World Engineering Day Celebrations
WFEO Young Engineers/Future Leaders
Webinar: Smart Sustainable Communities and Frontier Technologies
2023 Theme: Engineering Innovation for A More Resilient World

The *Fuzzier* Frontiers of Technology

Dr Fadi Shayya
Assistant Professor in Architecture & Urbanism, The University of Salford, UK

Abstract
This contribution argues for *grounding* Frontier Technologies (FTs) as sociotechnical associations. It highlights the techno- and anthropo-centric faith in FTs and challenges the notion of FTs as technological prescriptions. It offers an alternative approach for developing a relational thinking framework about technics – or technical thought, rather than technology.

Intro
Thank you, dear Firas, for the invitation. It is such a pleasure being with my esteemed colleagues here today.

Technics and Associations
I will situate my contribution to this panel within two parameters: first, as a direct response to the panel's topic on Frontier Technologies, or FTs; and second, relational to my present community of concern and field of impact as a practitioner-turned-educator, which are the students and researchers of the built environment.

I am cautious with using the word technology, let alone adding the *frontier* descriptor. Inspired by the work of Philosopher Gilbert Simondon[1], I ask my students to differentiate the static notion of technology, i.e., the ensembles available to us at a given time, from the more dynamic and useful concept of *technics*, i.e., the technical thought associated with specific energy eras: artisanal in the 18th century, thermodynamic in the 19th century, electrotechnics in the early-20th century, nuclear in the mid-20th century, and electro-metallurgic in the late-20th century[2]. Take the following example: "The smoke and smog of the nineteenth century can be understood as by-products of what Simondon periodises as a 'thermodynamic era', where factory machines were concerned with efficiency and located close to the sources of energy from coal. In contrast, the technics of twenty-first-century digital representations of clouds, smoke, fumes, and plumes are grounded in Simondon's 'electrometallurgic era', where computational processing capacities – of personal computers and data centres – rely on the thermal resistance, voltage regulation and amplification of silicon-metal transistors"[3].

---

[1] (Shayya, 2021)
[2] (Simondon, 1958/2017)
[3] (Shayya & Walker, 2021, p. 210)

Simondon has so powerfully articulated that technics – or technical thought – change relational to energy eras, and with it, the technical objects of that era where humans become potentiality that *participates in* the potentiality of technical objects. In this light, Simondon's philosophy *grounds* humans and technical objects in their environments and each other. We can understand technical objects as "technical beings" whose "mode of existence" is ontologically equal to human/living beings[4], where both come-into-being through their associations with their environments[5].

Technical thought then becomes a framework to understand technical progress in relation to contemporary energy eras and as grounded in specific environments. And humans are no more in control of nature or the enslavers of machines, but rather the *associates* of technical objects.

Pedagogical Notes

At the University of Salford, my colleagues and I are currently working with our postgraduates on translating the priority actions of the COP26 Breakthrough Agenda from a global "master plan [for accelerating] decarbonization"[6] into situated urban and architectural strategies to revitalize the Manchester Ship Canal, once the most significant maritime infrastructure in the world, the artery of industrialization, and a major profiteer from slavery.

We engage with two parallel threads: the archaeology of carbon, focusing on embodied and operational carbon, and how to ground contemporary technical thought to better the local communities' welfare and revitalize the derelict landscape of the canal. A key challenge in such work is localizing this global master plan to site-specific strategies, considering the scalar nature of regions and localities. And I would argue that the UN and international community's idealist discourse prompt a significant part of this challenge about the human-technology relationship, evident in the fervent hope for eradicating the human-nature divide in the interest of humans.

Idealist Developmental Discourses

"Frontier technologies herald great hopes for humanity," says the UN DESA's World Economic and Social Survey 2018[7]. Liu Zhenmin, the Under-Secretary-General for Economic and Social Affairs and head of DESA, affirms this grand statement and calls for, "our collective vision for a society [without hunger, illiteracy, and disease] where no one is left behind"[8].

Let us ask ourselves as engineers and professionals of the built environment: what is our *reason for being* – among other experts and professionals – in such a utopian society [without hunger, illiteracy, and disease], let alone if such a society is possible?

The obvious answer is that we have no *reason for being* if there are no problems, breakdowns, and developments. And as the late philosopher and social scientist Bruno Latour reminds us, for politics to be possible, "there [should be] no society, no

[4] (Combes, 2012, p. 59; Simondon, 1958/2017)
[5] (Shayya, 2021, p. 58)
[6] (Climate Champions, 2022)
[7] (Department of Economic and Social Affairs, 2018, p. 1)
[8] (Zhenmin, 2018)

social realm, and no social ties, *but there exist translations between mediators that may generate traceable associations*"[9].

And this is what I am arguing for today.

