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ABSTRACT:
Design is an inherently fluid process, that intrinsically has to remain open to be shaped by contexts and constraints and that, once applied in its many variations, extrinsically can influence the flows of matter, life, information, and energy that make up urban space. However, to design the city means to intervene with an irrepressible environment that is rhythmically changing and in constant flux. As, given enough time, nothing in the city remains as is, materials decay, fluids flow in and out, people stop by or die, thoughts sink into oblivion, and energy just dissipates. Designers might have to acknowledge their impermanent impact and focus their efforts on influencing the flows that are mostly out of their control. Fluid design is a proposal to add relationships, process, flows, and patterns to the traditional design concerns of form and meaning. And suggests, not only, that actions inspired by water management and electromagnetic wave theory, such as blocking, spreading, sinking, amplifying, dampen, modulating, or diffracting, could be used to continually shape the flows that make the city. But, also that analysing the urban fabric from a systemic perspective and seeing it as ecosystem that can be influenced by changing its underlying flows and structures, gives designers a powerful new toolkit to influence the further development of cities.

Short Biographies

Vincent Van Uffelen works with thoughts, computation, simple electronics, and everyday materials. He investigates how the making and utilization of artifacts can be used to learn about alternative ways to access and interfere with the constantly changing entanglement of natural, technological, sociological, and cultural systems.
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Rocio von Jungenfeld is an artist and researcher (Lecturer in Digital Media, University of Kent) interested in what environments are made of, how we perceive them and how they change. She is fascinated by textures, walking, participation, public space, co-creation and the use of digital technologies for creative purposes.
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Fluid Design

"In every age someone, looking at Fedora as it was, imagined a way of making it the ideal city, but while [s]he constructed [her/]his miniature model, Fedora was already no longer the same as before, and what had been until yesterday a possible future became only a toy in a glass globe." (Calvino, 1974)

Fluid design attempts to use new insights and thinking paradigms to explore the idea that designers may find new means for positive impact on our complex world by shifting their focus away from products and towards the determination of problems and their solutions for the environments where products and life coexist. We discuss *fluid design* in light of three current transdisciplinary paradigms: the relational, complexity, and performative turns; and suggest using these paradigms as ways to *think with*. Firstly, we explore how these turns influence contemporary design practices. Secondly, the turns allow us to see the world as the product of a dance of rigid structures and flows, so we discuss how design practices can incorporate this paradox. Lastly, while looking at applied design practices (e.g. experience, service, strategic, or speculative design), we examine the use of different sources (e.g. matter, time, energy, information, actions, policies) and the diversification from material to immaterial outcomes. These paradigms allow us to bring forward the notion that designers can actively engage with a variety of sources, which allows them to mediate and affect (the flows of) heterogeneous collections of flows: ecosystems.

Like turning a kaleidoscope, each of the turns reveals a different projection of an incomplete picture. These projections may even contradict each other, and result in a splintered, paradoxical worldview. Similarly, the rigid structures and flows that make our world may depend on and contradict each other at the same time. A flow may bring forth structures while dissolving others, and a rigid structure may support some flows while impeding or modifying others. Making turns, changing perspectives may reveal that the same flows and structures interact in dramatically different ways. We acknowledge that taking these turns often means changing the things ones scrutinizes, and in agreement with Aristotle (*there can be no knowledge of that which is in flux*) we have chosen to discuss a few cases where designers and cities are *in flux* but are also concrete subjects of study.

Herbert Simon defines a designer as someone *"who devises courses of action aimed at changing existing situations into preferred ones"* (Simon, 1969). Under this premise, when, for example, designing cities designers may need to consider existing situations and project those situations into preferred, alternative futures. However, as cities are emergent, layered, complex flows of matter, life, energy, information, thoughts, and emotions, designers also ought to grasp that, just as Calvino's Fedora, cities are made of simultaneous fleeting situations that are difficult to pin down or predict, and that, once executed, designs may have unintended consequences that spill over a city which no longer is what it once was.

