Chapter One Ontology

In which we learn that there is far more to the world than that we and our students experience directly. Helping them to undestand the world involves guiding them to look deeply into reality to see the mechanisms that cause events and experienes and continually shape and reshape nature, place and space. Critical realism offers a philosophy of science to guide such inquiry and integrate the natural and social sciences in ways that are illustrated by reference to the teaching of global heating.

Ontology means 'theory of being' from the Greek words *onto* meaning being and *logos* meaning science or theory. Ontology is concerned with the nature of reality, what exists in the world and how it exists. An ontology is an abstract theory of what the world is like. All teaching about the world reflects an ontology, stated or unstated. For the geography teacher not having an ontology is not an option.

Realism [1] maintains that a mind independent objective reality exists independently of how or whether it is perceived by people. Such realism opposes **idealism** that suggests that reality is entirely a mental construct or that ideas, discourse, language, and signs and symbols of all kinds have the greatest claim to be considered real. **Empirical realism** focuses on entities that can be observed either directly or with the aid of scientific instruments. **Critical realism** looks more deeply at the underlying mechanisms and events shaping these entities while idealism sees them entirely socially or culturally constucted culturally in dscourse etc. For critical realists something is **real** if it has causal effects. Hence ontology does not refer just to things that are **materially real** (e.g. landforms, oceans, weather, ecosystems, cities, economies, etc.), it slso refers to things that are **socially real** (e.g. market mechanisms, organisations, class and gender relations, norms, rules, convertions) and things that are **culturally real** (e.g. language, discourse, signs, symbols, ideas, beliefs, explanations, concepts, models, theories).

Critical realism is a philosophy of science that provides theoretical tools to sharpen social theory and render it a more effective vehicle of human emancipation [2]. It is **critical** of the way in which society is currently organised in seeking to expose the weaknesses of mainstream theory and dominant ways of thnking, advance alternatives, and so empower citizens as agents of social

change. As such it finds application among radical teachers, academics, and social / political movements.

Since the world exists independently of our knowledge or awareness of it, critical realists make a sharp distinction between two dimensions of science (geography): the **transitive dimension** which consists of our knowledge of the world (the facts, concepts, methods, theories, etc) that exist at any time, and the **intransitive dimension** that consists of the objects of science including the nature, places and spaces that geographers study. These objects and our knowledge of them change independently of one another as can be seen by considering the phenomena of climate breakdown and our changing knowledge of it. Critical realists warn against the **epistemic fallacy** or the attempt to reduce ontology to epistemology or the intransitive to the transitive dimension – to reduce what is to what is known.

The three domains of reality

Critical realists see the world as real, structured, and complex. It consists of multiple unobservable structures and mechanisms (operating in the **real domain**) that may under certain circumstances sustain and cause phenomena and events to occur (in the **actual domain**) that we may or may not observe (in the **empirical domain**).

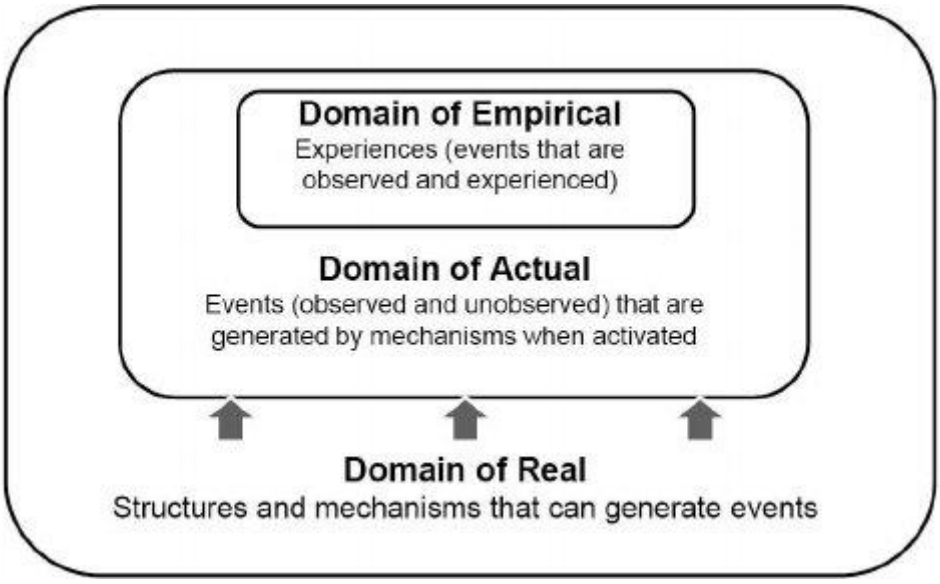


Figure 1 The three domains of reality [3]

These domains are nested within one another (Figure 1) such that the empirical domain consists of experiences and observations that along with events and

phenomena are also features of the actual domain. The real domain consists of all these (experiences, observations, events and phenomena) together with structures and mechanisms: bio-physical structures and mechanisms (Earth systems) and social structures and mechanisms / processes (social systems). These structures and mechanisms can be considered to comprise a **deep domain**. Here in addition to the laws that operate in the bio-physical world are such real social entities as agreements, customs, laws, networks, norms, procedures, rules, regulations, values, beliefs, language, institutions, and organisations.

Earth systems set flexible limits on the development of social systems which distribute resources and power to institutions and citizens across time and space that enable or constrain their actions. These actions (or lack of actions) create events (or non-events) in the actual domain that either reproduce or change structures and mechanism.

Since the phenomena that constitute Earth and social systems are so extensive, geographers have developed specialist branches of the subject: physical, human, environmental, economic, political, cultural, etc. In each of these, knowledge is to some degree contested and those developing a school curriculum are required to select from the totality of geographical knowledge based on their understanding of students' and society's needs. In English state secondary schools the sparce provision of economics, social studies and political / citizenship education means that geography is the main subject whereby students learn about social systems.

Mechanisms

Mechanisms are a core concept in critical realism, often termed **processes.** They are powers that are enabled by structures in the deep domain or things that may make something else happen as an event. They include actors (e.g. landforms, weather, soils, plants, animals, humans, ecosystems, capital, social class, corporations, governments, political parties, left and right populisms, NGOs); their actions; and the languages, discourse, ideologies, rules, institutions, media, beliefs, interests and values that shape the actions of citizens and institutions within society. There are always a multitude of active mechanisms in the real (deep) domain that can trigger, block or modify each other's effects. The relation between mechanisms and their effects is thus **contingent**. A mechanism may or may not be activated, may or may not cause an effect, depending on what other mechanisms are acting in a particular **conjuncture** of mechanisms that is time and place specific. A corporation has the causal power to make profits but

whether it does so is dependent on other mechanisms, such as the state of the market for its goods and services. Enquiry or research guided by critical realism involves abstraction [4] or identifying both the mechanisms at work and the contingent relations that allow them to cause the effect under investigation.

