. The sociological origins of conspecific violence in primates and hominids is discussed, and comparison with precedents in other animal species is made. We ask why boxing remains perennially popular among humans, and lay the groundwork for a thorough historical examination.

We begin by identifying the unique elements that are present in boxing and reviewing the criteria by which ancient accounts and depictions of boxing have been identified. We proceed through a prehistorical and historical recapitulation of boxing's development, including a biomechanical consideration of several features. As rules and conventions evolve, the practiced sport itself changes in response. We conclude with a précis of boxing as practiced in the Hellenistic period. Subsequent articles will outline Roman gladiatorial practices; the early modern development of boxing; and the transition to twentieth-century sport boxing.

1.1 Separating the modern from the ancient

In the ancient world, boxing was a mimetic practice adopted by a variety of cultures, but its earliest recorded origins are found in third millennium Mesopotamia, extending as far north as the Black Sea region. There is little unambiguous textual evidence for boxing before the Hellenistic era, when literary depictions of boxing became relatively commonplace. Visual representations of boxing are often in the eye of the beholder. However, we believe that the unique mechanics of unarmed orthograde combat can help disambiguate these examples. Graphic representations of boxing are remarkably similar over thousands of years: fighters step towards one another with their legs in profile, their bared chests twisted towards the viewer; each raises one hand in a fist and their forearms cross. The hand closest to the viewer (the back hand) is lowered, with the elbow bent. This is the "stock" illustration of boxing attested all the way from Mesopotamia in the third millennium BC to Bœotia and Northern Italy in the early first. Interesting variations occur, but the stability of this form is remarkable (Festuccia 2016, p. 108). It is tempting to find in this depiction some echo of modern boxing praxis, to gaze across four thousand years and witness the same scene taking place at a local recreational center or boxing gym. But in this we may be misleading ourselves.

Observing these ancient images, we are naturally inclined to reflect on the modern preoccupations of boxing, that is, of its participants, spectators, and critics. However, we might do well to approach these forms as if they were utterly alien to us. Consider for instance

the *Boxing Boys* of Akrotiri. If we take for granted some of the published hypotheses about this fresco (reviewed in greater detail in the subsequent article on Mediterranean boxing), we then encounter a truly curious spectacle taking place on Bronze Age Thera. It depicts an orthograde, paired combat in which pre-adolescent boys devel each other with a gloved hand while grasping each other's long locks of hair with the other, the fingers of their ungloved hands free to inflict even more punishment (Immerwahr 1990). One boy wears jewelry; both are naked but for a ceremonial girdle, possibly linked to a sea goddess (Parke 1987). The encounter arguably results in concussion and lasting injury to the spine (Davis 1977, Ferrence and Bendersky 2005). We wonder who might sanction such a duel, and for what purpose? Is this boxing, or something entirely different? Was this an elite sport of princes, a coming of age ceremony anticipated by parents eager to see the young fighters as the embodiment of their family's strength and vitality (Marinatos 1984, Morgan 2000)? Or perhaps these were ritual reenactors of a sacred story whose details were only half-remembered by the organizers of the combat. Or was it all merely a dance? The images simply do not tell us all we would like to know. Unfortunately, with no textual descriptions to accompany such images, with only the context of surrounding artefacts and the location where they were found as our guides, we are left to make our best guesses on limited information. Still, we argue that diverse types of Bronze Age boxing attested in the ancient Mediterranean and Near East form a coherent practice.

After a little more than a century of recorded boxing in England, Fewtrell (1790) commented on what he called "pitched battles." He described such an encounter in this way: "Two men free from enmity are matched in fight, without any cause for passion, without any motive for vengeance, nay immediately after having mutually given the most known marks of good will, they assault each other with all appearance of deadly hatred and determined revenge. The ties of humanity are broken, and Nature revolts at the fight" (pp. 10–11). Is he praising or criticizing the encounter? The perplexity with which boxing is viewed by moderns likely gripped the ancients, as well. Despite its brutality, boxing is by no means nonsensical violence; to characterize it as such is to miss a fundamental aspect of masculinity in ancient, early modern, and modern western culture. Using the earliest visual records of boxing and ancient textual sources, we argue that boxing has always been laden with value and virtue.

1.2 Definitions: Hand-to-hand combat and boxing

Conspecific violence is ubiquitous in the animal kingdom, with struggles over living environment, food and water, mates, and status being continually contested by members of most species. By including survival in the face of attack by a predator, essentially all nonsessile creatures engage in something we could term "combat". Humans, primates, and presumably early hominids all engage(d) in warfare and hand-to-hand combat, whether armed or unarmed. Recent theories about the evolution of the hominin fist propose that our species became fit for closed-fist (boxing-style) combat, presumably due to pressures of sexual selection. Forms of "play-fighting" are frequently observed in immature mammals, including primates, where hand/forelimb strikes are involved. This suggests a role for ontogeny in the development of pugilistic behavior and may even have implications for the development of human fighting abilities across the lifespan.

Is boxing a practical fighting technique? Is it "merely" performative? What selective

pressures have shaped it to mirror the aesthetic tastes and sensibilities of societies that boxed? What is the elemental, unchangeable core of boxing? We recognize boxing (synonymous with pugilism) as a family of orthograde combat techniques between two combatants.[1] We also consider boxing to be a sport practiced by those convention deems "boxers" (such as Roman boxers employing the *cæstus* or Greek boxers engaging in kicking). Much like the Germanic language family, swaths of mutually intelligible traditions span a dazzling variety of practices, and little can be said in common other than "orthograde combat": variations include kicking, grappling to the ground, use of hand-augmenting weapons, and helmets. In the modern era, boxing has become symbolically linked with the iconic padded boxing glove, which is arguably ancillary to the kinetic aspects at the core of boxing praxis. Boxing is differentiated from several East Asian martial arts such as Okinawan karate by a relative absence of formalism (e.g. *kata*) and the general (but not universal) absence of kicking and kneeing. Certain criteria have been used by previous authors in distinguishing boxers from other combatants; we examine the validity of these suppositions incidentally below and in subsequent articles.

