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Ontology and interdisciplinary research in esports

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ABSTRACT

This article identifies the benefits of adopting a critical realist ontology to researching esports in the social sciences. The article outlines some of the challenges in researching esports, paying particular attention to the emerging specialisms and sub-disciplines. The article suggests that different schools of thought have different ontological and epistemological commitments, resulting in a complex and somewhat fragmented or contested set of definitions and research directives. The article considers how the philosophy of science can enable researchers to gain a more complete understanding and appreciation of esports. More specifically, the article outlines some of the central philosophical commitments of critical realism and considers their benefits for researching the multi-layered and multifaceted nature of esports. What results is a stratified ontology of esports, in which various biological, psychological and sociological factors interact to produce emergent outcomes at micro, meso and macro levels of causality. Such an interdisciplinary approach resists previous attempts to reduce esports research to singular (and competing) epistemological claims. Instead, this article invites sports researchers to investigate the complex ways natural and social factors interact to generate and change esports structures, institutions and agential behaviours.

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Introduction

Research into esports is proliferating (Bányai et al. 2019; Pizzo et al. 2022; Reitman et al. 2020) and now covers a variety of academic disciplines, including business and management (Scholz 2019), sport science and psychology (Behnke et al. 2022; García-Lanzo, Bonilla, and Chamarro 2020; Pedraza-Ramirez et al. 2020), education (Funk, Pizzo, and Baker 2018; Jenny, Gawrysiak, and Besombes 2021), law (Holden, Kaburakis, and Rodenburg 2017; Windholz 2020), sociology (Brock 2021; Jin 2010; Taylor 2012; Witkowski 2012) and more. Various interests, themes and challenges emerge across these disciplines, from research into the business and economic aspects of the esports industry to using esports as a tool for education to concerns around player health, performance and psychology. Other themes also include research into the social and

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cultural impact of esports, the ethical and legal issues surrounding esports, and ways to improve the technology and infrastructure used in esports competitions.

Importantly, Pizzo et al. (2022) identify two issues with this exponential growth in esports research. First, 'esports scholarship remains fragmented, missing opportunities to connect with and inform scholarship transcending disciplinary boundaries' (Pizzo et al. 2022, 228). The second is that 'scholars are engaging in siloed research related to esports . . . . Neglecting their interdisciplinary nature, leading to disjointed scholarship' (Pizzo et al. 2022, 228). These issues are apparent when researching esports, which typically results in a variety of social and natural science subjects (health, psychology, economics, marketing, computer science, cultural studies) concentrating on primary epistemological objectives (e.g. cultural norms and practices in sociology; cognitive processes and actions in psychology; human-computer interfaces in computer science) that often overlook how some aspects of esports intersect to generate complex and multi-layered phenomena. This article will argue that an interdisciplinary approach based on the philosophy of science, critical realism, provides an approach to address this missing link.

Critical realism is a philosophical approach to understanding social and natural science that combines realism and critical theory. The version of critical realism presented in this paper is based on Roy Bhaskar's early work (Bhaskar 1998 [1978], Bhaskar 2008 [1975]) and, to an extent, his later works on interdisciplinary research (Bhaskar et al. 2010). It is also based on developments of these works by many critical realists, including Margaret Archer (1995) and Graham Scambler (2023).

Critical realism has two key commitments relevant to interdisciplinary research in esports. First, critical realism provides a philosophical underpinning for social research that offers an alternative to positivist and interpretivist accounts of esports phenomena. Second, critical realism foregrounds discussions about realist ontology above and beyond epistemological and methodological concerns. This article will discuss what critical realism offers through three key concepts: 'realism', 'causation', and 'interdisciplinarity'. It will suggest that critical realists see social and natural reality as made up of objects, structures and people that causally interact to produce new, emergent phenomena with more and more complexity, operating at different layers or 'strata'. The significance of such a 'holistic' approach is that it provides a theoretical case against unilateral reductions of any kind, whether to lower levels of biological, psychological or sociological explanation. What results is an explicit acknowledgement of the multi-layered nature of society, one that is amenable to interdisciplinary analysis in the context of esports research.

To help discern the utility of these ideas, this article develops a case for critical realism that supports esports researchers in two ways. First, it considers the need for a proper discussion of causality in esports research, paying particular attention to the limitations of current positivist and interpretivist approaches in the philosophy of social science. It will suggest that positivist research in esports produces a crude version of causality, which results in one-dimensional debates, such as whether esports is 'physical enough' to be categorised as a 'sport'. Alternatively, interpretivist approaches abandon causality altogether, focusing solely on the subjective experiences of agents and, thus, compromising the notion that social problems have an ontological status antecedent to individual action. Both positions commit what Bhaskar calls the 'epistemic fallacy' – the reduction of ontology to epistemology. Second, this article will advance Margaret Archer's (1995) 'morphogenetic model' to conceptualise

interdisciplinary research in esports. It will argue that this model decouples ontology from epistemology, allowing esports researchers to examine causality across natural and social 'layers' of reality. It will also argue that this model permits greater conceptual and methodological plurality in esports science, which can help transcend paradigmatic boundaries and disciplinary silos.

The challenge of researching esports

Electronic sports, or esports, refers to the competitive domain of video gaming where players and teams compete against each other in a formalised manner. Esports has witnessed tremendous growth in recent years as a swiftly evolving form of digital entertainment. Understandably, as the prominence of esports surges, the volume of scholarly research on organised, competitive gaming has also swiftly expanded. Meta-analyses of esports research suggest that the field has evolved from (almost) non-existent in 2002 to encompassing several academic disciplines by 2018, including business, sports science, psychology, informatics, law, media studies and sociology (Reitman et al. 2020). Generally, this research is divided into categories that showcase various disciplinary perspectives on and research approaches to esports. A concise overview of this research can be found in Table 1.

