

Speaker's Reference, Theoretical Terms and Continuity of Paradigms

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***Abstract:** According to the incommensurability thesis, during scientific revolutions, a paradigm shifts to another one, in a way that the theoretical terms of the later paradigm change their meanings from the former. Descriptive theory of reference supports this idea. But By proposing causal theory of reference, references of terms are theory independent and do not change during revolutions.*

In this essay I examined a scientific case in the history of science, i.e. the phlogiston case. By reviewing of debates about the analysis of definite descriptions, I examined what roles different types of terms have in saving progress of science in light of the causal theory. Then I argued by accepting causal theory the type of terms chosen by a scientist plays some roles in interpreting history as continues or discontinues

***Keywords:** Incommensurability, theoretical terms, Causal theory of reference, Phlogiston theory, Joseph Priestley, Saul Kripke*

1. Introduction

Conceptual incommensurability was introduced in Thomas S. Kuhn's famous book: *The Structure of Scientific Revolution*. Kuhn suggests that the history of science includes two different types of periods; Normal science and Revolutionary science. Normal science is a relatively dogmatic period and governed by a paradigm. A paradigm is an object of consensus and the consensus shows that how the work in a field should be done. The normal science generally consists of puzzle solving. But the controversial point in philosophers' view is Kuhn's treatment of revolutionary science. In Kuhn's exposition of history of science, rationality plays little role during these revolutionary periods. During revolutions in history of science, as Kuhn explains, a scientific paradigm shifts to another one, so that the theoretical terms of the later paradigm mean differently from the former's terms. The meaning of a term or statement results from the role it plays in a theory. Changes in theories or paradigms can bring about significant changes in meaning of a term or a statement. Einstein's usage of the term *mass* is not the same Newtonian use of the "mass". So, Einstein offered a theory about different stuff rather than an improved theory of the same stuff.

The descriptive theory of reference supports this idea. According to the descriptive theory, proposed by Gottlob Frege and Bertrand Russell, proper names and natural kind terms have of course references, but they have also a further property which is meaning, and these meanings are identical with the meanings of some descriptions. Names are abbreviated descriptions (Hughes 2004, P.2). Granting that descriptive theory is true, paradigms would provide the descriptions that scientists attribute to theoretical terms. So paradigm shift changes meanings of theoretical terms. It makes paradigms incommensurable. Therefore, in order to avoid

incommensurability, proposing an alternative theory of reference is inevitable. The most important alternative is Causal Theory of Reference (CTR) that is proposed by Saul Kripke and Hilary Putnam in 1970's. It is widely believed that CTR can save continuity between scientific concepts.

In this essay, I will argue that by accepting CTR, the type of terms chosen by a scientist plays some roles in interpreting history as continues or discontinues.

For this purpose, at the first I introduce some crucial ideas in causal theory. Then, in section three, I examine a scientific case in history of science that has been argued by philosophers repeatedly, i.e. phlogiston case. Section four is dedicated to the review of debates about the analysis of definite descriptions. In Section five, by proposing two counterfactual scenarios, I examine what roles have different types of terms i.e. descriptions and non-descriptive terms, in saving progress of science in light of causal theory. Section six shows that if we accept causal theory then simple choices of scientists will affect how rational science is. Finally, the type of terms chosen by a scientist plays some roles in interpreting history as continues or discontinues.

2. Causal Theory of Reference

In contrast to descriptive theory of reference, Kripke believes that proper names (and natural kind terms) do not have the same meaning as descriptions that are attributed to them. CTR distinguishes between non-descriptive terms (like proper names and natural kind terms) and definite descriptions¹. Theoretical terms i.e. scientific terms, will refer to kinds if their references

¹ Note that some common terms also can be descriptive and nonrigid. As Nathan Salmon in *reference and essence* (1982, 51), and in “can general terms are rigid?” (2005, 123), argued there are second order definite descriptions that refers nonrigidly to a property .For example “The color that cloudless skies at noon are instances of” may refer to some other color in other possible world.

have been fixed. Fixing the reference of a term is done by two different processes; by ostensive definition or by a[n accidental] description that determinates a kind in actual world (Soames 2002, P.5). When a term is rigidified, i.e. its reference is fixed; other users of language can borrow and transfer it to the rest of society. A name will denote a kind even if its users are not able to distinguish the extensions of that kind.

Hilary Putnam in “The corroboration of theories” comparing Kuhn’s theory with Carl Popper’s theory asserts that (Putnam1974, P.128):

“Kuhn also holds views on meaning and truth which are relativistic and, on my view, incorrect; but I do not wish to discuss these here.”

