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Technology and Epistemology: Environmental Mentalities and Urban Water Usage

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ABSTRACT

This paper examines the mentalities associated with the transformation of 'nature' into urban life in industrial societies, with particular reference to the conversion of rainwater into tap water. It argues that industrial technologies dissociate urban dwellers from the natural environment upon which they depend. The paper maintains that this dissociation has contributed to mentalities encouraging the depletion and degradation of water resources and critically examines technological strategies for managing urban water use. The paper argues that epistemological systems must be reformed in conjunction with changing technological systems before environmental management strategies are likely to succeed. It concludes by suggesting ways in which urban water provision could be transformed so as to encourage greater ecological awareness and activism.

KEYWORDS

Urban, water, technology, epistemology

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For the most part, solutions to environmental problems are approached from technological perspectives. Previous contributions to *Environmental Values* have critically examined this paradigm, arguing that renewed attention must be paid to the social context of our technological 'fixes'.[1] For example, Joan Hoffman observes the failure of engineering a solution to New York's water provision without due attention to the socio-economic conditions of the Catskill/Delaware catchment.[2] Likewise, Annelie Sjolander-Lindqvist analyses the problems associated with using technological discourses to prevent or manage the consequences of groundwater contamination.[3] Both authors conclude that social context and local understanding must be engaged as part of any environmental 'solution'. Following from these thought-provoking essays, this article also affirms the need for attention to the social context of our technologies. In particular, the article examines the need for a new technological approach that fosters local consciousness of environment, and which might then encourage a broader ecological perspective. The article builds upon the work of urban political ecologist Erik Swyngedouw to interrogate the 'naturalisation' of water in our cities, and critically examines ecosophical paths to 'reconnection' with 'nature', before suggesting some positive strategies.

Since the invention of the most basic stone tools, our technologies have been used to transform nature into the range of products required to sustain our civilisations. In industrial societies, our technologies are used to transform trees into paper, bauxite into cans, and rain into potable water. Using a dialectical analysis of the urban metabolism of nature from which both society and nature itself evolve, Erik Swyngedouw has provided much insight into complexities of the relationship between nature and society.[4] In particular, he postulates that technological networks 'are the mediations through which the perpetual process of transformation of nature into city takes place'.[5] Thus nature is transformed to meet human needs, while market and regulatory mechanisms price these products for human consumption – converting natural resources into products, which enter the market as commodities. The conversion of rainwater into tap water is one example of such a transformation. Although, in most countries, the production of water is still heavily subsidised by government, water is slowly entering the market – becoming a tradable commodity rather than a good available free to all.[6] Thus streams are diverted from nature, treated to be potable, standardised, and sold as a commodity for domestic, industrial and agricultural purposes: 'water enters one end of the network as H_20 and subsequently undergoes a chemical and social transformation to end up at the other end (the tap) as potable water, as a commodity properly priced and treated'.[7]

There is a large body of literature that establishes that the development of industrial technology has grown in tandem with a dualistic epistemology divorcing societies from their natural environment.[8] As Alan Irwin points out, 'the natural world – almost by definition – is regarded as asocial and external to human life'.[9] Our technologies are developed as a means of enabling civilisa-

tion to control and externalise its environment[10] – 'liberating' people from the 'limitations' of natural cycles.[11] For example, water is 'captured' in dams and transported through concrete channels to feed the ever-increasing demands of urban dwellers and the industrial economy, irrespective of seasonal variation. The industrial world is one in which 'emancipation resides in connecting to technological networks'[12] – with water provided at the twist of a tap. Engineering projects, including dams, channels and reservoirs, embody a Cornucopian dream of technological progress[13] – a dream in which human feats of engineering subdue nature, control the 'environment', and manipulate natural 'resources' to human ends.

