WHAT CONCEPTUAL ENGINEERING CAN LEARN FROM THE HISTORY OF PHILOSOPHY OF SCIENCE: HEALTHY EXTERNALISM AND METASEMANTIC PLASTICITY

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Conceptual engineering wants analytic philosophy to be centered around the assessment and improvement of philosophical concepts. But contemporary debates about conceptual engineering do not engage much with the vast literature on conceptual change that exists in philosophy of science. In this article, I argue that an adequate appreciation of the history of philosophy of science can contribute to discussions about conceptual engineering. Specifically, I show that the evolution of debates over scientific conceptual change arguably demonstrates that, contrary to what is commonly assumed in the literature about conceptual engineering, conceptual change is possible within an externalist metasemantics and that any adequate theory of conceptual change should be metasemantically plastic.

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1. Introduction

In recent years, philosophers have devoted considerable attention to the bundle of metaphilosophical positions that goes under the names of "conceptual engineering" (Cappelen 2018; Cappelen et al. 2020) and "conceptual ethics" (Burgess and Plunkett, 2013a, 2013b). Conceptual engineers propose the

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substitution of the traditional methodologies of conceptual and linguistic analysis in analytic philosophy with what they call conceptual engineering, broadly understood as the "enterprise of assessing and improving our representational devices" (Cappelen 2018, 3). According to conceptual engineering, then, the intentional change of philosophical concepts should be at the center of philosophical activity.

Traditionally, conceptual change has been primarily a topic in the philosophy of natural sciences. Following Kuhn's (1970) influential theory of scientific revolutions, radical episodes of scientific conceptual change have been considered one of the main obstacles to scientific progress, realism, and objectivity. As a consequence of these worries, philosophers of science have developed detailed models of conceptual change and applied these models to a plethora of historical case studies.

Given the centrality of conceptual change in conceptual engineering, one would expect a tight connection between the recent metaphilosophical debates on conceptual engineering and the vast literature on scientific conceptual change that exists in twentieth-century philosophy of science. Surprisingly, the connection between the two literatures is almost nonexistent. The literature on scientific conceptual change is (almost) never mentioned, let alone used, in contemporary debates about conceptual engineering.

In this article, I argue that debates about conceptual engineering should pay more attention to the history of philosophy of science. More specifically, I show how the literature on scientific conceptual change can help debates about conceptual engineering improve understanding of what conceptual change is and how we can analyze and model it.

I focus on two specific aspects with respect to which the evolution of philosophical discussions about scientific conceptual change can be helpful to projects of conceptual engineering. The first aspect concerns the compatibility of (meta)semantic externalism and conceptual change. In the literature about conceptual engineering, it is commonly assumed that within a (meta)semantic externalist picture of language, one cannot intentionally change meanings of terms in a feasible way. I show instead how in the literature on scientific conceptual change, one can find fine-grained externalist models of conceptual change that allow intentional meaning change. We will see that the key assumption of these externalist models of conceptual change is to accept what I will call "healthy externalism"—that is, an externalist metasemantics that recognizes a plurality of meaning components active in the change of meaning and reference of our scientific terms. The second aspect on which I focus is what I call "metasemantic finality"—the assumption that the factors that ground the meaning and the reference of our linguistic terms are general in nature, fixed, and easily ascertainable in their role and influence. I show how, despite many foundational proposals in the conceptual engineering literature that seem to assume such a fixed picture of language, contemporary approaches to scientific conceptual change give strong evidence against it. Instead of such metasemantic finality, I demonstrate how scientific conceptual change pushes us to model conceptual changes within a picture of language that upholds what I call "metasemantic plasticity"—the recognition of semantic individualities, semantic seasonalities, and semantic nuances.

My aims in this article are twofold. My first aim is to argue that the literature on scientific conceptual change can make a contribution to foundational discussions about conceptual engineering in two specific ways—namely, by showing how (meta)semantic externalism is compatible with intentional conceptual change and by demonstrating that any adequate picture of conceptual change should uphold a metasemantically plastic picture of language. My second, more general aim is to foster the interactions between the recent literature on conceptual engineering and the existing literature on scientific conceptual change.

In section 2, I give an overview of the two debates at the center of this paper—that is, the discussions on conceptual engineering and the literature on conceptual change in philosophy of science. In section 3, I focus on the compatibility of externalism and conceptual change, showing how the history of the rise and fall of radically externalist approaches in philosophy of science shows us that conceptual change is compatible with a healthy kinds of externalism. In section 4, I instead focus on metasemantic plasticity—the acceptance of semantic individualities, seasonalities, and nuances that our best pictures of scientific conceptual change prescribe. I argue that this kind of plasticity gives us reasons for doubting the sort of metasemantic finality that many authors in the conceptual engineering literature seem to assume. Section 5 concludes the article.

2. Conceptual Engineering and Conceptual Change in Science

Until recently, analytic philosophy did not include much debate about the correct philosophical methodology that its practitioners ought to employ. Since its beginning, analytic philosophy has primarily understood its goal to be the logical, conceptual, or linguistic analysis of abstract entities of philosophical interest such as concepts, propositions, and intuitions. These objects of philosophical inquiry were meant to be subject to a transformative analysis that would reveal their true logical or linguistic form. Philosophical concepts are then, in this metaphilosophical view, the passive and static objects of such a descriptive analysis (see Beaney 2021).