In order to face the upcoming challenges, we need to embrace theories and practices to make alternative preferred cities possible. The three turns bring different perspectives into play. First, the *relational turn* presents a shift from a world of interacting substances (subjects, things, objects, or even systems), towards a world of relationships that bring substances into life. Second, driven by findings in physics, biology, and computer science, the *complexity turn* describes a world of energy and particles that move, interact, and self-organise to create structures that remain in a constant spatio-temporal-informational process of *becoming*. Whereby, substance and structures emerge from cascades of countless, layered interactions, which are never fully finished nor predictable; change remains the only certainty. Third, the *performative turn* describes two related perspectives: one shows how matter (e.g. bodies, objects, structures) produces social and cultural meaning; while the other assumes a posthumanist position where meaning is necessary for substance to arise, and matter being the result of choices between alternatives.

Using the three turns' perspectives we can see the world as a dynamic, emergent, self-organised *system of systems* made of material and non-material systems, such as molecules, single cells, animals, information, cities, or ecosystems. All these systems may be alive (autopoietic) or human made (allopoietic), are governed by irreducible processes, laws, and actions, and constantly evolve by irreversibly stumbling from one (re-)constituting event to the next. These events are often changes in incoming or outgoing flows which may put pressure on the (semi-permeable) borders of the system and lead to saturation and overflow. Sometimes the presence of just the right flows and individuals in a limited space allows a new ecosystem to emerge. Hosting both autopoietic and allopoietic systems, our ecosystems strive to balance the needs of all the constituent parts while also being able to recover from external and internal perturbations. Ecosystems are highly efficient at distributing flows, however, if unable to provide for the needs of all by keeping a balance in the rhythmic changes of too little, enough, and too much, they eventually fail.

Thinking about our world through these three turns may intrigue designers to work with *flows* as material to further their aims. While in our examples we address the material flows of liquids, we want to highlight that these flows can also be non-material (e.g. energy, information, money, emotions) or even the forceful flows between living and nonliving agents, and the systemic patterns that emerge from these actions. In any case, designers may want to shape the flows of ecosystems through actions such as: shifting the system's borders, working with systemic layers, targeting emergence, influencing processes, fostering or impeding growth, changing the course of flows, or treating flows like waves that can be modulated in frequency, phase, and amplitude.

Before we delve further into the three turns, we would like to explain our interest in fluids and their subform liquids. Fluids are made up of tiny vibrating particles of matter, such as atoms, that are held together by intermolecular bonds; they are complex systems that in turn are the essential building blocks of higher level complex systems such as living beings or even ecosystems. Liquids and fluids are constantly on the move between two points of pressure and can only be contained by rigid structures, which they ceaselessly strive to escape from. They bring in the new, take out the unwanted, and their often rhythmically changing patterns of absence, presence, abundance, or even overflow are one of the essential beats of any ecosystem.

If one considers the four states of matter (solid, liquid, gas, and plasma) and their transitions, fluids are placed in the interesting position of being between solid and gaseous. Wedged between rigid structures and the chaotic movements of gas molecules, they can act as either; sometimes they are the reliable, comforting base for life and sometimes they just take everything with them (e.g. torrential flood). By being able to bond and relate with other of their kind, the molecules of a liquid become more than they would be on their own. Once the molecule joins many, many, others it becomes a mass that fills any gap in a container, that erodes slowly but surely surrounding solid structures, that washes things away, and stores energy in its constant movement.

Liquids mediate relationships of energies, substances, and processes, often over large distances and time, and evade in this capacity a clear distinction between substance or relation. When noticing that urban planners in the city of Portland (USA) added hydroelectric generators to their gravity fed water supply lines to skim off some of the energy that the water flowing through the pipes collects on its way into the city, one can only wonder what the water in this context is? Is it an energetically charged substance that drives the propellers of the generators? Or is it a link between the mountain range and the city? In this case, water might be best described as a flow whose complexity the fluid designers of Portland decided to partially divert into carbon free generated energy.