Both Maria Kaika and Erik Swyngedouw have suggested that nineteenth century water infrastructure took a 'festishistic' form, located prominently in the cityscape and attracting visitors to marvel at what was seen as the physical embodiment of technological and material advancement.[14] But during the twentieth century, these marvels of technological progress were dug underground, and in so doing water as commodity was 'naturalised' within our cities.[15] Since the early twentieth century, in most industrialised cities, water will simply appear from a tap, 'as if it had always been there,'[16] the infrastructure that provided it hidden, 'opaque, invisible, disappearing underground, locked into pipes… conduits, tubes, passages'.[17] Following Marx, Kaika and Swyngedouw describe this 'naturalisation' as a process of 'commodity festishisation', in which the productive context of urban water has been obscured.[18] Although Kaika and Swyngedouw allude briefly to the important ecological and social consequences of this 'fetishisation',[19] these ramifications are far reaching and deserving of further exploration. The remainder of this article will tease out important ecological consequences of water's 'naturalisation' in our cities, as well as strategies for regaining connectedness with the 'natural' source of 'water as a commodity' – a connectedness which offers hope of a broader revolution in ecological mentalities.

It has been postulated that urban water infrastructure allows people to 'take water for granted' – lulling 'consumers' into a sense of complacency: 'we turn on a tap, and there it is. Fresh, cold, ready to drink'.[20] Indeed, various studies have confirmed that most householders have little conception of the amount of water that they use for everyday purposes.[21] So while many urban dwellers may be conscious of water scarcity, rain is often greeted with dismay because the urban water infrastructure provides an alternative 'illusion of abundance'[22] – enabling twenty-four hour access to clean and potable water, seven days a week. As the United Nations Environment Programme points out 'the links between individual lifestyles… [and] the use of resources… are not widely understood. Many people simply do not see how changing their behaviour would help others.'[23]

Just as 'water as commodity' is naturalised in the household, so too are the range of products dependent on water for their manufacture. The processes that

sustain the industrial economy require massive quantities of water. In Australia, both sugar and cotton require over 1000L of water per dollar of product, while one dollar's worth of rice requires an astonishing 7459L of water.[24] Manufacturing the average car requires more than fifty times its weight in water.[25] In fact, it has been shown that, when considering embodied water, direct water use accounts for only 11% of an Australian household's total water budget.[26] Igor Kopytoff, in his insightful analysis of the cultural process of commodification, claims that every commodity has a 'biography', including where it came from and who made it.[27] Yet most consumers have little awareness of the volume of water required for the production of common household goods. Wendell Berry describes a culture that 'naturalises' commodities in this way as 'a culture of the one night stand'. He writes that, 'the global economy institutionalises a global ignorance, in which… the histories of all products will be lost'.[28] A culture that severs commodities from their biographies or histories obscures water's role in production processes and thus cultivates an ignorance of associated environmental damage.[29]

The environmental damage that accompanies the productive use of water is primarily related to its employment as a 'vehicle' for waste – using it to flush industrial and agricultural wastes into sewage systems, and subsequently turning water itself into 'waste'. Industrial processes allow us to relegate our wastes to a 'somewhere' or an 'elsewhere', hidden from consumer consciousness.[30] The urban water infrastructure and cultural practices that have grown with our technology teach industrial people that the primary use for water is to flush away our wastes. And so the industrial economy constructs its mirage of water abundance at the same time as it teaches that we may throw-away or flush 'out of sight and out of mind'.[31] It is therefore not only the link between water and its source environment, nor the link between water and consumer products that become obscured by urban life, but also the link between water and its waste counterpart. As David Suzuki contends, in the urban environment, 'the source of our water and energy and the destination of our garbage and our sewage become distant and obscured'.[32]

But wastes cannot be flushed 'out of sight and out of mind' without consequence. As Hawken et al. argue, 'the planet is not growing, so the 'somewheres' and 'elsewheres'', the places we flush our wastes, will always be with us.[33] Indeed, wastewater disposal can have a serious effect on water systems. One of the primary outputs of wastewater treatment plants is toxic sludge, while outfalls contain significant amounts of nitrogen and phosphorus, potentially resulting in the eutrophication of inland waters and excessive phytoplankton growth in coastal systems. Despite the contemporary 'mirage' of water abundance, shortages resulting from both the contamination and depletion of water resources are becoming a pressing global issue – exacerbated by the very infrastructure of our industrial progress. Both agricultural clearing and urban paving aggravate shortages by increasing the flow of fresh water to the ocean at the same time as

they decrease the absorption of rain to the water table.[34] As Paul Sears points out, 'we have the phenomenon of a technological culture whose demand for water is steadily rising at the same time that its processes accelerate the return of water to the sea'.[35] Thus industrial societies demonstrate increasing demand for water, while simultaneously dissociating water from its source – allowing people to consume and expel without awareness of consequence.