In the past 20 years, this descriptive conception of philosophical activity has been heavily criticized from several angles, ranging from the untrustworthiness of our philosophical intuitions to the inadequateness of many of our philosophical tools (e.g., Knobe and Nichols 2008; Machery 2017). As a consequence of these critiques, constructivist methodologies, once relegated to specific subtraditions of analytic philosophy such as neo-Kantianism or logical empiricism, have been reappraised as possible alternatives to traditional notions of philosophical analysis.

A kind of constructivist philosophical methodology that has attracted increasing interest is the bundle of metaphilosophical positions that goes under the names of conceptual engineering (Cappelen 2018; Cappelen et al. 2020) and conceptual ethics (Burgess and Plunkett 2013a, 2013b). Conceptual engineers propose the substitution of the traditional methodology of conceptual and linguistic analysis in analytic metaphysics and epistemology with what they call conceptual engineering, broadly understood as the "enterprise of assessing and improving our representational devices" (Cappelen 2018, 3). According to conceptual engineers, many of our traditional philosophical concepts are very likely to be defective (cf. Cappelen 2020; Scharp 2020). The list of alleged defects of our traditional concepts involves epistemic defects such as vagueness, ambiguity, and inconsistency, as well as pragmatic and lexical effects undesirable for social and political reasons. If many of our concepts have these defects, it seems that any descriptive conceptual analysis would just reveal these defects and not offer us any way of solving these issues. Conceptual engineers propose, instead, to replace conceptual analysis with conceptual engineering. After this methodological switch, from a descriptive to a inherently normative methodology, philosophers will have the metaconceptual tools for assessing any defectiveness of our traditional philosophical concepts and, when needed, to normatively choose better concepts.

In just a few years, the methodology of conceptual engineering has attracted a lot of attention in several philosophical subfields, such as metaphilosophy, philosophy of language, epistemology, metaphysics, and social philosophy. Nevertheless, there is still little agreement among supporters of conceptual engineering on the exact nature, goals, and methods of this normative methodology (cf. Cappelen et al. 2020; Isaac and Koch 2022; Isaac et al. 2022). Opinions vary, for instance, on the exact nature of the representational devices that should be the targets of conceptual engineering projects. Different authors take them to be psychological concepts (Scharp 2020; Fischer 2020; Machery 2017), abstract concepts (Sawyer 2020), linguistic meanings (Cappelen 2020; Richard 2020), speaker meanings (Pinder 2021), classification procedures (Nado 2021), inferences (Flocke 2020; Jorem and Löhr 2022), social norms (Nimtz 2021), and other entities somehow related to concepts. Another open question in the literature on conceptual engineering concerns the goals of conceptual engineering, with possible goals including changing the ways people classify objects (Nado

2021), the unconscious inferences associated with concepts (Fischer 2020; Machery 2017), the truth conditions for certain analytical sentences (Flocke 2020), the standard meanings or the typical meanings of certain terms (Cappelen 2020; Richard 2020; Jorem 2021), or certain social and linguistic norms (Nimtz 2021). Consistent with this variety of possible targets and goals, discussions about conceptual engineering have also included methodological debates, with possible methods for conceptual engineering including experimental methodologies (Machery 2017; Fischer 2020), conceptual genealogies (Dutilh Novaes 2020), and specific constructive methodologies in philosophy such as Carnapian explication (Carnap 1950) and ameliorative analyses (Haslanger 2012). To put some order into this range of possibilities, advocates of conceptual engineering have tried to organize their agenda into some foundational challenges that conceptual engineering, as a philosophical methodology, ought to meet (Isaac and Koch 2022, 2):

i) *Bootstrapping challenge*: What is it that conceptual engineers are "engineering," and what does "engineering" mean to begin with?
ii) *Challenge from topic discontinuity*: When engineering concepts, does that necessarily lead to a change of topic? If not, what separates good cases from bad ones?
iii) *Methodological challenge*: How should one go about assessing old and designing new concepts? In particular: how can empirical methods be put to fruitful use here?
iv) *Implementation challenge*: To what extent is it even realistic to actually implement conceptual engineering proposals? What would be required for it to be feasible?

To meet the bootstrapping challenge, advocates of conceptual engineering ought to specify the exact nature of the targets and the process of their engineering methodology, while the challenge from topic discontinuity is supposed to push conceptual engineers to specify the extent and the normative import of the change that they want to implement in philosophy. The methodological challenge seeks instead to make precise the methods that projects of conceptual engineers are entitled to use, while the implementation challenge questions the actual prospects of successfully engineering our philosophical concepts. Taken together, these four foundational challenges ask projects of conceptual engineering for a complete, precise picture of what it means to change philosophical representational devices. In other words, using the term "concept" in its most general and philosophically neutral way, what conceptual engineers need to meet these four challenges is a good model of philosophical conceptual change.

Traditionally, in analytic philosophy, conceptual change has been studied mostly by philosophers of science. This is due to the many epistemological and semantic problems that scientific conceptual change poses to the ideals of scientific rationality, objectivity, and realism. New scientific theories replacing old ones often drastically change the image of the world given by the replaced theories, modifying important aspects of old theories such as laws, explanations, ontological assumptions, and concepts. The most radical and important macrochanges in scientific theories have been dubbed, in analogy to political revolutions, "scientific revolutions" (Kuhn 1970). The frequency and the impact of scientific revolutions prompted philosophers to question overoptimistic accounts of scientific progress, rationality, and realism (cf. Hesse 1976; Laudan 1981, 1984a).

