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The Path to the New Urban Water Paradigm – From Modernity to Metamodernism

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ABSTRACT: The urban water sector in industrialised countries is transitioning towards a new paradigm, usually characterised by participatory approaches to governance, integrated modes of management, circular economies, partnership with nature, and green and distributed infrastructure. However, change in a prevailing paradigm is rarely seen in connection with shifts in the underlying societal beliefs, assumptions, and values of an epoch (that is, the cultural framework). In this paper, I review the alterations that the dominant urban water paradigm has experienced over the past 150 years, analysing them in relation to evolving cultural frameworks. I start with industrial modernity (mid-19th century to mid-20th century), followed by descriptions of postmodernism and reflexive modernisation (late 20th century). Finally, I provide an innovative analysis of the new urban water paradigm as a reflection of metamodernism, an emergent cultural framework recently described in the field of cultural studies. I show that metamodernism can be used to explain coherently how urban water systems in industrialised countries are responding to growing complexity and uncertainty. They do so by oscillating between principles associated with modernity, such as order, technological optimism and utopian development, and postmodern principles, such as eclecticism, partial views of reality and participation.

KEYWORDS: Urban water management, new paradigm, modernity, reflexive modernisation, metamodernism

INTRODUCTION

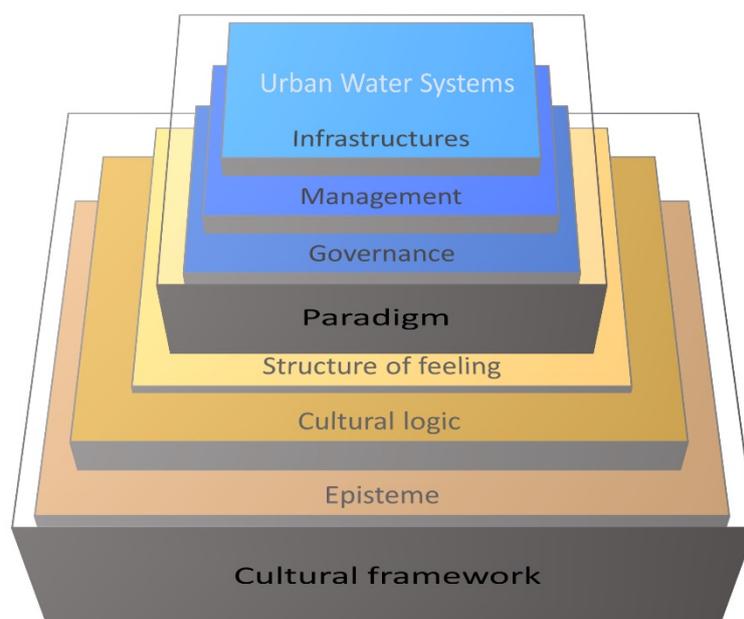
Urban water services, such as drinking water provision, wastewater collection, and urban drainage, are possible thanks to urban water systems (UWSs). These encompass interdependent technologies and physical infrastructures (e.g. computer models, water reservoirs, pipe networks, water treatment plants), social structures (e.g. values, beliefs, guidelines, rules, laws, contracts) and biophysical elements and processes (e.g. soil, vegetation, microorganisms, topography, precipitation, evaporation). The conventional configuration of UWSs in industrialised countries has remained strikingly unchanged for more than 150 years (Novotny et al., 2010), and it has been undeniably effective in providing basic water services. However, the sustainability of UWSs is currently being questioned, owing to their lack of capacity to cope with emerging developments, such as climate change, new social needs, degradation of infrastructure, and the appearance of new pollutants. This mismatch has led to the recent emergence (mostly in academic arenas) of an alternative blueprint for UWS configurations, a 'UWS paradigm', that better tackles contemporary water challenges (Pahl-Wostl et al., 2011; Franco-Torres et al., 2020a).

Throughout history, cities in industrialised countries have continually adapted to new water-related needs and problems by following similar trajectories (Staddon et al., 2017). Such adaptation is usually interpreted from the lens of 'technological determinism', which refers to a predefined and inevitable improvement path of knowledge accumulation and technical development that eventually succeeds in satisfying all water needs (e.g. Brown et al., 2009; Novotny et al., 2010). However, this explanation fails to consider that UWSs are culturally embedded. It can be argued that UWSs are sectoral expressions of an 'underlying culture' that they help to create, a wide cultural background characterised by the

fundamental, deeply entrenched, inconspicuous and taken-for-granted values, feelings, ideas, and assumptions of an epoch (Gandy, 1997; Swyngedouw, 1999). The transformation of paradigms is then a co-evolution of previously existing UWS configurations and a continuously changing underlying culture. This co-evolution influences certain technologies and infrastructures, social institutions, and types of relationship with the natural environment.

The underlying culture is also reflected in artistic expression, mass media, political discourses, science and technology, modes of social organisation, and paradigms of all societal services (Connor, 2004). It has been given many names, including *episteme* (Foucault, 1970), *cultural logic* (Jameson, 1991), and *structure of feeling* (Williams, 1961, 1977) (Figure 1). These three concepts do not refer to the same realities, and are categorically different, but are intimately related through being *cultural frameworks* with different degrees of maturity, pervasiveness, or reification. *Episteme*, the most rigid and structured of these concepts, refers to a distinct system of values, ideas, and assumptions that are deeply entrenched in a society and its artefacts. *Cultural logic* and *structure of feeling* refer instead to an emerging attitude, a zeitgeist or generalised sentiment towards reality that is not yet fully articulated and seldom reified.

Figure 1. Cultural frameworks (epistemes, cultural logics, structures of feeling) support and determine the configuration of the urban water system (UWS) paradigm, which can be analysed in terms of characteristic modes of governance, styles of management, and infrastructures.



Since the mid-19th century, traditional configurations of UWSs in industrialised countries – the traditional UWS paradigm – have resonated with an episteme called *modernity* (Swyngedouw, 1999; Kaika, 2005) that is still shaping modes of water governance, management, and infrastructures (Edwards, 2003). However, since the late 1960s, this episteme has been challenged in the urban water sector by a cultural logic called *postmodernism*, which acknowledges the existence of multiple – and potentially contrasting – values and needs (Allan, 2004), and suggests alternative arrangements to modern UWSs. To my knowledge, the contemporary structure of feeling currently shaping the emergent urban water paradigm, and challenging the still dominant modern paradigm, has not been described previously.