The Iceberg Analogy

The iceberg analogy is used by critical realists to suggest that the world as perceived is only a fraction of the world that exists (Figure 2). It prompts them to warn against **ontological actualism** – the reduction of the real to what is only actual.

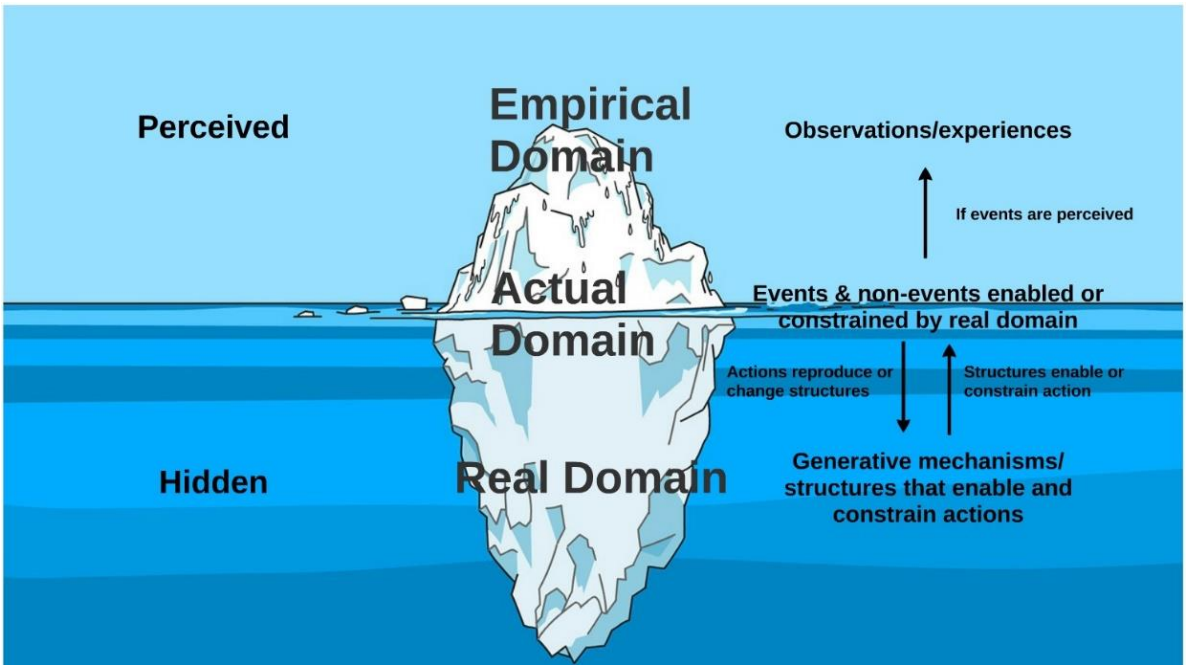


Figure 2 **The iceberg analogy to the three domains** [5]

Our experiences, observations, and knowledge do not necessarily reflect how things 'really' are. Reality and our understanding of it can be far removed from one another, a disjuncture that gives rise to critical theory's concepts of **false consciousness, ideology and fetishism**. We may misperceive our position in society and our true interests (false consciousness). We may adopt ideas that serve the interests of the rich and powerful (ideology), or we may come to see existing structures and mechanisms as somehow natural, fixed, and unchangeable (fetishism).

Critical realism warns about basing science or knowledge solely on what we experience (empiricism), what we deduce from one event or a combination of events seeming to cause another event (positivism), or what language, discourse

and texts tell us about reality (interpretivism). These philosophies of knowledge will feature in chapter two where their influence on the geography curriculum will be considered. Positivism [6] is currently the dominant or hegemonic philosophy of knowledge lending ideological support to those who rule and manage capitalist society in technocratic ways.

A dialectical view of the world

Critical realism is a **dialectical** philosophy or way of thinking. It suggests that the world is best understood not a complex of ready-made things but as a system of structures and mechanisms through which all things come into being, exist and pass away. The things that geographers study are best viewed as changing systems of structures, mechanisms, and events.

It is the relations between things or their structure that enable systems to function with powers to transform themselves and other systems. Things are the constitutive and constituted moments of systemic processes, or flows of matter, energy and information, and it is impossible to separate things from the network of systems within which they are embedded. Part and whole, organism and environment, male and female, nature and society, social structure and human agency, ruling class and working class, coloniser and colonised, curriculum and pedagogy, all such **opposites or dualities** are related. The one constitutes the other and the tensions or contradictions between them are what leads to change in the world. There can be few grounds for knowledge that seeks to understand the one without reference to the other. Hence critical realism is a holist rather than a reductionist philosophy, adopting a both / and rather than an either / or outlook. In this regard it accords with decolonial theory that draws attention to the **non-dual ontologies** of premodern, Indigenous, and some **subaltern peoples** [7] (those socially, politically, and geographically excluded from the hierarchy of power of an imperial colony and from the metropolitan homeland of an empire). It also acknowledges the **social construction of nature** while recognising a **realist nature** (the nature to whose laws human nature (society) is always subject as it works with the rest of nature to realise its needs and wants).

Dialectics seeks to explain the general laws of movement or development in nature, society and thought and reflects four principles:

- **Totality** (everything is related)
- **Movement** (everything is constantly being transformed)
- **Qualitative change** (the tendency to self-organisation and complexity)

- **Contradiction** (the unity and struggle of opposites)

As a philosophy of science, critical realism 'under labours' for critical social theory. For Marxism, it provides additional philosophical insights to add to its dialectical and materialist view of the world that is primarily focussed on the dialectics of global capitalism.