Conceptual change is at the heart of one of the most worrisome aspects of scientific revolutions: incommensurability between different (bundles of) scientific theories. The mathematical notion of incommensurability—namely, the lack of a common measure—was made a common term in philosophy of science by the influential work of Kuhn (1970) and Feyerabend (1962), who applied this term to the (alleged) breakdown of rational communication in scientific revolutions. In particular, radical conceptual change is central to one pivotal component of Kuhn's complex notion of incommensurability—what is known as "taxonomic incommensurability" (Hoyningen-Huene 1993; Sankey 1997). Taxonomic incommensurability denotes the fact that different theories can have a different understanding of a given scientific term and its related meaning, thus giving radically incompatible categorizations of a given part of reality. This conceptual kind of incommensurability challenges supporters of scientific progress, scientific rationality, and scientific realism to explain the continuity in goals, roles, values, and ontological imports of these incommensurable concepts.

The need to defend the rationality, the objectivity, and the reality of science made conceptual change a central topic in philosophy of science for the past 60 years. Philosophers of science have developed a plethora of models of conceptual change, such as syntactic models (Brown 2007), semantic models (Balzer et al. 1987; Kitcher 1995), cognitive models (Thagard 1992; Andersen et al. 2006), evolutionary models (Toulmin 1972; Hull 1988), and pragmatic models (Friedman 2001; Wilson 2006). Discussions about scientific conceptual change have also included the reconstruction of several episodes of conceptual change from the history of science, thereby creating a vast literature of detailed case studies. Moreover, in the interplay of these models and these case studies, various notions of continuity and change in conceptual affairs have been proposed and criticized, together with suitable fine-grained notions of objectivity, rationality, and realism.

One would expect any philosophical debate over whether and how concepts change to build upon this vast repertoire of models, examples, and theories of scientific conceptual change. However, debates about conceptual engineering do not engage much with the literature in philosophy of science on conceptual change.[1] The rest of the article is devoted to arguing that debates about conceptual engineering should pay more attention to the existing literature on scientific conceptual change. I show how an adequate appreciation of the evolution of the debates about scientific conceptual change can help conceptual engineers improve their understanding of how concepts can change. Specifically, I focus on two aspects with which debates over scientific conceptual change can be helpful for conceptual engineering projects: the compatibility of conceptual change and (meta)semantics externalism, an aspect that I discuss in the next section, and the metasemantic plasticity needed for adequately accounting for how concepts change, which is the focus of section 4.

3. Externalism and Conceptual Change

We saw in the previous section that one of the foundational challenges in the growing literature on conceptual engineering is the so-called implementation challenge, a challenge that questions the feasibility of successfully changing our philosophical concepts. Some authors argued that although conceptual engineers seek to implement real change in philosophy, it is not clear that such a change is within our reach to begin with (cf. Cappelen 2018; Deutsch 2020, 2021). In fact, if one takes conceptual engineering to be about changing the meanings of our philosophical predicates, as many do, seminal externalist works in philosophy of language have taught us that the meaning of many predicates is often more a matter of what the world is like than what we want them to mean (e.g., Kripke 1972; Evans 1973; Putnam 1975/1995). Thus, how can conceptual engineers be sure that they can successfully engineer philosophical predicates?

3.1. Cappelen's "Austerity Framework"

Such a question is asked in detail by Cappelen (2018) within the development of his "austerity framework" for conceptual engineering. According to Cappelen, conceptual engineering should be about changes in meaning—specifically, about changes in the extensions of words determined by changes in their intensions. To engineer a given concept is for Cappelen to successfully change its extension by

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[1] To my knowledge, in the already very large literature on conceptual engineering, one can find only three articles that contain some references to some literature on scientific conceptual change (see Perérez Carballo 2020; Shields 2020; Decock 2021).

changing its intension. Intensions and extensions are understood by Cappelen in a strongly externalist way, as strongly determined by the external world. From this perspective, conceptual engineering involves worldly changes—that is, actual changes in the status of the external reality. Cappelen's picture of what conceptual engineering is and should be makes conceptual engineering a difficult enterprise. Nontrivial changes in the extensions of words are difficult to obtain. From an externalist point of view, as the extension of a word is determined mostly by the world, parochial changes in the use or in the stipulated intentional meaning of a given word from a (group of) speaker(s) are (usually) not sufficient to determine a change in the extension of that word. Moreover, externalist extension change is not only difficult but also an inherently nontransparent phenomenon. Cappelen stresses with his three "Corollaries of Externalism: Inscrutability, Lack of Control, and Anti-luminosity" (72–78) that we often do not control, nor do we know, when and how the reference of our linguistic practices change. Reference change is, according to his strongly externalist view, mostly determined by worldly factors outside of our knowledge, and thus we are often not able to judge whether a change has actually occurred in the extension of a given word. Thus, in Cappelen's austerity framework, conceptual engineering is a mostly uncontrollable and untraceable worldly phenomenon. Nevertheless, he believes philosophers should engage with it, given the aforementioned inherently defectiveness of many of our philosophical concepts.