Solutions to water shortages have primarily been sought within the realm of science and technology, without appealing to consumer consciousness.[36] In particular, there have been myriad technologies invented to preserve water resources by reusing or recycling wastewater. In fact, many environmental engineers propose that industrial processes should emulate biological systems.[37] For the most part, biological systems do not 'waste', but instead use by-products to sustain further growth. By way of contrast, most industrial systems produce by-products that are so voluminous or so toxic that they cannot be assimilated by the earth's ecosystems, and therefore become pollution.[38] Environmental engineers argue that reusing by-products such as sewage can minimise pollution by closing industrial process loops. In fact, many treatment facilities are already investigating the potential of selling sewage for agricultural or industrial purposes, while some urban centres are establishing managed aquifer recharge projects.[39] In addition to the reuse or recycling of water, environmentalists have called for more water-efficient technologies to limit the urban burden on water supplies, while several cities have embarked on large-scale seawater desalination projects.[40]

Annelie Sjolander-Lindqvist provides an insightful analysis of the clash of scientific-technological discourses (techne) with cultural understandings (metis) in managing the issues associated with groundwater contamination.[41] Through a process of targeted interviews and discourse analysis, Sjolander-Lindqvist establishes that the dominant scientific discourses of 'experts' and 'administrators' have a tendency toward 'objectification' and categorisation of the natural world, while local communities instead reveal a tendency toward personal identification and ethical consideration.[42] These local communities demonstrate an emotional response to disappearing wetlands and contaminated groundwater not evident in the discourse of techne. Sjolander-Lindqvist's proposition has important ramifications for the engineering of urban water infrastructure. Constructed from within the discourse of techne, our centralised solutions to water shortages, such as desalination and recycling plants, are largely invisible to consumers, contributing to the disconnection of communities from their resource use and the marginalisation of metis. And even where localised water-efficient technologies have been popularised, these appliances have a tendency to 'automate' environmental improvements – saving water without requiring awareness of its use. As Ursula Franklin writes, machines can create 'only one way of doing "it"'[43] – transferring responsibility for resource use to a machine. In fact, by internalising resource efficiencies, environmental technology can negate the need

for conscious decision-making.[44] Thus techne contributes to the 'naturalisation' of water and the redundancy of metis.

A growing contingent of environmentalists are critical of this technological approach to conservation – arguing that protecting water resources cannot be achieved simply by 'tinkering with [societies'] minor technical bases',[45] but must also involve ecological consciousness and local decision-making, what Sjolander-Lindqvist describes as metis. These 'critical' voices form a counterpoint to the mainstream chorus of environmental 'reformists', with their focus on technology, science and management.[46] In fact, many thinkers from this 'critical' school argue that our current paradigm of centralised scientific and technological problem solving is, in fact, partly responsible for our current ecological predicament.[47] Rather than simply looking to technological innovation, they argue that we need to interrogate our social structures and institutions. They call for a new awareness of our resource use and a new ethical relationship to nature.

There is a large and steadily growing body of 'ecosophical' literature dealing with this 'reconnection' with 'nature'. In fact, Norwegian ecophilosopher, Arne Naess, coined the terms 'deep ecology' and 'ecosophy' to refer to a new ecological ethic, or 'earth wisdom', promoting the relational nature of all life, including the interdependence of human beings and nature.[48] Concurrently, Naess argued passionately that we must undo our 'master-slave' relationship with the natural world in favour of an alliance with life on earth.[49] As part of his 'ecosophy', Naess promoted the idea of the 'ecological self'[50] - a self that is constructed in relationship and connection rather than in antagonism and separation from the natural world.[51] Rather than looking to technology to solve our entrenched environmental problems, Naess believed that a new ecological ethic, supporting the intrinsic value of all life in its richness, diversity and interconnectedness, was imperative in moving toward sustainability.[52]