Recently, commentators have highlighted problems accompanying this rapid expansion of the esports research field. For example, Pizzo et al. (2022) argue that esports scholarship is fragmented and fails to seize opportunities to establish connections across disciplinary boundaries. This issue is compounded by the fact that academic research on esports takes place within disciplinary silos, which makes defining esports challenging as researchers concentrate primarily on epistemological objectives that overlook how some aspects of esports intersect. Scholz and Nothelfer (2022) confirm this position in their EU report on esports, arguing that esports research lacks the unified approach necessary for conceptualising adequate theories and methodological approaches. Flegr and Schmidt (2022) also suggest that esports scholars often build on established theories from sports and other disciplines but need to develop a dedicated theoretical base incorporating its interdisciplinary potential. Indeed, despite the proliferation of esports scholarship, there remain several 'wicked problems' (Rittel and Webber 1973) in esports research, which are challenging to solve because of incomplete, contradictory, or competing knowledge claims. Some of the major ones are as follows:

- *Definition and classification of esports*: there is an ongoing debate about whether esports should be classified as a 'sport' (Cranmer et al. 2021; Hallman and Giel 2018) and what the necessary and sufficient conditions of any definition are (Mareš and Novotný 2023; Parry 2023). Some argue that the competitive element, the need for strategy and coordination, the existence of professional leagues and tournaments, and the way it is consumed justify such a classification (Pizzo et al. 2018). Others argue that the lack of physical exertion differentiates esports from traditional sports (Jenny et al. 2017; Parry 2019). This debate has significantly influenced discussions regarding the role of esports in the Olympics, for example, with policymakers raising concerns about the lack of physicality (Parry 2021). On the one hand, it also contributes to ongoing concerns about whether gaming promotes a sedentary lifestyle (DiFrancisco-Donoghue et al. 2022) or gaming addiction (Ohno 2022). Such a debate

Table 1. Existing research approaches to Esports.

Title	Approach	Research focus	Example relevant disciplines
Professional gaming athletes	Esports is a professional sporting activity that shares parallels with traditional sports in terms of the significant amount of mental and physical effort needed to practice and compete at a particular video game title	The biological and physiological attributes that contribute to an athlete's performance include cognitive abilities like reaction time (Pluss et al. 2020) and physiological responses like emotion (Behnke et al. 2022) and stress (Palanichamy et al. 2020). It also includes research into esports player health (DiFrancisco-Donoghue et al. 2022) and sports performance management (Leis et al. 2023)	Sports psychology, sports physiology, sports coaching, sports health
Sports governance	Esports raises a range of sports governance questions, particularly as its growing recognition and legitimacy lead to the development of governing bodies and regulators similar to those in traditional sports	The legislative and policy aspects of sports law examine the structures, rules and organisations that oversee esports, addressing issues such as player welfare (Hong 2022), anti-doping policies (Frias 2022), and the potential inclusion of esports in the Olympic games (Abanazir 2022; Parry 2021) and its relationship to virtual sports (Cranmer et al. 2021)	Sports management, sports law, sports philosophy
Education and career development	Esports is a pathway for education and career advancement as it offers personal and professional opportunities through the development of transferable skills	Research highlights the increasing presence of esports in educational institutions, such as collegiate esports programs (Jenny, Gawrysiak, and Besombes 2021) and the growing range of career options within the esports industry, including coaching, management, marketing, journalism, and content creation and media production (Salo 2021)	Sports business, sports management, sports education, media and communication studies
Cultural phenomenon	Esports is a cultural phenomenon that covers a range of social and subcultural aspects, including gaming communities, fandoms, tastes, and practices	Research discusses the experiences and identities of esports players and fans, highlighting cross-cultural differences and similarities (Zhao and Zhu 2021) or drawing attention to diversity and equality concerns in gaming cultures (Taylor and Stout 2020)	Cultural studies, media studies, game studies, sociology, anthropology, philosophy sociology, anthropology, philosophy
Spectator/sport entertainment	Esports is a form of spectator/sports entertainment that covers a range of media and economic aspects, including advertising, sponsorships, media rights and viewership	Research discusses the motives of esports spectators (Pizzo et al. 2018), audience engagement, branding and marketing (Cranmer et al. 2021). Research also focuses on esports fandom and its relationship to traditional sports and emergent technologies (Rietz and Hallmann 2022)	Information and communication studies, sports marketing, sport management, business studies, game studies

(*Continued*)

Table 1. (Continued).

Title	Approach	Research focus	Example relevant disciplines
Digital economy	Esports represents emerging digital economic forms, including new revenue streams and business models that drive the industry.	Research focuses on the business and economic significance of esports (Scholz 2019), drawing attention to significant growth, professionalisation and investment opportunities (Parshakov, Naidenova, and Barajas 2020; Shenkman et al. 2022)	Business studies, sport management
Technological development and innovation	Esports is defined as a driving force for technological advancements in gaming, broadcasting, and sports.	Research focuses on emerging technology and advances in esports audience experiences (Miah 2017), particularly in the context of the Olympics (Anđelić et al. 2022) and education (Dirin et al. 2023)	Media studies, sports and exercise sciences, technology studies, education, business studies

echoes the 'virtual anxiety' often accompanying discussions about using virtual technologies in sports (Miah 2017).

- *Governance and regulation*: there are ongoing debates about how esports should be governed, identifying the benefits and drawbacks of local, national, and international regulation (Martinelli 2019). Relatedly, research identifies the potential litigation issues that will arise if esports is not effectively regulated as a sport (Holden, Kaburakis, and Rodenburg 2017), which is significant given concerns regarding gambling, cheating, match-fixing, doping and player welfare in esports (Abarbanel and Johnson 2019; Brock 2017). Research shows that inconsistent regulations and governance procedures at local, national, and international levels threaten the competitive integrity of esports (Windholz 2020).
- *Social inclusion*: like traditional sports, research on esports suggests significant challenges regarding diversity, equality, and inclusivity of players and fans. There is an ongoing debate about the barriers that competitive gaming presents to minority groups, including women (Rogstad 2022) and disabled people (Black and Gray 2022). In response, studies seek new ways of confronting toxicity in esports and building inclusive environments (Pauketat 2022).
- *Economic impact and sustainability*: the rapid growth of esports and its subsequent 'cooling off' period has generated a debate about its future economic viability (Peng 2020). Some research questions whether recent levels of growth and investment (particularly during the covid emergency) are sustainable and, if not, what plausible business models might be needed to support the development of esports in the long term (Nyström et al. 2022). Research also raises concerns about the environmental impact of esports on the planet, suggesting that esports businesses need to be 'greener' in the future to appeal to conscientious consumers (Nyström et al. 2022).

These 'wicked problems', set within the advancement of esports scholarship, suggest a need to examine esports more holistically to pinpoint areas of interdisciplinary potential. Whilst there has been some acknowledgement and appeal for more-encompassing

methodologies (Cranmer et al. 2021), esports scholarship remains disconnected from discussions in the philosophy of science that interrogate the ontological and epistemological assumptions that underpin research practices. Importantly, the philosophy of science can provide recommendations for improving scientific practices based on the need to clarify the foundations of scientific research (Crotty 1998). This can be achieved through concepts like 'ontology' and 'causality', which open up discussions about the nature of reality and how researchers can develop interdisciplinary knowledge whilst identifying weaknesses in existing approaches to scientific practice. This article now turns to these concepts and their relevance to researching (e)sports.