Cappelen's pessimistic depiction of the prospects of conceptual engineering within an externalist (meta)semantics heavily influenced the debate about the implementation challenge for conceptual engineering. Enthusiasts of conceptual engineering have, in agreement with Cappelen's negative assessment of the compatibility of externalism with intentional conceptual change, retracted to indirect, weak forms of collective control over reference change (Koch 2020b, 2021) or to different, more controllable targets for conceptual engineering, such as speaker meanings (Pinder 2021), psychological concepts (Scharp 2020; Fischer 2020), classification procedures (Nado 2019, 2021), or inferences (Jorem 2021; Jorem and Löhr 2022). Critics of conceptual engineering have instead built on Cappelen's (2018) "Corollaries of Externalism," claiming that the lack of control and knowledge of meaning change stressed by Cappelen makes any actual implementation of conceptual engineering either impossible or entirely trivial (cf. Deutsch 2020, 2021).

3.2. Externalism in Philosophy of Science

We have seen how Cappelen's negative assessment of the possibilities of intentional meaning change within an externalist (meta)semantics pushed conceptual engineers either to wrestle with problems of control and implementation of worldly entities or to retract completely to purely psychological or linguistic understanding of conceptual engineering. However, is intentional meaning change so incompatible with an externalist picture of language, as Cappelen (2018) argued? The history of externalist approaches to scientific conceptual change shows that this is indeed not the case.

Externalist semantics have been studied and heavily discussed in philosophy of science in connection with the problem of scientific revolutions. The so-called causal-historical theory of reference (Kripke 1972; Evans 1973; Putnam 1975/1995; Devitt 1981) has been extensively applied to the problem of scientific conceptual change. As stressed by Putnam (1973/1995), meaning externalism can explain the referential continuity of scientific terms better than internalist semantics. If internalist theories of meaning have to bridge the difference between the theoretical languages of two scientific theories with a complex translation, the world-based determination of reference championed by externalists provides an easy explanation of how different scientific theories can refer to the same entity. Even radical changes in the scientific description of a given theoretical term, such as the one common in scientific revolutions, do not pose a problem for the externalist. The sameness of reference is held fixed by the worldly causal relationships behind the natural phenomena that radically different scientific descriptions intend to describe (cf. Devitt 1979; Hardin and Rosenberg 1982).

Meaning externalism makes it easy, then, for different scientific terms to refer to the same natural phenomenon. Perhaps this is too easy, though. Externalist approaches to the problem of conceptual change in science have been accused of making referential continuity trivial (cf. Fine 1975; Nola 1980; Laudan 1984b; Psillos 1999). If the burden of fixing the reference is put solely on worldly factors, then almost all scientific theories proposed in history of science successfully refer to the same natural phenomena referred to our best scientific theories. No matter how bad or conceptually misguided the description given by a scientific theory of a certain phenomenon is, such a theory would correctly refer thanks to the hidden properties of the related external phenomenon. Laudan (1981, 1984b) argued in detail that such a purely externalist conception of how scientific terms refer to the world gives us a completely unbelievable depiction of scientific activity. Even scientific terms that have completely disappeared from the scientific image of the world without any recognizable heir—such as the famous case of "phlogiston"—successfully referred, according to the purely externalist picture, thanks to the causal relationship between oxygen and the intended baptism of phlogiston theorists. According to a strongly externalist metasemantics, phlogiston theorists, while they were trying to prove that oxygen was not a fundamental element of reality, successfully referred to the world thanks to the causal relationship between the world and the very element they were trying to disprove the existence of. This depiction of scientific theories reference is absurd, even for defenders of scientific realism and externalism like Psillos (1999) or Kitcher (1995), because it makes referential success an entirely trivial matter completely independent from actual scientific activity. An adequate picture of scientific conceptual change must allow failures of reference as well as a certain degree of intratheoretical referential continuity. Scientific conceptual change is not a trivial phenomenon.

Note that this easiness of referential continuity in purely externalist semantics is the dual issue of the difficulty of engineering concepts within a externalist framework stressed by Cappelen. To engineer a concept is difficult, from an externalist perspective, because referential continuity is incredibly easy to obtain and vice versa. The same historical arguments that Laudan and Psillos gave against overly externalist accounts of scientific term reference can be applied to Cappelen-like pictures of conceptual engineering within an externalist (meta)semantics. These pictures make the history of science absurd, locking the reference of failed scientific theory of the past to phenomena completely unknown to (and even explicitly denied by) the scientists of the time and, as such, these pictures are mistaken.

Luckily, if philosophy of science provides strong arguments for the failure of extremely externalist conceptions of meaning and conceptual change, it can also give us some possible solutions to the problem of understanding conceptual change within an externalist (meta)semantics. A natural solution to this problem is to hold a more inclusive view of meaning and reference where a multiplicity of components determines how scientific terms refer to the world.[2] As Psillos (1999) stressed, even strongly externalist approaches to scientific meaning have to take into consideration some kind of theory-laden structural component in the process of fixing the reference of a natural-kind term. If, in the case of proper names, original baptism seems a transparent way of fixing reference, the reference-fixing process for natural-kind terms is often dependent on some kind of theoretical framework—that is, it happens inside a given theoretical picture of the world. Negating this descriptive aspect of the reference-fixing process would lead to the trivial depiction of referential success incompatible with the history of science that we have criticized before. In order not to make