The insights of ecosophy are important, for the challenges of sustainability can only be fully met by social transformation and through a new understanding of our dialectical relationship with nature. But although ecosophy seeks to unravel the traditional dualism between nature and society by critiquing scientistic discourse and its objectification of nature, ecophilosophers themselves tend to reify wildnerness.[53] Ecophilosophers, for so long focussed on the importance of the human bond with 'wild nature', must begin to engage with 'urban nature' and technological change. Indeed, Naess himself acknowledged that epistemological change could only occur hand-in-hand with change in techno-economic systems: 'value priorities are socially and economically anchored, and changes in these priorities continuously interplay with other changes in a boundless, dynamic whole.'[54]

But while Naess made the dialectical relationship between epistemological and material processes clear in his own writing, there has been little elaboration within ecosophical literature regarding the ways in which technological systems can be utilised to encourage change in 'consciousness'. If its central tenets are

to have bearing on the future of our societies, ecophilosophy must reverse its 'anti-technology' stance. It is not helpful for ecophilosophers to 'wish-away' the architecture of the industrial city, for our technologies are central in constructing both our cultural and physical relationship with our environment and will therefore be vital in reducing the impact of human consumption on water systems. To truly contribute to a new 'worldview', more ecosophers must begin to engage with techno-economic systems and their architects – beginning with engineers, economists and policy-makers. Instead of using our modern technologies to assert 'autonomy' or dominance over the natural world, can we instead use them to build recognition and a sense of affiliation?

From a position of resource awareness, there is in fact vast potential for technology to foster recognition of interdependence with the natural world. Infrastructural change and creative technology can be a vital tool for transforming not only the urban metabolism but also the industrial epistemology. As Frank Fisher argues, when technology is recognised as a system that constructs our relationship with nature, it can be used in a reflexive and dialectical fashion 'that incorporates us actively' into sustainability.[55] Rather than automating or 'naturalising' consumption, innovative technology can be used to encourage ecological consciousness and reconstruct our relationship with water – fostering 'in the built environment all our tattered valuational connection with healthy natural process'.[56]

The cyclical industrial processes advocated by many environmental engineers represent an especially valuable means of reconstructing our cities' relationship with their 'environment' and their wastes. When wastewater technologies are used reflexively, rather than automating our responses, they have the capacity to transform the social relationship to water and waste. Importantly, grey water technologies, when introduced into communities, contrast with the existing infrastructure – sparking interest as well as potentially provoking resource awareness and thoughtful use. Wastewater reuse therefore not only saves water and minimises pollution, but also re-values water as a precious gift and demonstrates that 'wastes' cannot be flushed out of existence, but can be redefined as assets.[57] Thus, cyclical industrial processes, such as wastewater reuse, when used with appropriate social awareness strategies, provide an important means of reconstructing the social relationship with water and waste at an epistemological as well as a technological level.

Reflexive use of sustainable infrastructure can also connect people to water's environmental source. In particular, water harvesting technology, at the local level, has the potential to teach us that rain is a vital and life-giving gift,[58] rather than a nuisance. Currently stormwater infrastructure constructs water as devoid of value – captured in storm water drains and channelled to the ocean where it can neither sustain human life nor replenish groundwater.[59] It is possible, however, for users to harvest rain in tanks, or for communities to retain water through de-sealing or the construction of water retention basins. Rather than relying upon

'distant' bureaucracies to capture water at remote catchments, local harvesting of rain in our urban centres can actively engage people with water's environmental source. When infrastructure is overt, locally owned, or contrasts with mainstream water infrastructure, it has the potential to short-circuit the automatic use of water – teaching awareness of consumption, the value of local rainfall, and respect for water – reminding us of water's origin. Similarly, stormwater infrastructure reform, including aquifer recharge and the establishment of water retention basins, de-sealed or green places in our cities, can teach the value of water to the wider web of life, rather than placing it simply as a resource for human consumption. Thus infrastructure has the potential to construct both a new urban metabolism and a new relationship with rain.

To some extent, government authorities in conjunction with private developers have already been successful in establishing sustainable infrastructure in our urban landscapes. A number of Australian cities have subsidised or legislated for the incorporation of rainwater tanks in new homes,[60] while water sensitive urban design, including stormwater retention basins, water harvesting and wastewater reuse infrastructure, is also becoming apparent in the cityscape.[61] But rather than simply ensuring that this infrastructure is effective in an engineering sense, authorities must also ensure that it 'works' in a social sense[62] – provoking resource awareness and ecological consciousness.