A stratified, emergent and co-determined reality

Returning to the domains of reality (Figure 1, page 2) and building on their dialectical worldview, critical realists see the world as characterised by **stratification, emergence and co-determination**. Lower level strata tend to be more enduring than higher level strata with higher level strata (society) emerging from lower level strata (the bio-physical world) and being governed by lower level laws (e.g. the laws of physics, chemistry and ecology). Since the world is stratified, different structures, mechanisms and laws operate at different levels (e.g. those of thermodynamics, ecology, capitalist economies, liberal democratic politics, social media) and interact to co-determine or create environments and societies and related issues and solutions. Geographers should regard these structures, mechanisms and laws as their prime objects of study and seek to uncover them. They can then explain the development of nature, space and place, analyse issues and suggest solutions, and advance the critique of social structures and false beliefs that harm humans and suggest alternatives.

Naturalism

Naturalism [8] is the belief that nature is all that exists (nothing is supernatural). It holds that our mental powers are causally derived from and ontologically dependent on systems of non-mental properties, powers or things (bio-chemical-physical powers) that are natural. Similarly, society is natural, emergent from bio-physical strata as human animals invent technologies and social systems. Critical realism therefore seeks a science that can encompass both the natural (bio-physical) and social sciences with both engaging in depth explanation whilst acknowledging the limits of viewing social phenomena in the same way as other natural phenomena imposed by humans having beliefs about structures that shape their actions. As we have seen, it critiques empiricism, positivism, and interpretivism as partial explanations of phenomena that can be used to support false beliefs or ideology.

Nature is central to the study of geography which has long supported dualism and separate branches of physical and human geography. Key to addressing this

dualism and asserting naturalism and holism is enabling students to consider the social construction of nature [9]. Acknowledging that human natures, human societies, and human environments emerge from and are co-determined or co-constructed with non-human nature, leads to the following ideas:

- Nature and cultures / societies are not separate entities they are intertwined and interdependent. Without this vision it is not possible to understand nor to intervene in terms of a transition to sustainability (ecological transition).
- The way we conceive, explain and deal with nature and ecological challenges is influenced by our social-cultural background, the power relations in society, etc. Instead of a singular reality we have plural meanings, plural natures and plural relations with the rest of human and non-human nature, that co-exist in each territory and condition the ecological transition.
- In the context of contemporary socio-ecological challenges such as global heating and biodiversity loss, a deeper reflection on the concept of nature seems more necessary than ever.

In the light of these ideas, it helpful for geography teachers to distinguish between:

- **First or realist nature** – the nature to which society is always subject as it works with it to meet its needs and wants. A deep nature exhibiting such laws as those of gravity and thermodynamics and giving rise to such mechanisms as the greenhouse effect. While some associate first nature with wilderness the traces of human nature are detectable everywhere on the Earth's surface.
- **Second nature or co-constructed nature** – the nature that human nature produces by working with non-human nature. The nature of farms, factories, settlements, manufactures, commerce, places, the internet,
- **Third nature or nature as represented in culture**. The diverse forms in which we represent nature to ourselves in media of all kinds. Such representations may serve to conceal the role of society and power relations in the construction of nature (see false consciousness, ideology and fetishism above).

Open and closed systems

Co-determination (see above) means that while things have propensities (powers, capabilities) to act in a certain way, they may or may not act in these ways when they interact with other things in open systems. **Open systems** are those that allow energy and materials to flow across their boundaries while **closed systems** allow only energy to cross the system boundary. The Earth system is open to energy and closed to materials and is hence a closed system. **Sustainability** is about the ability of human society and its social systems to continue indefinitely within the limits or planetary boundaries imposed by natural / bio-physical systems (realist nature).

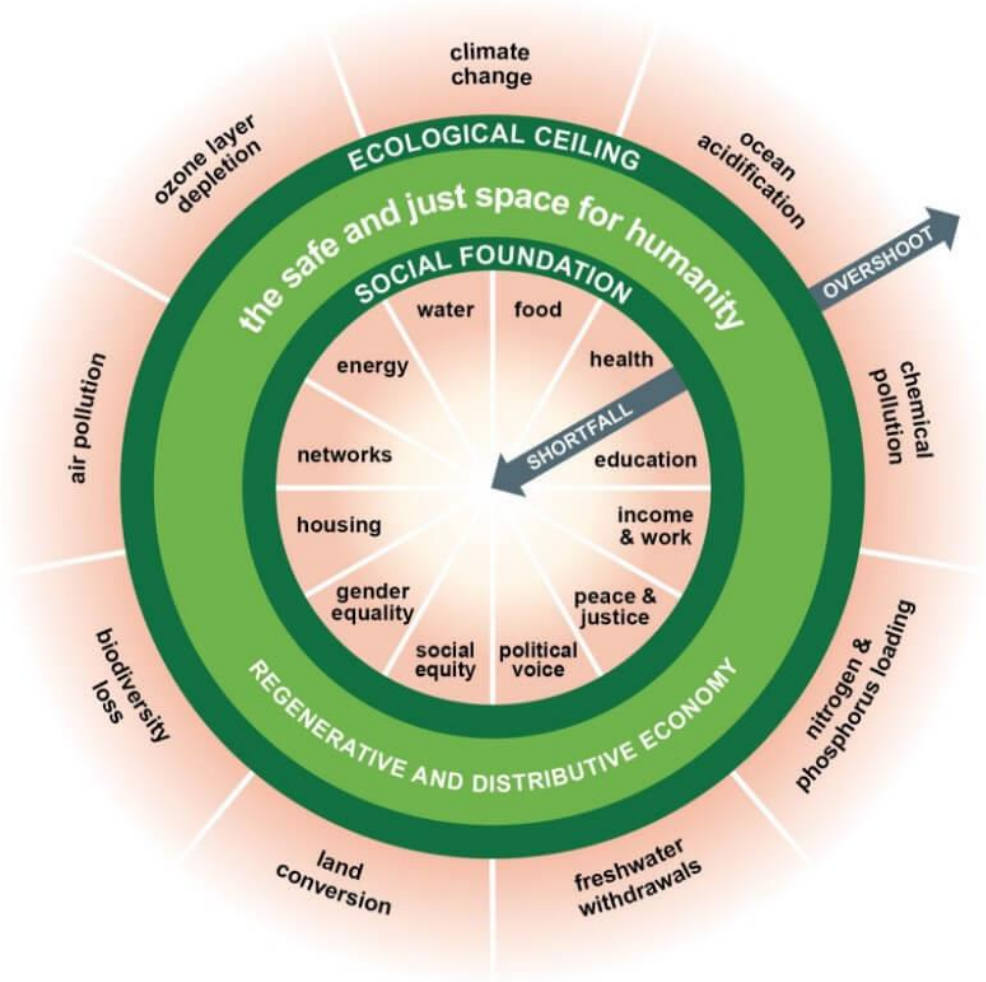


Figure 3 [Doughnut economics] [10]

Doughnut economics offers a form of accounting which takes account of planetary boundaries and finds application in such fields as city planning. Figure 3 suggests that there is a safe and just operating space for humanity and that it

should plan regenerative and distributive economies that meet its social needs (social foundations) without breaking through or overshooting the planet's ecological ceiling. Forms of knowledge that focus on such concepts as post-capitalism, post-growth, and degrowth are key to the transition to sustainability and they feature in subsequent chapters.