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[2] This more inclusive view of semantics and metasemantics is also, from a historical point of view, more faithful to Putnam's original aims in developing a causal-historical theory of reference. Although philosophers still refer indiscriminately to a Kripke-Putnam theory of reference, Putnam's views on meaning were far more nuanced that what is commonly assumed. For an excellent take on these issues, see Hacking (2007).

referential success too easy then, reference-fixing must include a descriptive component. This is the main insight of the so-called causal-descriptive theories of reference (Enç 1976; Nola 1980; Lewis 1984; Kroon 1985). Referential success is seen by these theories as the combined product of external causation and theory-laden causal explanations. Psillos's own version of such causal-descriptive theory of reference crucially involves the notion of kind-constitutive properties (Enç 1976), and it is particularly apt to show how the addition of a descriptive component allows externalists to have a nontrivial view of referential continuity in science.

Psillos's (1999) theory of how scientific terms refer to the world is centered around the notion of a core-causal description associated with a term—that is, the set of properties through which a theory explains the kind-constitutive properties by virtue of which the referent of the term it is supposed to play a given causal role. A scientific term successfully refers to a given entity when the kind-constitutive properties of the entity correspond to the ones postulated by the core-causal description that a given theory associates with the scientific term. In this way, in Psillos's theory, the reference of a term is jointly determined by an external causal element (i.e., the causal origin of the information that ultimately fixes the reference) and by a descriptive element (i.e., the theory-laden core-causal description). Consistently, referential continuity involves two conditions: the sameness of the causal role played by the putative referents of the terms together with the identity of the core-causal description associated with the terms. This required identity of core-causal descriptions ensures that there is a substantial overlap between the properties through which two co-referring theories explain the attributed causal role of a given term. In this refined externalist semantics, then, referential continuity in science is not at all a trivial matter. As Psillos shows, his theory allows scientific theories that share the central part of their causal description of a given phenomenon to co-refer, while it forbids theories that give radically opposite descriptions of a given situation to refer to the same phenomenon. In this way, causal-descriptive theories of reference can distinguish historical episodes of referential continuity between subsequent theories, such as the case of luminous ether in nineteenth-century optics (Psillos 1999, 125–39, 282–87), and cases of reference change, such as the aforementioned phlogiston/oxygen case in the chemical revolution.

The example of Psillos's causal-descriptive theory of reference for scientific terms shows why radically externalist metasemantic approaches cannot give us an adequate picture of scientific conceptual change. Scientific conceptual change cannot be trivialized into a purely worldly phenomenon, but it crucially involves a plurality of meaning components at work in fixing the reference of our scientific terms. Psillos's solution—the need of a plurality of meaning components—is analogous to the ones proposed by virtually all other refinements of externalist semantics available in philosophy of science (e.g., Kitcher 1978; Standford and Kitcher 2000). Refined externalist takes might differ from one another in the exact mechanism by virtue of which terms acquire their meaning and fix their reference, but they all involve a plurality of meaning components.

This aspect is the first with which debates over conceptual change in philosophy of science can make a contribution to contemporary debates about conceptual engineering: a healthy externalism—an externalist picture that recognizes a plurality of components at work in determining the meaning and the reference of our linguistic terms—is perfectly compatible with intentional conceptual change. The negative depiction of the prospects of conceptual engineering projects within an externalist framework, which Cappelen and other authors assume, is based on a faulty conception of the relationships between conceptual change and externalism. Differently from what Cappelen's "Corollaries of Externalism" assumed, fine-grained externalist accounts of scientific conceptual change such as Psillos's show us that intentional and controllable conceptual change is possible even for externalists.

4. Metasemantic Plasticity

Having seen how the literature related to scientific conceptual change demonstrates how conceptual change is possible within an healthy externalist framework, in this section I show how the same literature gives convincing evidence for approaching matters of conceptual change with (what I will call) a metasemantically plastic picture of language.

4.1. Metasemantic Finality

We saw in section 2 how one of the central challenges that conceptual engineers set themselves to address is the "bootstrapping challenge" (cf. Cappelen et al. 2020; Isaac and Koch 2022), which asks proponents of conceptual engineering projects to specify the nature of the targets and the changes involved in their methodology. As we recalled, opinions in the literature on what the targets of conceptual engineering are and what their engineering consists of vary greatly, ranging from proposals of changing speaker meanings or modifying the inferences and the classification procedures associated with our concepts (e.g., Machery 2017; Fischer 2020; Nado 2021; Pinder 2021; Jorem and Löhr 2022) to projects that want to affect the standard meanings of philosophically relevant terms or the social norms connected to them (e.g., Haslanger 2012; Cappelen 2018; Richard 2020; Nimtz 2021).

Despite disagreeing on the targets and the goal of conceptual engineering, most answers to the bootstrapping challenge share a certain general assumption on how language works—namely, (what I will refer as) metasemantic finality. I call "metasemantic finality" the statement that the factors that ground the meaning and the reference of our linguistic terms are general in nature, monolithically fixed, and easily ascertainable in their role and influence. To understand more clearly what this metasemantic thesis entails, it is helpful to split it in three subtheses:

1. *Generality*: The ways in which the meaning and the reference of our linguistic terms are grounded are general in nature.
2. *Fixity*: The ways in which the meaning and the reference of our linguistic terms are grounded are monolithically fixed.
3. *Ascertainability*: The ways in which the meaning and the reference of our linguistic terms are grounded are easily ascertainable.

