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# The many paths ahead: toward an interdisciplinary framework for Critical Cycling Studies

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This essay outlines our vision for Critical Cycling Studies (CCS), a framework for cycling-related research. At the core of CCS is a focus on interdisciplinarity and the reconceptualisation of cycles as "interfaces" that mediate the experiences of cycle users. CCS focuses not only on the object of the cycle as a physical interface, but also on the experience of cycling as a figurative "interface technology": that is, cycling as a form of situated knowledge rooted in practice that mediates between cyclists, non-cyclists, and the ecological, social, political, and cultural environments in which cycling occurs, and which shapes the bodily, sensory, cognitive, and emotional states of cyclists. In moving from an object-oriented focus to a broader conceptual perspective on cycling, CCS adopts a fundamentally interdisciplinary approach that accounts for cycling as a complex, multi-valent experience and phenomenon. Research in cycling studies is already to some degree interdisciplinary; however, many existing approaches in cycling studies more closely resemble "cross-disciplinary" work, insofar as such research involves exchange between related disciplines with shared methodologies and objectives. To address this problem, this essay explores some fundamental difficulties of interdisciplinarity as such and proposes that CCS should in part adopt perspectives from the humanities, which have a long history of bridging distinct methodologies and overcoming disciplinary boundaries. On this basis, CCS is introduced as a humanities-informed, self-reflexive, and dynamic framework for research into cycles and cycling that invites revision and expansion by all contributors. CCS advocates an openness to boundary-crossing forms of interdisciplinarity, a willingness to reflect critically on one's methods and disciplinary assumptions, and an awareness of the ways in which issues of power, class, gender, access, geography, culture, and identity have shaped and continue to shape cycling-related research and the experiences of cycle users themselves.

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## Introduction: setting the scene for Critical Cycling Studies

Cycles, ubiquitous around the globe, are versatile and adaptable instruments used across extremely diverse demographics, in many different contexts, for manifold purposes, and with wide-ranging effects on those who use them and those around them (e.g., Buehler and Goel, 2022; Goel et al., 2021; Sener et al., 2009). Cycles also structure diverse phenomenologies and epistemologies: being a cycle user, and even being around cycle users, shapes one's consciousness, thoughts, and moods. As such, cycles—and the underlying practices and experiences of cycling—represent important and fascinating opportunities for research. They function as interfaces that afford diverse and multimodal ways of being in, interacting with, thinking about, and acting upon ecological, social, political, economic, technical, and cultural environments. To a degree, scholars are already studying cycles and cycling in these terms. For instance, in the domain of sports science and cycle safety, researchers have proposed micro-gestural human-cycle interfaces for professional road cycling (Caon et al., 2020); in the technical sciences and mobility studies, new types of digital interfaces have been proposed to increase cycle safety by facilitating interaction between riders and autonomous vehicles (e.g., Lindner et al., 2024; Berge, 2024); and, in a more philosophical vein, urban cycling has been explored as a form of perceptual engagement that is powerfully shaped by different types of interfaces (Strehovec, 2010). We build on these perspectives in this essay, arguing for a fuller reconceptualisation of cycles as physical interfaces and of the experience of cycling itself as a complex figurative "interface technology," a form of situated knowledge rooted in practice that mediates between cyclists, non-cyclists, and the ecological, social, political, and cultural environments in which cycling occurs, and which consequently shapes the bodily, sensory, cognitive, and emotional states of cyclists. Such a reconceptualisation can help us to rethink the critical frameworks we bring to cycling-related research, pushing beyond applied research and cross-disciplinary investigations that instrumentalise methodologies and epistemologies which are already closely aligned (Kluger and Bartzke, 2020) and allowing us to realise opportunities for new kinds of interdisciplinary enquiry.

In this essay, we outline our vision for interdisciplinary cycling-related research, which we call "Critical Cycling Studies" (CCS). This approach not only bridges adjacent disciplines, but also emphasises, wherever relevant, pluralistic perspectives stemming from non-cognate disciplinary contexts, in order to frame research questions in new, broader, and more self-critical ways. In particular, we argue that humanities-informed perspectives are ideally suited to developing frameworks for exploratory, generative, and potentially transformative interdisciplinary cycling scholarship. Humanities scholarship frequently takes up concerns (e.g., the rhetorical, social, political, historical, philosophical, and aesthetic) that simultaneously fall under the purview of multiple established disciplines and methodological frameworks, and has developed effective and powerful approaches to combining them (Robinson et al., 2016). In this regard, the humanities can serve both to unify and deterritorialise critical points of view in cycling-related research while also providing researchers with the critical self-reflection needed to challenge the assumptions encoded in existing disciplinary orientations (Harpham, 2013).

The following sections elaborate the opportunities afforded cycling researchers by an interdisciplinary, humanities-informed CCS. Section 2 unpacks critical considerations related to the core focus of CCS and proposes that, in addition to attending to "cycles" as physical objects, researchers should also critically engage with cycling itself as an interface technology that mediates between cyclists and the various environments with which they interact. Following this broader reorientation, and in an attempt to transcend the constraints of individual academic disciplines and integrate multiple perspectives into research on complex issues tied to cycling, Section 3 positions CCS as fundamentally interdisciplinary. We parse the generative contributions that various humanities-informed approaches can make to existing perspectives in cycling scholarship and enumerate some of the opportunities—as well as productive risks and challenges—of interdisciplinary enquiry. Section 4 sketches potential future steps towards the formation and consolidation of CCS as a research framework, and Section 5 summarises our key findings and arguments.

The goal of CCS is to foster critical dialogue across research domains while promoting an interdisciplinary and humanities-informed approach to cycling research. In doing so, we recognise that our own epistemologies and standpoints have been shaped by our disciplinary training and personal experiences. As middle-aged, cis-gendered white men from Western Europe and North America, long-time cyclists, and humanities professors conducting interdisciplinary scholarship, we acknowledge that our perspectives on cycling extend from (and are limited by) specific cultural, social, and economic contexts. How someone uses (or does not use) a cycle, and how they think about cycling, will always be contingent on the complex interplay of many factors that frame their personal and professional lives. We believe that this great diversity of contexts and points of view represents a unique opportunity for the boundary-pushing and critically reflexive research that CCS hopes to realise. As we discuss below, cycling is a situated and dynamic critical practice, a multimodal way of being that shapes how cyclists relate to the world and how the world, in turn, can be shaped by them. Such a perspective, we argue, can provide the foundation for more pluralistic and holistic approaches to cycling scholarship.