2 Hominin combat and the biomechanics of violence

The ætiology of violence in humans and hominins is by no means a settled matter. To best understand the origins of ancient boxing, we will concern ourselves in this section with what is known about violence between male primates—and to a far more limited extent, other vertebrates—at different stages of their lifespan. We examine two lines of evidence: hominin aggression and biomechanical considerations.

2.1 Animal aggression

Male intrasexual competition is widely distributed throughout the animal kingdom. Fighting ability and performance in combat have been recognized as a determining factor in female mate selection since Darwin (Darwin 1859). "Agonistic behaviors help to ensure survival, provide advantage in competition, and communicate social status" (Fortes et al. 2017, p. 98).

Multiple studies have shown that aggressive behavior against conspecifics is rewarding, that positive outcomes can lead to more aggression, and that aggressive behavior can be a source of pleasure (Kudryavtseva 2020). It is also evident that "positive fighting experience" in mice can lead to a kind of "addiction" to aggressive behavior (ibid.). This takes place due to a neurochemical imbalance whereby inhibitory processes are dominated by excitation processes. These processes are themselves enhanced by the release of dopamine accompanying repeated experiences of victory over a conspecific. What inferences can we draw from this research about combat between humans?

Punching performance in hand-to-hand combat serves as a signal for sexual selection; skill at fighting likely translated into fitness at survival in the ancestral environment. Fighting to terms other than death not only reduces the devastating consequences of losing, it

[1] According to a second century AD inscription, at least one Greek community in Asia Minor designated a version of pankration that allowed only "upright hitting", a technique called ορτθοπαιία (from 'upright' and 'hit' or 'play') (Gardiner 1930, p. 221).

preserves necessary resources by strictly limiting and agreeing on the stakes of particular contests. We thus observe a spectrum from fighting, to ritual fighting, to play fighting.

In species that exhibit ritualized fighting, the phenomenon is proposed to develop from injurious fighting in three stages (Lorenz 1969, pp. 108–109):

- Increase in time between threatening movements and assault;
- Exaggeration, repetition, and colorfulness of threatening movements;
- Inhibition against devastating injury.

Groos (1898) argues that play-fighting behavior in animals is "preparation for the later struggle for the female" (Groos 1898, p. 135). He provides detailed observations of "tussling" in a wide variety of animals, particularly during their youth. This includes dogs, cats, hyenas, bears, badgers, and so forth. His description of seals is particularly charming, if a little on the anthropomorphic side:

> [Y]oung sea bears also play and quarrel like puppies. The father stands by and watches them, and if a quarrel begins in earnest he urges them on with growls, and kisses and licks the victor, then pushes him to the ground, and is pleased if he resists (Groos 1898, p. 144).

Because this "tussling" behavior is observed in non-carnivorous animals, Groos (1898) reasons that it must be largely due to the instinct to compete with rival conspecifics to gain sexual advantage, not as training to hunt, vel sim. However, Groos also admits that some animals, like dogs, may continue play-fighting well into adulthood. Tautologically, perhaps, he ascribes this merely to "playful" behavior (Groos 1898, p. 149). Play-fighting "furnish[es] practice for the contest of courtship, without being in any sense satisfying to the sexual instinct. Among many animals that play in this way the female yields to the victor of the males without resistance" (Groos 1898, p. 136).

2.2 Hominin aggression

Mankind engages in social violence of a kind distinct from that of any other known species. Some of this is norm-enforcing (such as parental or military discipline or some forms of bullying) while other violence may be ritual (such as human sacrifice or entertainment). These forms of violence are distinct from dominance displays due to the additional broader social substrate which enables them and lends them meaning. There are several competing (and complementary) theories about the utility of violence which seek to explain why it persists in ritualized form: a game-theoretic analysis, a naturalist account, a theory of civilizational preparedness, and a theory of play.

2.2.1 Evolutionary Game Theory

It has been argued by primatologists that "uncontrolled aggression is certainly disastrous to primate societies, but the complete absence of aggression may be equally disastrous" (Bernstein and Gordon 1974, p. 311). They maintain that ritualized aggression among primates enhances social cohesion. Of primates Bernstein (1984, p. 302) writes: "Many responses in

an agonistic exchange probably serve primarily to assess the ability and willingness of an opponent to escalate and continue the encounter."

Compare Lazar (2016)'s ethical observation that "individual human beings enjoy fundamental rights to life and liberty, which prohibit others from harming them in certain ways." If aggression (in both expression and release) is a necessary component of stable human civilization and coexistence, then we need to understand—as a descriptive rather than prescriptive ethics—why modern *H*omo sapiens continues to fight.

Per Wilson (1978, p. 100): "Human beings have a marked hereditary predisposition to aggressive behavior." Freud understood aggression as a drive that seeks release. Lorenz elaborated on the similarity between aggression in humans and other animal species. Like Freud, Lorenz agreed that aggression required release, which can be sought in competitive sport. Erich Fromm, in *The Anatomy of Human Destructiveness*, argued that humans have a death instinct unique to our species, which propels us to forms of violence unknown in the animal world. Wilson disagreed with all of this. He argued for at least seven different types of aggression, all with different ætiologies:

- Defense and conquest of territory
- Assertion of dominance within well-organized groups
- Sexual aggression
- (Acts of aggression by which weaning is terminated)
- Aggression against prey
- Defensive counterattacks against predators
- Moralistic and disciplinary aggression used to enforce the rules of a society

Which of these might apply to the development of pugilism? We remove only one from the list (given in parentheses above). All of the others are candidate possibilities that shaped *Urboxen*. (We further add an eighth option: scapegoating or sacrifice, as distinct from items 2 and 7.) Wilson argues that aggression in animal species is density-dependent and is exhibited in relation to the scarcity of essential resources. The natural outcome of aggression is that organisms move away from each other, die faster, and give birth less (Wilson 1978, p. 101).

