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# A Collective Imaginative Journey to Rethink Oil

## Interdisciplinary Collaboration Between the University of Applied Arts Vienna and the University of Leoben

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experiments
interdisciplinarity
crude oil
laboratory
viscometer
arts-based research methods
systems thinking
thought collectives
reflection

**Reflection—Experimentation—Reflection**

"Arts-based learning engagements are more ideally suited for habit-forming exercises, rituals of perception, acts of reflection, personal expression, and social agency which, if they are to be sensibly evaluated for their effectiveness, must be assessed over the long run to document how the life practices, thinking habits, and communities of the learner have been transformed."[2]

Creative group discussions and reflection were placed at the heart of *Reflecting Oil's* five-year collaborative research processes. They were facilitated from the very outset, in late 2019, to encourage exchange between artistic and scientific approaches to crude oil, setting the ground for the planning and execution of a series of

oil experiments.

These interdisciplinary reflections, which brought oil's cultural meaning and significance to the forefront, helped to create the conditions for a fruitful dynamic of encounters, dialogue, and mutual learning, broadening the research team's understanding of art and science and also developing its members' consciousness about themselves as a "science-art" thinking collective.

An emotive dimension running through the reflection processes opened up for the

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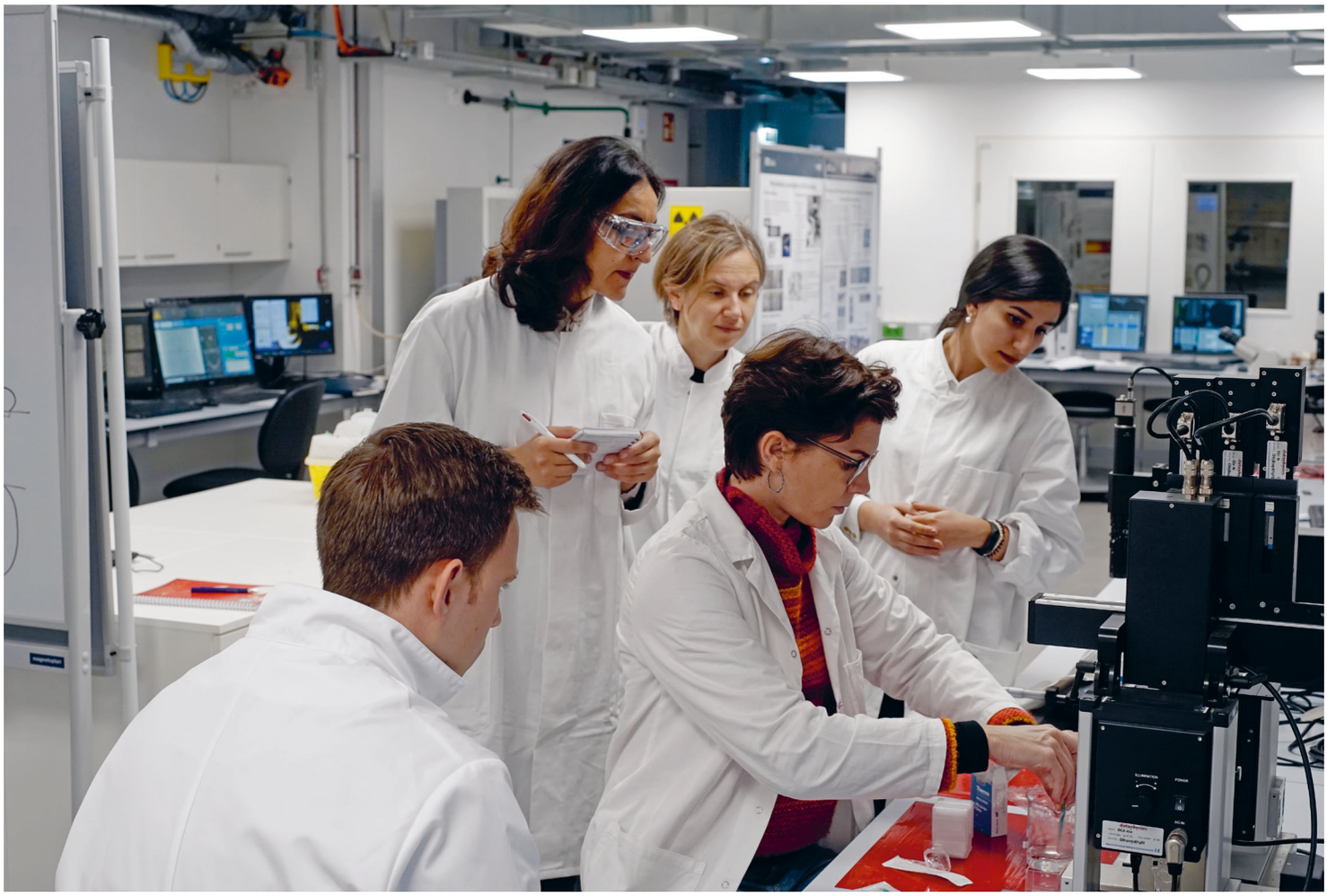