By looking at flows and their potential to be either substance or relationship, we can engage further with the mentioned *relational turn*. In practice, fluid designers can look at the manifold ways in which flows can be modulated into either substance or relationship. Often, designers will create structures to divert the flow (as substance) or connect it with other flows to strengthen its relational potential. Considering liquids as substance may involve building fortifications to keep water out, to flush it out, or to contain it, as for instance the flood gates along the Thames river in London, or the rainwater drainage system in the Los Angeles river. Similarly, placing infiltration plots to store vast amounts of stormwater protects the city from flooding, but also serves a second function by slowly releasing the water into the ground to replenish the water table. In this case water is not only treated as substance but as a relational medium connecting living and non-living things which operate at different scales

(from microbe to ecosystem) and times (from now and into the future). Like water, life is a mesh of substances and relations, always entangled with other life forms and non-living things, always in flow. Being alive is not only about individual being and becoming, but, as Donna Haraway proposes, also about collaborations with others to ensure that life remains *ongoing*. It is liquids, their relations, complexity and performative capacities that, to a large extend, drive this ongoingness.

Another important aspect about liquids to be aware of is one of the key findings of the *complexity turn*. Liquids are complex systems; to interfere with them means to try to tame chaos and to accept that certainty is being replaced by probability. Rain might come or not, a drop of blood might contain a virus or not, and two waves far out in the Atlantic ocean might meet at the right angle to become a "freak wave" or not. When dealing with fluids, designers often build contraptions that amplify or dampen the potential that a flow carries. This can be, in a literal sense, the re-direction of a flow. For instance, the city of Paris set up plant bucket urinals to collect nitrogen-rich urine which would otherwise be flushed away into the sewage system, or in the case of the Estonian Soomaa National Park, the seasonal floods pouring over the forests has lend itself to the rebranding of the areas as the Estonian Amazon which might divert the flows of tourisms into the region.

As this last example shows, liquids can also be used as conveyors of meaning, a notion that the *performative turn* engages with in depth. By not separating matter from meaning, fluid designers can find different insights into the situations they are designing for and identify alternative pathways that support the desired outcomes. When designing *with* (not *for*) ecosystems, fluid designers may find that the flows of meaning and emotions between elements within the ecosystem are one of the most powerful forces that holds the system together. Aiming to change the meaning of things or processes by carefully triggering events may be part of any fluid designers' toolbox. These events can be the switch-like moments of sudden absence, congestion, overflow, or transgression that trigger adaptation, but also the moments when small but compounding positive (amplification) or negative (friction) feedback slowly changes habits or structures within the ecosystem, and while doing so also change the meaning. However, it is worth mentioning that these events do not need to be (hu)man-made nor need they be meaningful only to humans, and may better resonate with wildlife and micro-organisms. Re-wildling and conservation initiatives that protect natural flows such as the flamingos of the "Fuente de Piedra" Lagoon in Malaga (Spain) are good examples of this. Visitors are invited to respectfully observe the lagoon's flows, a delicate ecosystem that gives identity to the area and nearby village. Both, the lagoon and village are intertwined and highly dependent on rainfall. If it rains, flamingos come and with them visitors; if the lagoon floods, more wetland is available for other species, and wildlife in the lagoon is more vibrant for longer. Water means avian visitors and the growing respect for the lagoon's flows and the livelihood of the local population.

Designing with ecosystems entails considering the complexity of these irrepressible systems. While the myriad flows that make our cities, parks and backyards resits to be pre-planned by all-encompassing master plans, their patterns, changes, and effects can be accommodated for by eco-systemic design approaches. In this context, fluid design is a proposal to add relationships, process, flows, and patterns to the traditional design concerns of form and meaning. Opening up to flows (and their changes over time), may enable designers to engage with environments in ways that are more sympathetic towards the sympoietical way in which life unfolds. We envision fluid designers to take action, make cuts, modify volumes and paths, identify things that are worth interfering *with*, and shape substances, meaning, and energies with the intention of triggering change. Only by

concocting events that trigger reactions, will fluid designers be able to meddle *with* the flows of a given system and invite it (and where needed only some of its parts) to change over time, to grow or shrink, to solidify or evaporate, to level or overflow. Since fluid designers are aware that they will never know enough about all the flows of any given system, they may choose to design openly, generating actualisable potential in their designs instead of actually seeking to actualize this potential.

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