The natural and social sciences

Having considered naturalism, rejected nature / society dualism, considered the ways is which nature is socially constructed, and noted the differences between open and closed systems, it is time to turn our attention to the duality of physical and human geography and the ways in which a non-dual or critically realist geography invites both a critical physical and human geography.

As we have seen the assumption of **naturalism** leads to consideration of the extent to which the social and natural (bio-physical) worlds are different and should be studied in different ways. Critical realism does offer a unified approach to the natural and social sciences (physical and human geography) that moves from observed phenomena to the configurations of underlying structures and mechanisms that cause them. But it recognises real but different structures and processes within the bio-physical and social worlds, the lower and upper strata of reality.

The causal mechanisms and properties of inorganic and organic nature combine with human nature in dialectical ways allowing each to evolve and develop in ways that are more of less sustainable. The new physical and life sciences enable us to understand the dialectical and systemic nature of the processes of emergence that underpin the principle of qualitative change [11]. The critical social sciences enable us to understand the ways in which social mechanisms (e.g. markets, systems of production and distribution, governments, schools, beliefs, values) facilitate or undermine the interactions between human and non-human nature that foster sustainability.

Social science needs to be combined with natural science to understand how society is embedded in nature, while natural science needs to be combined with social science to understand the forms that a socially constructed nature takes in specific social (historical and geographical) circumstances. Social sciences can be sciences in the same sense as the natural sciences but not in the same way.

This is because:

- The subject matter of the social sciences cannot be reduced to that of the natural sciences (e.g. human behaviour cannot be reduced to biochemical reactions) there are qualitative differences.
- We cannot close social systems to outside influences (flows of material, energy and information) and carry out experiments of the kind conducted in the natural sciences.
- Social structures are activity dependent while bio-physical structures are not (a key ontological difference). Society is both produced and reproduced by its members and is therefore both a condition and an outcome of their activity (shaped by social relations and structures). The social sciences have a subject-subject relationship with their subject matter rather than a subject-object one that characterises the natural sciences. The nature of human agents' relations with their social world is the subject of chapter four.
- Social structures, unlike bio-physical structures, are usually only relatively enduring. The processes they enable are not universal or unchanging over time and space. Critical realism suggests that the social sciences should be critical of social structures and thereby participate in the progressive transformation of global society towards a more just, democratic and sustainable world.

If critical realism offers a means of integrating the natural and social sciences and so overcoming the duality of physical and human geography, geography teachers require a conceptual framework or model of society that reflects its ontological assumptions. That model is provided by Marx's political economy and his model of capitalist society.

Critical realism and Marxism

As mentioned above, critical realism seeks to support Marxism as a form of critical social theory that digs deeply and critically into the world and offers ideas for refection and action that seeks to transform it (praxis [12]). As we will see in chapter two, Marxism regards education as a site of class struggle and school knowledge as political in that it serves to reproduce or challenge exiting social and environmental relations (relations of power between people and between people and the rest of nature).

Both critical realism and Marxism are driven by an ethical or axiological [13] commitment to human emancipation from alienating, undemocratic, de-humanising social and environmental relations. Both seek social transformation and to that end engage in productive dialogue to support Marx's historical and geographical materialism. Whereas Marxism operates at the levels of philosophy, social theory, and practice, critical realism operates solely as philosophy. Unlike Marxism, critical realism does not advance particular theories or political projects, but a majority of critical realists are on the left and claim to be democratic socialists [14].