Crude oil experiments, Department Petroleum Engineering (DPE) laboratory, University of Leoben, 2019

team an opportunity to explore their feelings linked with the substance, thereby addressing issues of perception and behavior, an experience that became particularly meaningful for the team's petroleum engineering experts who were unaccustomed to acknowledging and making explicit the effect of emotions upon scientific thinking. The reflections often tapped into the ambiguous and contradictory qualities of oil (associated with both progress and environmental degradation), which encouraged team members to talk about what they described as their mixed feelings towards the substance, attesting to its complexity and reinforcing the relevance of the project's multi-perspective approach.

It is pertinent to point out that the Leoben experts had never engaged in an art-and-science research collaboration before and that, though some of the other team members had prior experience of collaborating with scientists, they too had never participated in an art-and-science collaboration on the scale of *Reflecting Oil*. The preliminary reflections unveiled the shared view that technology alone cannot make our oil-addicted societies transition to renewable energies and that creativity should play a more prominent role not only in raising wider awareness about our dependency on fossil fuels but also in (re)imagining transition. However, initial conversations also evidenced differences in expectations among team members, which did impact communication at times, prompting Ernst Logar as the Principal Investigator to facilitate further spaces for open dialogue so as to unveil barriers. A process of self-evaluation in the shape of in-depth interviews, which took place in early 2021, a year after the project had begun, became key to identifying issues perceived

as either conducive or detrimental to a fruitful collaboration, like for example the unforeseen work conditions imposed by the COVID-19 pandemic (which made it exceptionally difficult for team members to interact in person) as well as the value systems and power relations at play within the two Austrian collaborating academic institutions housing the team. Neither the Principal Investigator nor the head of the University of Leoben's Department Petroleum Engineering (renamed Department Geoenergy in 2024 to reflect its research concentration on decarbonization and sustainability) leading the project's scientific contribution, Professor Holger Ott, shied away from speaking openly about their original expectations, which were based on their respective assumptions about what constitutes research and artistic practice and therefore *how* the project was going to be carried out. The Leoben experts had assumed that their quantitative research approach (characterized by a goal-driven linearity and strict timeframes) was somehow going to be the motor of the collaborative project. Though the Leoben experts described scientific processes as creative in their own right, they were quick to add that their approach was in fact dictated by the very technical and scientific nature of the urgent challenges posed by their ongoing research which focuses on securing sustainable energy supply and finding energy alternatives in an effort to mitigate climate change.

Seeking to encourage understanding about the diverse research stances held by team members at this early stage, the Principal Investigator facilitated a series of online sessions during which he introduced the team to his body of artistic work on oil, which he had initiated in the Scottish city of Aberdeen in 2008, and invited Professor Ott to present some key scientific parameters used in reservoir engineering and give an overview of the research on energy storage, simulation technologies, and enhanced oil recovery (EOR) techniques being conducted in his department. These sessions provided invaluable insights into artistic and scientific forms of inquiry. Logar used this instance to further contextualize *Reflecting Oil's* rationale holistically and also give a flavor of the *creative outputs* and the less tangible *outcomes* the project was striving for (like those involving perception shifts), while Professor Ott introduced basic subsurface processes involved in oil production and technical challenges, encouraging a more informed reflection about sustainability and environmental impact. Uncertainty about what specifically the final results to emanate from this explorative arts-based project were going to consist of created concern, an unknown that the team felt more comfortable working with as the project progressed and collaborators got to know one another.