The idealist developmental discourse on technology highlights the anthropo-centric and techno-centric faith in Frontier Technologies, where humans control nature, take centre stage in cosmic relations, and hail technology as an absolute panacea. You can read such discourse in the same UN DESA report in questions like "digital technologies: an opportunity for catching up or falling behind?"[10] and in Under-Secretary-General Zhenmin's claim that "technologies cannot, on their own, reach the people that need them the most"[11], alluding to the active role of national policies and international political will and cooperation.

While it is understood that such discourses are meant to be high-level, inspirational, and hopeful, the major misconception is that *technologies need to reach the people that need them*, as if they are artefacts distributed as a philanthropic handout. There needs to be consideration of how communities across the globe do not equally participate in technical thought, inhabit various environments, and are variably affected by the impacts of climate change and socio-economic development. This is a topic that has already been addressed in Science and Technology Studies[12] and is best exemplified in the discussions on situated and site-specific socio-technical associations of mundane artefacts like keys, doors, and seatbelts[13], photoelectric lighting kits for international aid[14], rural hand water pumps[15], the early electric vehicles[16], and Personal Rapid Transit systems[17].

The SDGs faith in technology is overconfident but not misplaced. As always, the problem is in localization, reminding us of Latour's imminent question: *how do you localize the global?*

Elemental Spatial Practice

I will share two more examples of how such idealist imaginaries of technology coupled with utopian aspirations do not provide any productive translations of our sociotechnical worlds. I will briefly discuss the concern for spatial practice altered by COVID-19 and the concern for physical exchanges transformed by contactless transactions.

The ghastly COVID-19 pandemic that swept the globe a few years back forced billions to reconsider the everyday spatial conventions in cities. But before FTs in biomedical engineering and biotechnology had any impact, the initial policy response was much more elemental: physical distancing or "spatial settings reminiscent of laboratories

[9] (Latour, 2005, p. 108)
[10] (Department of Economic and Social Affairs, 2018, p. 87)
[11] (Zhenmin, 2018)
[12] (Akrich, 1992; Callon, 1986; de Laet & Mol, 2000; Latour, 1991; Law, 1987)
[13] (Latour, 1991, 1992)
[14] (Akrich, 1992)
[15] (de Laet & Mol, 2000)
[16] (Callon, 1986)
[17] (Latour, 1996)

and wards"[18]. Architectural theorist and design sociologist Albena Yaneva eloquently documented and explained how this major breakdown forced the architecture profession to rethink its tenets and re-evaluate its epistemic practice[19], specifically at the intersection of architectural design with how science arranges space and generates social relations[20]. She insightfully claims that "mundane questions of spatiality and design shift scholarly attention towards a more 'localist' perspective on the making, meaning and evaluation of architectural knowledge"[21].

Homelessness is on the rise, according to the UN-Habitat, World Economic Forum, and many local authorities around the globe. The grim statistic is from 100 million in 2005 to 150 million worldwide[22]. As a general observation, schools of architecture engage with concerns for the rough sleepers and the homeless in one of two approaches hailed by FTs: employing advanced materials and modular designs to help governments produce social housing; or prescribing creative micro solutions for temporary shelters that homeless individuals can create on their own. But FTs in advanced materials, additive manufacturing, and robotic fabrication do not address elemental concerns for how publics – not public institutions – interface with rough sleepers and the homeless everyday: giving cash as a material form of mediation and gift-giving relating people. With more people relying on contactless payments and since COVID-19 instituted reduced physical exchanges, cash became a scarce resource for socializing. The response is not simply technological, but rather sociotechnical collaborations between civil society, government, industry, and individuals where technics is deployed to its fullest potential. For example, the iZettle model in Sweden (bought by PayPal for $2.2 billion in 2018) provides a clip-on extension to a mobile device to accept contactless payments (compare to the Square reader at £16). With time, this might become an integrated part of the smartphone, driven by commercial demand, not morality for rough sleepers. This is not the same as the token system, which is closer to charity cash, like the BillyChip model in the UK.

Conclusion

To conclude, the challenges that await us are daunting, and that is what makes design and engineering such exciting sociotechnical domains and future-looking professions. However, we must not lose sight that the agencies of technical beings[23] and human beings work – or fail to work – in alliance to produce the worlds we live in and aspire for. So maybe the concern that begs a platform with engineering and design is not about Frontier Technologies as prescriptions and artefacts but rather the *fuzzier* Frontier of Technics as grounded, relational, and responsive associations among humans, machines, and environments. This is a more inclusive approach, where communities are intelligent rather than smart.

Thank you.