Marxism and the political economy of capitalism

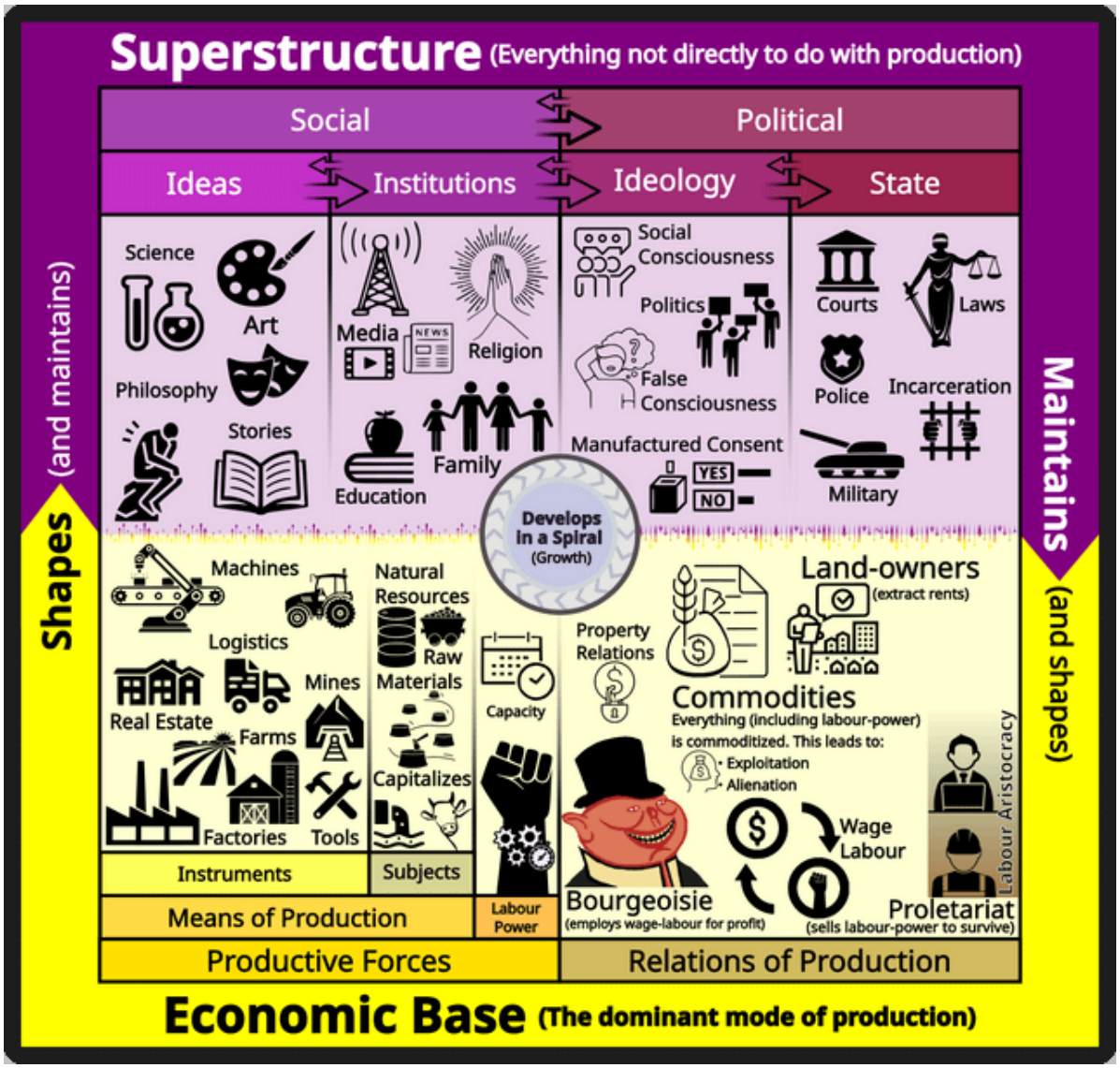


Figure 4 Base and superstructure in a nutshell [15]

Political economy models the economic, political and cultural structures and mechanisms that shape society, its social organisation and development. Marx's model of the political economy of capitalism accords with critical realism in that is sees an economic base to society (forces and relations of production) emerging from the necessity of people's need for subsistence and a social and political superstructure developing to govern the resulting economy and society (see Figure 4, page 11). Base and superstructure are in a dialectical relation to one another as the figure suggests.

Social or class relations in the base (between the bourgeoise, labour aristocracy, and proletariat or upper, middle and working class) are shaped by the need of the upper class to continue to accumulate capital without which they lose economic and political power. Social relations shape the relations between society and the rest of nature (environmental relations) and it is the circulation of capital in its continual search for profit that drives the exploitation of both human and non-human nature and results in a global crisis with multiple dimensions.

Marx saw contradictions between productive forces and the relations of production as the driving force of social change. Current and emerging technologies now allow all the world's people to meet their needs in sustainable ways (to live sustainably within the limits of planetary boundaries, Figure 3, page 8) but this is prevented by prevailing social / power relations. Only when all forms of power (economic, political, cultural) are rendered democratically accountable and corporations, governments and individuals act as global citizens, will the ecological transition take place. Global citizens would respect such universal values as those outlined in the Earth Charter [16] and would exercise responsibility to others (including others at a distance in time and space) in return for universal rights. Global citizenship education is the focus of chapter five.

Note that in Figure 4 (page 11), education is one of the institutions within the social superstructure. It takes private and public (state funded) forms and serves to reproduce workers and citizens who can help to sustain capital accumulation. Critical theorists claim that schooling functions as part of the 'ideological state apparatus' [17], manufacturing consent and transmitting false consciousness. This role is however contested with some students demanding a more critical and relevant curriculum and some teachers seeking to offer this. Critical school geography, underpinned by critical realism, is an example of such an offering.

Democratic socialism

Collier [18, p. 200] suggests why democratic socialism appeals to critical realists:

- Socialism suggests that change comes about by changing social structures and mechanisms not by changing the way we view the world (idealism).
- There is a correspondence between critical realism' worldview and certain models of socialist radical, cosmopolitan or ecological democracy. Just as the world is one of stratified structures and mechanisms, with wholes not reducible to parts, nor parts to wholes, so a genuine (radical) democracy should embrace all sites of power at all levels from the local to the global.
- A socialist political philosophy should be partly based on knowledge of those constraints which prevent human nature (and the rest of nature) from realising its potential. In that critical realism, linked to critical theory and Marxist political ecology, reveals the contradictions of global capitalism, and the associated causes and possible solutions to its current crisis, it is an appropriate foundation for revolutionary praxis [19].

Critical physical and human geography

Critical physical geography [20] combines critical attention to relations of social power with knowledge of a particular field of biophysical science or technology in the service of social and environmental transformation. It assumes that we cannot rely on explanations grounded in physical or critical human geography alone because physical landscapes and social systems are as much the product of unequal power relations, histories of colonialism, and racial and gender disparities as they are of hydrology, ecology, and climate change. Critical physical geography is thus based in the careful integrative work necessary to render these deep interconnections between biophysical and social systems understandable.

A growing body of research asks what are the opportunities for a more critical physical geography **and** a more physical critical geography? What new research, teaching, and political practices can be built on a foundation of, geomorphology, climate science, biogeography, political-economy, political-ecology, subaltern studies, and social studies of science? Such new and reformed knowledge and practice are needed if global society is to realise sustainability. The UN reports [21] limited progress in realising its sustainable development goals and this is

largely the result of nation states failing to deliver policies that promote sustainability.

When confronting these challenges, most OECD and EU governments continue to struggle with implementing sustainable policies. Short-term, ad hoc measures often take precedence, while rising debt shifts an unfair burden onto future generations. Persistent inequalities in labour markets, education and health care jeopardize the long-term viability of entire societies. Meanwhile, most countries fail to prioritize the efficient use of natural resources for long-term sustainability. [22]

Geographers are among those who consider democratic green socialism and associated forms of planning and governance to be key to realising sustainability (living within planetary boundaries) and they can be guided by critical realists who offer a unified model of the natural and social sciences and regard the ecological crisis as but one of the four dimensions of the current global crisis.

Critical realism's Four Planar Model of Social Being

Reflecting Marx's model of political economy, critical realism suggests that people's social being and activity exists on four dialectically interdependent planes: their material transactions with nature; their social interactions with other persons; their interactions with social structure (e.g. markets, laws, institutions of governance); and with their inner being. It terms this the **Four Planar Model of Social Being (FPMSB)** [23]. The world faces a multiple crisis relating to these planes: an ecological crisis, a crisis of democracy, a social crisis of deep and growing inequalities; and an existential crisis.