Differences in expectations within the team unveiled a clash of the perspectives held by the Leoben experts and Vienna experts respectively, recalling what physicist Fritjof Capra and chemist Pier Luigi Luisi refer to in their book *The Systems View of Life: A Unifying Vision*[3] as "analytical thinking" and "systems thinking." They write: "Systems thinking is 'contextual,' which is the opposite of analytical thinking. Analysis means taking something apart in order to understand it; systems thinking means putting it into the context of a larger whole."[4] While systems thinking emphasizes "relationships, qualities, and processes,"[5] Capra and Luisi are quick to call for a "complementary interplay between the two perspectives,"[6] rather than one cancelling the other out. This complementarity of perspectives suggested here to propel a shift in ways of thinking about oil was precisely what the *Reflecting Oil* project strove for, demanding the development of a more inclusive decision-making process which eventually not only brought the team closer together but also contributed to a sense of cohesion and authorship. Interestingly, Capra and Luisi also write about the "changes of values"[7] attached to "changes of thinking,"[8] aligning thinking that privileges analysis and linearity with values such as competition and domination, and thinking that privileges synthesis and nonlinearity with the values of cooperation and partnership, calling again for a "dynamic balance"[9] between these tendencies. The research team's encounter with different forms of thinking thus went hand in hand with the encounter with the disparate methodologies associated with them,

prompting discussions about diverse ways of knowing and doing, and particularly about the creative force at the center of arts-based research methods and about scientists' averseness to dealing with "subjective phenomena,"[10] which Capra and Luisi connect to "our Cartesian heritage."[11] *The Systems View of Life* was in fact useful as a key theoretical referent to facilitate the team's engagement with the holistic approach underpinning the project throughout, and thereby encourage the development of a shared understanding.

Once the team members had learned more about their counterparts' ways of thinking and working, a dynamic of mutual trust began to be established, and subjectivity (associated with artistic methodologies) and objectivity (associated with exact sciences) turned from a contested research territory into a broader field of possibilities which the group felt more at ease exploring together. Basic mathematical equations embedded in the language of petroleum engineering, for example, acquired new meanings not only for the Leoben experts, who were encouraged to contextualize them culturally and think about them as a potential source of imaginative thought, but also for the other team members who took part in these creative speculations. This playful exchange stimulated greater consciousness about limitations imposed by language, particularly scientific language, in a way that resonates with the physicists David Bohm and F. David Peat's claim, in their book *Science, Order, and Creativity*,[12] that most of the processes of language "take place largely unconsciously and unobserved and reflect the overall infrastructure of ideas embraced subliminally by the scientific community."[13] The ideas emanating from the exchange between diverse perspectives, "unimpeded by rigid attachments to particular points of view"[14] so as to be truly creative, according to Bohm and Peat, became the primary source for the experimental part of the project.


Emulsion formation experiment, DPE laboratory, 2021

### Experimentation—Artistic Approximations to Oil

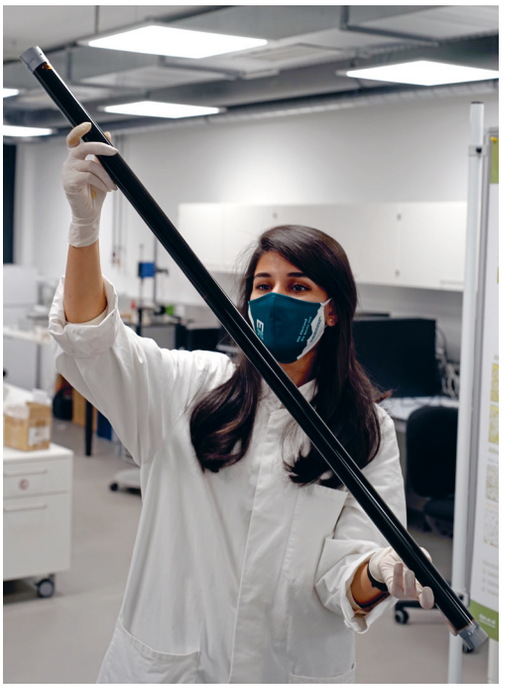
"We need to understand our societies as oil societies and our modernity as a *petro*-modernity to better grasp who and what we are."[15] "Scientific experience in particular derives from special conditions established by the history of ideas and by society."[16]

Throughout the project, a series of oil experiments was planned and executed in the laboratories of the University of Applied Arts Vienna and the University of Leoben's Department Petroleum Engineering, led by the Principal Investigator in collaboration with the research team, with the support of external guests on various occasions. These experiments sought to "rethink" crude oil using arts-based methodologies, focusing on the exploration of those sensory properties that are not usually researched—either for health reasons (in the case of smell, for example) or because they are difficult to quantify, measure, and describe objectively (in the case of color, for example).