This does not mean that all cycling researchers need to be cyclists. In fact, many important CCS insights regarding the cultural, social, socio-economic, and political valences of cycling should come from non-cyclist perspectives, including from those who may face structural barriers to cycling, such as economic constraints, health issues, gendered harassment, or hostile infrastructure, and perhaps even from those who dislike or are indifferent to cycling but who nevertheless indirectly share in the experience of cycling in their daily lives as, for instance, pedestrians or automobile users (e.g., Bernstein, 2016). All of those perspectives matter and harbour potentially transformative opportunities for truly interdisciplinary work.

Our own positionality is also important to attend to because cycling research frequently reflects WEIRD (Western, Educated, Industrialized, Rich, Democratic) biases (see Apicella et al., 2020; Allen, 2021; Castañeda, 2021). CCS must actively develop perspectives that challenge and overcome such biases and the inequitable distribution of power both in cycling studies and in cycling more generally. This requires a commitment to adopting intersectional perspectives. Intersectionality, as coined by the critical race theorist Kimberlé Crenshaw, generally refers to how social categories, including race, gender, class, sexuality, and ability, can intersect to create complex systems of disadvantage or privilege (Collins and Bilge, 2020). In relation to cycling, an intersectional perspective can, for example, reveal power dynamics and systemic and structural inequalities that produce uneven urban cycling experiences (Lam, 2020); such intersectional perspectives can then be integrated into cycling policies and projects to increase equity and inclusion around, for instance, gender and class (Lam, 2022). By extension, it is also important to adopt decolonial perspectives (e.g., Nachman et al., 2023) and to engage with the knowledge traditions of Indigenous communities (e.g., Dyer-Redner, 2017) and concerns emerging from other

regions. The Global South (e.g., Verstappen, 2023) is one illustrative example among many, but CCS must also champion scholarship from other non-Western contexts, including East Asia, Eastern Europe, and the Middle East. Specific examples for contexts out of which critical perspectives could emerge include Japan's integration of cycling and transit policy (e.g., Belliard et al., 2025; Lagadic, 2022), China's extensive bike-sharing ecosystems (e.g., Tao and Zhou, 2021), cycling infrastructure transformations in Eastern Europe (e.g., Šobot et al., 2024), and gendered cycling practices in Middle Eastern countries (e.g., Raab, 2022). CCS should also draw inspiration from such progressive research domains as disability studies (e.g., Clayton, Parkin, and Billington, 2017) and feminist geography (e.g., Ravensbergen, Buliung, and Laliberté, 2019).

Finally, we do not seek to define CCS exhaustively or conclusively. Instead, as we elaborate in Section 4, CCS should be seen as an adaptable and evolving framework. In describing the ways in which CCS could be defined, we also outline opportunities for others to contribute to the co-creation and evolution of a critical framework that is dynamic and open to expansion, revision, and reshaping by all those who wish to engage with it. What follows, therefore, is offered not as a definitive set of ideas but as critical reflection on a point of departure for boundary-pushing, interdisciplinary cycling scholarship.

## Cycling as interface technology

While the traditionally two-wheeled bicycle might seem like the most obvious focal point for cycling-related research, situating CCS as an object-oriented discipline can lead to considerable limitations. One step towards extending CCS's scope is to emphasise a broad definition of "cycle," which has been in use in British English since at least 1870, as "any pedal-powered vehicle with wheels and a saddle" ("Cycle" in the Oxford English Dictionary, n.d.). This allows for the inclusion of unicycles, trikes, tandems, recumbents, cargo cycles, and many other types of wheeled vehicles and mobility aids that align with the emerging concept of micro-mobility (e.g., Behrendt et al., 2022). Further, considering the "cycle" as a piece of equipment that may be powered by foot, hand, or otherwise, and which may be saddled or not, has several benefits. It can help to de-stigmatise different forms of mobility; to problematise elitist and exclusionary assumptions about what a cycle is, can, and should be; and to resist normative, gendered, and ableist conceptualisations of the idealised cyclist body (Ravensbergen, Buliung, and Laliberté, 2019; Norcliffe et al., 2022). In a further definitional step, the basic vehicular characteristics of cycles could also be questioned, allowing CCS to address cycles that are used in "non-mobility" contexts, including, for example, when old cycles are repurposed as pedal-powered devices for domestic and agricultural labour in the form of washing machines or corn huskers (see Hernandez, 2023, on the work of the Indigenous non-profit organisation Maya Pedal Guatemala). Overall, such redefinition enables CCS to think of cycles as physical interfaces that can facilitate a wide range of uses across a variety of contexts (e.g., Clist, 2017).

But broadening the object-oriented definition of cycles is not enough. Researchers, including Cox and Van De Walle (2007), have cautioned against taking the presumed artefactual and semantic fixity of the "bicycle" for granted. At the heart of CCS, therefore, is a traversal from the object of the cycle to the concept of cycling. In particular, by asking how cycling might be approached differently, researchers might be newly able to attend to diverse practices and experiences of cycling, to integrate wide-ranging interpretations and applications of cycling, and to study everything and everyone to which cycling is linked. In following this trajectory, researchers can attune themselves experientially and critically to the ambient noises of cycling—the forces that shape the cyclist's body and mind, including the wind on our face, the birdsong (or lack thereof) along the road, the engine sounds and exhaust fumes of passing motor vehicles, the narratives and politics that frame cycling in the world, and the wealth of sensations that vibrate through us when we are affected, directly or indirectly, by cycling (Fournel, 2019; Hopsicker, 2010; Larsen, 2017; Sarrica et al., 2019; Shilling, 2022). Cycling can thus be thought of as a complex subjective experience (Zhang et al., 2024) that is socio-culturally, spatially, environmentally, politically, physiologically, and metaphysically determined and that represents a particularly dynamic modality of interfacing with the world.