One argument against Freud and Lorenz' drive–discharge model is the observation that war does not seem to release enough steam, as it were, to displace aspects of lesser violence.[2] In fact, minor forms of personal violence like combat sports are perhaps even more prominent in warlike societies.

"The channels of formalized aggression are deep; culture is likely to turn into one or the other but not to avoid them completely. These channels are shaped by genetic predisposition to learn aggressive responses and the physical properties of the home range that favor particular forms of the responses" (Wilson 1978, pp. 114–115). According to this hypothesis, there are many ways that a stereotypical violence pattern, such as boxing, might develop. Consider a society in which male reproduction is limited by a relatively small female population. In

[2] Wilson includes among these: "combative sports, malevolent witchcraft, tattooing and other ritualized forms of body mutilation, and the harsh treatment of deviates" (Wilson 1978, p. 105).

such a case, pugilism between males might be used to determine which male is more fit to reproduce. This convention would help avoid excessive and potentially lethal competition that could affect activities like hunting and warfare where a large number of males is desirable and, in any event, bears less direct relation to the number of females. The specific conditions of boxing would be affected by material culture and adaptable traditions already present in the group. These might include a particular attitude towards blood, materials available for weaponizing the hands, and existing rites of passage for young men. It would be helpful to recognize how pugilism varied across ancient cultures and what elements remained the same, to better understand how the aggressive nature of humans is expressed in formalized ways. As with many other aspects of ancient culture, it may be impossible to determine whether boxing developed independently in a variety of Mediterranean and Near Eastern societies or whether it developed once and spread. In either case, boxing clearly scratched an itch among ancient people. The transcendence of boxing across space and time, when so many other human activities have disappeared or transmogrified, is truly impressive.

"[H]uman aggression cannot be explained as a dark-angelic flaw or a bestial instinct.... Human beings are strongly predisposed to respond with unreasoning hatred to external threats and to escalate their hostility sufficiently to overwhelm the source of the threat by a respectably wide margin of safety" (Wilson 1978, p. 119). Wilson goes on to admit that, "our brains do appear to be programmed to the following extent: we are inclined to partition other people into friends and aliens.... We tend to fear deeply the actions of strangers and to solve conflict by aggression" (Wilson 1978, p. 119).

In *The Selfish Gene*, Dawkins sets out to explain Lorenz' observation that animals fight in such a way that they do minimal damage to one another. "To a survival machine, another survival machine (which is not its own child or another close relative) is a part of its environment...It differs from a rock or a river in one important respect: it is inclined to hit back" (Dawkins 1976, p. 71). However, Dawkins reasons, "[T]here is no obvious merit in indiscriminately trying to kill rivals" (op. cit., p. 73). He declares, "There are costs as well as benefits resulting from outright pugnacity" (ibid.). Dawkins then goes on to outline an "evolutionarily stable strategy" for intraspecific competition. Consistent with his thesis against group selection, Based on the work of John Maynard Smith and George Price (a paper entitled "The Logic of animal conflict"), Dawkins argues that a population composed of genetically-predisposed 'hawks' and 'doves' (or fighters and lovers, if you will), naturally settles on a stable ratio where 'doves' outnumber 'hawks'. Given the naive assumptions of such a model, it has been elaborated to include 'retaliators,' which behave like doves until attacked; and 'prober-retaliators' which do the same, but experiment with unprovoked attack on occasion. Simulations show that 'retaliator' is the most stable strategy, followed closely by 'prober-retaliator' (op. cit., p. 80). In a population of retaliators, no other population is able to invade and succeed. According to Dawkins, this explains the 'gloved fist' aspect of animal aggression without resorting to arguments based on "the good of the species". It may be of interest to us, as well.

If early humans behaved as organisms with the dispositions available in the modified dove–hawk contest, they, too, would naturally settle on an equilibrium with a preponderance of retaliators in the gene pool. The retaliation strategy looks a lot like a boxing match: "a retaliator behaves like a hawk when he is attacked by a hawk, and like a dove when he meets a dove" (op. cit., pp. 79–80). A successful boxer, arguably, will employ some combination of the retaliator and prober-retaliator strategies to maximize potential for success in the ring

(and minimize potential for injury when confronted by a 'hawk').[3]. The stability of the of the (prober-)retaliator strategy may be what makes boxing such a ubiquitous form of male–male competition across human societies.

2.2.2 Naturalist origins

Although "nature red in tooth and claw" (a phrase due to Alfred Lord Tennyson) was a position notoriously attributed to the first advocates of the theory of evolution, thinkers earlier than the evolutionary biologists have also recognized upon naturalist grounds the origins and necessity or inevitability of personal violence. Political philosopher Joseph de Maistre wrote (in the mouth of a character), "In the immense sphere of living things, the obvious rule is violence, a kind of inevitable frenzy which arms all things *in mutua funera*. ... Once you enter the animal kingdom, the law suddenly becomes frighteningly obvious. A power at once hidden and palpable appears constantly occupied in bringing to light the principle of life by violent means. In each great division of the animal world, it has chosen a certain number of animals charged with devouring the others .... There is not an instant of time when some living creature is not devoured by another" (de Maistre 1821). Notwithstanding his picturesque phrasing, de Maistre recognizes the self-evident fact that nature exists in a churn of competitive violence. Any naturalist account must grapple with the observable facts that violence is endemic to the activities of life at all stages of development.

2.2.3 Naturalism and preparedness

Another theorist of mass violence (war) rather than personal combat, German WW1 officer Ernst Jünger proposed that violence is, or early became, innate to the human experience of the world: "War has raised us to fight, and we will remain fighters as long as we live." (Jünger 1922). In Jünger (1951), Junger further elaborates that civility is but veneer over an iconic figure fulfilling the Latin maxim *se* vis pacem, para bellum: "Long periods of peace foster certain optical illusions: one is the conviction that the inviolability of the home is grounded in the constitution, which should guarantee it. In reality, it is grounded in the family father, who, sons at his side, fills the doorway with an axe in his hand" (Jünger 1951, p. 78). Together, these present a way to sociologically understand combat sports, including boxing, as a call for the men of a community to be always vigilant and prepared for combat at need.