The Leoben experts made a vital contribution during this experimental phase of the project with their research expertise and their acute sense of curiosity and ingenuity, offering meaningful advice about the feasibility of the proposed experiments. Here, once again, language and communication became a critical issue as the Leoben experts (often under time pressure) found themselves attempting to explain abstract concepts and sophisticated procedures (that could not be improvised) to the rest of the team. The imaging techniques used at Leoben to make visible the pore structure of rock samples retrieved from the subsurface, for example, captivated the Vienna experts from the start not only for their aesthetic qualities but also because they gave a more tangible idea of the way reservoir engineers look at oil (and its movement inside the rock) and a sense of the methods they use to measure the flow of fluids within the porous space of the reservoir, which are at the heart of their quantitative research approach. An introduction to petrophysics, which allowed the Vienna experts to familiarize themselves with fundamental petrophysical properties like porosity and permeability commonly analyzed to determine

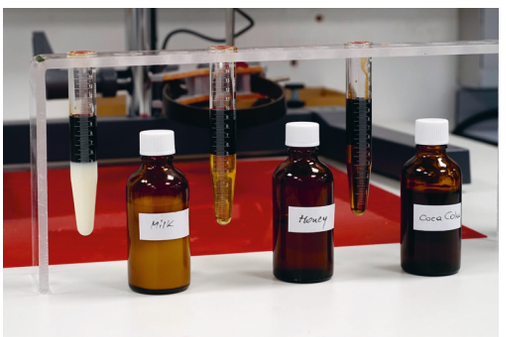
the interconnection of pores in the subsurface, proved essential to charging what initially looked like merely enigmatic visualizations with fresh scientific and artistic meanings. Patience and a predisposition to listen actively contributed to the team's trust-building process, which eventually paid off, as team members frequently praised the opportunity to engage in open dialogue and acknowledged the role that this openness played in forging mutual understanding.

Many of the experiments that were conducted privileged simple, hands-on procedures to facilitate direct manipulation of the substance and also the observation of unfolding processes that the Leoben experts do not normally get to see when they undertake highly mechanized procedures. However, some experiments that were conducted (like distillation to see the fractionating of oil's compounds, for example) were complex and did rely heavily on the scientific expertise of the Leoben specialists. Experiments such as this not only required a lot of preparation and waiting time but also highly specialized theoretical backgrounds to make profounder meaning of them, becoming particularly stimulating for the Leoben experts. A broad range of experiments was executed organically throughout the *Reflecting Oil* project, a sample of which can be found in the next section, responding to the explorative and intuitive impetus behind arts-based methods.



Viscosity experiment, DPE laboratory, 2020

A sense of play was embraced during the experimental stage of the project, a case in point being the construction of a DIY viscometer, which offered a new perception of viscosity, a key property related to oil's resistance to flow. The viscometer consisted of an acrylic tube with a metallic ball inside, which was filled with oil and worked through choreographed body movements. The abstract property of viscosity was thus brought to life in unison with the team members' kinetic performance, giving participants not only the opportunity to *feel* the viscosity as the ball slid inside the stick but also to speculate about society's viscosity through questions like: is it because we live in a viscous society that we react very slowly to pressing global issues like the climate crisis?




Emulsion experiment, DPE laboratory, 2020

Some of the experimental settings stipulated the execution of experiments in natural surroundings outside the laboratory's controlled environment, offering the team an opportunity to think about the formal space of the laboratory and its material culture differently and also to reflect about implicit epistemological implications behind given scientific parameters. Other experiments consisted of mixing crude oil with honey, milk, and Coca-Cola, which allowed the team not only to observe the oil's behavior under different emulsions, but also to reflect about the symbolic cultural meanings emanating from these mixtures, prompting multi-perspective discussions about "*petro*-modernity." Honey, for example, was associated with sustainable processes and the systems view of life while Coca-Cola was linked to the continuous flow of commodities feeding into our consumer societies, a movement fueled by oil and the ideology of unlimited growth. Experiments of this sort triggered the team's capacity to make imaginative connections and to extrapolate meanings, inspiring lively conversations about the ubiquity of oil, our modern consumer habits (that we find difficult to let go of), and their impact on the environment. Team members thus gained fresh awareness about the importance of narrative while attempting to describe contemporary societies' intricate interconnectivity with oil. This urge to narrate and even narrativize oil, propelled throughout the experimental phase of the project, turned the laboratory into an unprecedented site for the creative exchange of ideas and speculation.

The experiments were always followed by a time of reflection, both in writing and online group discussions, to give participants the opportunity to engage in the introspection necessary to integrate thoughts, make profounder sense of the experience, and also to raise new questions, which subsequently came to inform the project as a whole. The experiments entailed the production of artworks

(creative artistic-scientific outputs in their finalized versions or preliminary sketches, led by the Principal Investigator, using various media like photography, video, and sculpture) that also fed into the research process. Artworks were conceived from the start as a means of encouraging a shift of perception about oil and also new imaginings of sustainable energy futures both within and outside academia. Some of the Leoben experts took direct part in the process of artistic creation, an experience they felt broadened their horizons, which will hopefully continue to bear fruit, now that what Bohm and Peat refer to as an "artistic attitude" that "is conducive to a sustained creative perception"[17] has been developed.