Although the variety of the approaches to conceptual engineering available in the philosophical literature cannot be easily reduced to a single metasemantic picture, most answers to the bootstrapping challenge seems to assume all three subtheses. For instance, evidence for the implicit assumption of the generality thesis is provided by the fact that most metasemantic pictures of conceptual engineering are proposed as virtually applicable to any philosophical concept (e.g., Cappelen 2018; Flocke 2020; Koch 2020a; Scharp 2020; Nado 2021; Pinder 2021). Analogously, the aforementioned discussions about the implementation challenge are driven by arguments of general possibility (e.g., Cappelen 2020; Scharp 2020; Koch 2020b, 2021; Jorem 2021) and impossibility (e.g., Deutsch 2020, 2021), where little focus is put on domain-specific characteristics of individual concepts. For what concerns the fixity thesis, we can note the absence of virtually any account of conceptual engineering that highlights context dependency or open-endedness in its metasemantic pictures. Metasemantic accounts of conceptual engineering discussed in the literature seem to assume that factors grounding the meaning of linguistic terms (or alternative targets of the engineering process) are fixed and stable across time and contexts (e.g. Cappelen 2018; Flocke 2020; Nado 2021). Even Cappelen (2018), who, as we saw, strongly stresses our ignorance in matters of reference and extensions, seems to hold a strong belief in the fixity of the external grounding factors postulated by his radically externalist metasemantics. Finally, an implicit assumption of the ascertainability thesis seems to be implied by the relative scarcity of worked-out examples of conceptual engineering analyzed in these discussions. Despite the alleged constructivist focus of this methodology, specific examples of conceptual engineering occupy a very small place in the literature (see the few examples of actual conceptual engineering mentioned in Cappelen [2018] or the few extremely short case studies contained in Cappelen et al. [2020]).[3]

In summary, the literature on conceptual engineering exhibits, in answering the bootstrapping challenge, a certain trend toward organizing itself around extremely general contrasting pictures of conceptual engineering that do not leave much space for contextual and domain-specific characteristics of their targets. Such general pictures implicitly assume what I call metasemantic finality—that is, the thesis that wants the factors that ground the meaning and the reference of our linguistic terms general, fixed, and easily ascertainable. However, as I argue in the rest in the section, such a metasemantic picture and the related general picture of conceptual change that assumes it stand in stark contrast with the long-recognized plasticity and context dependency that the history of many scientific terms exhibits.

4.2. Metasemantic Plasticity in Philosophy of Science

If, as we just saw, contemporary debates about conceptual engineering seem to be guided by a certain tendency toward a metasemantically fixed picture of language, the situation is different in the contemporary literature on scientific conceptual change. Factors grounding the meaning of scientific terms appear, according to our best philosophical pictures of science, very dependent on the specific theory (or even concept) under focus, contextually adjustable to the practical need of science, and often ascertainable only through an in-depth analysis of a specific conceptual history.

Specifically, instead of metasemantic finality, we can find in contemporary philosophy of science an opposite tendency toward a certain degree of metasemantic plasticity in semantic affairs. I call "metasemantic plasticity" the acknowledgment that the factors grounding the meaning and the reference of our scientific terms are often not general in nature, are extremely likely to change synchronically and diachronically according to the practical needs of science, and are only gradually ascertainable via an in-depth technical analysis of the history of how a certain term was (and is) used in all the related scientific contexts. As I did for metasemantic finality, it is helpful to split the notion of metasemantic plasticity in three subtheses:

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[3] See Scharp (2013) for an exception to this trend.

1. *Semantic individualities*: Different scientific terms rely on different semantic and metasemantic architectures in order to be meaningful and to refer to the world.
2. *Semantic seasonalities*: Even the same scientific term often relies on different semantic and metasemantic architectures in different contexts and at different stages of its use.
3. *Semantic nuances*: The semantic and metasemantic architectures behind a certain scientific term are often not easily ascertainable, but they are instead only recognizable through a detailed technical examination of the history of the term and the related scientific practices.

Each of these three subtheses composing the notion of metasemantic plasticity stands in direct opposition to one of the subtheses composing the notion of metasemantic finality that we saw earlier. Specifically, the recognition of semantic individualities challenges the generality thesis, the recognition of semantic seasonalities negates the fixity thesis, and recognizing semantic nuances amounts to canceling the ascertainability thesis. As such, metasemantic plasticity stands in direct opposition to metasemantic finality.

My strategy in what follows is to show that contemporary philosophy of science recognizes semantic individualities, semantic seasonalities, and semantic nuances. This perspective shows that contemporary philosophy of science upholds metasemantic plasticity and therefore leaves no space for any metasemantic finality.

4.2.1. Semantic Individualities

The first component of metasemantic plasticity is the recognition of semantic individualities—that is, the differences in the semantics and metasemantics of different (kinds of) scientific terms. Looking at contemporary philosophy of science, we can see many types of semantic individualities that have been highlighted in past decades.