Putnam objected Kuhn’s view on meaning and truth in his other papers. This discussion led to the causal theory of reference for natural kind terms (Putnam1973, P.93). This theory sounds like a strong defense of Kripke’s theory of proper names and natural kind terms.

During the revolutionary periods of history of science some theoretical terms are produced that we intuitively believe that they are related to each other. For example we believe that Newtonian mass is the same mass of theory of relativity. Or we believe that both phlogiston theory and oxygen theory are theories for explaining combustion. By proposing CTR, we envisage an idea that the theoretical non-descriptive terms have ostensive definition. So references of these terms are theory independent and if we shift from one theory to another one using the same vocabulary, the references of theoretical terms do not change (Psillos 1999, P.272). Contrary to CTR, for descriptive theory, reference of a term is theory dependent. Thus CTR certified continuity of subject-matters of theories in history of alternative paradigms.

Furthermore, one should not forget that accepting CTR does not imply that all concepts in different theories are dogmatically continuous. Two issues can awake us from this dogma.

The first issue is about reference shifting. Sometimes reference of a proper name or a natural kind term can shift to another object or another kind. Gareth Evans has remarked a famous example about it. The term “Madagascar” before Marco Polo, denoted to a part of Africa. But Marco Polo’s mistake in using this term changed reference. The reference was shifted to an island near South Africa. This case shows us that someone who believes this theory have not a strict guaranty for conceptual continuity between two scientific paradigms (Reimer 2003).

The second issue is that the references of some theoretical terms, fixed by descriptions in historically false theories, were empty. For example there is no corresponding natural kind to which “phlogiston”, produced in the Joseph Priestley and Henry Cavendish’s theory about combustion, refers to.

Although references of “oxygen” and “Phlogiston” are not the same, by reviewing the history of phlogiston theory, we will be convinced to think that there is a kind of continuity between theoretical terms of phlogiston theory and oxygen theory. Philip Kitcher has mentioned some historical evidences that confirm this idea (Kitcher 1993, P.99). Next section dedicated to examine one of his historical cases.

3. A Historical Case

Before eighteen century, the image that scientists had in their minds about combustion was based on this idea that during combustion something emits and goes into the air. The term “phlogiston” had been used by George Stahl for the first time. Phlogiston theory proposes that every combustible contains a kind of matter called “phlogiston”. When it burns, Phlogiston emits, and

ashes which are phlogiston free, remains. Or when a metal oxidizes, phlogiston emits, and calx remains. Priestley, one of the most important defenders of phlogiston theory, during his experiments comes to the conclusion that the capacity of air for absorbing phlogiston is limited. If calx gets warmed then it will transform to mercury again, and some transparent air will cumulate around the mercury that is insoluble in water but supports combustion very well. He called this new kind of air "dephlogisticated air". He realized that this kind of air can help combustion better than ordinary air. His explanation for this phenomenon was that since the produced air is empty of phlogiston, it has more capacity for absorbing phlogiston than ordinary air.

Cavendish also, by adding sulfuric acid to a metal, proposed the existence of other kinds of air. He called it "inflammable air". Inflammable air was the same thing as Stahl's phlogiston. In 1781 Priestley had exploded a complex of some inflammable air and some dephlogisticated air in a bottle and produced pure water. By comparing these conceptions with conceptions of modern science, we can identify inflammable air with hydrogen and identify dephlogisticated air with oxygen.

So on one hand, we might conclude that Priestley asserts some true statements. But, on the other hand, we can say statements of this theory can't be true because their corresponding descriptions i.e. descriptions that use fixed the reference of "dephlogisticated air" and "inflammable air", contain "phlogiston" and phlogiston is non-referring because its corresponding description i.e. the matter that emits during the combustion does not refer to any kind.

Philip Kitcher believes that some statements that Priestley and Cavendish used, for example the statements about their experimentations with calx and mercury, and some statement they

expressed about “dephlogisticated air”, succeed to refer and most of them are true statements. Kitcher extracts these examples from Priestley’s classic book *Experiment and observation on different kind of air* and Cavendish’s *The Composition of Water*. For example Priestley after breathing dephlogisticated air said that (Kitcher1993, P.100):

“The feeling of it to my lungs was not sensibly different from that of common air; but I fancied that my breast felt peculiarly light and easy for some time afterwards”

Or Cavendish said that (Kitcher1993, P.100):

“when a mixture of inflammable and dephlogisticated air is exploded in such proportion that the burnt air is not much phlogisticated, the condensed liquor contains a little acid which is always of the nitrous kind, whatever substance the dephlogisticated air is procured from; but if the proportion be such that the burnt air is almost entirely phlogisticated, the condensed liquor is not at all acid, but seems pure water, without any addition”.