Following work by Allan (2004), I examine how the urban water paradigm was shaped by the modernity episteme during the 19th and 20th centuries, and how postmodernism and later variations of

modernity brought new values and needs to the urban water sector in the late 20th century. I then apply *metamodernism* (Vermeulen and van den Akker, 2010), a structure of feeling that emerged at the turn of the millennium, to theorise about the evolution of contemporary UWSs.

This analysis does not aim to demonstrate a complete paradigm transformation in the urban water sector in the past 150 years or so, as the sector is still patently dominated by the episteme of modernity (Edwards, 2003), like contemporary life in general (Giddens, 1990). Citing Huyssen (1984: 8), the objective is rather to describe "(...) a noticeable shift in sensibility, practices and discourse formations which distinguishes a post-modern set of assumptions, experiences and propositions from that of a preceding period". The analysis centres on an emergent structure of feeling, metamodernism, which is tightly connected to the slow crystallisation of a new UWS paradigm. The latter can serve as a blueprint for alternative approaches to conventional – or 'modern' – urban water governance, management and infrastructures.

The analysis considers three periods with their characteristic, though not necessarily dominant, cultural frameworks: (i) (industrial) modernity (mid-19th to mid-20th century), characterised by the episteme of modernity; (ii) late modernity (mid- to late 20th century), demarcated by the emergence of, firstly, postmodernism as a juxtaposed cultural framework to modernity and, secondly, the process of *reflexive modernisation*; and (iii) the early 21st century, typified by the arrival of metamodernism. Following a description of each period and its characteristic cultural framework, I show how the cultural frameworks can be used as lenses through which we can understand the evolution of the urban water paradigm over the past 150 years.

MODERNITY

The basic social arrangements and physical structures that have made possible the UWSs enjoyed today in Western societies began to take shape in the mid-19th century, coinciding with *industrial modernity* (period) (Beck, 1992; Allan, 2004) and *high modernism* (cultural framework) (Scott, 1998). For simplicity, industrial modernity and high modernism are referred to hereafter as 'modernity'.

Modernity has its philosophical roots in the Enlightenment, an intellectual movement of Western culture that peaked during the 18th century. The Enlightenment often caricatured its predecessor, the Middle Ages, as a period of mysticism, superstition, ignorance and dogmatic faith in God, in order to present itself as the opposite (Kant, 1784). Before the Enlightenment, nature was considered wild and feminine, a source of life, wonder and danger, expressing the almightiness of God and punishing mankind's disobedience with droughts or floods (Merchant, 2003; Kaika, 2005).

According to Lechner (1989), the end of the pre-modern period meant a transition from a divinely imposed order to a humanly produced one, which would allow the establishment of a definitive system of social organisation and the domination of nature in order to fulfil all human needs. Natural scientists of modernity saw the world as an orderly place governed by the simple laws of physics described by Newton; a clockwork that spoke the language of mathematics and that could be understood, predicted, and controlled by a human (certainly masculine) operator.

These principles of the Enlightenment, and other closely associated ideas (reason, objective truth, mastery of nature, freedom, capitalism), became anchored in Western societies during the 18th century, and they were seen as contributing to the exponential scientific and technological improvements of the Industrial Revolution. These advances dramatically improved the quality of life in industrialised countries (Pinker, 2018), endowing modernity with assertive, optimistic and enthusiastic features; there was a belief that humanity was on the road to continuous and linear progress, leading to a utopian future of order, welfare, and happiness.

Modernity imbued all aspects of society (politics, economics, technology, urbanism, arts) with simplicity, order, certainty, control, and efficiency. Modern society, satirised by Huxley (1932) in the

dystopian futuristic novel *Brave New World*, became obsessed with rational homogenisation, technological knowledge, straight lines, pure forms, standardisation, and isolated categories (Scott, 1998). All these tropes are easily recognisable in the early 20th century architecture of American and many European metropolises, with skyscrapers and social housing, respectively, being the most iconic examples. For all their differences, both are functional, simple and minimalistic constructions that lack superficial ornamentation, and project an image of order and stability with defined volumes and straight lines (Marmot, 1981).

On the political plane, modernity was urged to respond to the social unrest deriving from impoverished living conditions in industrialised cities, and it did so through strong centralised governments that sought to impose a rigid social order (Foucault, 1975) and to promote growth. These governments controlled regulation, the allocation of resources, and the development of large welfare programmes. The latter required high public spending, and involved clear roles, mechanical functions, and neat hierarchical organisations based on rational planning (Osborne, 2010).

Despite its ubiquity in industrialised countries, modernity had many critics. These included in particular the followers of *romanticism*, a European cultural movement that peaked in the 19th century. Romanticism served as a counterpoint to the Enlightenment, Industrial Revolution and modernity. For example, it worshipped emotion instead of reason; sublimity, beauty and freedom of nature instead of the power of technology and the machine to dominate nature; and feelings of nostalgia, devotion to the past and tradition instead of enthusiasm and hope for the future and progress. Linked to the romanticism movement, in German-speaking countries the so-called 'life reform' (*Lebensreform*) movement appeared at the end of the 19th century. It encouraged humans to live in harmony with nature, instead of subduing and exploiting it, and promoted the creation of alternative communities that prioritised values such as sharing, equity, and justice (Repussard, 2017).

PRE-MODERN UWS

The modern UWS paradigm that has been hegemonic in industrialised countries from the mid-19th century is perhaps better understood when compared with the urban water sector in pre-modern times. In the early 19th century, the crowded, polluted cities of the Industrial Revolution grew chaotically, without clear planning for essential services and with weak or non-existent institutional arrangements. People managed their water needs individually, with ad hoc solutions consisting of local, small-scale, decentralised infrastructures that were labour-intensive (Wolfe, 1999). City dwellers had modest water consumption (15-20 litres per day), and drinking water was obtained from local wells, rainwater tanks, or nearby ponds and streams (Tarr et al., 1984). Wastewater from washing, cooking and cleaning was disposed of in cesspools, in backyards or directly on the streets, while human waste was deposited in privy vaults or cesspools located in cellars or nearby houses. These were periodically emptied, and their contents were dumped in watercourses close by or used as fertiliser on farms. Improvised drainage gutters and pipes provided a degree of protection against stormwater, and were occasionally used to convey waste (ibid).