2.2.4 Play and sport

As mentioned above, play-fighting is frequently observed throughout the animal kingdom and serves as a proxy for genetic fitness in nature. Play encourages physical development and preparation against an eventual need for future combat. Play serves a key role in psychological development (e.g. hand-eye coordination), social development, and physical development. J. S. Russell considered the value of "dangerous sport" for the normal developmental behavior of adults and children: "Dangerous sport with its higher level of danger can provide a venue

[3]The classic division in boxing styles between boxers and brawlers may at first blush seem roughly equivalent to the distinction bteween doves and hawks. The comparison is not entirely apt, however, since doves must run away when attacked and a boxer does not do so (at least not in any kind of terminative sense) On the other hand, if dove-like behavior in the boxing ring is considered periodic rather than terminal retreat, then the application of Maynard Smith and Price's work may still be relevant.

for participants not only to test themselves against danger to see what they are capable of, but it also creates the possibility of realizing an important fact in human life that leads to living more fully and meaningfully, that is, the fact that we are mortal beings" (Russell (2005); cf. Russell (2007)) (Russell hints at a deep psychological point as well: at some point in the conscious awakening of mankind, our ancestors recognized their own mortality in a way distinct from animal instinct.) Play affords developing children the opportunity to observe and internalize the importance of rules, honor, status, and sportsmanship; in short, play as social activity socializes its participants.

2.3 The biomechanics of orthograde combat

Orthograde combat is not unique to humans, but in other species it frequently represents a departure from the norm, such as two dogs standing on their hind legs to gambol or kill, or two bears standing to claw and swat each other. Only kangaroos seem to mimic the otherwise hominid behavior of striking with the forelimbs, as "boxing kangaroos" will use their short forearms to hold an opponent still while they kick at them.

In an anthropological attempt to understand the uprightness of human combat, we invoke the theory of "spinal catastrophism" (Moynihan 2019). Spinal catastrophism draws attention to the spine's literal embodiment of the history of evolutionary trauma, including the cervical spine's role in the final erection of the skull and face in hominid evolution. The spine facilitates reflex arcs which allow hair-trigger reactions to the antagonist's movements. The orthograde spine embodies the distinctly human nature of boxing as two opponents face off, able to look each other in the face and present the entire forward surface of their bodies in personal combat. This mutual upright facing paradoxically demonstrates disarmament and engagement simultaneously, as the vulnerable belly and organs are forward and protected only by the guard and reaction of the fighter's skill and chance.

Carrier, Morgan, Horns, and colleagues have recently proposed and studied the theory that hominin hand evolution occurred along a line highly compatible with hand-to-hand striking-based combat (Carrier 2011, Morgan and Carrier 2013, Horns et al. 2015). According to the pugilism hypothesis of hominin hand evolution, humans can strike with 55% more force with a "fully buttressed" fist than an unbuttressed fist, and with twice as much force as an open-handed slap. "The evolutionary significance of the proportions of the hominin hand...[made] it possible to use the hand as a club during fighting" (Horns et al. 2015, p. 3215).[4] Altogether, the ontogeny of the hominin fist, with a high thumb-to-digit length ratio in hominins vs. the last common ancestor of humans and chimps, exhibits the hallmarks of an evolutionarily selected feature.

2.4 Biomechanics of striking

We refer to all hand-based blows, punches, and elbows as "strikes" and all leg-based kicks and knees as "kicks". These include many kinds of contact (such as eye gouges, eye rakes, and "fibbing") which are so illegal in modern sport boxing as to be almost forgotten, as well as

[4] We note as an aside that gloved v. ungloved combat does not seem to affect the biomechanics of striking: "Few differences were evident when comparing the kinematics of gloved versus bare-handed punches" (Whiting et al. 1988, p. 130). See also Dinu and Louis (2020).

common but modern innovations (such as the hook). We denote chancery, clinching, and to-the-ground wrestling (as in pankration) as "grappling".

How does an archetypal untrained, inexperienced human strike under duress in combat? The joints which administer strikes using the arms are the shoulder and elbow. The elbow tends to naively favor the biomechanics of a hammer blow, that is, a hit along the plane of the arm striking with the little finger muscles (the meat at the edge of the hand opposite the thumb). The shoulder is farther away and conditions the motion less, providing a fulcrum around which the hammer blow occurs.

A developmentally primitive fighter will also be fighting bare-fisted ("bare-knuckle"), which tends to expose the fine bones of the fist to damage and limits the power and targets of blows. For these and related striking angles, even glancing blows can break the fifth and fourth metacarpals, a condition known eponymously as "boxer's fracture" (Soong et al. 2010). Between damage to the fingers, fist, wrist, and forearm, the hammer strike is often abandoned in an,experienced or reflective fighting strategy. The canonical "karate chop," however, retains something of its flavor.

The next ontogenetic development after the hammer strike is the direct punch, which has many nuanced forms but all share in common that the strike occurs in line with the forearm and is delivered and absorbed by the fist, primarily in the first and second metacarpals. (These bones are harder and the knuckles tend to be more calloused than the third and fourth metacarpals.) A buttressed fist can deliver kinetic energy effectively into another's body, while remaining capable of quick reconfiguration to grapple, grab, or rake with an open hand.

A more sophisticated catalogue of strikes, including uppercuts, hooks, and technical nuances of grappling, cannot be recovered from the ancient record. We defer a more complete discussion of advanced strikes to a later article.

2.5 Duel vs mêlée

Boxing characteristically distinguishes itself as a duel rather than a brawl or mêlée of many combatants. Generalized battle of one group against another, as observed among chimpanzees, is a pragmatic tactic in warfare but likely results in generalized injury and destruction. Limitation of combat to a pair of competent warriors allows each side to put forward a "strong horse" who can demonstrate before the gods the worthiness of their claim. However, as boxing clearly occurs for reasons besides the open or covert warfare of two groups, dueling combat persists for reasons other than the limitation of damage and injury.

