

Supplementary material of Situated Green Chemistries: a starting proposal

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S1. Additional information on “Situated Knowledges”

Since its inception in primatology and biology (Haraway obtained a Ph.D. in biology from Yale in 1972 and has published a renowned essay about situated knowledge and primatology in 1990) *situated knowledge* is continuing to percolate in nature and physical sciences and co-evolve with cognition theories, such as recently in computer sciences¹ and the other examples given in the main text. The *situated knowledge* concept, largely embraced in disciplines of human geography and anthropology² is now discussed in many fields. An overview of such a prolific concept as “situated knowledge” that connects with disciplines far removed from chemistry can therefore

only be very partial here. Readers are encouraged to consult the original works cited throughout; in case the readers find it useful, the three most accessible explanations for me, the author,³ among the texts I have accessed so far are by Thompson,⁴ Puig de la Bellacasa,⁵ and the entry “situated knowledge” in the Dictionary of Human Geography.⁴

Since the focus of this paper is mainly on improving the quality of the knowledge produced by the green chemistry community in order to better address the ongoing socio-ecological downfall (see introduction of the main manuscript), I have focused the explanation of situated knowledges to its epistemological (what counts as valid knowledge) and ethical (what is considered right or responsible) levels. The concept of situated knowledge also ramifies to the ontological (what are the general features of reality), and political (how power, rules, and responsibilities are organized in society) levels which will not be put forward here and yet remain present because cohesively connected to the concept of situated knowledges.⁶

S.1.1. Tailored definition of “situated knowledges” and further elements of discussion around “situated green chemistries” framework

In the context of this paper, and based on the points made in the preliminary statement of the main text, I propose the following definition of situated knowledge: *“a scientific way of knowing that explicitly addresses and co-evolves with a need, a problem, a specific condition for which it emerges. In order to produce more objective science, all scientists involved remain accountable*

for how they remain in relationship with the specificity, effects and connections that such scientific of knowing produces and from which it results.”

This definition is dense because it tries to capture some of multiple layers of the situated knowledge concept, some of them listed as points in section 2.2 of the main text. Below some explanations on some aspects present in the definition and in the main text:

- *“All knowledge depends on the context in which it emerges.” (main text section 2.2). All scientific knowledge is connected to the material conditions (such as, for example, what are the scientific instruments possible at the time, the funding options, the safety protocols, or what are the means by which the scientists producing the knowledge provide for their basic needs), the interests, institutions, practices and cultural contexts (such as languages and communication modes used, for example), that make such scientific knowledge possible. This level of the definition, embedded in the notion of situated knowledge, and called the **constructivist approach*** to scientific knowledge is mostly connected to the field of Science and Technology studies (STS). [The term **constructivist approach*** as well as other terms in **bold and starred*** below are entries in section S.1.2.]*

- *“Knowledge and context shape each other and co-evolve” (main text section 2.2).*
 The scientific activity changes the material, social, ecological conditions it studies. The knowledge-making process is part of the **situation**,* not separate from it. Science does not merely describe or fix the world it participates in making that world. Chemistry, a science intimately connected with the transformation of matter reshapes the **situation*** that made it possible. A **situated knowledge*** emerges because it responds to a specific context and by doing so modifies the context itself. For example, how collaboration with affected communities can change research priorities or interpretations.

- *“ a need, a problem, a condition for which it emerges” (definition above) the preposition “for” in the first part of the definition is intended in two ways : the first one is “ because of which” aims at capturing the **constructivist*** aspect of scientific knowledge (see entry “All knowledge depends on the context in which it emerges.” above). The second level put forward by the preposition “for” is connected to the meaning “for the benefit of”, in the sense that the situation itself elicited the need to produce knowledge. This aspect of the notion of **situated knowledge**,* central in this manuscript, is distinctive of the Harawayan concept, goes beyond the **constructivist*** side explained above, and relates to epistemology, the branch of philosophy addressing what can be known. It also connects to ethics.*

S.1.2. Further terms from humanities relevant to “Situated Green-chemistries” framework

Some terms, such as *situation*, *care*, *perspective*, have been used with no formal definition in the main manuscript hereto. They actually carry a disciplinary depth that could be overlooked by the reader untrained in humanities. Some other terms, such as *positionality* or *embodiment*, have not been mobilized yet but are important for the approach around situated knowledges. This section aims at signaling these facts to the readers : there is a scholarly depth that has not been addressed yet.

