1   **Cycle E-racing: Simulation or a New Frontier in Sports Technology ?**

2

3   **Abstract**

4   Cycling-based e-racing is a growing sector of e-sports. Unlike more traditional forms
5   of e-sports, it comprises a high level of physical exertion that is directly comparable
6   to the activity it simulates in reality. However, as this activity has developed, it has
7   also provided the basis for new forms of controversy. Additionally, it has provided the
8   potential for performance enhancement that, technologically speaking, could
9   decouple the user from how they cycle in reality compared to how they are perceived
10   within the virtual environment. Either way, the recent development of cycle-based e-
11   racing provides an argument that it has transcended from being a simulation of cycle
12   racing into a new form of competitive discipline in its own right.
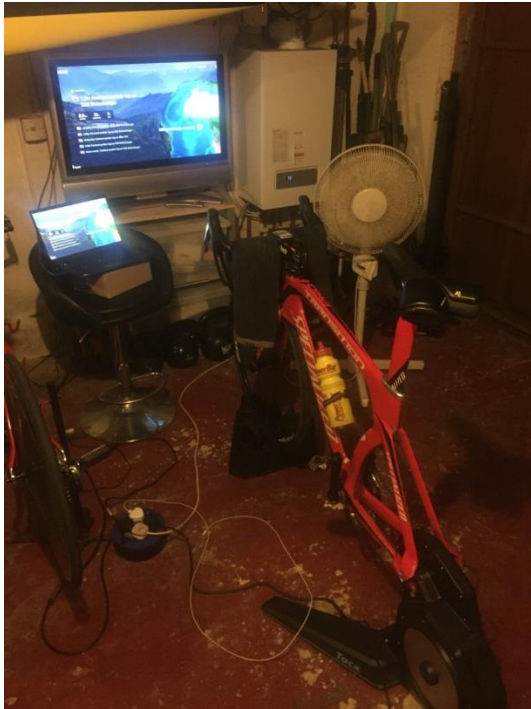
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14   *Keywords:* Cycling, e-racing, Virtual.

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16   **Highlights**

17   • Cycling e-racing currently demonstrates its own nuances that transcend that
18   of merely being a cycling simulator to ultimately being a new form of cycling
19   discipline entirely.
20   • This form of sport provides new forms of cheating or technological
21   performance enhancement when compared to those seen in traditional forms
22   of sports technology discourse.
23   • The scope for manipulating and optimising e-racing's equipment comprises
24   many of the same philosophical issues and risks as the sport it is simulating.
25

26   **Introduction**
27   Cycle-based e-racing is a relatively new form of competitive endeavour. It provides a
28   participant with the means to physically participate in the sport of cycling but when
29   represented as a digital avatar in a simulated and virtual environment. Cycle-based
30   e-racing is typically available utilising a range of commercial apps or digital platforms
31   with the fundamental required equipment consisting of a computer, a static trainer
32   with a bicycle fitted to it and an internet connection. Optional additional equipment
33   may also include a fan for rider cooling and a gradient simulation device. An example
34   of a rider's set-up is shown in figure 1.

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Figure 1. Typical e-racing equipment.

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As an organised sport, it has gained official recognition quickly. For example, in 2020, cycling's governing body, publicly endorsed a virtual Tour de France and officially sanctioned the first Cycling Esports World Championships. As a result, the rise of cycle-based e-racing is potentially a good example of 'exergaming' (Miah, 2017, p86), confounds the attempt to separate conventional sport from e-sports (Parry, 2019) and could provide the most radical evolution of competitive cycling since its inception over a century ago. However, with this technological and philosophical opportunity for competitive cycling, it raises questions over what it is and what issues it can create.

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New Technology But Old Problems

Whilst, e-racing is in a state of relative infancy, it has not been immune to the issues surrounding cheating as per other technologically sensitive sports (Dyer, 2015). In 2019, the winner of the British E-racing Championships was disqualified for obtaining virtual advantageous equipment that they had not acquired correctly or fairly (Arthurs-Brennan 2019). The cyclist used a computerised 'bot' to ride on multiple occasions prior to the race at an unrealistic power, weight and durations to then gain access to the use of a favourable bicycle avatar within the app (https://www.cyclist.co.uk/news/7188/obvious-flaw-in- e-racing-exposed-by-rider-cheating-to-win-national-championships).

Likewise, there are frequent concerns over data manipulation in e-cycling. In essence, many current cycling e-racing platforms typically regulate or categorise a rider's performance in the virtual environment by knowing their true height, mass and power output. These metrics all dictate the virtual performance of an e-cyclist in a

63 variety of topographical simulated scenarios but are entered by the user themselves.
64 These require them to be honest and up to date with these values. For example,
65 there are issues surrounding 'weight doping'. Much of the simulated physics applied
66 in a virtual environment are governed by the power to weight ratio of a cyclist. This
67 calculation is determined as the power they are putting out at a given moment
68 divided by a rider's body mass. Because the platform simulates the physics of the
69 outdoor environment, an increase in the power to weight ratio of a rider means they
70 will ascend inclines within the simulation faster. This then provides the temptation for
71 a rider to enter an unrealistic low body mass to allow themselves to be more
72 competitive. Another issue with this is that it also depends on how accurate an e-
73 racing platform requires the entered body mass to be. For example, if it only requires
74 a rider to enter their body mass to the nearest kilogram, it does not account if the
75 riders true mass falls somewhere between two rounded values. Day to day variability
76 in body mass may also provide further inaccuracy. At which point, it could be argued
77 that an e-racing cycling app indirectly encourages or coerces many riders to provide
78 inaccurate data that conventional cycle racing could not be afflicted by. The irony of
79 this is that it may take robust measures grounded in reality such as real time mass
80 measurement, physiological diagnostic monitoring and formally staged competition
81 to provide the rigour that this e-sport requires. Without formal regulation, such issues
82 may also impede the future growth and credibility of cycle e-racing as a sport or
83 create controversy that could negatively impact upon it (Dyer, 2015).