Critical realism and sports research

Critical realism is an approach in the philosophy of science that is rooted in Roy Bhaskar's writings on realist ontology (Bhaskar 1998 [1978], Bhaskar 2008 [1975] Bhaskar et al. 2010; Bhaskar et al. 2010). What makes Bhaskar's meta-theory significant is that critical realism emphasises discussions about ontology over concerns with epistemology and methodology. This emphasis leads Bhaskar to develop an ontology characterised by 'realism', 'causation' and 'interdisciplinarity', where natural and social causes interact to create progressively emergent and complex objects, structures, and relations. This ontological approach enables the examination of natural and social phenomena across multiple levels and disciplines, from the subatomic through to the intergalactic (and everything in between). More specifically, critical realism adopts several propositions and concepts that build layer-on-layer into an integrated philosophical system for interdisciplinary science:

- *Realist*. As the name implies, a central tenet of critical realism is that it is realist, philosophically speaking. It proposes a mind-independent reality, allowing research to distinguish between the world and our knowledge of it. This distinction between what the world is and what we can know of the world is essential because it underpins Bhaskar's (1998[1978], 2008[1975]) distinction between the 'transitive' and 'intransitive' dimensions of reality. Of these two dimensions, the 'intransitive' represents the constant, real, material world we strive to understand, while the 'transitive' reflects our fallible but advancing comprehension of that world. Importantly, critical realists dispute the idea of absolute knowledge, which Bhaskar (2008[1975]: 5) refers to as an 'epistemic fallacy', where one answers a question about 'ontology', i.e. whether a particular thing exists, with an answer about our knowledge of it, i.e. 'epistemology', as if whether something exists were the same question as to whether we know it exists. The epistemic fallacy concerns, then, the reduction of ontology to epistemology, eliminating a discussion of the intransitive objects of knowledge. Instead, critical realists develop models to examine the intransitive (or 'underlying') causal mechanisms that generate the conditions of possibility for natural and social phenomena to emerge. This is most apparent in Bhaskar's 'RRREIC model' (Bhaskar, 2009[1975]). The RRREIC proposes that, in the social sciences, where events take place in an 'open system', and causal mechanisms are charactered by multiplicity and emergence (as described below), it might be more fitting to concentrate on understanding the causal mechanisms that generate

phenomena, rather than merely describing events or experiences as evidence of whether a particular thing exists. As such, the first stage is to *Resolve* the complexity of reality into multiple causes that create observed outcomes. The second stage is to *Redescribe* these causes in an explanatory way, moving from the abstract to the specific. Thirdly, through *Retroduction*, researchers posit which causal powers and mechanisms have been involved in the event. Fourthly, researchers *Eliminate* explanations until they, in the fifth stage, *Identify* some that provide a coherent explanation (not unlike abduction). This new knowledge may necessitate *Correction* of previous theories (Price and Martin 2018). As such, the RREIC model offers a way to study the complexity of the world whilst maintaining that such knowledge is always fallible, given that intransitive causal mechanisms may remain absent from our theories or empirical observations of events under study.

- *Causality*. Critical realism operates with a 'stratified' view of ontology, in which our empirical observations and experiences stem from the influences of hidden yet real causal mechanisms operating at various 'levels' of reality. Significantly, Bhaskar explains that the 'emergence' of social and natural phenomena cannot be simplified to lower levels of causal explanation. On this point, critical realists distinguish between 'closed' and 'open' systems of science. In the former, the scientific method is used to make determinations about reality based on the testing and controlling of variables to identify empirical regularities. In the latter, overlapping layers of natural and social phenomena, each with distinctive properties and characteristics, interact at 'deeper' levels to produce causal effects, some of which may be rendered (un) observable through discipline-specific epistemologies and methodologies. As such, Bhaskar concludes that causality involves complex and unpredictable feedback loops over time, meaning that social and natural phenomena are irreducible to one causal mechanism or set of regular patterns. In the social sciences, Bhaskar offers the 'Transformational Model of Social Activity' (TMSA) as a way to study these feedback loops. The TMSA is based on the Aristotelian idea that every productive activity necessitates both a material cause emanating from society, i.e. pre-existing social forms, as well as an efficient cause (reason) emanating from an agent. As such, social scientific explanations must involve some element of social structure and human agency interacting together over time (Bhaskar, 1998[1978]). Importantly, Margaret Archer (1995) develops Bhaskar's TMSA in her 'morphogenetic approach' (described in detail below) to distinguish the temporal elements through which these feedback loops occur.
- *Interdisciplinarity*. The existence of causal mechanisms at different levels of social and natural phenomena demands, at a minimum, a multidisciplinary approach (Bhaskar, 2010). Bhaskar argues that the possibility for interdisciplinary research is based on recognising an 'open system', which underpins any examination of how causal mechanisms interact and generate emergent outcomes at different levels of reality. There are two vital results of this analysis. First, critical realists accept neither the view that there are fixed philosophical first principles which guarantee epistemic certainty, nor the idea that first order activities are self-justifying. As such, one needs to be careful in establishing the elements of a causal narrative, as neither may be a necessary or sufficient condition for the outcomes that follow. Second, critical realists embrace conceptual and methodological pluralism, which is more

> reasonably a way to integrate knowledge about such conditions into an interdisciplinary model of causality and research practice (Nastar, Boda, and Olsson 2018).

Scambler (2023) has considered the significance of these philosophical propositions for researching sports from a critical realist perspective. First, Scambler argues that critical realism helps sports researchers *resolve* the complex ways in which causal mechanisms generate sporting outcomes across disciplinary boundaries. Scambler argues that sports exists within a stratified ontology of natural and social factors that range from the biological dispositions and psychological traits necessary for athletic activity to the social, cultural, and material assets that condition athletic performance and structure the decision-making of sports teams, governing bodies, and policymakers. From this perspective, sports research is multi-layered and multi-faceted, which Scambler *redescribes* in terms of the causal mechanisms that travel 'upwards' from biology and psychology to those that travel 'downwards' from the social, cultural, and economic aspects of life (Scambler 2023, 146–147). As an example, Scambler (2023, 53) considers elite athletic performance, suggesting that it is expedient to *retroduce* the underlying causal mechanisms that might be involved in generating performative success, including genetics (biology), mental resilience (psychology), and access to financial and familial support (sociology). Second, such mechanisms are causally effective on multiple levels or 'layers' of reality. Like Bhaskar (2008 [1975]), Scambler is critical of approaches in the (sport) sciences that reduce explanations of behaviour to either macro, meso or micro-level phenomena and/or rely on empiricism to establish categorical truths. Instead, Scambler contends that critical realism offers sports research a way to analytically distinguish between macro and micro-level causes, such that a more holistic or interdisciplinary view of elite athletic performance is possible. As Scambler writes (Scambler 2023, 54), there would be no such thing as an Olympic champion without the 'mentor-rich urban environments' that provide competitors with distinct performance advantages through access to material and social resources. Equally, there would be no Olympics without the biological predispositions that condition athletes' bodies or the psychological attributes that support performative preparedness. As such, critical realism provides sports researchers with a 'depth ontology' through which their explanations countenance the complex ways in which sporting outcomes are generated (also see North 2017).