[18] (Yaneva, 2020, p. 189)
[19] (Yaneva, 2020, p. 189)
[20] (see Yaneva, 2023)
[21] (Yaneva, 2020, p. 190)
[22] (Henry, 2021; HWC, 2022; UN DESA Voice, 2020)
[23] (after Simondon, 1958/2017)

References

Akrich, M. (1992). The De-Scription of Technical Objects. In W. E. Bijker & J. Law (Eds.), *Shaping Technology / Building Society: Studies in Sociotechnical Change*. MIT Press.

Akrich, M., Callon, M., Latour, B., & Monaghan, A. (2002). The Key to Success in Innovation Part I: The Art of Interessement. *International Journal of Innovation Management*, *06*(02), 187–206. https://doi.org/10.1142/S1363919602000550

Callon, M. (1986). The Sociology of an Actor-Network: The Case of the Electric Vehicle. In M. Callon, J. Law, & A. Rip (Eds.), *Mapping the Dynamics of Science and Technology: Sociology of Science in the Real World* (pp. 19–34). Palgrave Macmillan. https://doi.org/10.1007/978-1-349-07408-2_2

Climate Champions. (2022, November 11). *The Breakthrough Agenda: A master plan to accelerate decarbonization of five major sectors*. United Nations Framework Convention on Climate Change. https://climatechampions.unfccc.int/breakthrough-agenda/

Combes, M. (2012). *Gilbert Simondon and the Philosophy of the Transindividual* (T. LaMarre, Trans.). MIT Press. https://mitpress.mit.edu/books/gilbert-simondon-and-philosophy-transindividual

de Laet, M., & Mol, A. (2000). The Zimbabwe Bush Pump: Mechanics of a Fluid Technology. *Social Studies of Science*, *30*(2), 225–263. https://doi.org/10.1177/030631200030002002

Deloitte. (2023). *Scope 1, 2 and 3 Emissions: What You Need to Know*. Deloitte United Kingdom. https://www2.deloitte.com/uk/en/focus/climate-change/zero-in-on-scope-1-2-and-3-emissions.html

Department of Economic and Social Affairs. (2018). *World Economic And Social Survey 2018: Frontier Technologies For Sustainable Development* (E/2018/50/Rev.1). United Nations. https://www.un.org/development/desa/dpad/publication/world-economic-and-social-survey-2018-frontier-technologies-for-sustainable-development/

Freire, C. (2021, August 12). *The Impact of Frontier Technologies on Inequalities Across Countries*. Industrial Analytics Platform. https://iap.unido.org/articles/impact-frontier-technologies-inequalities-across-countries

Henry, P. (2021, October 29). *These Innovative Projects Are Tackling Homelessness Around the World*. World Economic Forum. https://www.weforum.org/agenda/2021/10/innovative-projects-tackling-homelessness-around-the-world/

HWC. (2022). *Global Homelessness Statistics*. Homeless World Cup. https://www.homelessworldcup.org/homelessness-statistics

Latour, B. (1991). The Berlin Key or How to Do things with Words. In *Matter, Materiality and Modern Culture* (pp. 10–21). Routledge. http://www.bruno-latour.fr/node/384

Latour, B. (1992). Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts. In W. E. Bijker & J. Law (Eds.), *Shaping Technology / Building Society: Studies in Sociotechnical Change* (pp. 225–258). MIT Press.

Latour, B. (1996). *Aramis, or the Love of Technology*. Harvard University Press.

Latour, B. (2005). *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford University Press.

Law, J. (1987). Technology and Heterogeneous Engineering: The Case of Portuguese Expansion. In W. E. Bijker, T. P. Hughes, & T. Pinch (Eds.), *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (pp. 111–134). MIT Press.

Shayya, F. (2021). *Politics of Survivability: How Military Technology Scripts Urban Relations* [PhD Thesis]. University of Manchester.

Shayya, F., & Walker, S. (2021). On Cloud Studies. *Arq: Architectural Research Quarterly*, *25*(3), 204–211. https://doi.org/10.1017/S135913552200001X

Simondon, G. (2017). *On the Mode of Existence of Technical Objects* (C. Malaspina & J. Rogove, Trans.; 1st edition). Univocal Publishing. (Original work published 1958)

UN DESA Voice. (2020, March 9). *First-ever United Nations Resolution on Homelessness*. United Nations Economic and Social Commission for Western Asia. https://www.un.org/development/desa/dspd/2020/03/resolution-homelessness/

Yaneva, A. (2020). Choreographies for the Laboratorized City. *Architectural Theory Review*, *24*(2), 188–191. https://doi.org/10.1080/13264826.2020.1804957

Yaneva, A. (2023). *Architecture after COVID*. Bloomsbury Visual Arts.

Zhenmin, L. (2018). Frontier Technologies: A Window of Opportunity for Leapfrogging! *UN Chronicle*, *LV "New Technologies: Where To?"*(3 & 4). https://www.un.org/en/un-chronicle/frontier-technologies-window-opportunity-leapfrogging