For example, the artist Alec Geluykens' installation "BTS_200X," which he calls an "ideal cycle" ("*ideale fiets*") for urban travel (De Meulder, 2024), illustrates the intersections between the cycle as a physical interface and cycling as an interface technology that mediates the cognitive and affective experiences of the cycle user. "BTS_200X" (a title employing the double entendre "Bike to Survive" and alluding to Antwerp's various postal codes) satirically illustrates the omnipresent physical and cognitive challenges that cycle users face even in "movement-friendly" cities like Antwerp (Devos et al., 2023), with a humorous wink to the many domains of cycling research and policy-making (including urban planning, mobility, traffic engineering, and product design) that require further reflection, innovation, and improvement. The result is a surreal cycle-like contraption that includes a telescopic arm for reaching awkwardly placed road infrastructure buttons to trigger green lights on cycle crossings, an espresso machine to mitigate the tedium of long waiting times at traffic crossings, and three extra wheels enclosing the cyclist in a "roll cage" to counter tumbles taken when crossing tram tracks or traversing the steep stairs sometimes illogically connected to cycling bridges (De Meulder, 2024). The installation is thus designed both to entertain and to protect its rider, permitting them literally to roll on, against all odds. Through such satirical exaggeration, "BTS_200X" defamiliarises both the cycle itself and the experience of cycling in urban environments. In this regard, the installation illustrates two concepts central to CCS, offering thought-provoking commentary on the experience and challenges of urban cycling: of the cycle itself as a physical interface and of cycling as a figurative interface technology.

In addressing both the cycle as a literal interface and cycling more broadly as a figurative interface technology that mediates between cyclists and the many different domains with which they interact, CCS should be considered as something more than an object-oriented framework. A focus on literal interfaces is already present across a diverse range of research projects (see, e.g., Caon et al., 2020, on micro-gestural interfaces for professional road cycling; and Strehovec, 2010, on bicycles as phenomenological interfaces through which riders "read" cityscapes). To explore cycling more broadly as an interface technology marks an important step towards adopting fundamentally interdisciplinary perspectives in cycling-related research for two reasons. First, because an interface always represents a link between different fields, and second, because the interface is already embraced as a malleable concept across various disciplines. For example, the natural sciences and some branches of the physical sciences define an interface as a boundary surface between different fields of matter, with fixed or changeable characteristics that may selectively allow matter or information to pass through (e.g., Belardi et al., 2020); in the computing sciences, an interface is a hardware or software boundary across which data is exchanged by human and/or non-human participants (e.g., IEEE Standard glossary of software engineering terminology, 1990, p. 41); in the

field of communications, an interface is a point of interaction between agents participating in a communicative event (e.g., Littlejohn and Foss, 2010); and in the social sciences and cultural theory, an interface technology links nodes between different lifeworlds, social fields, points of view, or critical perspectives (e.g., Galloway, 2012).

In approaching cycling as an interface technology, researchers could focus, for example, on how various components of a cycle —not only the tyres, the saddle, and the handlebar grips, but also peripheral devices, such as GPS computers and biometric sensors —act as membranes that connect users of cycles to their surroundings and to one another and that amplify their senses and experiential capacities (Haraldsson, 2010). An interface technology is thus a figurative and practical concept grounded in the philosophical notion of *technê*—a form of situated knowledge rooted in embodied practice (Parry, 2024)—which describes activities that mediate between individuals and their broader ecological, social, political, and cultural environments. Rather than referring solely to physical tools, interface technologies like cycling involve experiential and performative engagements that shape perception, cognition, emotion, and social interactions, and which consequently function as dynamic mediators that structure how people relate to and navigate the world around them. These dimensions, between cognitive activities, bodily experiences, and sensory awareness, are co-constituted, as the sensory feedback from external interactions feeds internal cognitive and affective states.

Literal interfaces and figurative interface technologies can be technical in nature, but they can also represent powerful cultural, social, and aesthetic constructs that can be used to inform a broader analytical framework. Brown (2022), for example, is developing an aesthetic-led approach to designing stationary bicycle interfaces and interaction methods for increasing athletic engagement in virtual environments. Cycling, in this view, excites a collection of organic, cognitive, and technological sensors that augment and expand perceptual faculties, affording a relational coupling (Nunes, 2019) between cycle users, devices, environments, and other actors present in those environments. According to Johnson (1997), interfaces do more than merely frame encounters between discrete participants in an interaction and are more than merely passive conduits for transmitting information. Interfaces (along with the technologies that frame them) actively and dynamically shape perception, movement, individual cognition, collective cultural practices, and social relations.

While Johnson's analysis primarily focuses on computational systems, such as graphical user interfaces (GUI), his conceptualisation can also inform critical inquiries related to cycling. Just as a GUI can mediate multivalent engagements with information, so too can cycling be understood as a kind of membrane that translates bodily motion into sensory feedback, spatial awareness, thought, and cultural meaning—regardless of whether cycling is viewed as an interaction between an individual and an environment, as an interpersonal exchange, or as an event that mediates between an individual's experience of interiority and the external world. Seen as an interface technology, cycling therefore extends and reshapes agency and perception, and creates dynamic internal and external feedback loops between terrain, cognition, and behaviour.