This multiple crisis has been long in the making but has been accelerated by the **neoliberalism** [24] in the past four decades. This political project used the state to reshape political economy in ways that further favoured the bourgeoisie and eroded the rights and welfare of the working class. Corporations and finance were given new freedoms with financial markets, institutions and elites favouring financial asset activity over investment in the real economy. Levels of growth and productivity fell, real wages declined, and periodic recessions, notably the financial crisis of 2008, led to austerity or reduced spending on welfare and public services. The social contract that promised children's lives would be better than those of their parents, was broken and in the UK, following Brexit and the Covid pandemic, trust in politicians and liberal democracy declined. Politics fractured with populist parties emerging on both the right and left and the arrival of refugees

together with declining living standards prompting increasingly divisive culture wars. Neoliberalism largely explains the limited progress in realising the UN's sustainable development goals and the reluctance of states to reform school curricula in ways that deliver education for sustainable development and global citizenship. The reforming of state education is considered in chapter two.

The Four Planar Model insists that every social phenomenon including every act and every event, exists on its four interdependent planes and that transformative change requires action on all four. This is made possible by humanity's ground state or its capability for creativity, love, and freedom, the subject of critical realism's **philosophy of metaReality** that we will consider in chapter five in the context of global citizenship.

Critical realism and global heating

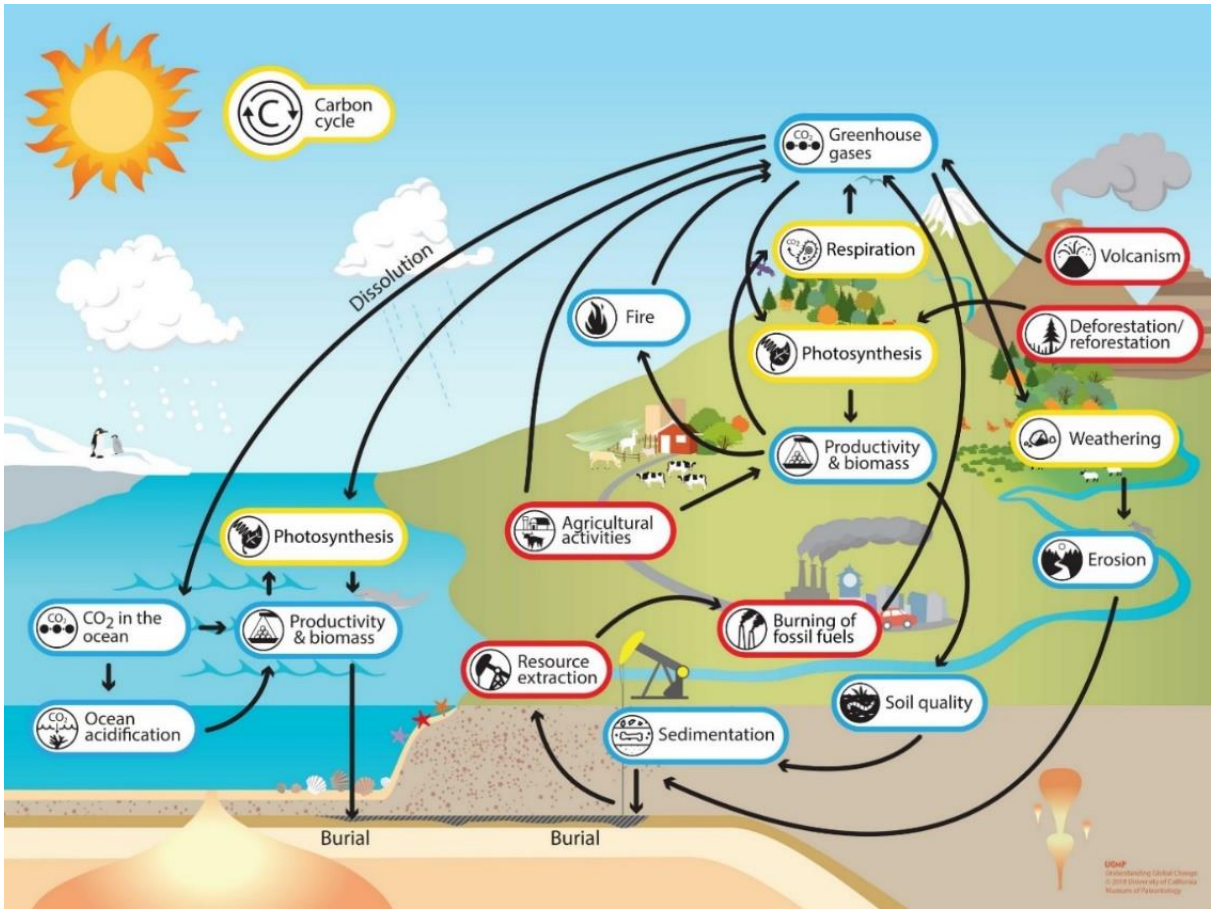


Figure 5 [The Carbon Cycle] [25]

An examination of the carbon cycle illustrates how the event of rising global temperatures is explained by reference to multiple mechanisms operating in a specific conjuncture. These mechanisms are not only the physical mechanisms operating in the atmosphere but the economic, political, cultural and

psychological mechanisms operating in society. Neoliberalism has accelerated globalisation and consumerism and led to the burning of more fossil fuels, a process set in motion by the industrial revolution.

Figure 5 (page 15) is typical of textbook / classroom illustrations of the carbon cycle and you should try to decide the logic behind the colours it has used for different mechanisms and stores of carbon and how useful it would be for a teacher seeking to explain global heating. The major omission is those social mechanisms driving the increased extraction and burning of fossil fuels (the global neoliberal capitalist energy economy) and those, linked to global climate governance that seek to limit global heating.

The COP process [26] is central to this and COP29 in Baku in 2024 took place in a conjuncture that included the recent election of Trump (a climate change denier), the threat to multilateralism posed by the US President elect and other authoritarian leaders, 2024 destined to be the hottest year on record with many extreme weather events, the determination of some states to issue new licences for oil drilling, and the failure of rich states to fund the efforts of poor states to adapt and transition to a clean energy future. The cost of renewable energy technologies continued to fall, some states had made significant progress in meeting targets agreed in Paris in 2015, and citizens' movements had pushed the issue up the political agenda since 1994 when the UN Framework Convention of Climate Change came into force. But state sovereignty meant nation-states were reluctant to accept supranationally imposed carbon-reduction targets and climate justice activists [27] were urging the international courts to require such states as the US, Australia, China and Saudi Arabia to meet their obligations under the UN's climate change regime.