Monomachy is incentivized by the higher payoff in terms of status, access to mates, and so forth, while entailing typically commensurable risks. (One of the highest risks is that the opponent defects and allows into the combat space other allied combatants, but we elide this eventuality for now.) Winning and losing leads to direct hormonal and physiological effects, notably increased testosterone for the winner and increased cortisol for the loser (Slimani et al. 2018). (The evidence for decreased testosterone in the loser is contestable, cf. Oliveira et al. (2014).) Personal combat demands a high level of performance from each combatant in terms of reaction speed, striking power, situational awareness, and ability to remain within mutually agreed parameters of combat (rules and conventions). (Dueling and its cousin, single-champion combat, are considered in their social ramifications in a subsequent article.)

3 Paleolithic/Neolithic combat

Philostratus of Athens, a chronicler of boxing who wrote in the early Roman Imperial period, gave us his best guess as to the *fons et origo* of the sport. However, no one in that era could have possibly unearthed the prehistoric origins of boxing. Even the Sumerians, who grant us the first glimpse of pugilism in the historic record, could not have captured in stone or clay the details of the first boxing match. This is not merely because of the great time depth at which the first boxing encounter likely took place, but because boxing represents something so elemental to our natures that it is hard to imagine it ever being invented at all.

Given that it is impossible for us to observe boxing *in statu nascendi*, the inferences we make about combat between early humans must remain speculative. We know of no representation of upright, single combat predating the reliefs and plaques made by Mesopotamian artisans and their Caucasian counterparts in the third millennium BC (see the subsequent article on Mesopotamia). While we might learn something about the agonistics practiced by our earliest hominin ancestors by studying fighting behaviors in chimpanzees (see Section 2), we have few options for filling in the enormous gap between the dawn of humanity and the rise of Sumer.

Perhaps the only way to reasonably speculate about this vast developmental period is to study spontaneous fighting between untrained, unarmed *homo sapientes*. One early observation of young children fighting one another has it thus: "[V]ery small boys seldom stand for their combats...[T]hey fight, rolling over on the floor, and each seek[s] to keep the upper hand" (Groos 1901, p. 175). The same author continues his description of contests among children: "In playful fighting...the blow with the fist is not much used" (Groos 1901, p. 179). We speculate from anecdotal evidence that such encounters may be initiated with a few standing punches but quickly resolve into 'horizontal' fighting—something akin to the Greek pankration, or an instigated fight between two fourteen-year-old boys. The impulse to push an opponent to the ground is strong. This downward 'trajectory' is likely a functional primitive of single combat between humans. The combatant who goes to the ground first is at a manifest disadvantage, since strikes will be more effective from above and his mobility for defense is limited. Of course, many tactics can be learned and subsequently employed to shift the balance in favor of the fallen, overwhelmed combatant; and a fallen, armed opponent is still in good shape with respect to a standing, unarmed one. However, if both combatants are untrained and unarmed, we take it as a functional primitive that the one on the ground first is more likely to suffer injury and defeat.

Moreover, spontaneous agonistic encounters between young humans are typically brief, and may involve only a few strikes with the hands or feet. This is typically followed by submission or retreat of one combatant. In one study, hitting and pushing/pulling serve as the most common instigation of fights between children.

All of this is to argue in favor of our position that boxing is not natural. That is, prolonged agonistic encounters where combatants remain on their feet for the duration of the fight are unlikely to be observed among the untrained and the unarmed, just as they are rare among the very young. If the natural course of fighting (when it continues) is to fall and wrestle, as we suppose, then we are presented with a riddle. Why remain standing in a fight? Indeed, why box at all?

3.1 Boxing ritual in the earliest human societies

It is a *locus communis* to claim that sport is ritual. The validity of the claim depends, however, on the contested and pliable definition of both the subject and predicate across an anfractuous literature. Despite this, it is relatively uncontroversial to claim that sport is a type of play. So what are play and ritual? A foundational argument has been made that play and ritual are the same thing. Or, at least, they are both aspects of the same process, one by which humans channel "rhythm, harmony, change, alternation, contrast and climax" into a coherent practice (Huizinga 1955, p. 75). Huizinga argues that, "[P]lay is older and more original than civilization" (ibid.). This is an appealing lens through which to speculate on the development of pre-civilizational boxing.

In its ritual context, (modern) sport, including boxing, has been confirmed as "a social situation during which individuals engaged in problematic and consequential action communicate to one another that they understand the ideal demands their roles place on them, agree with the values assumed by those ideals, and are capable of fulfilling role expectations" (Birrell 1981, p. 355–356). At the same time, sport may be considered "a social ceremony structurally capable of fulfilling social functions comparable to those of religious ceremonies, specifically as an arena for the creation of symbolic leaders and the display of heroic action." In this sense, sport-as-ritual "reaffirm[s] the values of the social order" (Birrell 1981, p. 356). Thus sport presumes some form of social order and so, too, must the most primordial form of boxing. We imagine that at some early stage of social development, humans transduced the elemental energies of rough-and-tumble, largely 'horizontal', fighting into a form of upright, unarmed combat that was both a projection and a reinforcement of an emerging social order. Such an order likely invested value in qualities associated with success in hunting animals, defending the community from outsiders, and subduing rivals. Such qualities probably included competitive and aggressive behavior, resistance to pain, courage, strength, perseverance, agility, and, not least of all, spunk. All are associated with successful modern sport boxers, whose tradition ultimately devolves from Mesopotamia. In Mexico, the same qualities seem to be prized among traditional *Tïgre* boxers, who practice a sport with a distinct, American lineage (see the subsequent article on pre-Columbian boxing).

One definition of a game is "a voluntary attempt to overcome unnecessary obstacles"; the addition of physical exertion, to the point of exhaustion, makes the activity a 'sport' (Connor 2012). Perhaps related to notions of play, we also tentatively connect boxing to Neolithic dancing: it has been argued that the "significance of dancing is related to the Neolithic revolution"... "[T]he beginnings of agriculture involved a cognitive revolution concerning the relationships between work investment and its final product, referring to the agricultural cycle. Through dancing at scheduled agricultural ceremonies and festivals communities transmitted messages to themselves with regard to the task at hand" (Verhoeven 2011, p. 805). "The high supernatural powers also became involved in the process, as the circle of dance is the actual place where contact is made between this and the other world" (Garfinkel 2003, p. 82).