Conceptualising cycling as an interface technology opens new directions for cycling-related research. Consider, for example, how philosophical approaches might inform such research. Following Merleau-Ponty's phenomenology of embodiment (Reuter, 1999), one could explore how cycling forms a pre-reflective extension of the cyclist's body. Similarly, one could consider Heidegger's concept of "readiness-to-hand" (*Zuhandenheit;* Wrathall, 2025) in a discussion of how the cycle, when in use, disappears from conscious attention and conceptually relinquishes its objecthood until a flat tyre or other obstacle intrudes. Finally, the concept of Husserlian intentionality (Zahavi, 2003) could aid critical reflection on how cycling structures consciousness itself and attunes us to phenomenologies of smoothness, roughness, speed, or control when we interact with cycling infrastructure. Each of these philosophical perspectives mobilises the conceptualisation of cycling as an interface technology with potential links to existing cycling-related research in, for example, material design or urban planning. Taking such examples as indicative of the usefulness of this approach, we propose that CCS researchers should understand cycling as a prismatic lens, a dynamic and multi-modal interface technology whose functioning is powerfully shaped by those who use it and which can, in turn, powerfully shape the experience of its users and actors in the orbit of cycling, along with their relationships to and understanding of the physical and conceptual spaces they occupy.

## Critical Cycling Studies and interdisciplinarity

Adopting a view of cycling as an interface technology makes available to CCS a malleable concept that already bridges various research domains. Methodologically speaking, this proposed shift from an object-oriented perspective to a broader conceptual perspective also requires an openness to adopting (and adapting) interdisciplinary approaches that can account for this reframing of cycling as a multi-valent and situated phenomenon.

**(Re-)defining interdisciplinarity for CCS**. The need for and benefits of interdisciplinarity in cycling-related scholarship are already recognised. For instance, research in urban studies has pointed to the need for insights from other disciplines to positively impact urban mobility practices, given the profound number of context-specific variables in built environments (Saelens et al., 2003; Uttley and Lovelace, 2016), which pose challenges for both policy recommendations and urban design practices (Kollert, 2017). In a large-scale review, Pucher et al. (2010) have also integrated insights from public health, transportation policy, and behavioural science, in diverse geographical areas, to examine how cycling-infrastructural elements, educational programmes, and supportive policies can combine to affect cycle-use safety and population health.

However, existing cycling-related research often resembles what theorists of interdisciplinarity describe as "cross-disciplinary investigation," insofar as it represents efforts that "mostly come in the form of the exchange of expertise between closely related disciplines" (Kluger and Bartzke, 2020; see also Klein, 1990; Keestra et al., 2022). While "cross-disciplinary" research tends to integrate fields that already feature common methodologies and ontologies, and is undertaken within "epistemic communities that are already aligned with each other's vocabularies" (Pedersen, 2016), interdisciplinary research reflects critically on meaningful ways to integrate disparate frameworks and generates new conceptual approaches that may not emerge from any single field alone or from combinations of existing approaches that are already closely aligned. Complex approaches to interdisciplinarity therefore entail "bridg[ing] a much wider gap between disciplinary backgrounds and approaches" (Pedersen, 2016). Depending on the context and aims of a project, there can be good reasons for a cross-disciplinary approach. Such research may be easier to design, fund, and undertake because it may align more closely with familiar methodologies, institutional support structures, or predetermined strategic goals (e.g., Rylance, 2015). In cycling-related research, this often involves a focus on practical outcomes and immediate applications (such as policy recommendations, infrastructure improvements, or health benefits). Such research

can also be described as an applied, pragmatic, or utilitarian approach to interdisciplinarity.

A central goal of CCS is to add to existing approaches—not only by developing research practices that adopt complex and field-bridging approaches to interdisciplinarity, but also by conducting work that is not "always-already applied" (Berbary, 2020). Through nuanced critical reflection, such practices and work can provide exploratory and generative foundations that potentially lead to further transformative research. Such a vision is captured by the German term *Grundlagenforschung*, a concept which, in the philosophy of science and other contexts, roughly translates as "non-applied foundational research," and which generally refers to scholarship that has an increased potential for long-term scientific advancement and innovation precisely because it is not bound by predetermined goals (Janger et al., 2024; OECD 2015). CCS scholarship, in this sense, might take a salutary reminder from the philosopher of science Karl Popper (1963, p. 88), who observed that "We are not students of some subject matter, but students of problems. And problems may cut right across the boundaries of any subject matter or discipline."

The challenges of "complexity-driven approaches" (Pernecky, 2019) that lead to "inter-epistemological ways of knowing" (Freiband et al., 2022) are not unique to CCS. Currently, much cycling-related research, like most academic research (Keynejad et al., 2021), continues to be shaped by the requirements and mandates of narrowly defined disciplines, institutions, and funding bodies, and through discipline-specific definitions that can bar interdisciplinary approaches (Rylance, 2015; Pedersen, 2016). Consequently, for many researchers, it is difficult to assume the critical distance from their main research domain that may be required for developing the kinds of interdisciplinary perspectives invoked by CCS (Ledford, 2015; Bammer, 2017). To overcome such barriers, CCS should be open to perspectives and methodologies that allow researchers to consider cycling more broadly while accounting for the social (e.g., Williams, 2018), cultural (e.g., Withers and Shea, 2016), political (e.g., Cox, 2023), and philosophical (e.g., Haraldsson, 2010) dynamics of cycling understood as a complex ontological "event" (i.e., an activity or state that encompasses actions, bodily movements, and mental or physical occurrences; see Badiou, 2007; Casati and Varzi, 2023).

Applied to CCS, such an approach is not simply about drawing on insights from multiple fields, but about a form of interdisciplinarity that can transform how cycling is studied precisely because it invites researchers to rethink methodologies, integrate theoretical frameworks, and generate new modes of enquiry that challenge conventional disciplinary boundaries (Keestra et al., 2022). CCS involves, therefore, what Graff (2015) describes as a process of "undisciplining" knowledge: the rethinking and breaking open of established categories to create space for dynamic and fluid intellectual exchanges.