THE MODERN UWS PARADIGM

The migration of workers from the countryside to the city accelerated in the mid-19th century, but contrary to urban expansion in the early 19th century, it was now 'ordered' according to the central tenets of modernity. Regarding potable water, modern cities engaged in the 'hydraulic mission' (Swyngedouw, 1999). A continuous water supply into cities became a prerequisite for public health, food security, economic growth, and general progress. New infrastructures – such as dams, pumps, and piping systems – were installed to meet exponential growth in water demand due to industrial production, firefighting and household consumption, particularly following the introduction of the flush toilet. This

supply-driven logic, a vicious circle of continuous socioeconomic and industrial growth, led to incessant expansion in water demand, water supply, resource exploitation and water infrastructures (cf. Moss, 2016). At the core of this logic was an assumption that water was an unlimited resource to be subjected to human reason, technology, and needs (Gleick, 2000; Allan, 2004).

The exponential increase in water use in modern cities rendered the pre-modern wastewater management approach unsustainable (Tarr et al., 1984). Existing privy vaults and cesspools became overloaded, flowing directly to nearby streams or filling alleys with faecal waste until rainfall washed it away. Paved surfaces were extended across the modern city to improve transport and to facilitate construction, but they also had the unintended effects of impeding rainfall infiltration and altering natural drainage patterns. In wet weather, water flowed quickly over the smooth urban surfaces, generating higher volumes of runoff and causing floods and material damage. Lack of infiltration also impeded groundwater recharge. As a consequence, baseflow to nearby streams decreased and in dry weather, these streams mainly carried waste from households and industries, producing odours and sanitary concerns.

Open management of wastewater and industrial pollution made industrialised cities barely habitable. Cross-contamination of drinking water sources with wastewater caused multiple outbreaks of diseases, such as typhoid fever or cholera, that killed tens of thousands in Europe and America (Harremoës, 1999; Wolfe, 1999). In the early to mid-19th century, the dominant theory was that these diseases were transmitted through *miasma* – the pestilent odours that emanated from waste or dead bodies, and that inundated the industrialised city. In the 1840s-1850s, this belief triggered the *sanitary movement*, a new urge for 'cleanliness' that linked waste with sickness (Tarr et al., 1984). The sanitary movement – and the modern ideals of order, progress, national development, welfare, public health, and willingness for large public spending – resulted in the construction of vast sewerage network systems that conveyed waste to streams, rivers, or the sea. This technology quickly spread through Europe and North America in the late 19th century, propelled by the assumption that cities with sewerage networks would grow faster by attracting industry, workers, and investment (ibid).

During this period, hydraulic engineers gained a leading role in the design and management of water infrastructure. These professionals exalted the scientific interpretation of reality, observation, objectivity and reason, and believed that problems should be approached mathematically, quantitatively and through application of predictive models that could provide absolute certainty (Forman 2007). Imbued with this discourse, engineers and urban planners advocated the development of grandiose, rational, and city-wide plans for progress. Ironically, hydraulics and hydrology were (and mostly still are) eminently experimental disciplines that resort to trial-and-error methods, heuristics, and approximation. These methods certainly provided solutions with pragmatic validity, but were distant from the ideals of scientific inquiry (ibid).

The colossal sewage networks of the early 20th century deviated greatly from the perfect or definitive design solutions they were intended to represent. It became common practice to divert polluted streams into large, buried pipes in order to hide waste and odours from people, and to level the terrain to facilitate construction and mobility, effectively creating combined sewers that conveyed wastewater and stormwater. During the modern period, most urban streams disappeared (Novotny et al., 2010) and waste accumulated in harbours, which became endemic points of pollution, or in rivers, contaminating the water source for other cities downstream and triggering new disease outbreaks (Tarr et al., 1984; Okun, 2000). In addition, the urge for 'cleanliness' introduced new technologies, cultural norms and habits that greatly increased use of water for personal hygiene and comfort, with e.g. bathing and laundering displaying a five-fold increase compared with the pre-modern period (Shove, 2003).

As local sources of drinking water became exhausted or polluted, new infrastructures were created to transport pristine water from more distant sources, and many coastal cities built submerged sewage outlets to convey the waste farther away. However, in the early 20th century people were still dying of

typhoid fever and cholera, leading to a focus not only on the quantity, but also the quality, of drinking water (Barraqué, 2003). The first drinking water treatments and new public health policies appeared; large-scale chlorination was applied (markedly increasing life expectancy in the Western world); and the first wastewater treatment plants were constructed, notably improving the status of harbours, rivers, and lakes. Once again, however, solutions were never optimal and, up to the mid-20th century, modern cities experienced new types of waterborne diseases and eutrophication of lakes and rivers (Okun, 1996; Wolfe, 1999).

The above illustrates how modern solutions that aimed at controlling nature were not as ordered, rational, and effective as intended. This was partly because increasingly complex systems were not amenable to rigid control strategies and were in practice managed by trial-and-error (Petroski, 1996), and partly because modern solutions had unintended and increasingly complex consequences. However, the dominant narrative persisted, demanding redoubled efforts to reach higher levels of understanding, prediction, and control. This self-reinforcing pattern, whereby modernity is both the problem and also the solution, not only persists but is gaining ground (Beck et al., 2003).

The UWSs of modernity were primarily regarded as a mechanical issue, reflecting the mechanical nature of reality and confidence in technical progress. Large dams, interbasin canals, major reservoirs, and centralised pipe networks and treatment plants formed ubiquitous and homogeneous infrastructural grids, a megamachine supplying a one-size-fits-all product (one quality of drinking water, one type of wastewater) in a linear metabolism of extraction, consumption, and disposal (Kaika, 2005; Sofoulis, 2005; Tarr et al., 1984). This large-scale, capital-intensive and centralised infrastructure was both the driver and the consequence of modernity (Tarr and Dupuy, 1988; Scott, 1998). It reinforced modern values and beliefs, such as the need for centralisation in government and management; bureaucracy; professionalisation; scientific knowledge; and rational planning to control nature and society.

Regarding governance and financing, in the late 19th century Western cities experimented with different forms of public and private UWSs. Initially, water supply was offered by private companies, and they limited their activities to rich neighbourhoods since poor households lacked the capacity to pay for this service (Bakker, 2010). However, the generalisation of water supply services soon started to be seen as a prerequisite for urban progress and, following a public service ethos, municipalities were increasingly expected to ensure service provision (Kellett, 1978; Tarr et al., 1984; Bakker, 2010). Economic elites had an interest in promoting city-wide water supply services ensured by the public sector rather than private companies; such services would benefit industrial development, firefighting, and the health of workers. These elites made use of their political influence and urged municipalities to take responsibility for this expensive infrastructural development in a monopolistic fashion (Hassan, 1985). The shift from private to public service provision was also compatible with the underlying assumption of modernity, inherited from the Enlightenment, that water services were the right of all citizens. In addition, the government had democratic authority, regulatory power, and the capacity to gather the necessary knowledge, thereby contributing to the professionalisation of the service (Bakker, 2010). Finally, the assumption that needs and solutions were well-defined and undisputed (Pahl-Wostl et al., 2011) facilitated the concentration of decision making in a central agent that could rationally determine the 'right' actions to achieve the 'right' outcomes.