Postcolonial critical realism

Tinsley [28] argues that the origins of the climate crisis are to be found in discourses, among them capitalism, extractivism, racism, sexism, classism and ableism, located in the domain of the real. They provide the logic for events in the domain of the actual, including conquest, slavery, globalisation and ultimately climate change. Within this context of power and oppression, individuals experience floods and famines, forced migration and other events in the empirical domain and it is communities in the global South who are most affected. Too much commentary on global heating foregrounds its visible effects on the privileged and risks producing superficial solutions for them while leaving intact the system that produces the crisis. It also upholds science as the objective

measure of the crisis and invites scientific interventions (e.g. green energy) to solve it. This too leaves racialised capitalism unscathed and erases Indigenous knowledge that 'has endured and resisted climate crisis for generations.'

Postcolonial critical realism provides insights from global social theory [29] for critical realism. It acknowledges the causal power of discourses, including those underpinning the colonial project and various form of resistance, to shape social institutions and practices and is attentive to power in general and to coloniality specifically. It has implications for schools where some teachers seek to decolonise the geography curriculum and for social movements more generally.

David Harvey's ontology

To conclude this chapter we can consider David Harvey's ontology. He is among the most influential Marxist thinkers of the last half century and in their critical introduction to his thought Castree, Charnock & Christophers [30] summarise his ontology after admitting that they are glossing over some of the philosophical complexities.

- Processes, flows and relationships are as important as objects, entities and things;
- Processes are, as capitalism demonstrates, often structured into totalities, systems or wholes;
- These totalities can be contradictory in their operation, creating forces of stability and change;
- Specific parts or 'moments' within a system offer insights about the whole because they, in effect, internalise all other parts or moments;
- Relatedly, parts and moments of a bigger system can be both causes and effects interchangeably; and
- Processes do not simply have a history and geography but can constitute their own spatio-temporality. (Castree, Charnock & Christophers, 2023, p. 47)

Critical realism suggests that it is the relationships between things in the real domain that causes processes / mechanisms that drive flows of energy, materials and information. Marx's model of political economy claims that economic, social and cultural systems are emergent from bio-physical systems and that agreements and contradictions between different social classes create forces of stability and

change. Postcolonial / decolonial theory further supports such analysis by adding the dimension of coloniality.

The phenomena that geographers study, for example global heating, are specific parts or moments within the global capitalist system. They can provide insights into that system and can be both cause and effect of its ongoing development. Such thinking helps us to rethink the social construction of nature, the concept of sustainability, and the need for new forms of global governance and citizenship to deliver sustainability. It also helps us rethink the ways in which social processes exist in time and space and shape (and are shaped by) a changing geography.

Further reading

Dima Khazem [31] elaborates on the principles of critical realism and their relevance to sustainability, climate change, and global learning. Her article supports the outline of critical realism's approach to ontology, epistemology and methodology in the first three chapters of this text. To what extent are the principles Khazem outlines reflected in the GA curriculum resource Global Inequalities and the Climate Crisis? {32}

Leigh Price [33] argues for an enlightened, commonsense approach to environmental education with special reference to climate change. She argues that 'thinking in terms of a layered reality which includes structures and mechanisms allows us to discuss how the Greenhouse Effect continues to act'. How does she suggest its action is mediated by the workings of society? What are the implications of her argument for the teaching of climate change?

Noel Castree [34] offers a Marxist interpretation of how the biophysical world is entrained in the dynamics of capital accumulation especially during the period of neoliberalism. He argues that Marxist geographers continue to offer important insights into a 'more than capitalist world' that is nonetheless, utterly dominated by contradictory logics of growth, economic competition, endless technological innovation, uneven development, accumulation by dispossession and crisis. Marx's attention to capitalism as an expansive 'totality' is critical, obliging geographers (including teachers of geography in schools) to attend to how different places, people and political projects are brought into a single, if exceedingly complex, universe. He concludes that the research frontier for Marxist geography focuses on the question of what sorts of political visions and

proposals will gain traction in a variegated yet tightly connected world where capitalism is manifestly dangerous for people and planet? These visions and proposals will be considered in chapters 4, 5 and 6.

Consult Andreas Malm's reading guide to ecology and Marxism [35]. Clearly there are many partly competing and partly complementary schools of thought and you should consider whether such theories / concepts as the second contradiction of capitalism, the metabolic rift, the political ecology of the world system, and energy and capitalism, warrant consideration in secondary school geography. The section on climate politics is particularly relevant to teaching about global heating but note Malm's recommendation of Naomi Klein's *This Changes Everything: Capitalism vs the Climate* [36]. Castree's review of Malm's book *The Progress of This Storm* [37] mentions Malm's dismissal of constructivism, hybridism, and the new materialism and his search for a theoretical position between Cartesian dualism and a 'fairly shapeless holism'. This position, which Malm terms climate realism, can be considered to reflect critical realism and leads him to base his understanding of global heating on Marx's historical materialism.

Simon Boxley's chapter (38) on green Marxism in the *Encyclopaedia of Marxism and Education* covers its origins and its relations to actually existing socialisms, eco-activists, eco-revisionists, and eco-Marxists, all in the context of education. He also considers related branches of green pedagogy: revolutionary critical eco-pedagogy, eco-socialist pedagogies, and total liberation pedagogies, and deeper green variants, together with their themes of the reproduction of labour, alienation, and ideology. He concludes 'the seeds of eco-socialism and communism are alive and germinating within the darkness that lies at the heart of neo-liberal capitalist ideology. As diligent gardeners, Green Marxist educators water and attend to those shoots that dare to erupt into the sunlight'.

Smith argues that China's driver of environmental harm is not simply the market but 'statist-nationalist extra-economic drivers' leading to 'overproduction, over consumption, overdevelopment, profligate resource consumption and wanton dumping and venting of pollution' (Smith 2020 [39]: xxi–xxii). How would you explain these drivers to students? Are such drivers in operation elsewhere in the world?