The critical reflexivity invoked here is a prominent characteristic of humanities-based research, which, we argue—in full acknowledgement of our own positionalities—can helpfully serve as a foundational framework for CCS. The humanities offer theoretical tools that are particularly useful for interrogating and integrating the social, political, and cultural dimensions of human activities and behaviours, in ways that might be missed from the perspective of discrete disciplinary orientations (Robinson et al., 2016). Collini has described the humanities as a "collection of disciplines which attempt to understand, across barriers of time and culture, the actions and creations of other human beings considered as bearers of meaning, where the emphasis tends to fall on matters to do with individual or cultural distinctiveness and not on matters which are primarily susceptible to characterisation in purely statistical or biological terms" (2012, p. 64). Importantly, the integration of humanities perspectives into cycling research does not preclude applied and pragmatic research efforts and should not displace the "statistical or biological" methods of more empirical approaches. Instead, as a fundamentally self-critical field of enquiry, the humanities are well-positioned to supplement research efforts by questioning how knowledge about cycling is produced, who gets to define it, and what ideological structures shape policies and infrastructures related to mobility. In this regard, cycling research situated in empirical domains could benefit from adopting humanities approaches specifically as a means for critical reflection and as a bridge to interdisciplinarity itself.

"Perhaps the most comprehensive term to describe" the distinctiveness of the humanities, Harpham (2013, p. 511) has argued, "is resistance: the humanities resist—that is, they both adhere to and deviate from—all the basic premises of disciplinarity as such." Adding friction to the basic premises of disciplinarity promotes critical self-reflexivity, which allows CCS both to move beyond technical and utilitarian discussions of cycling as they currently exist within discrete disciplines and to connect new interdisciplinary concerns to the broader cultural narratives, power dynamics, and historical trajectories that underpin existing cycling discourse. The work of some cycling scholars already points in this direction. Cox (2019), for example, has identified a need to push beyond artefactual and Eurocentric historiographies of the bicycle; Vivanco (2013) has called for broader anthropological reconsiderations of the bicycle and those who use it; Augé (2019) has considered the bicycle as an object with the utopian potential to give new meaning to our being in time and place; Bennett (2019) has employed perspectives from film theory to enact a broader consideration of cycling as a cultural medium; and Bee et al. (2022) have drawn on media studies to explore the bicycle as a vehicle for social and cultural change. These efforts highlight the value of humanities-informed perspectives to interdisciplinary cycling scholarship.

The rich history and evolving aims of the field of Cultural Studies can offer an indication of how CCS might become an interdisciplinary framework. Cultural Studies emerged in the mid-twentieth century from the conjunction of numerous disciplinary contexts (including literary criticism, sociology, anthropology, and political theory) and became a home for many critical perspectives that later established their own disciplinary domains (such as media studies and gender studies) (Hartley, 2002). From the start, the strength of Cultural Studies lay precisely in its ability to navigate—and resist—disciplinary boundaries (Grossberg et al., 1992). This has allowed Cultural Studies scholars to address questions of power, ideology, and representation in ways that would be impossible within a single discipline. Applied to cycling-related research, this could mean, for example, that CCS expands established perspectives (such as focussing on empirical data and other statistical patterns of cycle use and infrastructure development) by investigating how cycling is also a site of contested identity, shaped by issues of power, including those of race, class, and gender, and by historical narratives of urban space. Usefully combined with quantitative and experimental approaches from other disciplines, a humanities-informed CCS could then help to reveal, for example, how media representations of cyclists, regulatory policy, and urban design choices intersect to reinforce or challenge dominant mobility paradigms. In this way, elements of qualitative Cultural Studies methodologies could contribute historical, anthropological, cultural, or aesthetic understandings of cycling to the theoretical scaffolding for empirical research in the social sciences.

Importantly, a call for a humanities-informed CCS does not diminish the importance of contributions from other disciplines. CCS builds on the premise that cycling itself already operates

across multiple domains, where it can represent both a mode of transportation and, for instance, a cultural practice, an economic force, or an ecological intervention. To study cycling in all of its complexity, as a highly dynamic practice and phenomenon, researchers need various tools not only from the social sciences, natural sciences, and applied fields such as engineering and public health, but also from the humanities. For example, where the social and natural sciences contribute essential empirical insights regarding infrastructure design, health impacts, and urban mobility, the humanities can add interpretive frameworks that enable researchers to better situate cycling as a complex cultural and socio-political phenomenon. New perspectives emerging from such integration can foster self-reflexive research models that foreground the value of critical theory, cultural analysis, and historical enquiry in non-cognate research domains, thus complementing quantitative, empirical, and applied perspectives. Ultimately, building on humanities-informed frameworks allows CCS to reflect on how interdisciplinarity as such can reshape our understanding of cycling as a social, political, cultural, technological, and ecological practice and phenomenon. Even in empirical or policy-oriented work on cycling, scholars need to consider cycling's affective, cognitive, and discursive dimensions alongside the power structures that shape mobility choices and experiences. Interdisciplinarity in CCS, in this sense, is about rethinking the questions we ask, the contexts in which we ask them, and the assumptions that we bring to cycling research.

**Navigating the challenges of CCS as an interdisciplinary framework**. No matter the context, interdisciplinarity always poses challenges and requires tremendous effort and commitment from collaborators, institutions, publishers, and funding bodies (Brown et al., 2015). This fact alone might dissuade researchers from adopting bold interdisciplinary approaches. This subsection addresses some of the practical and conceptual challenges of interdisciplinarity for CCS and how they might be overcome.

A potential lack of methodological and thematic coherence is CCS's first major challenge (see Callard et al., 2015). Some practical suggestions for organising interdisciplinary research have begun to emerge (e.g., Kluger and Bartzke, 2020). In CCS contexts, however, it will nevertheless be difficult to align, for example, quantitative approaches of fields such as public health, engineering, or urban planning with qualitative and interpretive methods of cultural studies, philosophy, and sociology (Lyall et al., 2011). Interdisciplinary projects may also struggle with focus: attempts to integrate too many perspectives without a clear guiding framework can lead to fragmentation instead of synthesis, a dilution of analytical depth, and the diffraction of data (Uprichard and Dawney, 2019). Finally, institutional barriers also pose a challenge, as traditional, discipline-bound research models are frequently privileged over new, boundary-crossing approaches (Bromham et al., 2016).