The content below is under the form of a glossary to facilitate its peruse. It should not be considered as a set of academic definitions from scholars in the humanities, but rather as the author’s current understanding as a chemist training in situated knowledges, reflecting the literature accessed so far and attempting to summarize the content in a way catered to an interested chemistry readership. This type of information is not available elsewhere, to the best of the author’s knowledge. The goal that can make such limitations acceptable is to facilitate the interdisciplinary exchanges, by easing the learning curb of the untrained chemist while at the same time signaling to better versed readers, such as potential readers from STS and philosophy, the attention to their production, the effort to understand and use it, and the lucidity on some of the limitations of the content here below. In summary, this section is a manifestation of the availability to engage the interested readers into co-exploring how to develop practices inspired by situated knowledges within green chemistry research and co-develop the culture and common language necessary to this goal.

Care. In situated knowledge, care can mean the attention to how scientific work affects and co-evolves with its context. Care appears thus as a way of knowing and way of doing, a practice, of maintaining and adjusting relations : it keeps science attentive to the changing consequences of its own activity, ensuring that knowing and acting remain connected rather than detached. Care in this context appears therefore not primarily an emotion or an ethical add-on, but a mode of attention and connection. This said, as in the word « thoughtful », there is connection between the practical meaning of philosophical care exposed here and the affective and ethical investments connected with care in plain English. For Feminist theorists, such as Puig de la Bellacasa especially, care seem to include thoughtful attention, affective commitment, and situated attachments that orient practice. Affect can be a motivating component of care. Feelings can inform disciplined practices but they are not substitute for methodological rigor at the basis of care.

Constructivist approach. The following citation by geographer John Pickles can help flesh out the constructivist approach to scientific knowledge: “knowledge (including scientific knowledge) [is] always historically and socially constructed out of specific projects in particular times and places: knowledge is always produced by someone; knowledge and human interests are always inextricably linked”.⁷ It is important to stress that Harawayan situated knowledge is not the addition of social constructivism to ethics (moral necessity to stay responsive to effect on environment, also see term **response-ability***). Its central part is the reframing of objectivity that is necessary for robust science through bringing forward and handling partiality, accountability and situated partial perspectives, rather than unteachable and incorrect neutrality.

Embodied conditions, embodiment. Bodies, and the fact that different bodies experience and shape knowledge differently is a central part of situated knowledge. In green chemistry research some relevant aspects of embodiment could be, whose bodies are exposed to risks or benefit from protections connected to the research? Which forms of bodily experience are rendered visible or invisible? These and other questions are relevant because they shape what counts as a relevant research question, an acceptable solution, or a “sustainable” outcome.

Feminist epistemologies. Overall, feminist epistemologies are ways of thinking about knowledge which propose more accountable ways of producing knowledge by unmasking unsubstantiated claims to neutrality and highlighting exclusions. “Feminist” in *feminist epistemologies* is not to be intended in a possible common meaning ‘for woman (and against men),’ but as connected to the history of women’s struggles to be recognized as knowers. Some parts of feminist epistemologies are historically rooted in women’s liberation movements. Feminist epistemologies also connect with movements such as subaltern studies and cultural studies.

Position, positionality, perspective. In Haraway’s framework, as far as this paper is concerned, the position of the scientist (the principal form of knower considered in this paper) within a situation is, at least in part, where a person (or group) stands in terms related to material, institutional, social (with elements such as gender, class, race), and political/economic aspects that connect the person to the situation. Positionality is when these positions are made explicit. With positions and positionalities come perspectives: partial views which highlight some aspects

while obscuring others. Situated knowledges are not deterministic : no collection of components above determines fully the knowledge produced.

Response-ability. Harawayan wordplay. The word “response-ability” stresses both the *capacity* of scientific knowledge to act upon the situation in which it emerges and the *responsibility* to act with **care*** in favor of improving the “situation” (which here can initially be intended more as “problem to be addressed”, see definition below for more accurate definition of **situation*** in the context of situated knowledge).

Situated knowledge. A scientific way of knowing that explicitly addresses and co-evolves with a need, a problem, a condition for which it emerges. In order to produce more objective science, all scientists involved remain accountable for how they remain in relationship with the effects and connections that such scientific way of knowing it produces and from which it results.