A first piece of evidence for the need to recognize semantic individualities is the great variety of semantic reconstructions of scientific theories accepted today. Fifty-sixty years ago, the debate about the correct way of reconstructing scientific theories centered around opposing monolithic views (e.g., statement vs. nonstatement, logic-based vs. cognitive-based, linguistic-based vs. model-based), whereas the consensus has moved toward a great deal of pluralism (cf. Lutz 2014; Schurz 2014a, 2014b; Winther 2021). Different kinds of reconstruction might be more suitable for certain special sciences or particular stages in the life of a scientific theory. This great variety of semantic architectures can be seen as evidence of an analogous variety of metasemantic pictures of our best scientific theories and, therefore, of our best scientific terms.

Analogously to the many ways in which we can reconstruct a scientific theory, we find many different kinds of models of scientific conceptual change available in contemporary philosophy of science. Just like in the debate about the correct reconstruction of a scientific theory, the discussion of the correct way of modeling conceptual change in science has moved from a fight among opposing monolithic views toward a growing recognition of the different perks and limitations of different models. Virtually all the different kinds of models proposed, such as syntactic (Brown 2007), semantic (Balzer et al. 1987; Kitcher 1995), cognitive (Thagard 1992; Andersen et al. 2006; Gärdenfors and Zenker 2011), pragmatic (Friedman 2001; Wilson 2006), and evolutionary (Toulmin 1972; Hull 1988), have their strengths and weaknesses, as shown by the set of conceptual histories that each kind of model can adequately reconstruct. Conceptual histories that are best reconstructed with specific models of conceptual change will thus be best coupled with consistent metasemantic approaches, reinforcing the need to recognize many semantic individualities.

Even scientific terms that seem best reconstructed within the same model of conceptual change can still exhibit significant differences in their semantics and metasemantics. Different scientific terms often refer to the world in very different ways, singling out a single referent (this case is easy for many natural kinds terms), multiple ones (e.g., the case of force in classical mechanics; Wilson 2006, 158–65, 175–82), or even none (e.g., the case of hardness; 335–55). Moreover, different kinds of terms can be compatible with different theories of reference and meaning, as was convincingly argued by Schwartz (1978, 1980) in comparing natural kind terms with artifact terms. The kind of (meta)semantic architecture related to a scientific term is also dependent on the specific role that the term plays within a scientific theory. This point was stressed most famously in the traditional discussion on theoretical terms (e.g., Carnap 1956, 1961, 1966; Andreas 2021), in relation to the relativized a priori in science (Friedman 2001; Hacking 2002; Stump 2015), and also in relation to so-called design-oriented (Wilson 2006, 401–16) and epistemic-oriented (Brigandt 2010) scientific concepts. If the change of an observational term or a term that does not figure in any constitutive law of a theory can perhaps be considered a self-contained problem, to revise a theoretical term (e.g., "force" in classical mechanics) requires a radical modification of the whole theory, as the meaning of a theoretical term is (at least partially) holistically determined by the central laws of the theory.

This list of semantic individualities recognized by contemporary philosophy of science shows us then that the semantic and metasemantic architectures by virtue of which our scientific terms acquire meaning and refer to the world vary greatly from science to science, from theory to theory, and even from term to term.

4.2.2. Semantic Seasonalities

The second subthesis in which the notion of metasemantic plasticity can be divided amounts to the recognition of semantic seasonalities—that is, differences in the semantics and metasemantics that a given term presents in different places or at different stages of its use. Diachronic and synchronic semantic seasonalities have been recognized for many important scientific terms.

Strong evidence for synchronic semantic seasonalities is given by the recent popularity of patchwork approaches to scientific concepts (Wilson 2006; De Benedetto 2021; Haueis 2021b). These theories conceptualize the semantic architecture behind many scientific terms as a cluster of partially interconnected semantic patches. Patchwork approaches legitimize polysemic constructions as an epistemic advantage of many central scientific terms such as force (Wilson 2006, 2017), hardness (Wilson 2006), species (Novick and Doolittle 2021), homology (Novick 2018), gold (Bursten 2018), and neural column (Haueis 2021a). Different patches of the same term can enjoy different referents, different definitions, different inferential behaviors, and different boundaries. Thus, an adequate account of scientific conceptual change must take this fine-grained patchwork structure into consideration. To engineer, say, force in the elastic forces patch (Wilson 2006, 175–76) would imply a modification in a very different semantic structure than to engineer force in, say, the viscous fluids forces patch (158–59). Even outside patchwork approaches, the possibility for a given scientific term to enjoy different semantic architectures has been long recognized in the debate about the status of theoretical terms in science. Some popular characterizations of theoretical terms in science allow them to have multiple initiating events (Kitcher 1978), to have incompatible models (Wilson 2006), to be extremely scale dependent (Batterman 2013; Bursten 2018), and to partially refer (Field 1973). The context sensitivity of scientific terms has also been stressed in relation to other important philosophical discussions, such as debates on scientific emergence, causality, truth, and realism (e.g., Cartwright 1983, 1999; Batterman 2001; Wilson 2006).

Diachronic semantic seasonalities have been similarly appreciated and analyzed in many debates about conceptual change in science. Looking at the aforementioned debate about the status of theoretical terms, a long-recognized phenomenon is the openness of their semantics to future changes (Waismann 1945; Carnap 1956). This openness includes the open-endedness of such terms (Carnap 1961; Field 1973; Leitgeb 2022)—that is, the fact that they are essentially open to subsequent specifications—and also their open texture (Waismann 1945; Shapiro and Roberts 2019)—namely, an essential indeterminacy that makes their applications not specifiable in advance in all directions and cases. Even scientific terms that do not enjoy particular kinds of openness can still be subject to serious semantic revisions in their semantic and metasemantic architectures. Scientific theories are not fixed entities but instead are heavily dynamic entities with a semantic structure that often undergoes several metamorphoses (cf. Wilson's [2006, 545–52] concept of semantic detoxification and Moulines's [2014] concept of crystallization). In connection to these changes between the stages of a theory, scientific terms might also change their semantics and metasemantics architectures, and they might have different roles and different functions at different times.