84

Simulation or New Cycling Frontier ?

86 What is debatable is whether e-racing is an established alternative to conventional
87 cycling or whether it could evolve to be a credible cycle sport discipline in its own
88 right. Eysenck et al. (1982) defined a sport as an amusement, diversion, fun, pastime
89 or game pursued for exercise or pleasure and often involving the testing of physical
90 capabilities. Likewise Hallmann & Giel (2018) argued that generally speaking, e-
91 sports in general could not be considered sports due to their lack of physicality.
92 However, it could be argued that both of these needs have now been achieved by
93 cycle e-racing. Either way, it asks whether this has placed cycle e-racing as merely a
94 simulation or instead, transcended this and become a unique cycle sport through the
95 nuances it has. For example, due to use of the rider being ultimately static when
96 using an e-racing app, a rider cannot independently choose to apply their brakes to
97 improve their position on the virtual road nor incorporate any advantages of skilful
98 bike handling. It has also been reported anecdotally that the starting effort of an e-
99 racing cycle event involves a very large power output for 0-10 seconds to ensure a
100 rider starts the event at maximum velocity. This is to ensure they don't lose the
101 simulated aerodynamic draft of a group of riders. However, this is inherently different
102 from a typical road cycling event that has to accelerate from rest – thereby requiring
103 different physiological behaviour from that of reality. In essence, this form of e-racing
104 has effectively both 'deskilled' and 'reskilled' a sport as summarised by Dyer (2015).

105 Additionally, what has also been interesting has been the introduction of gamification
106 characteristics within cycle e-racing. For example, platforms such as 'Zwift' have
107 incorporated 'power ups' that temporarily provide superhuman physical abilities or
108 negate the apps simulated conventional laws of physics. These aspects are more
109 akin to traditional games console entertainment (Miah, 2017 p.86) than traditional

110 sport and this changes the tactical approach that a rider has when in e-racing
111 competition. The ability to change a style of camera view also changes the athletes
112 approach as this provides the ability to see other avatars in a way that provides
113 tactical insight and advantages that are not feasible in reality.

114 Finally, virtual races remain relatively short in duration but see a far greater
115 frequency in availability compared to traditional bike racing. It is therefore not known
116 whether this added level of convenience will alter athlete training behaviour (and its
117 response) or deviate it further from the traditional approach to competitive cycling.

118

119 *A New Arms Race*

120 The initial entrance to the sport itself raises issues surrounding equipment parity.
121 This is because the type of static trainer utilised typically offer a potentially different
122 accuracy and the inertia-based replication of when riding on a road. Furthermore,
123 some trainers are 'smart' (in that they will automatically adjust their resistance as the
124 gradient changes) whereas those that are 'dumb' do not. It cannot be stated whether
125 one trainer is better or worse than the other but instead recognise that there are
126 different virtual experiences and that tiered costs of equipment could influence
127 competitiveness too (Dyer, 2015).

128 It could also be argued that e-racing diverges further away from that of a road cycling
129 simulator if its unique equipment is tailored differently with the goal of optimising
130 performance. For example, this could include providing assistance to a rider through
131 the number and unique orientation of fans that would be inherently different in their
132 volume, flow, direction, intensity and temperature from that of cycling in reality. To do
133 so could assist in the benefit of maintaining optimal core body temperature
134 (Wegmann et al. 2012) and perceived comfort to then reduce fatigue. Secondly, the
135 bicycle the rider may typically use with e-sports may well be their normal road bicycle
136 when held in a static trainer. However, this could be optimised in the future to
137 position the cyclist in a riding position that maximises their physiological power
138 production (Dorel et al. 2009) as it would not need to handle the forces, traction or
139 exhibit the behaviour that a bicycle would need to when being raced in reality. This
140 could mean unusual geometries or seating positions of bicycles as the importance of
141 subsequent riding aerodynamics in cycling (Lukes et al. 2005) would no longer be
142 relevant – even if their cycling avatar still appears on the screen showing a
143 conventional appearance. Ultimately, an arms race could result to encourage
144 specialist e-cyclists to yield the best performance, yet be visually undetectable within
145 the virtual environment. Therefore, this digital arms race replicates not only the sport
146 of cycling itself but also the criticism sometimes levelled at the influence its
147 equipment may have on it (Zabala & Hopker, 2015).

148

149 **Conclusion**
150 The nature of competitive cycle e-racing suggests it now has the potential for
151 technological innovation and behaviour to distinguish it from that of conventional
152 cycle racing grounded in reality. However, it offers exponents the potential to
153 achieve technological performance advantages grounded in the real world that may
154 not be obvious within the virtual environment they are competing in. This e-sport has

already seen situations regarding cheating that are novel in nature to those seen
historically in other forms of sports that utilise technology. As a result, e-cycling will
likely require formal governance and ongoing vigilance. Nonetheless, a firm case
could now be made to regard e-cycling as a unique sporting discipline in its own
right.

Conflicts of Interest

The author confirms that there are no conflicts of interest to declare.

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