Because sustained pugilistic combat is unlikely to occur spontaneously among unarmed, untrained combatants, boxing is a good candidate for an emergent ritualistic behavior. Fistfighting is arguably such a basic ritual that we can imagine it accompanying humans in their greatest and earliest migrations. Thus, we find positive evidence for boxing in both the pre-Columbian Americas and southwest Asia at early dates. Another possibility is that boxing is not passed on culturally but that it emerges over and over again as a basic ritual behavior as

a response to any number of bio-social primitives including sexual selection, aggression, and hierarchy.

Rituals "are not in themselves immediately and functionally productive in the material world" (Renfrew 2018, p. 13). This characterization is apt for boxing insofar as boxing does not accomplish the same real-world objectives as fighting. In other words, *any* regulation of fighting removes fighting from its essential evolutionary functions and makes it a product of culture. In boxing, one's opponent is permitted to stand; indeed he is compelled to stand, thus forcing both fighters to contend with each other on equal ground throughout the duration of the encounter. It is this neutralization of advantage, which is most elemental to boxing, that suggests to us ritual behavior.

The following basic attributes of ritual have been proposed and subsequently debated (Bell 1997, pp. 138–69), as summarized by Renfrew (2018, p. 12):

1. Formalism of expression and gesture
2. Traditionalism, [in] conformity with earlier cultural practices
3. Disciplined invariance, involving repetition and physical control
4. Rule governance, restricting human action and interaction
5. Sacral symbolism, with the use of sacred symbols
6. Performance, involving actions undertaken in public

As to all of these, with the possible exception of number five (see below), there is no question that all modern sport boxing fits the bill. As for our hypothetical, prehistoric proto-boxing, there is of course no way to assess formalism or traditionalism. However, we will indulge in shameless speculation regarding the others. By limiting fighting to an upright posture, regardless of the many other rules that accresced to the sport over time, it is arguable that even 'vertical' proto-boxing achieved a level of physical control and restricted human action far more than its evolutionary antecedent, rough-and-tumble. In addition, we can assume some form of public performance if the earliest forms of boxing were related to sexual selection, and this is a strong possibility, as we argue in Section 2. Together, we find some evidence that proto-boxing at its inception had some ritualistic elements. To these, other formal characteristics were added. We find it relatively easy to argue in favor of boxing-as-ritual in any tradition for which graphic or textual evidence exists.[5]

One of the most controversial points in Bell (1997)'s schematization of ritual is the fifth, since it inevitably draws the litigant into the question of what, exactly, is sacred. "Sacral symbolism" need not be associated with a particular religious tradition. Can a boxing ring become a sacred space that represents, symbolically, a field of battle or a lek? Do boxing gloves stand in symbolically for some more lethal form of violence? Are the accoutrements of the boxing ring (the gloves, the headgear, the mouthpiece) sacralized through use, if not by prayer and offerings (cf. the *cascos* of Tigre boxing, discussed in the article on pre-Columbian boxing)? The sacred may be ever in the eye of the beholder, so we leave it for now, as many students of ritual have also chosen to do (Rappaport 1999), only to return when we present more palpable evidence from the historical civilizations that have, in one way or another, entered the squared circle.

[5] As noted earlier, equating sport and ritual in any case is hardly controversial. We will later attempt to examine more specific ritual aspects of boxing in post-neolithic cultures, based on evidence rather than mere speculation, as is regrettably our only recourse in the current section.

Are all sports rituals? All games? All play? What made boxing special? Perhaps some are uncomfortable citing chimpanzees' playful rough-and-tumble as a ritual (despite indications that this activity includes formalized gesture). On the other hand, it may be difficult to accept a repentine transformation from play to ritual that uniquely characterizes our species. Now we find ourselves wading into debates about what constitutes ritualized behavior among humans, as opposed to other species—another world into which we choose not to venture. In any event, the boundary between play and ritual is, upon reflection, a vexation to our discernment. We leave this argument to be taken up by others, but we do assert that the *Urboxen*—a hypothetical, upright, pugilistic combat that took place when the city-states of Sumer were yet dust—must have met the standards of ritual on a number of criteria.

One critic claims, "Boxing and wrestling clearly emerge from the 'rough-and-tumble' play of animals and children" (Renfrew 2018, p. 17). At least for boxing, this is hardly as clear as it may seem at first glance, as we have attempted to show. Boxing could just as easily have emerged from the sacralization of earnest fighting with the fists, nails, legs, and so forth. When under duress, and in an authentically aggressive stance, children seem just as unlikely to naturally engage in 'vertical' pugilism as their adult counterparts. The same question that bedevils our analysis also vexes Renfrew's: how exactly did horizontal rough-and-tumble become vertical boxing? Renfrew's claim provides no additional light on that particular matter. Perhaps upright fighting is in fact more playful in some sense, but we are aware of no reports, and find no anecdotal evidence of our own, to suggest that very young children engage in standing fisticuffs or do so as a form of spontaneous play (absent the influence of modern sport boxing). We are confident that the ritual patrons of proto-boxing were grown combatants who chose to go about their usual rough-and-tumble while standing up, thus severely limiting their options. By restricting themselves it is possible that they were paying reverence to some now long-forgotten god.

As we point out elsewhere, the norms of modern sport boxing appear to limit the amount of wrestling that can go on in the ring. Ancient depictions reflect a standing posture, as well. Indeed, we define boxing as an upright activity; when it ceases to be vertical, it ceases to be boxing. Agreements, pacts, covenants, codes, etc., are necessary to keep the fighters from tackling each other and otherwise doing whatever else is necessary to claim victory. Two solitary fighters engaged in a contest are unlikely to hold themselves to such a standard, absent a highly-internalized code of morality.[6] More likely, in the earliest boxing matches, a participative audience or one or more referees were necessary to keep the fighters vertical. In the oldest representations of boxers we find a 'third man in the ring', whose staff-wielding job was as likely to impose order on the fighters as it was to perform ritual blessings on them before or after the encounter.