Turton and Meissner (2002) claim that modern governance of UWSs is based on a *Hobbesian hydrosocial contract*, as it shares many similarities with the broader social contract proposed by Thomas Hobbes in his book *Leviathan* (1651). According to the Hobbes doctrine, citizens renounce their rights and empower a central authority – a strong, bureaucratic, paternalistic government – to impose morality, truth and social order, and through strict regulation, to enforce the social collaboration that large collective projects require. In the modern water paradigm "the individual looked to government to provide for their basic needs such as water supply and sanitation, so the government responded accordingly" (Turton and Ohlsson, 1999: 19). A good example of this is the British Public Health Act of 1848, which made the government responsible for safeguarding the health of the general population,

underpinning in practice the universal and public provision of water supply and sewerage services (Okun, 1996).

Citizens were seen by the government and the water managers simply as unknowledgeable and passive clients, dissociated from the technological system and the natural context. The buried water infrastructures became inconspicuous ('out of sight, out of mind'), while the urban population was under the illusion that water supply was endless. Waste disappeared automatically ('flush and forget'); cities appeared to be fully protected against floods; seasonal fluctuations were rendered imperceptible; and there seemed to be an absence of environmental externalities (Sofoulis, 2005; Stuart, 2007).

LATE MODERNITY

In Western societies, the intense development of science and technology during the early 20th century helped to reduce natural risks, fuelled the economy and improved living standards through cheaper food, energy, building materials and water, in the process reinforcing the narratives of the power of reason, progress and mastery of nature. Despite these undeniable advances, in the 1960s there was a sense of the end of an era and the emergence of a new cultural framework, a structure of feeling that is often referred to as postmodernism (Lyotard, 1984; Jameson, 1991).

In the 1970s-1980s, postmodernism gained much popularity in academic circles, despite its multiple (and often contradictory and confusing) uses in fields like philosophy, history, arts, linguistics and sociology. However, all these uses represented a rejection of modernity's accounts of progress, and a more or less radical rupture with the core postulates of modernity and the Enlightenment (Best and Kellner, 1997).

Today, postmodernism is commonly associated with the growing social dissatisfaction and feeling of social decay in the 1960s-1970s, exemplified by social movements against war; racial, class, and gender discrimination; the AIDS pandemic; the oil crisis; the economic recession; the environmental crisis and nuclear power; or simply general disenchantment with capitalism, consumerism and the traditional institutions of modernity (Jameson, 1991). Postmodernism emerged from the major problems generated by modernity; a prevailing feeling of uncertainty, risk, absence of opportunities, injustice and, generally, decline instead of progress. Multiple social critics, feminists in particular (e.g. Haraway, 1988, 1991; Harding, 1992), claimed that the core of the problem was that, behind the ideas of emancipation, freedom, welfare and progress of modernity, there lay an elitist, white, masculine, controlling, oppressing and techno-optimist (meta)narrative of rationality, order and simplicity that endowed a ruling class with the power to impose *its* reductionist and 'objective' vision of reality through rules, norms and certain types of knowledge. Inevitably, this biased narrative – legitimated by rationality, science, and technology – produced interest-based accounts of reality, and negative consequences for the environment and marginalised groups.

While modernity promoted simple, standard and context-independent, all-embracing narratives that (arguably) formed one single objective truth, postmodernity promoted complex, contextual and situated knowledge ('small narratives'; Lyotard, 1984) that allowed for the existence of multiple perspectives about that truth. Postmodernism thus embraced a plethora of practices, logics, values, and needs that were all equally valid. It advocated heterogeneity, deconstruction and diversity, as well as the inclusion of scientific and non-scientific views, and it was preoccupied with issues of values, power and justice. In practice, postmodernism was associated with a tendency for flexibility in industrial production, labour, and the economy; such flexibility was required for innovation and adaptation to a context in constant change, and superseded the rigidity and standardisation of modernity (Harvey, 1989).

Despite the popularity of postmodernism in the late 20th century, there is a lack of consensus among scholars about when modernity ended. Indeed, scholars do not agree on whether it has ended at all. According to some sociologists, like Ulrich Beck, Anthony Giddens and Scott Lash (1994), we still live in

(late) modernity, as today's Western society is still deeply embedded in this episteme's characteristic 'ordering status'. We roughly preserve the modern systems of production and consumption, the same ways to acquire knowledge (deduction, logic, and the scientific method), and similar systems to organise time, space and social life, while other radically different systems are very difficult to imagine. Giddens (1990) argues that postmodernity does not exist in practice (i.e. there is not a *postmodern* UWS) and that it is at most an 'aesthetic reflection' of the generalised sense of disorientation resulting from the unintended consequences of modernity. In other words, for Giddens, postmodernism is just a structure of feeling and not an episteme, because modernity still is *the* episteme.

This idea of continuity with modernity has been described by Beck et al. (2003) as 'reflexive modernisation'. This refers to the radicalisation and saturation of modernity in the late 20th century, an 'abuse' of the postulates of modernity (too much order, reason, science, technology, progress, capitalism, and production) that attempts to restrict the emerging complexity using the same tools that provoked it in the first place. The multiplication of technologies, advances in communication, emergence of the information society, and growth in international trade during modernity and late modernity have made the world an increasingly diverse, interconnected, and dynamic place (Giddens, 1990; Castells, 2010), where small changes often have disproportionate and unintended effects. These include 'manufactured risks' (Giddens, 1999) and new social, environmental, and technological problems (Beck, 1992) – such as global wars, environmental catastrophes, depletion of resources, financial crises, and social and economic inequalities – that form the basis of the postmodern feeling.

The rigid and isolated categories of modernity, which sought to impose simplicity and order, eventually became ineffective for classifying, understanding and controlling the growing diversity of actors, values, needs, relationships, forms of knowledge, and technologies (Bauman, 2000). While the postmodern framework regards this growing diversity as a manifestation of the deconstruction of a modern world on the verge of collapse, the reflexive modernisation framework sees fragmentation and micro-categorisation as an unavoidable solution to the continued production of (increasingly unmanageable) order and the elimination of (ever-growing) uncertainty.