Situation. The main text tries to reconcile everyday meaning of “situation” with Haraway’s, risking to sounding vague. In more formal terms but still oversimplified, in Haraway, a “situation” is not just context — it is the entanglement of material, cultural, political, value-infused and **embodied*** conditions that connect the scientific way of knowing with the specific context and network of relationship that make the knowledge possible. Without that nuance, “situation” could be assimilated to a backdrop or problem-to-be-solved, which is closer to applied science than to situated knowledges.

Standpoint. Shared experience at the edges of dominant perspectives can offer critical insight, especially by revealing what dominant positions overlook. In standpoint theory (Harding) aspects

can come through where marginalized positions can produce epistemically *advantaged* insights. The epistemic privilege claim that is central to standpoint epistemology has also been critiqued for its essentialist aspect. Situated knowledge does not appear as a defense for a “privileged standpoint”.

S2. Precisions on method for constructing the situated green chemistries framework

The ten core drivers of the situated green chemistries framework stem mostly from literature analysis in the field of green chemistry by me, the author. The literature surveyed were articles published in journals of the area (see for example list of the Journals Citation Report category “*Green & Sustainable Science and Technology*”) and mostly *Green Chemistry*, the peer-reviewed academic journal of the Royal Society of Chemistry, between 2015 and 2022, period during which I served as member of the journal editorial board, as well as the hundreds of submitted manuscripts I have handled in my position of the journal’s associate editor between 2017 and 2022. To this peer-reviewed literature are added the oral and poster communications I paid attention to during the dozen green chemistry conferences and events I attended in various roles over that period among which “*Green chemistry*” Gordon conferences (2012, 2014, 2016 (organized as co-chair but not attended), 2018, 2022) as well as publication in grey literature

such as community magazines *Chemistry World*, mentioned below, and *Chemical & Engineering News*.

A critical aspect guiding the selection of *situated green chemistries* core drivers was to strive to allow space for all the types of different aspirations toward desirable futures present in the research community (see main text for more). I chose this self-imposed blue-sky “space-for-all” objective because epistemological strong objectivity invites to strive for (unattainable) completeness in perspectives. At the same time, I tended to keep the scope of each driver large enough to allow a sizable community-building around each and to keep the total number of drivers manageable for sparking engaging and accessible exchanges around situatedness in the green chemistry community. I did not have a preconceived number of necessary drivers when I started such endeavor, nor knew if the process could converge. The current set is the smallest one that appears to be able to showcase the different collective aspirations that I have encountered (personal ones such as career-advancing are excluded). In order to test the absence of blatant incompleteness in the set of drivers I had put together, I checked if at least one driver could be associated with each abstract presented at the conference⁸ where I was about to present this framework for the first time. Since I could successfully infer a reasonable driver to be associated with each abstract, I considered that enough drivers were present in the starting proposal for this occasion. Noteworthy, currently, inferring rather than knowing what is the connection between a paper, its authors and their situated drivers is a necessary approximation since the declaration of one’s programmatic aspirational futures is not established as a practice in our community now, with noticeable exceptions.⁹

As discussed in the main text, literature survey lead to the identification, of drivers #1-to-#6 : “Global Forces”, “Start-ups & Small businesses”, “Intrinsic Value of Research”, “Research as art”, “Do no harm”, and “Cure and repair”. The selection leading to the further four drivers is based on other forms of exchanges with peers, colleagues and other sources within the community. Here below some detail on some significant events for each to exemplify the approaches used to define them :

- The “+°5C fighters” core driver (driver #7) has been hypothesized following the question raised by an attendant at a 2022 green chemistry graduate winter school in the session “Scenarios for the Energy Transition”. After the keynote speaker’s presentation, the attendant’s main question was : “What could be the chemistry in a +4°C IPCC trajectory? What is the research that would be adapted for such a scenario of crisis where major disruptions are to be expected?” (Aussois, March 18th 2022, the attendant is very gratefully acknowledged). Follow-up exchanges with the attendant confirmed that the question stemmed from their own interest in such research. This lead to postulate the driver. The pertinence of such driver was confirmed by other researchers in other informal exchanges following pointed questions by me aiming at confirming or infirming it.
- The “social justice” core driver (driver #8) has been proposed after reading the article “*Chemical definition of brine as water could help clear up Chile’s lithium controversy*” by James Urquhar in *Chemistry World* (6 September 2021).¹⁰
- The “North ↔ South” core driver (driver #9) was proposed based on my own tropisms.³ One central event that consolidated the pertinence of the “North ↔ South”

driver was that upon presenting to an audience at a green chemistry conference the article “*Is lithium brine water?*”¹¹ to discuss social-justice steered research, one attendant considered important to share with me the article entitled “*Lithium extractivism and water injustices in the Salar de Atacama, Chile: The colonial shadow of green electromobility*”.¹²

- The “Low Tech” driver (driver #10) results from the thought-piece “Les low-techs comme objet de recherche scientifique. Vers une société pérenne, équitable et conviviale”,⁹ where the authors clearly lay out the programmatic connection between their desirable future and the research they wish to perform.