Defamiliarisation of infrastructure is central to encouraging ecological consciousness – ensuring that infrastructure is no longer 'hidden' and thus 'naturalised' within the urban landscape. Already, wind turbines have proved a popular site for visitors to learn about renewable energy. Sustainable water infrastructure, such as wastewater recycling plants or sites for biofiltration of stormwater, offer the same potential. Returning infrastructure to a position of prominence within the urban landscape, rather than contributing to its 'festishisation', would, in conjunction with appropriate interpretive material, help connect citizens with the ecological context of their water supply. Rather than constructing our water infrastructure as a 'fetish' embodiment of human power over nature, we must instead learn to build technology that represents and communicates our interdependence and affiliation with the natural world.

Incorporation of appropriate interpretative material and educational programs into sustainable technology is a vital part of encouraging ecological mentalities. While some authorities already provide interpretative materials and demonstration technology, for the most part these educational programs focus on communicating the science of water management, without conveying the important cultural implications of technique.[63] Educational programs must begin to teach communities about their social nexus with the environment – revaluing wastes as assets, reinterpreting both stormwater and wastewater as important ecological and cultural assets. By designing educational material to teach the social context of water infrastructure, authorities can begin to encourage a new epistemology of interconnectedness with nature.

Fostering community involvement and awareness through decentralisation and community-based technology is also critical to building a sense of interdependence with environment. Locally based technology demands interaction with the community, challenging what Sjolander-Lindqvist describes as 'the social unquestioning of technologically reproduced knowledge'.[64] Many nations now recognise the importance of decentralisation and direct community participation in environmental management.[65] In fact, Marcus Lane asserts that 'some sixty countries around the world have pursued decentralisation as a means of improving governance across a range of policy sectors, including environmental management'.[66] Decentralisation of natural resource management to the regional level has thus been advanced as an effective means of engaging communities with environment.[67] In addition, the institutionalisation of participatory processes or 'neighbourhood associations' to debate issues associated with water infrastructure has been shown to be an effective way of engaging communities with political process and with the environmental context of their resource provision.[68]

Connecting consumers to their resource use is by no means a perfect solution to our water shortages. Our 'metabolism' of nature will always be subject to the limitations of our cultured understandings of 'environment' – with some degree of unforeseen ecological degradation necessarily a consequence. However, the creation of greater resource awareness among citizens is a vital part of ensuring that our urban 'metabolism' of nature occurs in the most sustainable manner possible. Connecting consumption with its environmental context will be important in changing individual resource consumption patterns. But community engagement with political process will be by far the most important consequence of a new epistemology of ecological engagement.

In most industrial nations, domestic water consumption accounts for a relatively small proportion of total use. For example in Australia, domestic water consumption represents only 11% of the nation's total water use.[69] Changing agricultural and industrial water consumption practices is paramount, with appropriate policy incentives for achieving efficiencies in these sectors a priority. Political will to achieve strengthened water policy necessarily arises from community demand. It is here that the nexus between local implementation of water conservation technology and broader political action for sustainability is crucial. In engaging citizens with environment, strategies of defamiliarisation, interpretation and decentralisation of our local water infrastructure have the potential to inspire broad-based political activism. Rather than simply 'thinking globally and acting locally', we must also begin to 'think locally' and 'act globally' – engaging politically from a new sense of ecological interconnectedness. New mentalities recognising our interdependence with environment, strengthened grass roots activism, and powerful local voices will be vital in demanding national and international action for sustainability.

The multitude of environmental issues confronting industrial society does not begin and end with water. But water can be seen as a useful 'reference point' for

recognising society's interplay with nature. Water is not only a vital economic product, but also an important 'symbolic' good – a 'cleansing' or 'purifying' substance[70], the 'wellspring of life'. This symbology represents a crucial cultural 'tool' for the environmental movement. People have a deep-seated cultural connection with water, and its depletion is an environmental issue that is easily made apparent. Unlike energy (a somewhat nebulous entity) water is tangible and ubiquitous, something we see and use every day. This ubiquity, tangibility and symbology provide important means for connecting communities with the importance of healthy water systems. Furthermore, connection with the environmental source of 'water as a commodity' can be seen as a useful starting point for recognising our interdependence with other biophysical systems – thus mainstreaming conservation beyond 'environmental' activism and creating a legitimate political movement for sustainability. Already the 'mirage' of water abundance is beginning to fade, inspiring political action for conservation. The 'thinking locally' stimulated by a grey-water scheme could lead to the 'acting globally' for a sustainable world.