But it is precisely the element of risk involved in interdisciplinary research (Repko, 2008; Lyne, 2015) that may also represent CCS's greatest opportunity. If approached carefully, the very aspects that might be seen as threats—difficulty of implementation, broadness of focus, methodological diversity—can become elements of strength. Rather than imposing a rigid mould that all cycling-related research must fit, CCS can develop a research culture that values flexibility alongside coherence and that cultivates the ability to adapt, expand, and redefine its perspectives in anticipation of and in response to challenges and emerging insights.

Practical risks associated with CCS as an interdisciplinary framework could be mitigated in a number of ways. To begin with, care must be taken at the level of scoping relevant interdisciplinary connections and defining research questions and methodologies accordingly. Additionally, interdisciplinarity requires a strong commitment to rigour when it comes to understanding and adopting conceptual and methodological elements of established disciplines. In order to avoid misalignment, this involves exploring and clarifying differences in terminology, methodology, and epistemological frameworks between participating researchers at the outset.

Thankfully, CCS has an inherent structuring principle that can help guide interdisciplinary projects: cycling itself. This returns us to a central idea raised earlier, namely that cycling—as an interface technology that mediates vernacular as well as professional expertise through both first-hand and indirect experience—can serve as an anchor facilitating boundary-crossing interdisciplinary approaches which might otherwise be difficult or impossible to implement. Cycling, in other words, is also the interface between different researchers and research disciplines. It allows CCS to remain centred on shared concerns and interests while facilitating generative interplay between diverse theoretical frameworks, conceptual approaches, and methodologies.

There is evidence that interdisciplinary perspectives are positively associated with research impact and dynamism (e.g., Okamura, 2019). This is also reflected in urgent present-day calls for fundamentally interdisciplinary approaches in a wide range of research domains (see, for example, Bommasani et al., 2021, and The New Real, 2025, regarding AI development; Banerjee et al., 2024, regarding public health crises; Coopersmith et al., 2023, regarding environmental sustainability challenges; and British Academy, 2024, regarding increased civic engagement through the integration of the humanities and social sciences). We are, likewise, convinced that the risks of interdisciplinary CCS research promise great rewards.

## Discussion: implementing CCS

As suggested in the preceding sections, virtually anything and everything can merit rethinking with and through cycling. If this is done rigorously, in a self-reflexive mode, and with a commitment to the complexities of interdisciplinarity, new and unexpected approaches become possible that might benefit research, policy, and innovation while offering new insights into the socio-cultural dimensions of cycling. As noted already, interdisciplinarity is a process that is not only pragmatic and utilitarian but also exploratory and transformative. As such, CCS emerges as a framework that realises its potential by actively rethinking and reconfiguring diverse theoretical and methodological approaches to cycling-related research. Complex issues that involve, for example, mobility justice, sustainability, infrastructural inequities, or the socio-political dimensions of cycling culture can then be addressed in ways that reach beyond what would be possible from the viewpoint of individual disciplines. This section sketches future steps towards the formation and consolidation of CCS as a sustainable research framework, first by presenting several examples of possible research directions, and then by offering practical suggestions for CCS events, publications, collaborations, and organisation.

**Possible directions for CCS research**. Our examples are illustrative rather than exhaustive. We have chosen them strategically to suggest possible directions for CCS that existing cycling-related research does not yet, to our knowledge, fully pursue; that demonstrate the benefits of implementing interdisciplinarity in an exploratory mode; and that show the usefulness of humanities-informed approaches.

*Cycling and research-creation*. The first example focuses on cultural practices that explore new ways of mobilising cycling in relation to societal and political issues. Many activist initiatives do this already (the most visible and widespread among them being Critical Mass; see Carlsson, 2002; Furness, 2010; Labozone, n.d.). A more general attention to a variety of cultural practices also reveals how cycling acquires meaning across various social contexts. While considerable scholarly attention is already dedicated to highly visible cycling cultures—such as those associated with national identity in Denmark and the Netherlands (Oosterhuis, 2016; Agervig Carstensen and Ebert, 2012; Kuipers, 2012)—we suggest that CCS could also usefully expand its scope to include many other forms of cultural practice. These might include the collective identities formed through local group rides or cycling clubs; the rituals of daily commuting; the circulation of cycling-specific language (including both celebratory and stigmatising terms); and the emergence of virtual cycling cultures on social media and other digital platforms. Such practices invite interdisciplinary enquiry and could benefit from humanities-informed analysis, particularly when exploring how cultural meaning is shaped, shared, and contested in and through cycling.

More specifically, creative practitioners in the arts have raised and addressed similar concerns, showing how we might rethink the socio-political dimensions of everyday life with and through cycling, although relevant artworks, viewed as both research and critical commentary, have largely remained outside the purview of cycling studies. Scholarship on research-creation has highlighted, however, that creative practice can contribute significantly to critical discourse (e.g., Loveless, 2019; Manning, 2016) and can inform innovative knowledge production in research domains aligned with both qualitative (Truman, 2023) and quantitative (Sha, 2013) methodologies. There is, by now, some scholarship that considers the cycle as the subject or medium of art-making. This research generally links cultural representations of cycling with efforts to shape progressive cycling policy (e.g., Poole, 1989; Furness, 2010; Bennett, 2019). But through its performative dimensions (Johnson, 2019), cycling can also be linked to political art practices, and could therefore be described, in a link back to activist contexts, quite literally as "revolutionary" (Bennett, 2022). Key artworks focusing on cycling, such as Marcel Duchamp's *Bicycle Wheel* (1913), Ai Weiwei's *Forever Bicycles* (2003), and Rainer Ganahl's *Bicycle Manifesto* (2018), incorporate experimental aesthetics to develop powerful critical commentaries (Bennett, 2021).