A further “currently missing driver” is added to the drivers to stress the evolutive nature of this proposal, subject to community refinement and improvement. The point made here is more about the method used and to showcase the existence of a way to leave room for community self-refinement rather than to claim for completedness in currently proposed framework’s drivers.

References

- (1) Lucy Suchman. Agencies in Technology Design: Feminist Reconfigurations*. In *Machine Ethics and Robot Ethics*; Routledge, 2017.
- (2) Situated Knowledge. *The Dictionary of Human Geography*; Derek Gregory, Ron Johnston, Geraldine Pratt, Michael J. Watts, Sarah Whatmore, Eds.; Wiley-Blackwell, 2009; pp 683–685.
- (3) *Accessible to me, an experimental academic researcher in chemistry, active mostly in western europe research institutions, for over 30 years (in-training, as post-doctoral fellow and then as staff) since the beginning of my PhD in 1994. With no formal academic education is social sciences, I have been self-training on the topic for the past 4 years taking up between 20 to 10% of my time including exchanges with scholars in the field. My experiential knowledge in the field is due to decades of interest and involvement in feminist and altermondialist movements, which are fields with relevant ties with academic arenas connected to Haraway’s situated knowledges.*

- (4) Charis Thompson. Situated Knowledge, Feminist and Science and Technology Studies Perspectives. In *International Encyclopedia of the Social & Behavioral Sciences (Second Ed.)*; James D. Wright, Ed.; Elsevier, 2015; pp 1–4. <https://doi.org/10.1016/B978-0-08-097086-8.85031-X>.
- (5) María Puig de la Bellacasa. Divergences solidaires: Autour des politiques féministes des savoirs situés. *Multitudes* **2003**, 12 (2), 39–47. <https://doi.org/10.3917/mult.012.0039>.
- (6) Monika Rogowska-Stangret. *Situated Knowledges (22 March 2018)*. in COST Action IS1307 New Materialism Networking European Scholarship on “How matter comes to matter.” <https://newmaterialism.eu/almanac/s/situated-knowledges.html> (accessed 2026-01-16).
- (7) Objectivity. *The Dictionary of Human Geography*; Derek Gregory, Ron Johnston, Geraldine Pratt, Michael J. Watts, Sarah Whatmore, Eds.; Wiley-Blackwell, 2009; p 508.
- (8) 2022 Green Chemistry Conference GRC, July, 24th-29th 2022 Castelfels (Spain). <https://www.grc.org/green-chemistry-conference/2022/> (Accessed 2026-01-16).
- (9) Carrey, J.; Lachaize, S. La recherche scientifique en Low-Tech : définition, réflexions sur les pistes possibles, et illustration avec un projet de métallurgie solaire. *Pensée Écologique* **2020**, 5 (1), 7–7. <https://doi.org/10.3917/lpe.005.0007>.
- (10) Urquhart, J. Chemical Definition of Brine as Water Could Help Clear up Chile’s Lithium Controversy. *Chemistry World*. September 6, 2021. <https://www.chemistryworld.com/news/chemical-definition-of-brine-as-water-could-help-clear-up-chiles-lithium-controversy/4014312.article> (accessed 2024-04-02).
- (11) Ejeian, M.; Grant, A.; Shon, H. K.; Razmjou, A. Is Lithium Brine Water? *Desalination* **2021**, 518, 115169. <https://doi.org/10.1016/j.desal.2021.115169>.
- (12) Bárbara Jerez; Ingrid Garcés; Robinson Torres. Lithium Extractivism and Water Injustices in the Salar de Atacama, Chile: The Colonial Shadow of Green Electromobility. *Polit. Geogr.* **2021**, 87, 102382. <https://doi.org/10.1016/j.polgeo.2021.102382>.