Kitcher believes that at least in these cases “dephlogisticated air” seems to refer to oxygen. Kitcher extracts other examples that show there are also many cases in which “dephlogisticated air” cannot refer because in these cases Priestley intends to refer to the air which is purified from phlogiston. So “dephlogisticated air” sometimes refers and sometimes does not refer. But it seems in opposition to CTR. According to CTR, if the reference of a term is fixed then the term will refer correctly always and in every possible state. For solving the problem, Kitcher proposed an

alternative theory of reference. Kitcher's theory is a context dependent theory. In his theory every type terms has a potential reference that is a compendium of ways in which the reference of tokens of the term are fixed. Although “phlogiston” does not refer to any natural kind, some statements about “dephlogisticated Air” succeed to refer.

But I suppose that CTR is not falsified by Kitcher's examples. CTR can also explain these cases. To this end, it resorts to the distinction between speaker's reference and semantic reference. The distinction is based on some debates on analysis of definite descriptions.

4. Referential Use of Definite Descriptions

After Bertrand Russell's analysis of definite descriptions, Keith Donnellan in “Reference and Definite Descriptions” argued for an alternative application of definite descriptions (Donnellan1966, P.231). Donnellan proposed that we should distinguish attributive use and referential use of descriptions. The first usage of descriptions introduced by Donnellan, i.e. attributive use, has no differences with Russell's analysis. Donnellan's example is “The murderer of Smith is insane”. When a speaker asserts this statement for referring to real murderer, she uses attributive use. “The murderer of Smith is insane” is identical with “there is a unique person who is murderer of smith and he is insane”. But when she asserts it to refer to somebody who is arrested wrongly (called him “Jones”) and his behaviors during the investigation are like a mad person, she uses referential use of definite descriptions. As a matter of fact Jones isn't murderer of smith but when someone, by asserting the sentence, intends to refer to Jones; this token of the above type-sentence succeeds to refer to Jones. As Donnellan offers, it is called “referential use” of descriptions.

Kripke (1977) by borrowing the distinction between Speaker's Reference and Semantic Reference from H. P. Grice (Grice 1957, P.55), presents an argument to show that Donnellan's use of "referential use" of descriptions is an extension of speaker's reference and concerns the pragmatics of language and not its semantic² (Kripke 1977, P.250).

Thus, by using this distinction, a causal theorist can explain Kitcher's Examples. On one hand the most tokens of "dephlogisticated air" do not refer to oxygen (or any other natural kind) because the reference of term is fixed by a description and the description doesn't describe any natural kind. On the other hand some of its tokens refer, because they are some extensions of speaker's reference.

5. Two Counterfactual Scenarios

Does "dephlogisticated air" in the Priestley's statement "dephlogisticated air supports combustion and respiration better than ordinary air", refer to a natural kind, in the same way that "The murderer of Smith" refers to Jones? Does it pragmatically refer to oxygen? The original cases that Russell, Donnellan and Kripke concerned with were definite descriptions. Although in previous section it is said that the referential use of terms is not just about descriptions, it is important for the argument to know which theoretical term is description and which one is name. On one hand we know that the structure of definite descriptions contains definite article i.e.

² Kripke invites readers to imagine a possible language in which Russell's analysis of descriptions is the only correct analysis of description. Or as a stronger argument, he wants us to imagine a language that every definite description has been replaced with an existential form sentence that Russell proposed i.e. "there is a unique A that is B". Kripke showed that referential uses of descriptions can be observed in this language as well. Kripke also argued, this kind of referring not only exist for definite descriptions but also can be applied proper names and other terms

“the”³, and on the other hand Kripke argued that names are rigid and most definite descriptions are nonrigid. Although none of them is the base of difference between names and descriptions (partly because there are some names with structure of description⁴ and also there are some rigid descriptions⁵), but we usually distinguish these two. We know that the meanings of all descriptions depend on the meanings of their parts but nondescriptive names refer to objects directly and their referring are independent of their parts.

What kind of term “dephlogisticated air” is? Whether it is a (common) nondescriptive name or a description? Although “Dephlogisticated air” contains some parts that have independent meaning, it is not a description since it does not possess the structure of descriptions. On the other hand it is not a completely nondescriptive term. The ambiguity of this sort of terms might be the reason that Kitcher proposed a context dependent theory of reference.

Let us stop searching for the type of the term, and imagine two different scenarios. Let’s start with accepting the supposition that the term is either a name or a description and then imagine two different scenarios.