Reflexive modernisation is underpinned by a philosophy that shows some similarities to, yet differs in some critical points from, the fundamentals of modernity. In terms of similarities, both reflexive modernisation and modernity exhibit a realist ontology, which is the belief that the external world exists independently of the human mind; they assume an objective truth 'out there' that can be judged from a detached and disinterested perspective. In modernity, this realism was 'naïve', and assumed that the use of observation and reason would be sufficient to obtain a complete understanding of the (simple) world exactly 'as is'. Reflexive modernisation applies a critical realist philosophy (Bhaskar, 1975), which assumes that perfect knowledge of reality is unattainable because the complexity of this external reality is such that our empirical methods, cultural predisposition, and limited cognitive capacities will never allow us to completely understand it (Simon, 1997). We are condemned to create biased versions of reality.

Unlike naïve realism, critical realism – and by extension, reflexive modernisation – does not maintain a defence of observation and rationality. It argues that accumulation of knowledge and triangulation among multiple commensurable methods and perspectives (from multiple sciences or points of view) can bring us very close to a perfect understanding without ever attaining it (Bhaskar, 1975). One of the obsessions of reflexive modernisation is to minimise uncertainty, to cancel the risks that modernity itself has created, and to bring back certainty and control. As in modernism, reflexive modernisation is optimistic for a future of prosperity and continued growth despite limits, risks and uncertainties, but at the same time, there is a rising fear of losing the advances made so far (Giddens and Pierson, 1998).

THE LATE-MODERN UWS PARADIGM

Despite the unprecedented technological development that industrialised countries experienced during the 20th century, their urban water infrastructures did not undergo substantial intrinsic transformations

over this period. Nonetheless, the reliability of these infrastructures did improve and they showed solid expansion, markedly contributing to increased life expectancy and improved life quality. This expansion also gave rise to a diversity of interdependent actors, forms of knowledge, values, needs, services, and 'unintended consequences'. Complexity in the water sector manifested itself as new types of problems that were "multi-dimensional, multi-sectoral, and multi-regional and filled with multi-interests, multi-agendas, and multi-causes" (Biswas, 2004: 249).

The most notorious 'unintended consequences' of modernity are: the emergence of new contaminants; the depletion of water sources; environmental degradation; urban floods; the decay of infrastructures; and financial problems caused by diminishing willingness for public spending (Barraqué, 2003; Bakker, 2010; Novotny et al., 2010). These challenges did not emerge simultaneously in all Western countries; different regions were affected by their particular problems and pressures, but in general Western countries responded to the growing complexity, and the 'side-effects' of modernity, with a discursive shift from certainty to uncertainty (Allan, 2005), and an ambivalent attitude, combining modern enthusiasm and postmodern pessimism. There is, thus, an insistence (especially among practitioners) on the most fundamental modern principles – i.e. more reason and technology to control nature, top-down approaches to water management based on 'expert knowledge', and the goal of a fixed utopian future of total satisfaction of needs. There is also a feeling (especially in academic circles) of pessimism, crisis, and vulnerability that reflects the postmodern ethos. This latter view rejects standardised and all-embracing rational narratives of science, technology and universal knowledge, and instead embraces uncertainty, variety, individuality, and bottom-up approaches to water management (Franco-Torres et al., 2020a).

In the context of this ambivalence, the 'progress' of modernity mutated into the concept of '(substantive) sustainability' (Truffer et al., 2010). This refers to an optimal state of the system where consumption of natural resources equals their rate of recovery in a mechanical fashion, with flows and stocks. It still follows the linear path of modernity towards a utopian future, though this time one of optimal efficiency, null uncertainty, and elimination of risks (Hollick, 1993). It also introduced a multi-perspective vision of reality where various environmental, economic, and social needs are fulfilled once-and-for-all. This meant, for instance, that hydraulic engineering lost its absolute hegemony in favour of other disciplines, such as chemistry, biology, planning, ecology, and economics.

In the late 20th century, two of these disciplines, namely ecology and economics, gained a prominent role in the pursuit of sustainability. During the 1970s, ecological values were incorporated into water policy in most Western countries (Hajer, 1995; Gleick, 2000). From the postmodern perspective, these values represent biocentrism or ecocentrism, and challenge the modern perception of water and nature as expendable commodities (Brand and Thomas, 2013). From the perspective of reflexive modernisation, the introduction of ecological values indicates a shift from concerns about how nature can harm humans to concerns about how humans have harmed nature, triggering negative consequences for human welfare (Giddens, 2013) and motivating an even higher level of intervention and dominance of nature.

After the fever of maximisation and eternal growth that characterised the modern period, the economic sustainability of late modernity became tightly linked to the idea of efficiency, whereby limited resources should be optimised and allocated for maximal utility, in order to decouple (sustainable) growth from resources exploitation and environmental degradation (OECD, 2001). During the 1980s, the neoliberal economic logic became increasingly popular in most Western countries, where the modern style of rational resources allocation was blamed for most problems affecting the water sector, i.e. water scarcity, pollution, lack of maintenance and, generally, low performance and low economic efficiency (Bakker, 2010). The underlying argument was that the expanding complexity of UWSs exceeded the capacity of governments for rational prediction and top-down control, while the free market (the 'invisible hand' of capitalism) was a better regulatory mechanism that could automatically create an optimal order through pricing of water and water services (Chandler, 2014). Countries such as the USA, Australia and the UK adopted a New Public Management approach that resulted in widespread

privatisation of water services. Other Western countries did not opt for full privatisation but this style of management nonetheless influenced their public utilities, which followed the management model of private companies by introducing full cost pricing, property rights, economic incentives, cost-benefit analysis, decentralisation of management into independent specialist agencies (in silos), and outsourcing contracts (Bakker, 2010).

Although neoliberalism in the water sector created efficiency gains and greater interest in service provision among competing private actors, in extreme cases it also resulted in fragmentation of governance, management and infrastructure systems, eroding the (modern, Hobbesian) hydrosocial contract. It splintered the modern political consensus on large-scale strategic planning, and deprived central government of its monopolistic capacity to organise, finance and provide extended services to the entire population, eventually resulting in higher levels of inequality, service inefficiencies, conflicts of interests, and risks (Graham and Marvin, 2001).