This list of synchronic and diachronic semantic seasonalities demonstrates how even a single scientific term often relies on different semantics and metasemantics in its different uses and at different times in its history.

4.2.3. Semantic Nuances

The third component of metasemantic plasticity consists of recognizing semantic nuances—that is, the complex technical, pragmatic, social, and historical factors that determine how our scientific terms acquire meaning and refer to the world. A correct (meta)semantic account of a given scientific term is often not easily ascertainable in advance but rather can be recognized only through detailed historical and technical examination of its uses in scientific practice.

Evidence of the subtleties of the metasemantics of our scientific terms can be seen in how different the surface grammar and the working grammar of a scientific theory often are. Mature scientific theories are often prone to hide, behind apparently neat superficial semantic pictures, a far more intricate web of models and applications that constitute the real way in which the elements of a theory acquire meaning and refer to the world (cf. Cartwright 1983; Giere 1988; Wilson 2017). To understand what truly grounds the meaning and the reference of our scientific terms, most of the time it is not sufficient to look at the standard uses of a given term; we have to take into serious consideration the scientific practice involving a given term. A detailed analysis of the actual mathematical language in which a scientific term is used is often the only way in which we can appreciate the semantic work it performs (Batterman 2001; Wilson 2006).

Moreover, the semantic and metasemantic picture related to a given term arguably must often take into consideration the social-pragmatic dimension of its scientific practice. Decades of sociology of science and science studies have provided strong evidence of the ubiquitous pragmatic encroachment of this dimension of scientific practice into the semantic underpinnings of scientific terms (e.g. Bloor 1976; Pickering 1995).

Semantic nuances are not made only of technical, social, and pragmatic aspects of current scientific practice; crucially, they also involve historical analyses of related past scientific practices. The common practice in philosophy of science of employing detailed, sometimes even book-length historical reconstructions of certain conceptual histories has been paramount in improving our understanding of scientific conceptual change. A thorough historical analysis of past scientific practice can often radically change the more naive pictures of the semantics of a certain scientific term, such as shown by the cases of temperature (Chang 2004), electron (Arabatzis 2006), and phlogiston (Chang 2012).

This list of conceptual nuances shows us how the correct semantics and metasemantics of a given scientific term can often be ascertained only after a detailed technical analysis of the history of the term and the related scientific practices.

We have seen how contemporary philosophy of science gives us strong evidence for the significance of semantic individualities, semantic seasonalities, and semantic nuances in scientific conceptual change. The ways in which our scientific terms acquire meaning and refer to the world, as well as the factors grounding them, are neither general in nature nor monolithically fixed or easily ascertainable in their role and influence. The semantic and metasemantic architectures related to a given scientific term appear instead to be extremely dependent on the specific term under focus, prone to change during the life of a term, and often determinable only through an in-depth analysis of the past and present scientific practices connected with that term. Thus we can say that there is strong evidence of what I called metasemantic plasticity. Evidence of metasemantic plasticity is then evidence against the kind of metasemantic finality often implicitly assumed in contemporary debates about conceptual engineering.

The second aspect with respect to which the literature on scientific conceptual change can contribute to contemporary debates about conceptual engineering is by providing evidence for embracing metasemantic plasticity in its conception of how concepts and their (meta)semantic substrata can change. Any adequate theory of how concepts change must take into consideration a plurality of components that ground the meaning of our linguistic terms. In addition, it must be sensitive to the individualities, seasonalities, and nuances of all the terms involved. Arguably, proposals for conceptual engineering cannot be constructed in a top-down fashion as fixed one-size-fits-all theories, as many answers to the bootstrap challenge seem to assume; instead, they must be developed as bottom-up generalizations of adequate models of actual historical cases of conceptual change.

5. Conclusion

Here I recap the main steps of the present work. I started by highlighting the lack of connection between recent debates about conceptual engineering and the vast literature on scientific conceptual change. I then showed two specific aspects for which discussions on scientific conceptual change can be helpful to conceptual engineering projects. Differently from what is commonly assumed in debates about the implementation challenge for conceptual engineering, we saw how the evolution of externalist approaches in philosophy of science shows us the compatibility of conceptual change and a healthy kind of externalism. Then we saw how contemporary approaches to scientific conceptual change provide strong evidence for the necessity of having a metasemantically plastic picture of conceptual change, a plasticity that conceptual engineering projects should embrace if they want to adequately model how concepts can change.

What did we achieve by virtue of this discussion? A first conclusion is that any picture of conceptual engineering, even an externalist-based one, must recognize a plurality of meaning-determining factors in its metasemantics, and it must leave space for the semantic individualities, seasonalities, and nuances of our philosophical terms. A second, more general conclusion of this work is that the vast repertoire of frameworks, models, and case studies of scientific conceptual change exhibited by the history of philosophy of science can be helpful to contemporary discussions of conceptual engineering.

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