It is notoriously difficult to detect play and ritual in early human societies. Speculation can run wild when we consider the 'lives' of artefacts and imagine the lives of those who created them. However, the association between ritual behavior and boxing is pervasive across human cultures in time and space. We believe that is suggestive of a deep-time connection between boxing and ritual. Ritual behavior is still evident in the conventions and traditions of modern sport boxing, including the procession of fighters to the ring (the 'ring walk'); sounding the time-keeping bell in honor of the recently deceased; and the way fighters 'touch

[6] In modern sport boxing, sparring has a richly-elaborated, if sometimes tacit, set of rules relating to personal conduct during the simulated bout. In a local boxing gym, a sign posted near the ring presents sparring partners with the brief, paradoxical reminder: "This is NOT a fight!"

gloves', primarily, to signal mutual respect.[7] Tigre boxing in Guerrero, Mexico, is explicitly ritualistic in its imbriferous pretensions (see the subsequent article on pre-Columbian boxing)). Many analyses of the Boxing Boys rely on ritual to explain the strange scene that unfolds before us on the palace wall at Akrotiri (see the subsequent article on Mediterranean boxing). To be clear, we do not argue that all of these ritualistic elements are relics of boxing's past, or that any of them can be used to reconstruct the character of our hypothetical *Urboxen*. Instead, we believe that boxing naturally attracts ritualistic behaviors: its participants extend the practice into new zones of meaning. The core elements of boxing (stay standing; use only the hands; fight in the presence of witnesses) may be elaborated in countless ways, depending on the sacramental proclivities of the fighters and the spectators.

There is a common apothegm among English-language sports writers that one does not "play" boxing, therefore (they reason) it is more than a game, like other sports. While it it may seem infelicitous to think of boxing (or wrestling) as a 'game' like backgammon, croquet, or basketball, boxing is indisputably recognized as an Olympic 'game' and has other characteristics of games. According to one commentator on the Greek games:

> Certain sports, such as boxing, clearly appear to be substitutions for what Huizinga would call "original violence":[8] that is, they are 'restrained' and relatively 'safe' versions of contests that might otherwise lead to serious injury or death (Spivey 2018).

However, boxing is not merely a simulation of violence; it *is* violence. Anyone who has boxed competitively will affirm this, fully aware of the fact that all offensive techniques in boxing are designed to maximize injury as quickly as possible, regardless of context. Even routine sparring matches are hardly 'safe' and frequently result in injuries, non-devastating though these may be. There is no path to victory in a competitive boxing match other than by beating one's opponent into submission.[9] In a lek or even a local bar, by contrast, a symbolic gesture—including a low-pitched growl—may scare off an opponent and thereby win the day. Rather than a "substitution" for violence or a "safe" form of violence, boxing is in fact hyper-violence. To argue that boxing substitutes for violence among men is as absurd as arguing that cockfighting substitutes for violence among roosters. By adhering to a strict code, boxers are compelled by other men to attack each other in a confined space. They must remain on their feet while doing so. Moreover, while one depends on social sanction and explicit commitment to remain within the rules, violence above and beyond that permitted does take place on occasion in the ring. Violence in the boxing ring is not optional—it is

[7] While commanded by the referee to 'touch gloves' at the beginning of a bout, it is increasingly common to see fighters 'touch gloves' without an authority compelling them to do so, e.g., at the beginning of each round when the fighters emerge from their corners (including the first round, redundantly, mere seconds from the last time they 'touched em up'); after a foul, perhaps to indicate that the infraction was not intentional and as a mutual recommitment to the rules; other instances are less explicable but may even be intended, in some cases no doubt haplessly, to reduce the aggression of a rival. This behavior is less common in professional boxing.

[8] Huizinga invokes this concept when discussing the breakdown of international law, i.e., what results when "one member...of a community of states...proclaims the interests and power of its own group...as the sole norm of its political behavior...Society then sinks down to the level of the barbaric, and *original violence* retakes its ancient rights" (Huizinga 1955, p. 101, emphasis added). Huizinga views original violence (one cannot help but think of Cain and Abel) as the contradiction of the "immemorial play-spirit" (ibid.).

[9] The introduction of timed rounds allows a fighter to stay on the defensive a good part of the time, but even the most effective defensive tactics cannot lead to a clear victory without some convincing aggression.

inevitable. To remove the violence from boxing (wrestling, pankration, etc.) would be to change it into something else entirely. The most primordial conventions make it so.

The boxing ring itself serves as an ideal incubator for what Lorenz (1969) called 'critical reaction' fighting. In the boxing ring, fighters are completely hemmed in by the ropes and can seek no exit but victory or defeat; flight is not among their options. In more traditional settings, pugilists are kept in place by the encircling crowd of spectators. Circumcluded by the bodies of men who prevent their escape, the fighters feel a a dual obligation to not only suppress their flight instinct but to measure up to the cultural expectations of the peers who corporally surround them. In such a situation "the fighter stakes his all, because he cannot escape and can expect no mercy. The most violent form of fighting behavior is motivated by fear, by the most intense flight impulses whose natural outlet is prevented by the fact that the danger is too near; so the animal, not daring to turn its back on it, fights with the proverbial courage of desperation" (Lorenz 1969, p. 25). It is little wonder that western culture has so readily adopted the construct of fighting for sport in a cage, e.g., in mixed martial arts competitions that also sometimes feature boxing and kickboxing.[10]

Boxing is a ritual designed to commit combatants to concentrated, unrelenting violence.[11] We agree with Spivey that the rules of boxing restrain the fighters, but we differ with him when it comes to how this changes the outcome. For us, the primordial restraints (stay standing; use only the hands; fight in the presence of witnesses) make boxing a more dangerous, protracted, and social form of violence than a typical encounter between, e.g., two inebriated rivals who clash briefly in an alleyway. We believe that understanding this dynamic is crucial to understanding how and why boxing arose. Ancient rules of boxing matches, so far as we can discern them, were unconcerned with the safety of fighters. Instead, these codes potentialized human aggression and turned it into an offering worthy of the supernatural patrons that governed the contexts in which it occurred. Boxing was (and remains) a transpersonal experience, typical of other forms of ancient ritual. Boxing dissolves the egos of the combatants. By fighting each other in a sacralized context, with all natural options for flight and negotiation removed, boxers are united in purpose. While each fighter directs violence against his rival, it is precisely the same form of violence for each, ideally matched in intensity.