NOTES

[1] Hoffman 2005; Sjolander-Lindqvist 2005.

[2] Hoffman 2005.

[3] Sjolander-Lindqvist 2005.

[4] Swyngedouw 1999; Kaika and Swyngedouw 2000; Swyngedouw 2003; Swyngedouw 2006.

[5] Kaika and Swyngedouw 2000: 120.

[6] Igor Kopytoff notes a certain class of 'thing' so common as to be considered worthless and thus *beneath* the 'sphere of exchange'. He also describes another class of 'thing' considered sacred and thus *beyond* the 'sphere of exchange' (Kopytoff 1986: 74). Throughout history, water has been considered both ubiquitous and worthless, as well as sacred and priceless. This condition of being both '*beneath'* the 'sphere of exchange' and simultaneously '*beyond'* the 'sphere of exchange' gives rise to conflict over water's commoditisation. It would appear, however, that as shortages have arisen, so too, has water slowly entered the 'sphere' of tradable commodities.

[7] Kaika and Swyngedouw 2000*:* 124.

[8] Irwin 2001; Naess 1989; Roszak 1995; Swyngedouw 2003.

[9] Irwin 2001: 3.

[10] Glendinning 1995: 49.

[11] Irwin 2001: 6.

[12] Kaika and Swyngedouw 2000: 124

[13] Ibid.: 125–130.

[14] Ibid.*;* Kaika 2006.

[15] Kaika and Swngedouw 2006: 134.

[16] Ibid.: 123.
[17] Ibid.
[18] Ibid.; Swyngedouw 2002.
[19] Kaika and Swyngedouw 2000; Swyngedouw 2003.
[20] Postel 1997: 11.
[21] Lant 1993: 87; Trumbo et al. 1999: 1269.
[22] Suzuki 1998: 186.
[23] International Union for Conservation of Nature and Natural Resources, United Nations Environment Programme and the World Wide Fund for Nature 1991: 52.
[24] ABS 2002.
[25] Postel 1997: 190.
[26] ABS 2002.
[27] Kopytoff 1986: 66
[28] Berry 1998: 30.
[29] Soper 1996: 87.
[30] Hawken, Lovins and Lovins 1999: 6.
[31] Prakesh and Richardson 1999: 67.
[32] Suzuki 1998: 28.
[33] Hawken, Lovins and Lovins 1999: 7.
[34] Sears 1956: 479.
[35] Ibid.
[36] Geller, Winett, and Everett 1982: x; Brown 2004: 111.
[37] Hawken, Lovins and Lovins 1999; Lyle 1999.
[38] Lyle 1999: 154.
[39] Melbourne Water 2004; Water Corporation 2005.
[40] Water Corporation 2007; Sydney Water 2007.
[41] Sjolander-Lindqvist 2005.
[42] Ibid.: 231.
[43] Franklin 1990: 24.
[44] OECD 2002: 87.
[45] Foster 1993*:* 121.
[46] Elliott 1998: 242–256.
[47] Ibid.: 252.
[48] Naess 1989.
[49] Ibid.
[50] Naess 1986.
[51] Barrows 1995: 108; di Zenega 1997; Macy 1995: 253-4; Roszak 1995: 13.
[52] Naess 1989: 29.
[53] Greenway 1995; Harper 1995.
[54] Naess 1989: 24.
[55] Fisher 1992*:* 6.

[56] Kellert 1999: 47.

[57] Costner 1986: 4.

[58] Mobbs 1998: 67.

[59] Lyle 1999: 153.

[60] South Australian Government 2007; Gold Coast City Council 2007.

[61] WSUD in the Sydney Region 2006.

[62] Naess 1989: 94.

[63] For example, see Melbourne Water 2007.

[64] Sjolander-Lindqvist 2005: 235.

[65] Warren 2003

[66] Lane 2006.

[67] Ibid.

[68] Putnam and Feldstein 2003.

[69] ABS 2006.

[70] Illich 1986.

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