One could likewise point to Geluykens' installation, "BTS_200X," discussed above, as a concrete example of an artwork that challenges assumptions about the adequacy of cycling infrastructure in Antwerp, a supposedly cycling-friendly city in the supposedly cycling-friendly Low Countries (Devos et al., 2023). Approximating key aspects of research-creation methodologies, the installation offers a humorous and yet clear-cut artistic commentary on the experiential challenges of using a cycle and of being a cyclist through the strategy of defamiliarisation (or "*ostranenie*"), a concept central to various artistic practices studied across the humanities (Bayraktar and Godioli, 2024). Here, defamiliarisation is itself a methodological perspective—a different way of viewing, knowing, and expressing the challenges of urban mobility. The artistic medium in which the work is presented also offers a perspective not so readily available in academic disciplines built on epistemic models that privilege scientific objectivity, evidence, and logical analysis (Kuhn, 1962; Latour and Woolgar, 1979; Haraway, 1988). From such examples, it is a small step to recognising the importance of cycling-based cultural and artistic practices for cycle utopias more generally, as they are also envisioned, for example, in the fields of mobility studies, urban planning, and human geography (e.g., Popan, 2019). A large collective of mobility studies scholars has recently called for increased focus on the contributions made by creative practitioners to critical discourses surrounding new mobility paradigms (Barry et al., 2023). This appeal resonates strongly with our proposal for CCS, where research-creation can, similarly, make important contributions to interdisciplinary scholarship.

The work of composer and media artist Kaffe Matthews provides a particularly good example of the potential productive overlaps between artistic and research-oriented inquiries. Matthews explores participative and performative approaches to art and cycling activism with her itinerant "Bicrophonic Research Institute" (Matthews, n.d.), which revolves around custom-built "Sonic Bikes" equipped with various sensors, micro-computers, sound-generation modules, and speakers (Hope, 2020; Keylin, 2020). Matthews' bicycles serve as instruments that can simultaneously record, analyse, and sonify both rider activities and the resonances of cycling environments. Forming a dynamic interface between artistic research, environmental data analysis, participatory activism, and performance art, Matthews' project exemplifies how CCS could bridge creative practice and scientific enquiry to address pressing mobility issues and ecological concerns. In a 2021 iteration of the project, riders (and bystanders) experienced music generated in real time based on the sonification of environmental pollution recorded by the bicycles in urban spaces (Enviro Bike, n.d.). The project suggests new productive links between art-making, research, and activism that could be highly instructive for existing policy efforts in, for example, environmental or transportation studies. Heeding the call of Barry et al. (2023) and linking existing domains of cycling research to domains of artistic practice, CSS scholars should take inspiration from such work, and explore how cycling itself can be approached as what Greaves (2013) has called an "environmental art" and as an embodied and situated experience that operates not only creatively but also analytically, discursively, and critically.

It is conceivable that the defamiliarising function provided in art practices such as this can serve broader purposes in cycling-related scholarship, not merely in the aesthetic sense of rendering cycles and the experience of cycling alien, but also in the sense of allowing researchers to renew their perception of cycles and cycling. In this regard, the shifted perspectives afforded by art projects such as Geluyken's or Matthews' might point researchers towards new research questions and towards developing interdisciplinary methods that integrate critical insights from the humanities and empirical methods from other disciplinary contexts.

*Interdisciplinary approaches to cycling data*. A second example can help to further illustrate the potential for developing new interdisciplinary approaches that build on humanities-informed approaches in broader contexts. Consider the enormous amount of data—such as GPS and biometric information—that is constantly being produced by cyclists and shared across numerous networked platforms. Cycling data presents an opportunity for CCS to examine critically how digital technologies can shape mobility research. Heavy reliance on WEIRD datasets can, however, skew cycling policy and infrastructure decisions (e.g., Aldred et al., 2019), which suggests not only that more diverse data sets are needed, but also that non-cognate critical methodologies, developed to decolonise knowledge production (e.g., Giroux, 2020; Radcliffe, 2017; Walsh, 2015), could be productively integrated with cycling research. The Digital Humanities (DH), for example, provides computational methods for analysing large datasets without pre-determined hypotheses (Underwood, 2019), an approach that could offer CCS researchers new ways to explore cycling data at the intersection of

empirical and interpretive methods and at scale in addressing, for example, the ethical concerns of bias-prone datasets (Roy et al., 2019). Care must be taken to develop analytical approaches that can contend with such distortions, so that insights drawn from cycling data may benefit broader and more diverse groups of those with both direct and indirect experiences of cycling. The trajectory envisioned here already pushes beyond conventional DH territory, and suggests that additional approaches, for example, from social theory and critical data studies, might also be useful. By combining such perspectives, CCS can critically interrogate how cycling-related data is produced and interpreted, and feed applicable insights back into existing policy-driven research efforts.

It is also important to keep in mind that most rider-generated cycling data—concerning biometrics, performance, movements across time and space, and geographical and topological information—is owned by corporations or is in the stewardship of state institutions (e.g., Nelson et al., 2020). This raises concerns regarding, for example, user privacy and the for-profit exploitation of user-generated data (Curry, 2020). To address such concerns, CCS could additionally incorporate perspectives from legal studies, information ethics, platform studies, and FOSS (free and open-source software) contexts to begin developing alternative, open-access cycling data infrastructures that resist corporate exploitation and promote open access. The user-generated nature of cycling data also suggests the potential for adopting new kinds of citizen-science approaches. Interdisciplinary and methodologically adventurous research in these directions could, for example, develop collectively owned, decentralised information infrastructures for cycling data. Here, interdisciplinary CCS scholarship could ask what counterpoints to policy-driven cycling advocacy discourse can be envisioned and developed, and what roles cooperatively owned cycling data infrastructure could play in advancing existing policy efforts. By acknowledging cycling data as both technologically and socio-politically determined, CCS can pioneer new interdisciplinary perspectives and methodologies that are relevant to a wide range of existing domains of cycling research.

**Building and growing CCS: practical suggestions**. A budding research framework needs more than what each of its contributors can offer individually. This is particularly true for efforts that are envisioned as profoundly interdisciplinary and where members conduct research against a backdrop of institutional pressures and funding schemes that may favour applied research. CCS is no different. CCS perspectives will seek something more than what might be prescribed by the constraints and requirements that often delineate academic work. Regardless of how specific and well-defined the scope and focus of a research effort may be, something important can always be gained by adopting an exploratory stance, by asking new questions, and by asking them differently. To this end, what CCS needs above all else is a community interested in forging new paths of cycling scholarship outside of existing disciplinary boundaries and research agendas. This requires a commitment to self-reflexivity, to transformative approaches, and to rethinking methodologies as needed.