[10] Perhaps more effectively than the boxing ring, the cage communicates to a modern audience the desperate nature of the battle: both fighters are trapped and only one can emerge victorious. The reluctance of boxing promotions to adopt the cage may be an element of traditionalism. It may also be functional, since, despite its metaphorical power, the cage also obstructs the audience's view. More recent promotions have toyed with the shape and depth of the fighting area. As mentioned, Ultimate Fighting matches occur in a UFC-octagon™, effectively eliminating corners, and surrounded by material resembling chain-link fencing which varies in height; the Bare Knuckle Fighting Championship uses a circular fighting area, circumscribed by traditional ropes wound through eight (!) posts, a fighting area which it has patented as the "Squared Circle"; BYB Extreme Bare Knuckle Fighting touts a three-sided ring "affectionately known as 'The Trigon"'; the Valor Bare Knuckle promotion introduced the Bout Circle™ (or more colloquially, the 'pit'), with no ropes or caging, a circular, flat ring surrounded by an octagonal area of inclined mats; this intellectual property was pioneered, but apparently not legally protected, by Big Knockout Boxing, which from 2013 to 2015 staged matches in a similar fighting area also christened 'the pit' (`https://www.ufc.com/octagon`; `https://www.bareknuckle.tv/about`; `https://www.youtube.com/c/BYBExtreme/about`; `https://valorbk.com/about-valor-bare-knuckle/`; `Keefer (2014).` accessed November 25, 2021).

[11] A spare number of innovations have been introduced to conceal the true nature of boxing from its Victorian, Edwardian, and modern critics, but safety of fighters remains illusory, as indeed it must: Purged of risk, boxing ceases to be recognizable. By far, the most consequential of modern innovations to promote safety in boxing is time-keeping, including limiting the number of rounds.

Figure 1: Huizinga regarded "original violence" as the antithesis of the "immemorial play-spirit". "Cain Killing Abel", woodcut by Albrecht Dürer (1511).

Only when we recognize the concentrated—certainly not diluted—violence at the heart of boxing do we begin to glimpse the terrible rationale behind its most brutal variations. For example, if we persist in regarding boxing as mock violence, we will never understand why fighters in northern Italy and the Eastern Alps hammered each other with weights clutched in their hands; why the Lucanians gloried in sprays of blood from a boxer's bursting nose; or why the Romans strapped sharp objects to a boxer's hands in order to make fatal trauma inevitable. Rules define an ambit of acceptable violence, making escalation legible.

Like other games, boxing is rule-governed and it involves risk. The outcome is not predetermined. If the first rule of boxing is 'thou shalt stand up', then from the moment of this declaration, it became a game. But why not a ritual, instead? Indeed, the murky boundaries between play, games, and rituals are contested. In the earliest days, we speculate that divination by ritual, hence (in one form) religious divination by single-champion combat, became a "game" by the introduction of non-religious divination, i.e. gambling.

4 Boxing in History

Tales and depictions of boxing are almost as old as written history. We see boxing or close analogues presented in many ancient cultures from Mesopotamia to the Orient. While the foregoing analysis of human sociality, ritual and play, and biomechanics places real limits on the development of pugilism, at only a few points are we able to identify the speculative first introduction of an innovation by a civilization.

Consider, for instance, the ring. In prehistory, two fighters would have faced off without the expedient of a confined space of encounter. Yet at some point before the modern age, the ring became *de rigueur*. Each of the elements of boxing was invented and introduced; in some cases, we have evidence of early usage, and in others, none. We identify the following elements of boxing, all of which are associated with the tradition at some point. Some are primeval to the sport; others are as late as the twentieth century.

- Strikes (*sine qua non*) (and particular strikes: from hooks to haymakers to eye rakes)
- Stance (upright as *sine qua non*; squared-off, orthodox, southpaw, etc.)
- Paired combatants/unarmed single-champion combat (*sine qua non*)
- Bloodshed
- Ring/definite boundary
- Ring walk
- Rounds (timed or otherwise delimited breaks)
- Clinching/chancery/fibbing
- Swatting/blocking
- Grabbing/grappling
- Slipping
- Throws
- Kicks/knees
- Trading blows
- Tapping out/yielding
- Termination conditions
- Pre-fight devotions, including a face-off
- Musical accompaniment
- Gambling/fixing fights
- Gloves/*sphairai*/*cæstus*
- Wraps/*himantes*
- Glovedness: dual vs single (sinistral, dextral, enantiomorphic)
- Handheld "dumbbells"
- Kilt/skirt/shorts
- Helmet/headgear
- Belt or girdle (for title or devotion; see also the Muay Thai *Pra Jiad* armband)
- Groin protection (incl. the κυνοδέσμη *kūnodesmē̆*)
- Mouth guard
- Motivation (ceremonial, funerary, entertainment)
- Amateur v. professional designation
- Training/training camp/*palaistra*
- Weight classes
- Punching bag/speed bag
- Shadow boxing
- Adjutants: judges, referee, coaches, seconds
- Corporal correction

- Seasonal competition
- Disqualification/fouling/forbidden strikes or moves

As our subsequent articles review the history of boxing in various ancient cultures, we will highlight the earliest known occurrences of many of these features, as well as situate interesting forms, such as glove development. We will also consider the ramifications which different rule sets had for the fighters and the sport as a whole.

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Changelog

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