The *Sustainable Development Report* tracks the progress of UN member states in realising its sustainable development goals. It includes country profiles. Examine

the profile for the United Kingdom [40] Does this accord with your perception of the 'state of the nation'? Does it confirm or contradict the evidence in Danny Dorling's 2023 text *Shattered Nation: Inequality and the Geography of a Failing State* [41]?

Discussion

Does school geography suggest that there is more to reality than that which we experience? How does the history of geography as a school subject reflect a growing understanding of 'deep' structures and mechanisms that lie beyond our experience?

Does school geography focus on the actual and empirical domains at the expense of the real domain? If so, is this a greater feature of the human geography taught rather than the physical geography taught? Is such ontological actualism a result of learning theory that suggests concrete experiences and events are more real to students than abstract structures and processes? Or are there other causes linked to the history of the subject, its links to colonialism and imperialism, and its role in sustaining the British empire, capitalism and more recently neoliberalism?

Staying with the history of school geography in the UK, what role, if any, has it played in fostering false consciousness, ideology, and fetishism? What literature would you cite to support and/or deny is role in obscuring the true nature of reality and so fostering these outcomes? You might answer this question with specific reference to the workings of global capitalism as it shapes nature, place and space.

How would you introduce your students of the dialectical nature of the world and it's four principles of dialectics?

What geographical phenomena would you use to illustrate the concepts of emergence, stratification and co-determination?

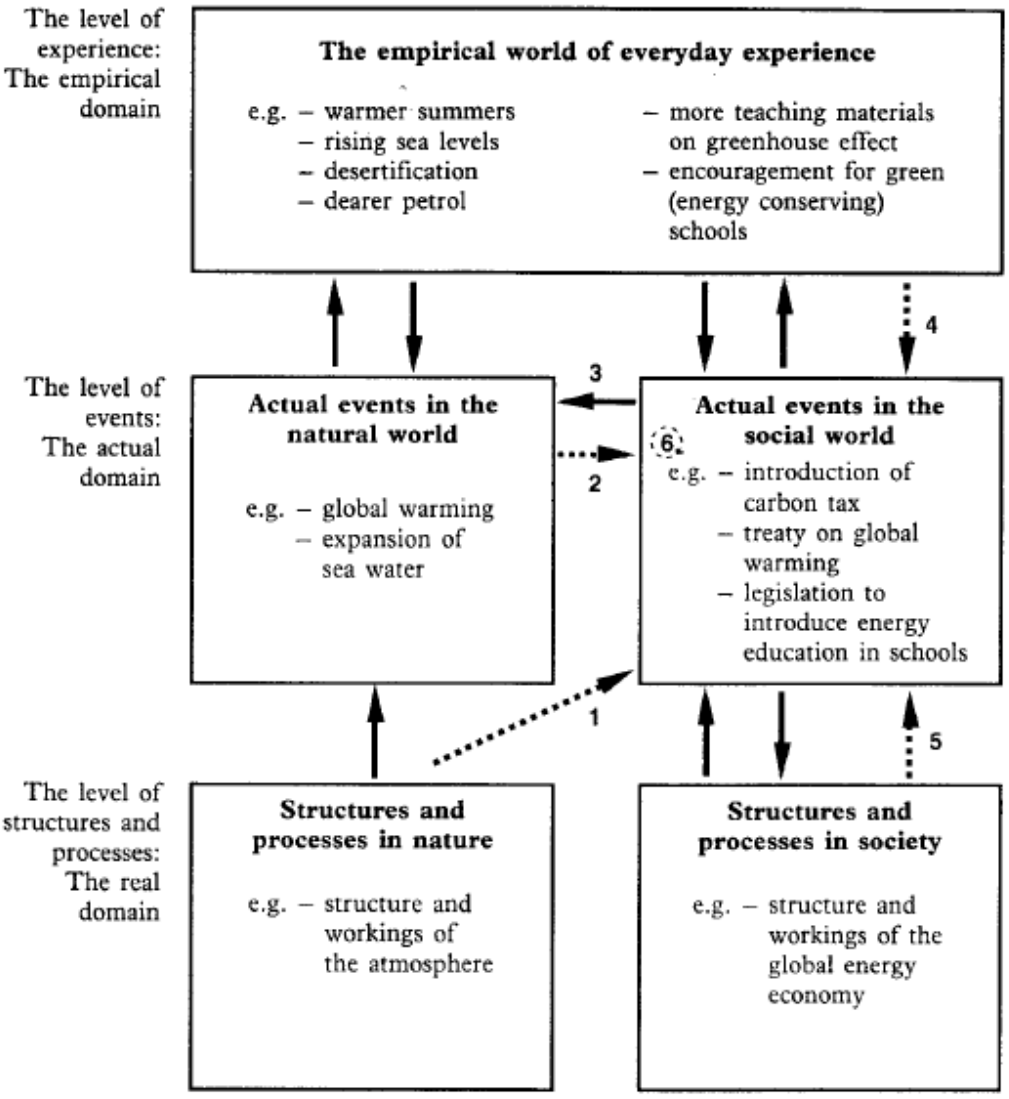
How can case studies of rainforests and cities as ecosystems be used to illustrate the differences between natural and social systems and the natural and social sciences (physical and human geography)?

Figure 6 (page 21) is a depiction of how the three domains of reality can be applied to an understanding of global heating. How should a teacher of key stage 4 geography plan a curriculum unit to ensure that all the domains and all the solid and broken arrows are featured? What are the implications of interpreting 'our interpretation' to include Indigenous knowledge?

In what ways are the writings of Castree, Malm and Klein relevant to school geography? How can Boxley's green Marxist perspective be incorporated into the geography curriculum in ways that avoid charges of political bias and indoctrination?

Does education for sustainable development and global citizenship (ESDGC) as advocated by Unesco continue to provide a relevant framework for a critical school geography as explored and developed in the author's 2020 text *Critical School Geography*?

What of David Harvey's ontology is explained by chapter one and what awaits explanation in subsequent chapters?



Key

Interactions between empirical, actual and real domains

Human interpretations of the natural and social worlds that shape human action

1 Our interpretation of structures and processes in the natural world
2 Our interpretation of events in the natural world
3 The actual impact of events in the social world on those in the natural world
4 Our interpretation of our everyday experience
5 Our interpretation of structures and processes in the social world
6 Our interpretation of events in the social world

Source: based on Johnston (1989, p. 61).

Figure 6 A realist view of nature, sociey and environmental education (Huckle 1993 [42] based on Johnson 1989 [43].

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