To establish CCS as a sustainable interdisciplinary framework, it will be essential to develop structured yet open-ended opportunities for knowledge exchange, collaboration, and public engagement. Because critical perspectives should have the flexibility to respond dynamically to the needs of different contexts within which research is undertaken, we will here only briefly sketch some practical suggestions for how a CCS research culture could be fostered through events, publications, partnerships, and institutional support:

1. A dedicated, itinerant CCS conference series could provide a platform for interdisciplinary dialogue, methodological innovation, and the development of shared research agendas. Such a conference series should feature academic panels alongside practitioner-led discussions and participatory sessions and a hybrid format that ensures accessibility and inclusivity for participants across diverse geographic and institutional contexts.[1] Smaller thematic workshops can help sustain ongoing discussions and collaborations across disciplines.
2. CCS-themed special issues in established journals could help build visibility for CCS scholarship within relevant disciplines. This effort should prioritise open-access publication venues to facilitate dissemination beyond institutionalised academia and to ensure accessibility for broader audiences of policymakers, activists, artists, and other relevant communities.
3. Beyond academic structures, CCS should engage with the public through participatory research projects, citizen-science initiatives, cultural events, and artistic interventions. Cycling culture already offers many opportunities for this kind of engagement. This could also lead to longer-term collaborative efforts involving researchers, art communities, activists, and policymakers.
4. Because it is not structured using formal institutional affiliations or disciplinary boundaries, CCS also requires a mode of organisation that reflects its dynamic and evolving nature. Instead of adopting statutes, guidelines, or rules, CCS might best be served by a manifesto—an adaptable, living document that articulates core principles and methodologies while remaining open to updates and adjustments. Such a manifesto could serve as a shared foundation for CCS scholars, offering a guiding framework without imposing a rigid governing structure. Since we propose CCS as a research paradigm that must be at least partly re-invented for each emerging research context, a manifesto can articulate foundational commitments—to interdisciplinarity, critical enquiry, plurality, inclusivity, and a research culture that is reflective and generative rather than prescriptive—while also allowing scholars to retain intellectual and disciplinary flexibility to adapt CCS approaches to different academic, institutional, cultural, and policy environments. The manifesto should not be intended as a static declaration but as an invitation—a text open to adjustments from all those who seek to engage with CCS. By foregrounding adaptability and collective authorship, this can ensure that our work remains attuned to the diverse and shifting challenges to which interdisciplinary cycling research should respond.[2]

## Conclusion: the many paths ahead for CCS

The establishment of Critical Cycling Studies (CCS) as an interdisciplinary framework invites a broader rethinking of how cycling is conceptualised and studied. By moving beyond the instrumental and applied dimensions of traditional cycling research to explore cycling as an interface technology, CCS reimagines both the methodologies and epistemologies of cycling research, with the ambition to account for cycling in all of its cultural, social, and political dimensions. Cycling, we have argued, should not only be the subject of study for CCS, but also a critical lens: a way of engaging with and interrogating the boundaries of knowledge production itself.

This article has sketched several trajectories for CCS, each illustrating the ways in which a critical, humanities-informed approach can complement and challenge existing cycling

research. The theorisation of cycling as an interface technology, for example, suggests new ways to understand the embodied, cognitive, affective, and environmental dimensions of cycling as an experience, linking material and phenomenological perspectives in novel ways. Likewise, the call for deeper interdisciplinarity in cycling studies, beyond "cross-disciplinary investigation[s]" between fields that already share closely aligned methodologies and epistemologies (Kluger and Bartzke, 2020), highlights the risks and rewards of both critically questioning and potentially even breaking with entrenched disciplinary habits and institutional structures. Not only does interdisciplinarity hold the promise of generating richer, more nuanced insights into cycling; it also demands a heightened willingness to reflect critically and routinely on the coherence and focus of one's own research and on CCS as a field.

As we have also argued, the humanities—with their long-standing traditions of questioning disciplinary assumptions while also attempting to synthesise diverse theoretical perspectives—might provide an ideal foundation for CCS. However, CCS is not and should not be prescriptively defined. Instead, CCS should remain an evolving interdisciplinary framework that prioritises self-critical methodological reflection and that is open to contributions from all those who engage with cycling, whether as researchers, practitioners, activists, policymakers, or everyday cyclists, or even as non-cycle users. Moreover, because cycling research has frequently reflected WEIRD (Western, Educated, Industrialized, Rich, and Democratic) biases, CCS must actively attend to the operations of power, seeking to intersectionally incorporate perspectives from underrepresented geographies, cultures, socio-economic contexts, and identities, ensuring that its critical scope extends beyond established paradigms.

Ultimately, our vision for CCS is not simply about conceptually expanding the field of cycling studies but about challenging and reshaping its contours. This requires theoretical and methodological innovation as well as a practical commitment to fostering new collaborations and dialogues across disciplines, sectors, and communities. This essay has offered a few preliminary pathways forward, informed by our own positionality as cyclists and as interdisciplinary scholars in the humanities, but these pathways should be understood as beginnings rather than endpoints. If CCS is to succeed as a critical project with broad relevance, it must remain as dynamic, flexible, adaptive, and open-ended as the activity of cycling itself. The many paths ahead, to invoke our title, are not fixed courses but open roads in the making that should be navigated collectively, rerouted frequently, and continually reimagined.

## Data availability

No data has been collected as part of this research.

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## Notes

1 We are in the process of planning a first iteration of such an event for 2026, the programme of which will be available at https://www.bikestudies.ugent.be/conference/.
2 Following publication of this article, an initial version of such a manifesto will be made available on our website: at https://www.bikestudies.ugent.be/.

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## Ethical approval

This article does not contain any studies with human participants performed by any of the authors.

## Informed consent

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## Additional information

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