Notably, the work of Margaret Archer, a prominent critical realist, is also salient here. Archer (1995) is best known for developing Bhaskar's TMSA into the 'the morphogenetic model', which is represented through the following formula: (T1) structural conditioning ➔ (T2) social interaction (T3) ➔ structural elaboration (T4) (described in detail below). According to Archer, this model provides a means to empirically understand the temporally complex ways in which social structures and human agents interact to reproduce (morphostasis) or change (morphogenesis) existing circumstances. Scambler argues (Scambler 2023, 67) that the morphogenetic model enables sports researchers to think through the interactions of macro, meso and micro- level mechanisms and how they might shape sporting performance outcomes. North (2017, 189) agrees, arguing that the morphogenetic model affords sports researchers an analytical starting point to trace the complexity of sporting outcomes across disciplinary boundaries and macro, meso and micro-level interests.

What critical realism offers, then, is a viable means of theorising the nature of scientific research into sports. As Scambler's (2023) example of elite athletic performance shows, sporting behaviour and outcomes exist within an 'open system' characterised by multiple causation across disciplines and macro, meso and micro- levels of society. Such a system means that predictive regularities are not only rare, but that attempts to categorise and explain sport through reference to specific disciplines and/or empirical studies alone will likely result in eliminating the intransitive dimension from the discussion. From this perspective, researchers can begin to investigate multiple causation by utilising the models of Bhaskar and Archer.

Implications for esports research

The propositions of critical realism have two crucial implications for esports research.

First, *esports research requires ontological depth*, which is to say that current epistemic framings lack the philosophy of science needed to generate interdisciplinary research questions and explanations. We see this most clearly in debates concerning whether esports is a traditional sporting activity (or not), which hinges on questions about how 'esports' should be defined and whether it meets specific disciplinary definitions of 'sport' or not (Mareš and Novotný 2023; Parry 2023).

One side of the debate is positivist. It attempts to test whether or not esports play meets a particular set of biological, physiological or psychological criteria of sport. For example, Hallman and Giel (2018, 15–16) suggest that esports research fails to establish the importance of physical activity in competitive gameplay and its role in improving (or not) physical fitness and/or mental wellbeing. Jenny et al. (2017, 9, 15) concur, suggesting that, whilst esports are an example of organised gaming competitions, they lack the physicality and athleticism traditionally associated with elite athletic performance. DiFransciso-Donohue et al. (2022) take this further, arguing that when compared to non-esports players, collegiate esports players are significantly less active and have a poorer body composition than sports athletes (e.g. higher body-fat percentage), which correlates with potential health issues. Indeed, there is a long-standing medical literature that maintains a correlation between video gaming, physical passivity and adverse health conditions (see Marker, Gnambs, and Appel 2022) and esports is seen as an extension of this trend. In contrast, sports psychologists argue that esports are similar to traditional sports. Both involve strategy, teamwork, competition, and coping with stress and pressure (Palanichamy et al. 2020). Indeed, the issue of cognitive performance and resilience is common to definitions of traditional sports and is an emerging area of research in esports scholarship (Pedraza-Ramirez et al. 2020). From this perspective, esports is a sport as it offers many (non-physical) developmental opportunities commonly associated with sport, including education and learning through collegiate esports (Zhong et al. 2022).

The other side of the debate consists of interpretivist research that challenges existing (positivist) definitions of esports by focusing on the subjective experiences, meanings and social constructions within competitive play. For example, Taylor (2012) argues that definitions of esports are fluid and constantly evolving due to changing social and cultural contexts. Preferring to avoid any 'definitional judgment', Taylor (2012, 37) describes how players and other stakeholders make sense of esports through various activities and practices. From this perspective, the definition of esports is not fixed but shifts as

'assemblages' of actors (including people, technology, media and organisers) negotiate and reinterpret the phenomenon. Seo and Jung (2016) agree, arguing that definitions of esports are shaped by social recognition and legitimacy within gaming communities. Indeed, researchers examine how players reinterpret notions of physicality through the embodied dimension of esports play, revealing the subjectivity within 'sporting movements' (Witkowski 2012) and contesting the virtual/real distinction (Ekdahl and Ravn 2022). Esports, then, is a social construction insofar as its 'reality' is shaped through intersubjective experiences, which differ across historical, cultural and social contexts (Jin 2010). This enables these researchers to deconstruct existing definitions of esports (Seo and Jung 2016), rather than establish a causal view on the multiple strata that shape its conditions of possibility.

Both sides of the debate fall in line with Bhaskar's description of the 'epistemic fallacy'; they define esports in terms of what can be observed and experienced through their respective epistemologies, ignoring underlying generative causal mechanisms. In the first instance, research approaches esports as a 'closed system', attempting to establish regular patterns of behaviour as evidence of predictive cause-and-effect relationships. As such, they attempt to isolate out particular biological, physiological, or psychological traits (e.g. heart rate, BMI, eye-hand coordination, stress, fatigue) and test them against performance indicators to make predictions about the physical effects of competitive gameplay. The problem with this approach is that it reduces esports to a natural target—biology or psychology—and reifies the definition of sport as either a physical or mental activity. Indeed, through experimental testing or predictive modelling, health researchers maintain the epistemic boundaries over whether esports is physical or mental 'enough' to be considered a sport (DiFransciso-Donohue et al. 2022). We can suggest that these researchers 'upwardly conflate' (Archer 1998) the explanatory power of the health sciences, such that it appears as if only sports physiologists and psychologists have epistemic access to address definitional questions. In the second instance, interpretivist researchers avoid causality altogether, focusing solely on the subjective experiences of esports actors. As Archer (1995) notes, this approach tends to be 'voluntaristic', focusing on the meanings actors give to their actions rather than exploring the causes and conditions that shape them. Whilst subjective meanings are important, they are insufficient to fully explain esports phenomena, including the underlying material conditions, structures or power dynamics that influence individuals' interpretations (Jin 2010).