The alternative forms of perception and the associations resulting from the experiments set the grounds for the team's embrace of fresh thinking in a fashion that chimes with scientist and philosopher Ludwik Fleck's pioneering conceptualization of "thought collectives" and "thought styles" in his book *Genesis and Development of a Scientific Fact*[18] where he endeavors to apply the principles of sociology and culture to scientific knowledge production. Here Fleck argues that communities of researchers ("thought collectives") assimilate distinctive ways of doing research ("thought styles") that research communities perpetuate unconsciously, shaping the way they see and think about the world to the detriment of alternative forms of inquiry. Fleck claims that "even the simplest observation is conditioned by thought style and is thus tied to a community of thought"[19] but that thought styles can shift (and as a matter of fact have shifted throughout history) when members from different thought collectives cooperate and engage in an exchange of ideas and consequently embrace new thinking.

Fleck's theoretical framework illuminates the Vienna–Leoben cooperation (and its underlying epistemological implications), calling on us to defy those "habits of thought"[20] we latch onto when we stay within our comfort zones and instead engage in interdisciplinary and holistic thinking necessary to approach not only energy transitions but other interrelated pressing global challenges like biodiversity loss and world poverty. The collaboration empowered the entire research team in a way that superseded expectations, making an impact at an institutional level, now that the Universities of Leoben and Applied Arts Vienna have introduced curricular innovations that seek to initiate students into a holistic approach to oil transitionings grounded on an exchange between the arts and science to ignite novel post-oil imaginings.

By facilitating direct contact with oil's materiality, *Reflecting Oil's* series of experiments involved participants in a multisensorial experience of the substance and in new perceptions. The experiments carried out throughout the project with the support of experts from Vienna, Leoben, and beyond (attesting to the complementarity of perspectives that Capra and Luisi call for), can broadly be classified into two strands: those that were more explorative and artistic in nature (albeit having a scientific basis) and those that followed scientific principles and premises in the stricter sense. The six experiments discussed below, representing but a sample of the wide range undertaken, exemplify these two strands; while the *Petrolio* rock, loudspeaker, fingerprints, and color experiments fit more comfortably within the former strand, the smell and bacteria experiments (drawing on olfactory and bacteriology respectively) fit within the latter. Each experiment involved a creative approximation to oil, offering participants an opportunity to feel oil's sensory properties in a unique way, which in turn engaged them in reflection about their own entanglements with oil and those of society as a whole. To return to the James Haywood Rolling Jr. quotation that I began this chapter with, the effectiveness of "arts-based learning engagements" at the center of these experiments cannot be appropriately evaluated in the short run. However, seen from the long-term angle proposed in Imre Szeman's chapter in this book, the experimental dimension of *Reflecting Oil* illuminates "the collective experiments we need to undertake to move past the experiment of oil modernity.

1 Petrocultures Research Group, After Oil (Edmonton, Alberta: Petrocultures Research Group, 2016), 14–15, https://afteroil.ca/wp-content/uploads/2024/04/After-Oil.pdf

2 James Haywood Rolling, Jr., "A Paradigm Analysis of Arts-Based Research and Implications for Education," in *Studies in Art Education: A Journal of Issues and Research* 51, no.2 (Winter 2010), 111, https://www.jstor.org/stable/40650456

3 Fritjof Capra and Pier Luigi Luisi, *The Systems View of Life: A Unifying Vision* (Cambridge and New York: Cambridge University Press, 2014).

4 Capra and Luisi, *The Systems View of Life*, 66.

5 Capra and Luisi, 79.

6 Capra and Luisi, 83.

7 Capra and Luisi, 13.

8 Capra and Luisi, 13.

9 Capra and Luisi, 13.

10 Capra and Luisi, 262.

11 Capra and Luisi, 262.

12 David Bohm and F. David Peat. *Science, Order, and Creativity* (1987; reis., London and New York: Routledge, 2011)

13 Bohm and Peat, *Science, Order, and Creativity*, 67.

14 Bohm and Peat, 78.

15 Petrocultures Research Group, 69.

16 Ludwik Fleck, *Genesis and Development of a Scientific Fact* (1935; reis., Chicago and London: University of Chicago Press, 1979, translated by Fred Bradley and Thaddeus J. Trenn), 48.

17 Bohm and Peat, 263.

18 Ludwik Fleck, *Genesis*, 1935.

19 Fleck, 98.

20 Fleck, 104.