The neoliberal approach was also disputed by other elements of the sustainability concept that exhibited a postmodern disposition. Civil groups and environmental organisations plainly rejected the neoliberal mantra of water as an economic good (cf. UN, 1992a; The World Bank, 1993), claiming instead that water is a human right and heritage with natural and cultural value. They argued that social sustainability should consider the ethical dimension, particularly the unequal distribution of social and environmental costs of new water infrastructures, which was not encompassed by market approaches or cost-benefit analysis. This postmodern approach also rejected the standard, rationally designed technical solutions, suggesting instead contextualised solutions, qualitative methods, participatory policy making, and iterative practice (Jeffrey and Gearey, 2006; Postel and Richter, 2012). For example, these principles are central to Agenda 21 (UN, 1992b), the Dublin principles for sustainable development (UN, 1992a) and the IWRM framework (GWP, 2000a).

The postmodern disposition also provoked scepticism about many other modern management tools, such as comprehensive city-wide plans, which were deemed unrealistic, inflexible, and unable to meet local and varied problems and needs (Graham and Marvin, 2001). In the previous period of modernity, there was a focus on capital-intensive solutions to support fulfilment of rational, grandiose and standardised plans, while in late modernity the focus is on knowledge-intensive solutions to tackle unique local problems through multi-perspective approaches. This is done in practice through a plethora of quantitative tools for analysis and optimisation (Hellström et al., 2000), e.g. modelling tools, cost-benefit analysis, risk assessment and key performance indicators.

Regarding infrastructure, the sustainability problems of the late 20th century are addressed in late modernity by improving efficiency, adapting to stricter environmental requirements and reducing natural risks through more advanced technological fixes, without abandoning the essence of modern infrastructures. Late-modern infrastructures are still rigid, and do not respond adaptively to complexity and uncertainty, as the latter are 'cancelled' by the certainty provided by the increasingly enhanced management tools. For example, the (economic) risk of urban floods is minimised by construction of optimised underground stormwater reservoirs; end-of-pipe pollution is brought within regulatory thresholds with the help of enhanced methods of phosphorus removal in wastewater plants; and energy-intensive desalination plants are constructed to compensate for exhaustion of conventional water sources and to cancel out climate variability. These solutions remain on the technological path of modernity in that they retain the large, linear (one-through-flows) centralised constructions, and the technocratic, standardised, deterministic design that seeks to tame nature.

However, in late modernity a postmodern opposition to this type of infrastructure has emerged in the form of 'nonconventional' alternatives (e.g. EPA, 1977). They often suggest small, decentralised, flexible, eclectic and context-dependent constructions that allegedly improve efficiency by providing locally adapted solutions that are more democratic, have lower environmental effects, and do not involve sunk costs (Pinkham, 1999; Hiessl et al., 2001; Gleick, 2003). However, their implementation has so far been

merely anecdotal, in small and dispersed demonstration projects, that rarely achieve their intended results (Larsen et al., 2016).

METAMODERNISM

While modernity as a social and cultural phenomenon is relatively well-defined and undisputed by most social theorists, postmodernism as a cultural logic still prompts widespread debates about its degree of influence, and its very existence. It is even more difficult to find any general agreement about our contemporary cultural framework. Nonetheless, in recent decades, fundamental changes in discourses about governance, management and production of infrastructures – a UWSs paradigm – have emerged from the academic arena; these changes can be traced back to an emergent structure of feeling in the 21st century.

Vermeulen and van den Akker (2010) found that the attitudes, feelings and perspectives in the arts and Western culture, which emerged at the turn of the 21st century, did not fit the mainstream characterisations of modernity or postmodernism. They suggested instead that these patterns corresponded to a new, distinct and coherent structure of feeling born in response to several tumultuous events in the new millennium, e.g. terrorism on a global scale (such as 9/11), climate change, and the 2008 financial crisis. The accelerated complexity of late modernity is yet again being manifested as unpredictable phenomena – the side-effects of reflexive modernisation. These are 'wicked' problems (Rittel and Webber, 1973), ones that are unstructured, interdependent and pervasive, in permanent transformation, and without an optimal or definitive solution. Such disruptive and unexpected events herald a new generalised perception of a dynamic and complex reality governed by "unknown unknowns" (Steffen et al., 2011), where: "[N]ot only are risks not known with certainty, but the degree of uncertainty is itself highly uncertain" (Dietz et al., 2002: 332). It could be said that the principles of modernity are once again being radicalised in such an extreme way that what they are, and what they claim to be, result in two completely opposing themes. There is renewed enthusiasm for reason, order, progress, capitalism, science and technology, but the factual reality shows such an extreme degree of fracture, complexity and dynamism that it forces any ordering system to shatter into minuscule pieces (Bauman, 2000), resulting in a society that in practice better fits a postmodernist description than modernity patterns. This ongoing fragmentation and volatility, which in the late 20th century was seen in postmodern terms as a sign of uncertainty, risk, unrest, chaos, and decline, is accepted as a natural part of life and a motivating challenge in the 21st century.

In accordance with this narrative, Vermeulen and van den Akker (2010) discerned a new structure of feeling that aims to make the growing diversity, complexity and uncertainty more manageable, while providing a new sense of ontological purpose. They called this cultural framework *metamodernism* and described it as a permanent oscillation between modernity and postmodernity. This does not mean that its predecessors have ceased to exist, but rather that metamodernism embodies continuous negotiation between these two 'contradictory' positions.

The term metamodernism has been used previously with a different meaning. In the meaning adopted by Vermeulen and van den Akker (2010), 'meta' denotes 'temporally beyond' the modern period and at the same time 'in-between' modernity and postmodernism perspectives. Similar descriptions of this metamodern structure of feeling were suggested in the late 20th century by other scholars, but they identified metamodernism as a late transformation of either modernity or postmodernism, as in the case of 'moderate postmodernism' (Best and Kellner, 1997), 'liquid modernity' (Bauman, 2000) and, most recently, the very last transformation of reflexive modernisation (Beck et al., 2003). The present analysis is based on the metamodernism described by Vermeulen and van den Akker (2010), as their idea of oscillating or interspersing between modernity and postmodernity seems to offer a coherent cultural framework for shaping the emerging paradigm of UWSs.

Metamodernism recognises that the growing complexity and uncertainty evidenced in late modernity cannot be reduced to a simpler system, objectively understood or universally optimised through reason. At the same time, it also does not suggest abandoning reason entirely. For example, in an attempt to describe a milder, more reconstructive postmodernism (here understood as metamodernism), Umberto Eco argued that the goal is "not to kill reason, but to render bad reason harmless, and to dissociate the notion of reason from that of [absolute] truth" (Eco, 1986: 126). This can be seen as an invitation to use reason pragmatically (Pierce, 2011), with the aim of revealing 'useful truths' that provisionally 'work' under certain circumstances and for certain intentions. This practical truth is the only reality that humans experience or will ever get to know.