Critical realism offers an alternative approach: it invites researchers to consider the *stratified* nature of esports and the material and social factors that contextualise definitions and explanations. Following Scambler (2023, 146–147), there is a range of causal mechanisms: from those that travel 'upwards' from physiological and psychological accounts of players to those that travel 'downwards' from the social, cultural and economic aspects of life. For example, Table 2 considers the factors that causally effect esports athletes' performance.

Second, *an interdisciplinary account of esports is possible* by researching the causal mechanisms that operate across macro-, meso- and micro-levels. Archer's (1995) 'morphogenetic model' is salient here. As noted above, Archer's theoretical framework explains the interplay between social structure and agency in social phenomena. It suggests that social structures and individuals' actions mutually influence and shape each other over time. Applying this framework to esports player performances involves

Table 2. Stratified nature of esports performance [adapted from Scambler (2023), 146–147].

Strata	Description	Disciplines
Physiological	The gaming body at a molecular level, including biological measures of esports performance	Sports physiology, sports medicine, anatomy, biomechanics, biochemistry, kinesiology, sports nutrition, data science and analytics
Psychological	The gaming mind at a mental and emotional level, including distinctive personal traits like resilience and competencies like interpersonal communication	Sport and exercise psychology, sociology, game studies, media and communication studies, education, data science and analytics
Social	The level of social relationships that contextualise player behaviour, including natal context, team integration and wider social forces, including governments, sporting bodies and international associations	Sociology, business, sports psychology, media and communication studies, anthropology, game studies, education, law, sport ethics and philosophy
Cultural	The level of ideas, tastes, preferences, and practices that contextualise player behaviour and inform national and international sports agendas, including cultural norms and values and the metagame	Cultural studies, sociology, game studies, media and communication studies, law, sport ethics and philosophy
Spatial	The level of space, equipment and access needed to compete at and broadcast esports effectively, including well-equipped and non-hostile esports venues and related environments	Media studies, sports business and management, game studies, urban studies, sport pedagogy and education, law, sport ethics and philosophy
Symbolic	The level of social status and acceptance of esports, including the recognition of esports players in terms of social and cultural positioning	Cultural studies, sociology, law, sport ethics and philosophy, media and communication studies, sport pedagogy and education
Economic	The level of money and other assets that contextualises the background of esports players and influences institutional decision-making, including job opportunities, investment in research and development, and business partnerships	Sports business, sports economics, sociology, law, sport ethics and philosophy, sport pedagogy and education

understanding how natural and social structures and player agency interact, at different levels, to influence performance. It can be applied by considering the following:

- *Structural properties* refer to the frameworks, rules, and institutions that shape the competitive gaming environment. This includes game design, tournament structures, organisational hierarchies and economic incentives within the esports industry. These structural properties provide the foundations for player performances (Scholz 2019).
- *Cultural-cognitive factors* represent the given esports community's shared understandings, norms, and beliefs. This includes the meta-strategies, game knowledge, and collective expectations influencing player performance. Consider, for example, how the dominant strategies and tactics within a game can shape how players approach their matches, influencing their decision-making and gameplay style (Reitman 2018).
- *Institutional contexts* involve the formal and informal rules, norms, and practices that govern esports ecosystems. This includes tournament regulations, team dynamics, coaching structures, and the roles of various stakeholders. The institutional context provides the framework within which players operate and compete. It can also influence physiological, cognitive and coaching aspects, including player section,

training methodologies, and career management and development pathways, all impacting player performance (Abbott, Watson, and Birch 2022).

- In the morphogenetic model, *agents' reflexivity* refers to players' capacity to reflect on and adapt their actions in response to social structures and cultural-cognitive factors. This includes their ability to analyse gameplay, identify weaknesses, and develop strategies to improve. It also refers to their decision-making within and outside of the game, whether in terms of adjusting training routines, seeking guidance from coaches on issues concerning anxiety or deciding to cheat or match-fix (Brock 2017).
- The interplay of structural properties, cultural-cognitive factors, institutional contexts and agents' reflexivity gives rise to *emergent properties* in player performances. These properties are the observable outcomes of complex interactions between natural and social structures and agency. They can encompass aspects such as skill level, decision-making abilities, teamwork, adaptability, resilience and physical and mental health.

Figures 1a, and 1b graphically represent these factors regarding Archer's morphogenetic model. It shows that at T1, structural properties objectively shape the factors (natural and social) that esports players confront, often involuntarily, which among other things, possess generative causal powers of constraint and enablement. Structural properties, like game design mechanics, for example, structure the extent to which play is 'balanced' and provides equal opportunities for players to show their skills. Structural properties may also refer to macro-level phenomena such as economic incentives, like prize pools, or business models, such as revenue sharing, which provide players with the resources, equipment and training required to compete effectively and ensure a sustainable living. As Scambler (2023) notes, structural factors provide the context for macro-meso-level mechanisms, like athlete preparedness, to operate. So, esports researchers must be attuned to the effects that macro-level mechanisms like GPD per capita, I. T. infrastructure, and investment in public goods and services can have on the development of esports within a country and the performance of its players (Parshakov and Zavertiaeva 2018).

At T2-T3, the powers and properties of these structures influence but do not determine players' concerns as they reflexively deliberate on their circumstances, subjectively determining their projects concerning potential courses of action. An interdisciplinary

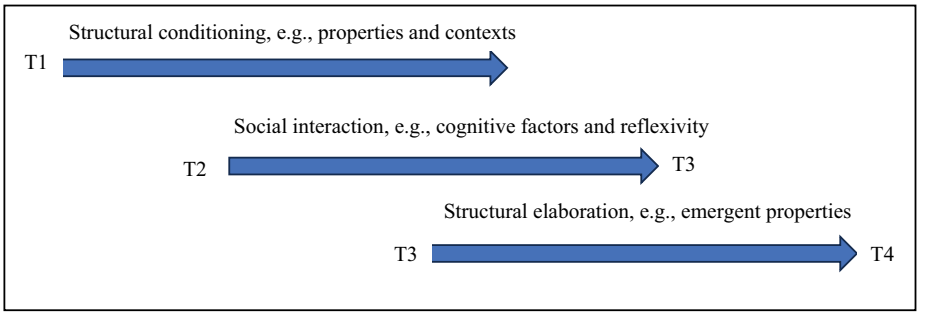

Figure 1a. The morphogenetic model [adapted from Archer (1995), p.157].

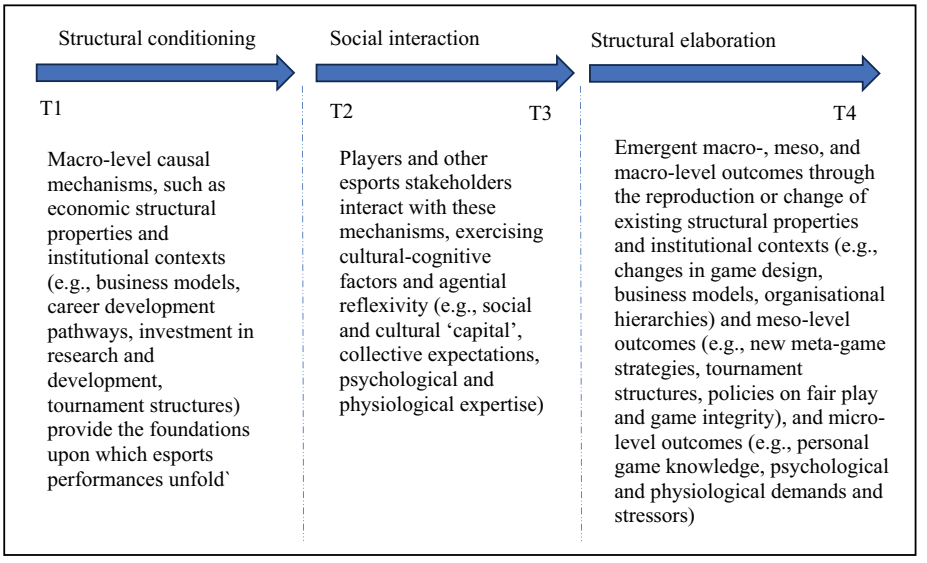

Figure 1b. The morphogenesis of esports [adapted from Archer (1995), p.157].

approach to esports recognises that explanations of 'performance' may neither be reduced to epistemic measurements of physical or mental activity nor conflated with the structural properties of games or the economic systems in which they are developed. Instead, at T2-T3, performance is socially constituted as players reflexively evaluate their capacity for in-game achievements in the context of broader physiological, psychological and sociological factors. For example, research shows that social norms can negatively effect player performance by creating conditions that emphasise the importance of university education, making it challenging to excel at esports (Zhao and Zhu 2021). Alternatively, research shows that hostile encounters and exclusionary contexts can negatively effect esports performance, particularly for women, who question whether professional gaming is personally sustainable (Pauketat 2022). Research also shows that players reflexively evaluate the impact of training volume on their physical and mental health, questioning 'the grind' typical of most esports titles and whether it positively or negatively impacts their performance (Abbott, Watson, and Birch 2022). At T2-T3, researchers can investigate how players come to evaluate their performances, which requires thinking through these various natural and social conditions of possibility.

At T4, courses of action contribute to the reproduction (morphostasis) or change (morphogenesis) of existing structural properties *and* subjects' concerns about their projects/performances. For example, Zhao and Zhu (2021) suggest that Chinese players, in reflecting on their cultural-cognitive beliefs, economic situation and social positioning (with regards to the authority of Chinese government policy), reproduce an array of micro (individual) concerns and macro (structural) contexts in Chinese esports. Specifically, through the concept of '*mianzi*', they describe how Chinese players manage their education and esports priorities but, in doing so, often reproduce negative concerns about the addictive quality of competitive gaming. Alternatively, Pauketat (2022) shows that

personal troubles can be quickly turned into public issues as women and gender minorities critically reflect on existing inequalities and organise change in esports. Talking about the creation of esports leagues, tournaments, and organisations for women and gender minorities, they illustrate how marginalised players are responding to harassment and misogyny in competitive gaming cultures. Finally, Abbott, Watson, and Birch (2022) show that players, in reflexively evaluating esports demands and stressors, adapt their lifestyles to find a 'balance' in physical and mental health. Drawing on critical realism, they invite a more complex view of esports performance, describing how players' understanding of health reproduces or changes (at an individual and societal level) positive and negative gameplay habits, which have psychological and physiological consequences. At T4, researchers can then answer questions about the effects of player interactions with pre-existing structural properties and institutional contexts while maintaining a sense of agency through decision-making.

From this perspective, Figures 1a and 1b give insight into the temporal nature of esports performance and the macro-, meso-, and micro-level causal mechanisms that interact to generate the reproduction or change of existing structures and contexts. Importantly, Figure 1b stratifies these mechanisms according to the various disciplinary factors in existing esports research. Interdisciplinary researchers can appreciate that identifying causes and their effects will require working across disciplinary boundaries because existing expertise will be able to reveal insight into the generative capacity of macro-, meso-, and micro-level mechanisms. As such, critical realism provides a meta-theoretical grounding for interdisciplinary research as researchers recognise and incorporate their theoretical and empirical contributions into a more comprehensive critical realist framing.

Conclusion

This article is purposively ambitious. It establishes a new meta-theoretical grounding for social and natural scientific research into esports. Utilising Bhaskar's critical realist philosophy, it argues that an interdisciplinary approach to esports research requires a 'depth ontology', one which understands the emergent effects of causal mechanisms at different levels or strata of social and natural phenomena. This article offers such an endeavour by applying critical realism to existing definitions of esports and examples of research into esports performance. Significantly, it shows that an interdisciplinary framework for esports research is possible, mainly if researchers analyse how esports-related phenomena emerge over time. Through Archer's (1995) 'morphogenetic model', esports researchers can begin to effectively address questions about the effects of micro-, meso- and macro-level causal mechanisms that interact to reproduce or change existing structural properties, institutional contexts and agential behaviour. Such an endeavour avoids some of the epistemological 'trappings' of positivist and interpretivist research in esports, whilst developing the theoretical tools to research its complexity.

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References

ABANAZIR, C. 2022. Of values and commercialisation: An exploration of esports' place within the Olympic movement. *Sport, Ethics & Philosophy* 16 (4): 397–412. 10.1080/17511321.2021.1945669

ABARBANEL, B. and M.R. JOHNSON. 2019. Esports consumer perspectives on match-fixing: Implications for gambling awareness and game integrity. *International Gambling Studies* 19 (2): 296–311. 10.1080/14459795.2018.1558451

ABBOTT, C., M. WATSON, and P. BIRCH. 2022. Perceptions of effective training practices in League of Legends: A qualitative exploration. *Journal of Electronic Gaming and Esports* 1 (1): 10.1123/jege.2022-0011

ANĐELIĆ, B., A. BIANCO, N. MAKSIMOVIĆ, N. TODOROVIĆ, and P. DRID. 2022. A milestone in the era of esports: The Olympics through the lens of virtual reality. *Frontiers in Psychology* 13: 990189. 10.3389/fpsyg.2022.990189

ARCHER, M. 1995. *Realist social theory*. Cambridge: Cambridge University Press.

ARCHER, M. 1998. *Culture and agency*. Cambridge: Cambridge University Press.