The pragmatism of metamodernism is reflected in a new mutation of the idea of progress, modernity's core value. From being a straight line leading to (substantive) sustainability in late modernity, i.e. the point in optimal human development where all present and future needs are fulfilled, it transforms into a continuous pursuit of an elusive future, a moving target or utopia that is constantly reconfigured and ambiguously defined. In this new '(procedural) sustainability' (Kemp and Martens, 2007; Truffer et al., 2010), the process is what really matters. Practical knowledge and satisfactory solutions are discovered by means of relentless experimentation (learning by doing), while recognising that attempts to reach truth or optimality are futile.

This new interpretation supersedes the reductionist approach to sustainability, seen during late modernity, which involved optimisation of the economy, society and the environment as isolated categories, and instead focuses on hedonism and better quality of life. This might seem an anthropocentric (that is to say, modern) view of reality, but it reveals a postmodernist and complex understanding of reality where quality of life unavoidably involves the welfare of the environment in which humans are embedded. For example, a Danish environmental entrepreneur described work towards a green energy utopia in the following way: "We have small objectives all the time. We erect 11 windmills, and we have a party and drink beer. Then we build a system for district heating, and we drink beer. The small objectives are what is interesting. Not the final goal, because we will never be done" (Lie, 2019: 27).

Procedural sustainability moves back and forth between postmodernism and modernity. Postmodernism provides an awareness of ubiquitous complexity, uncertainty, ephemerality, fragmentation and dispersion. It is deconstructive, experiments continuously and triggers a certain amount of chaos, from which variety can flourish in the form of multiple categories of governance, management and infrastructures. Modernity then intervenes to 'prevent' excessive fragmentation and dispersal, integrate the diversity, and provide certainty, order, continuity, and purpose. Modernity brings the elusive future, the utopia, which gives meaning, a sense of direction, a source of enthusiasm, and becomes a social binding agent, combined with an assertive and constructive attitude (Constanza, 2000). This type of sustainability is a metamodern reconstruction that continuously creates new ad hoc objectives and categories to integrate the chaotic multiplicity. It relentlessly observes, evaluates, negotiates, experiments, transforms, and learns to fulfil an "impossible possibility". Metamodernism "seeks forever for a truth that it never expects to find" (Vermeulen and van den Akker, 2010).

THE METAMODERN UWS PARADIGM

In recent decades, there has been a progressive reduction in natural risks, improvements in efficiency, and minimisation of the most obvious environmental impacts. However, in the same way that modernity did not manage to maintain perpetual linear progress, late modernity has never achieved the perfect sustainable equilibrium. Development has triggered even more uncertainty, "manufactured risks" (Giddens, 1999), institutional fragmentation and social confrontation (Milly et al., 2008; Brown and Farrelly, 2009; Barnett and O'Neill, 2010). New problems faced by the urban water sector in the 21st century include constrained sources of financing; conflicts among regulatory policies; climate change;

depletion of water sources; a growing number of water pollutants; and the security threats of digitisation and bioterrorism.

The polarisation and ambiguity between modern and postmodern attitudes that emerged in late modernity seem to have expanded recently. The urban water literature shows dissatisfaction with the status quo, and a clear tendency to dismiss modern UWSs as completely outdated, unsustainable, and unable to meet the water challenges of the new century (e.g. Andoh et al., 2008; Hering et al., 2013; Marlow et al., 2013). However, practitioners (mostly engineers) display strong confidence in modern pathways and future technical advancements to solve all water problems. This can be read as an entrenched confrontation between, on the one hand, postmodern gloom, uncertainty, change and a commitment to diversity and flexibility, and on the other hand, modern progress, enthusiasm, technological solutionism and a commitment to robustness, continuity and optimization. Some observers (e.g. Sedlack, 2014) claim that the present situation is untenable, and that the water sector faces a bifurcation and must choose between modern continuity and postmodern disruption.

Metamodernism offers a new approach to this dilemma: oscillation between the modern and the postmodern. The contemporary (metamodern) discourse of the water sector seems not to reject modern social structures in their totality, but rather promotes their coexistence and hybridisation with postmodern alternatives (Ferguson et al., 2013; Coutard and Rutherford, 2015). Moreover, the sector seems to perform adequately in its fusion of pessimism and enthusiasm.

The metamodern approach, which with careful analysis can be observed at multiple levels of UWSs, acknowledges the uniqueness and heterogeneity of individual elements of the system, and also their integrated behaviour. In modernity, the focus was on *bundling* water services, actors, processes, rules, knowledge, technologies, infrastructures and flows according to predefined standard categories. In late modernity the categories multiplied, became fragmented, confronted, and *unbundled*. Now, metamodernism promotes *rebundling* those (still independent and continuously multiplying) pieces in a myriad of possible customisations that pragmatically fit particular circumstances and needs (Figure 2).

In late modernity, the number of public, private and civil actors multiplied in the urban water sector, and they became increasingly interdependent. This trend continues today, and it is increasingly difficult to achieve satisfactory institutional arrangements. Therefore, in the 21st century, it is often claimed that water crises are mainly crises of governance (GWP, 2000b; UN, 2003; OECD, 2011), requiring collaboration-intensive approaches that fairly integrate multiple needs, values, beliefs, and worldviews. Metamodern governance of UWSs responds to institutional fragmentation by 'oscillating' between the vertical/hierarchical structures of modernity, the horizontal/network/participatory modes of postmodernism, and the market logic of late modernity, producing a new kind of UWS governance called 'hybrid governance' (van de Meene et al., 2011; Gupta et al., 2015) or 'polycentric governance' (Ostrom, 2010). In this approach to governance, formal government does not disappear, and the sector does not become completely privatized. Rather, the public/private dichotomy becomes less distinct, new actors continuously emerge, and formal government acquires a softer role, becoming a supervisor, an umpire, a gatekeeper, a motivator, or an integrator of a diversified network of rebundled actors. This institutional arrangement corresponds to what Turton and Meissner call the *Lockean hydrosocial contract*, where "the rulers are merely the trustees of people" (2002: 18) and participatory processes guarantee the fulfilment of their water rights.

Figure 2. In modernity, UWSs were bundled as a homogeneous and simple whole. In late modernity, UWSs were unbundled into a variety of elements that competed with the traditional modern configuration (large grey circle). Metamodernism suggests rebundling elements in an infinite number of possible cluster configurations that hybridise with more traditional modern structures to adapt to particular circumstances and needs.