BÁNYAI, F., M.D. GRIFFITHS, O. KIRÁLY, and Z. DEMETROVICS. 2019. The psychology of Esports: A systematic literature review. *Journal of Gambling Studies* 35 (2): 351–65. 10.1007/s10899-018-9763-1

BEHNKE, M., M.M. STEFANCZYK, G. ŻUREK, and P. SOROKOWSKI. 2022. Esports players are less extroverted and conscientious than athletes. *Cyberpsychology, Behavior, and Social Networking* 26 (1): 50–56. 10.1089/cyber.2022.0067

BHASKAR, R. 1998 [1978]. *The possibility of naturalism*. London: Routledge.

BHASKAR, R. 2008 [1975]. *A realist theory of science*. London: Verso.

Bhaskar, R., C. Frank, P. Høyer, P. Næss, and J. Parker Eds. 2010. *Interdisciplinarity and climate change*. Abingdon: Routledge. 10.4324/9780203855317

BLACK, W.L. and K.L. GRAY. 2022. Using esports to amplify historically black colleges and universities: Shifting the narrative, *Understanding collegiate esports* pp. 21–32. London and New York: Routledge.

BROCK, T. 2017. Roger Caillois and e-sports: On the problems of treating play as work. *Games and Culture* 12 (4): 321–39. 10.1177/1555412016686878

BROCK, T. 2021. Counting clicks: Esports, neoliberalism and the affective power of gameplay metrics. In D.Y. Jin edited by. *Global esports: Transformation of cultural perceptions of competitive gaming* pp. 132–48, New York: Bloomsbury Academic. 10.5040/9781501368745.0013

CRANMER, E., D. HAN, M. GISBERGEN, and T. JUNG. 2021. Esports matrix: Structuring the esports research agenda. *Computers in Human Behaviour* 117: 117. 10.1016/j.chb.2020.106671

CROTTY, M. 1998. *The foundations of social research*. London: Sage.

DIFRANSCISO-DONOHUE, J., W. WERNER, P. DORURIS, and H. ZWIBEL. 2022. Esports players, got muscle? Competitive video game players' physical activity, body fat bone mineral content, and muscle mass in comparison to matched controls. *Journal of Sport and Health Science* 11 (6): 725–30. 10.1016/j.jshs.2020.07.006

DIRIN, A., M. NIEMINEN, T.H. LAINE, L. NIEMINEN, and L. GHALEBANI. 2023. Emotional contagion in collaborative virtual reality learning experiences: An eSports approach. *Education and Information Technologies* 1–47. 10.1007/s10639-023-11769-7

EKDAHL, D. and S. RAVN. 2022. Social bodies in virtual worlds: Intercorporeality in Esports. *Phenomenology and the Cognitive Sciences* 21 (2): 293–316. 10.1007/s11097-021-09734-1

FLEGR, S. and S.L. SCHMIDT. 2022. Strategic management in eSports–a systematic review of the literature. *Sport Management Review* 25 (4): 631–55. 10.1080/14413523.2021.1974222

FRIAS, F.J.L. 2022. The "big red bull" in the esports room: Anti-doping, esports, and energy drinks. *Performance Enhancement & Health* 10 (1): 100205. 10.1016/j.peh.2021.100205

FUNK, D.C., A.D. PIZZO, and B. BAKER. 2018. eSport management: Embracing eSport education and research opportunities. *Sport Management Review* 21 (1): 7–13. 10.1016/j.smr.2017.07.008

GARCÍA-LANZO, S., I. BONILLA, and A. CHAMARRO. 2020. The psychological aspects of electronic sports: Tips for sports psychologists. *International Journal of Sport Psychology* 51 (6): 613–25.

HALLMAN, K. and T. GIEL. 2018. eSports - competitive sports or recreational activity? *Sport Management Review* 21 (1): 14–20. 10.1016/j.smr.2017.07.011

HOLDEN, J.T., A. KABURAKIS, and R. RODENBURG. 2017. The future is Now: Esports Policy Considerations and Potential Litigation. *Journal of Legal Aspects of Sport* 27 (1): 46–78. 10.1123/jlas.2016-0018

HONG, H.J. 2022. eSports: The need for a structured support system for players. *European Sport Management Quarterly* 23 (5): 1–24. 10.1080/16184742.2022.2028876

JENNY, S.E., J. GAWRYSIAK, and N. BESOMBES. 2021. Esports.Edu: An inventory and analysis of global higher education esports academic programming and curricula. *International Journal of Esports* 1 (1): 1–47.

JENNY, S., R. MANNING, M. KEIPER, and T. OLRICH. 2017. Virtual(ly) athletes: Where eSports fit within the definition of 'sport. *Quest* 69 (1): 1–18. 10.1080/00336297.2016.1144517

JIN, D.Y. 2010. *Korea's online gaming empire*. Cambridge, MA: The MIT Press. 10.7551/mitpress/9780262014762.001.0001

LEIS, O., M. WATSON, L. SWETTENHAM, I. PEDRAZA-RAMIREZ, and F. LAUTENBACH. 2023. Stress management strategies in Esports: An exploratory online survey on applied practice. *Journal of Electronic Gaming and Esports* 1 (1): 10.1123/jege.2023-0002

MAREŠ, L. and D. NOVOTNÝ. 2023. What is sport? A response to Jim Parry. *Sports, Ethics and Philosophy* 17 (1): 34–48. 10.1080/17511321.2022.2064538

MARKER, C., T. GNAMBS, and M. APPEL. 2022. Exploring the myth of the chubby gamer: A meta-analysis on sedentary video gaming and body mass. *Social Science & Medicine* 301: 112325. 10.1016/j.socscimed.2019.05.030

MARTINELLI, J. 2019. The challenges of implementing a governing body for regulating esports. U. *Miami International and Comparative Law Review* 26: 499.

MIAH, A. 2017. *Sport 2.0: Transforming sports for a digital world*. The MIT Press. 10.7551/mitpress/7441.001.0001

NASTAR, M., C.S. BODA, and L. OLSSON. 2018. A critical realist inquiry in conducting interdisciplinary research. *Ecology and Society* 23 (3): 10.5751/ES-10218-230341

NORTH, J. 2017. *Sport coaching research and practice: Ontology, interdisciplinarity and critical realism*. London: Routledge.

NYSTRÖM, A.G., B. MCCAULEY, J. MACEY, T. SCHOLZ, N. BESCOMBES, J. CESTINO, and M. TÖRHÖNEN. 2022. Current issues of sustainability in esports. *International Journal of Esports* 1 (1): 1.