Formal government acquires an integrative role that involves facilitating the creation of collaborative governance networks, offering direction, and providing certainty by establishing clear institutional frameworks. For example, re-municipalisation of water utilities is a growing trend (Kishimoto et al., 2015; McDonald, 2018), underpinned by the integrative need, and emerging aspirations to social and environmental justice that compete with, and often eclipse, the logic of cost minimisation (Lobina, 2017). The 'ambiguous utopias' of metamodernism – such as sustainability, resilience, liveability, climate change adaptation or even the water-sensitive city – are further rebundling elements of these governance networks; they provide compatible meanings to complex problems and coalesce disparate interests, needs and values (Franco-Torres et al., 2020b).

Metamodern management acknowledges a diversity of needs and the complexity, fluidity, and uncertainty of reality. It seeks no 'silver bullets' or 'right' answers, but searches instead for pragmatic solutions that are 'satisfactory' under particular circumstances. These solutions are identified by experimentation and learning in partnership with multiple social actors and with nature, and involve rebundling multiple sources of knowledge (multiple disciplines, mixed inquiry methods, objective and subjective knowledge, explicit and tacit knowledge), disparate models and decision-making tools (predictive and non-predictive, quantitative and qualitative), and multiple partial measures (technical, educational, economic, regulatory).

Metamodernism does not completely reject the approaches to risk and optimisation held in late modernity, such as probabilistic risk evaluations, life-cycle analysis or cost-benefit analysis, but neither does it view them as 'machines of truth'. Instead, metamodernism considers these approaches as admittedly unreal constructions treated 'as-if they were real', "a kind of informed naivety, a pragmatic

idealism" (Vermeulen and van den Akker, 2010). They function as heuristic devices that help shape the problem at hand, design testable solutions, take decisions, and keep moving forward towards utopia.

Metamodern management exhibits a clear systemic approach that builds internal coherence and reinforces the integration of UWSs with their contexts. It combines the isolated solutions of modernity that extract resources and deliver waste in a linear fashion with local solutions of circular management, and promotes the reuse, recycling and upcycling of water, nutrients and energy. Metamodern management emphasises integration with the natural environment through the concept of 'ecosystem services' (MEA, 2005), and the adaptation of UWSs to natural processes and structures, instead of aiming to control them. Integration with the social environment is emphasised through maintaining awareness of water in all urban development, e.g. stormwater is viewed as a valuable social, economic and ecological element, instead of a waste that must be quickly removed.

The metamodern infrastructure of UWSs is also a rebundling of standard modern infrastructures and an emerging multiplicity of alternatives. There are still large, conventional centralised infrastructures like pipe networks, reservoirs and large water treatment plants, which provide robustness, stability, and integration. These are combined with diverse, small, decentralised infrastructures like rainwater tanks, infiltrating pavements and user-scale water treatment plants, which provide local adaptability and multiple functions (e.g. Saurí and Palau-Rof, 2017; Tortajada et al., 2017). Thus hard/grey elements made from metal and concrete co-exist with natural/green elements that benefit from ecosystem services, like swales, infiltration ponds, or small streams.

While the individual infrastructure elements are locally adapted, they are also part of a large ecosystem of infrastructures that effectively covers the cityscape and works as a living system. This ecosystem involves a wide range of modular solutions at multiple scales that complement and compete with each other; provide several levels of redundancy and risk protection; are flexible enough to adapt to continuous change; and contribute simultaneously to a range of tailored functions. These modular solutions manage water volumes, purify water, regulate the urban temperature, support biodiversity, and create attractive recreational spaces. They form a network that is in constant transformation and renewal, simultaneously ephemeral and eternal, relentlessly experimenting and adapting to new technologies, new needs, and continual disruptions. It is a living part of the city, unashamedly visible (Mitchell and Campbell, 2004), that blends synergistically with its environment and all other societal services.

DISCUSSION AND CONCLUSIONS

This paper describes how the UWS paradigm, with their characteristic modes of governance, styles of management and types of infrastructures, has evolved in Western countries during the past two centuries, and how it reflects different underlying cultural frameworks that exist on a wider social scale.

Identification of UWS paradigms and societal cultural frameworks is not new; e.g. Swyngedouw (1999), Kaika (2005) and Bakker (2010) have formulated clear descriptions of modern water management, while Allan (2004) has described an evolution through modernity and late modernity. However, the influence of postmodernism in the UWS paradigm is only barely mentioned by authors like Sofoulis (2015), Pahl-Wostl et al. (2011) and Jeffrey and Gearey (2006), and to my knowledge, no previous study has provided a sound and coherent description of the emerging water paradigm as a reflection of a nascent cultural framework – here called metamodernism. I argue that this new cultural framework is represented in UWSs as an oscillation between the order, simplicity and assertiveness of modernity and the eclecticism, fluidity and uncertainty of postmodernism, opening the way for innovative methodological approaches like pragmatism, flexibility, distribution, and experimentation in UWSs.

Viewing transformations in UWSs (or any other societal service) in relation to underlying beliefs, values and feelings of an epoch can serve as a critical reflection exercise for practitioners. Understanding

how framings of reality determine choices and, ultimately, have tangible effects on reality – or recognising that an inherited paradigm may be outdated for dealing with emerging challenges – should be part of basic professional education, prompting practitioners to select alternative solutions.

At a systemic level, cultivating awareness of cultural frameworks and paradigms may serve to accelerate transition towards more sustainable futures, and also create the very possibility of their existence, because 'natural/unconscious' evolution into a future better than modernity should not be taken for granted. UWSs are still eminently modern and metamodernism is merely a structure of feeling; that is, an emerging way of thinking that continuously challenges the hegemonic late-modern paradigm, becoming visible in ambivalent or contradictory infrastructures and social structures that often drift away from sustainability, instead of approaching it. Therefore, instead of following a predetermined path to sustainability, there is a risk of the late-modern UWS paradigm becoming entrenched or deteriorating.

Even if the metamodern UWS presented in this paper eventually becomes the dominant paradigm, it is important to avoid the trap of regarding metamodernism as the ultimate cultural framework bringing us to the climax of social development (cf. Fukuyama, 1992). Metamodernism is inherently maladapted to future development because it is emerging as a response to past and present problems, not future problems. Yet another cultural framework will emerge to correct the problems that metamodernism will generate, but that we are currently unable to perceive. Meanwhile, it may be useful to continue exploring and understanding metamodernism in order to orient its capabilities towards more sustainable UWSs.

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