OHNO, S. 2022. The link between battle royale games and aggressive feelings, addiction, and sense of underachievement: Exploring esports-related genres. *International Journal of Mental Health and Addiction* 20 (3): 1873–81. 10.1007/s11469-021-00488-0

PALANICHAMY, T., M.K. SHARMA, M. SAHU, and D.M. KANCHANA. 2020. Influence of Esports on stress: A systematic review. *Industrial Psychiatry Journal* 29 (2): 191. 10.4103/ipj.ipj_195_20

PARRY, J. 2019. Esports are not sports. *Sport, Ethics & Philosophy* 13 (1): 3–18. 10.1080/17511321.2018.1489419

PARRY, J. 2021. Esports will not be at the Olympics. *Journal of Olympic Studies* 2 (2): 1–13. 10.5406/jofolympstud.2.2.0001

PARRY, J. 2023. On the definition of sport. *Sport, Ethics & Philosophy* 17 (1): 49–57. 10.1080/17511321.2022.2077814

PARSHAKOV, P., I. NAIDENOVA, and A. BARAJAS. 2020. Spillover effect in promotion: Evidence from video game publishers and eSports tournaments. *Journal of Business Research* 118: 262–70. 10.1016/j.jbusres.2020.06.036

PARSHAKOV, P. and M. ZAVERTIAEVA. 2018. Determinants of performance in eSports: A country-level analysis. *International Journal of Sport Finance* 13 (1): 34–35.

PAUKETAT, R. 2022. Confronting toxicity in Esports and building inclusive environments: Challenging "It's just part of the game" culture. *Understanding collegiate esports* pp. 33–49, Routledge.

PEDRAZA-RAMIREZ, I., L. MUSCULUS, M. RAAB, and S. LABORDE. 2020. Setting the scientific stage for esports psychology: A systematic review. *International Review of Sport and Exercise Psychology* 13 (1): 319–52. 10.1080/1750984X.2020.1723122

PENG, Q., G. DICKSON, N. SCELLES, J. GRIX, and P.M. BRANNAGAN. 2020. Esports governance: Exploring stakeholder dynamics. *Sustainability* 12 (19): 8270. 10.3390/su12198270

PIZZO, A.D., B.J. BAKER, S. NA, M.A. LEE, D. KIM, and D.C. FUNK. 2018. eSport vs. Sport: A comparison of spectator motives. *Sport Marketing Quarterly* 27 (2): 108. 10.32731/SMQ.272.062018.04

PIZZO, A.D., Y. SU, T. SCHOLZ, B.J. BAKER, J. HAMARI, and L. NDANGA. 2022. Esports scholarship review: Synthesis, contributions, and future research. *Journal of Sport Management* 36 (3): 228–39. 10.1123/jsm.2021-0228

PLUSS, M.A., A.R. NOVAK, K.J. BENNETT, D. PANCHUK, A.J. COUTTS, and J. FRANSEN. 2020. Perceptual-motor abilities underlying expertise in esports. *Journal of Expertise* 3 (2): 133–43.

PRICE, L. and L. MARTIN. 2018. Introduction to the special issue: Applied critical realism in the social sciences. *Journal of Critical Realism* 17 (2): 89–96. 10.1080/14767430.2018.1468148

REITMAN, J.G. 2018. Distributed cognition and temporal knowledge in league of legends. *International Journal of Gaming and Computer-Mediated Simulations* 10 (1): 23–41. 10.4018/IJGCMS.2018010102

REITMAN, J.G., M.J. ANDERSON-COTO, M. WU, J.S. LEE, and C. STEINKUEHLER. 2020. Esports Research: A literature review. *Games and Culture* 15 (1): 32–50. 10.1177/1555412019840892

RIETZ, J. and K. HALLMANN. 2022. A systematic review on spectator behaviour in esports: Why do people watch? *International Journal of Sports Marketing and Sponsorship* 24 (1): 38–55. 10.1108/IJSMS-12-2021-0241

RITTEL, H. and M. WEBBER. 1973. Dilemmas in a general theory of planning. *Policy Sciences* 4 (2): 155–69. 10.1007/BF01405730

ROGSTAD, E.T. 2022. Gender in eSports research: A literature review. *European Journal for Sport and Society* 19 (3): 195–213. 10.1080/16138171.2021.1930941

SALO, M. 2021. Career transitions of eSports athletes: A proposal for a research framework. *Research anthology on business strategies, health factors, and ethical implications in sports and eSports* pp. 478–90, IGI Global.

SCAMBLER, G. 2023. *A critical realist theory of sport*. London: Routledge. 10.4324/9781003157106

SCHOLZ, T. 2019. *Esports is business*. London and New York: Palgrave. 10.1007/978-3-030-11199-1

SCHOLZ, T. and N. NOTHELFER. 2022. Research for CULT committee: Esports - policy recommendations, European Parliamentary research Service. Belgium. Available at https://policycommons.net/artifacts/2413866/research-for-cult-committee/3435406/ (7 July 2023).

SEO, Y. and S.U. JUNG. 2016. Beyond solitary play in computer games: The social practices of eSports. *Journal of Consumer Culture* 16 (3): 635–55. 10.1177/1469540514553711

SHENKMAN, E., D. COATES, A. CHADOV, and P. PARSHAKOV. 2022. Team vs. individual tournament: An organizer's dilemma. *Journal of Economic Behavior & Organization* 198: 476–92. 10.1016/j.jebo.2022.04.012

TAYLOR, T.L. 2012. *Raising the Stakes: E-Sports and the professionalization of computer gaming*. Cambridge, MA: The MIT Press. 10.7551/mitpress/8624.001.0001

TAYLOR, N. and B. STOUT. 2020. Gender and the two-tiered system of collegiate esports. *Critical Studies in Media Communication* 37 (5): 451–65. 10.1080/15295036.2020.1813901

WINDHOLZ, E. 2020. Governing esports: Public policy, Regulation and the Law. Sports Law E-Journal, Monash University Faculty of Law Legal Studies Research Paper 3622662 Available at 3 Jan 2023 https://ssrn.com/abstract=3622662.

WITKOWSKI, E. 2012. On the digital playing field: How we "do sport" with networked computer games. *Games and Culture* 7 (5): 349–74. 10.1177/1555412012454222

ZHAO, Y. and Y. ZHU. 2021. Identity transformation, stigma power, and mental wellbeing of Chinese eSports professional players. *International Journal of Cultural Studies* 24 (3): 485–503. 10.1177/1367877920975783

ZHONG, Y., K. GUO, J. SU, and S.K.W. CHU. 2022. The impact of esports participation on the development of 21st century skills in youth: A systematic review. *Computers & Education* 191: 104640. 10.1016/j.compedu.2022.104640