³ There is also an alternative structure for descriptions. For example “Smith’s murderer”

⁴ Kripke in naming and necessity asserts (Kripke1980/26):

It should not be thought that every phrase of the form 'the x such that Fx' is always used in English as a description rather than a name. I guess everyone has heard about The Holy Roman Empire, which was neither holy, Roman nor an empire. Today we have The United Nations. Here it would seem that since these things can be so-called even though they are not Holy Roman United Nations, these phrases should be regarded not as definite descriptions, but as names.

But it is important to distinguish a name having the structure of definite description from a definite description having referential use.

⁵ For example: "the square of two" in all possible worlds refers to four.

First scenario supposed that Priestley, when he produced oxygen in his laboratory, instead of “dephlogisticated air” used a definite description for calling it. For example, suppose he used “the air that is purified from phlogiston”. It can be a description that, Priestley thought, had determined the kind of air he had produced in his laboratory. As I mentioned, prevailing theory about descriptions discusses that the meaning of them depends on the meaning of their parts. “The air that is purified from phlogiston supports combustion and respiration better than ordinary air” according to Russell’s analysis, is equal to “there is a unique kind of Air that is purified from phlogiston and it supports combustion and respiration better than ordinary air”. So this statement will not refer to any natural kind if “phlogiston” can not refer to anything. As I argued in previous section, according Kripke’s argument, even if Priestley had succeeded to refer to oxygen, as Kitcher said, it will be not real reference of the description. The description will not refer semantically to oxygen. If one of its tokens refers to oxygen then it will refer just pragmatically to oxygen. No concept in the theory is about oxygen and we do not have any chance to escape from incommensurability⁶.

The second scenario asks you to suppose Priestley has chosen a non-descriptive common name instead of “dephlogisticated air”. In this case the reference of the term requires a condition for becoming fixed. The first option is that the term was introduced ostensively by referring to oxygen produced in Priestley's laboratory. If it was so then the name would refer to oxygen, and it would do *semantically*. The second option for fixing the reference is done by a description.

⁶ Another possible scenario, in the case of “the air that is purified from phlogiston” is the supposition that “phlogiston” refers to oxygen. This is the case when someone believes we have permission to fix terms by causal power of their references. So the scenario comes to this result that “the air that is purified from phlogiston” refers to Nitrogen. It seems there will be a kind of continuity, but it is not interesting because we expect “the air that is purified from phlogiston” is about oxygen and not about nitrogen.

Although In this case the term is non-referring, the reference of this term (as in the case of “Madagascar”) has a chance to shift. In some cases reference shifting can save continuity⁷. As I explained in Section four, this type of chance is impossible for a definite description like “the air that is purified from phlogiston”. Definite descriptions can only *pragmatically* refer to a new reference.

So depending on what sort of term “dephlogisticated air” is, it has two different chances for referring. It will refer semantically to oxygen if it is a common name. And it will pragmatically refer to the same kind if it is a description. If the term, in the theory of phlogiston, semantically refers to oxygen, the scientific paradigms in history of science are conceptually continuous. But if it pragmatically refers to oxygen, shifting the paradigm to a new one, i.e. shifting from phlogiston theory to Oxygen theory is revolutionary. But the first question still stands: Does progress or revolution in science depends on what type of terms scientists choose as a theoretical term?

6. Scientist’s *Important Simple Choice*

For CTR, difference between definite descriptions and non-descriptive term (proper names and natural kind terms) is pivotal. Descriptions are theory dependent terms and proper names (and natural kind terms) are independent of theories. Scientist, in most cases, can choose one of these

⁷ There are two possibilities about this case: a) if in the first theory (some tokens of) one term refers to something pragmatically and in the second theory a term has the same reference and refers to it semantically then there will be not conceptual continuity. b) If in the first theory a pragmatic reference caused a semantic shift of reference to an object and in second theory a term refers semantically to the same object then there will be a conceptual continuity.

two types of term and, I suppose, this choice does not change the content of her theory⁸. By replacing every token of “dephlogisticated air” with “The air that is purified from phlogiston“, the theory-independent term in the previous theory would become a theory-dependent now but the theory has the same strength that it had before.

If the content of theory is not changed then naming by description or by name only will depend on simple choice of scientist. If Priestley had chosen a completely non-descriptive term, then there would be a connection between Priestley’s terms and Lavoisier’s terms and if Priestley had chosen a description, the connection would have been lost. But the distinction between these two cases depends on a kind of relation that does not have any role in *internal* content of a theory. This kind of relation can only link a name into the theory with other names outside of the theory. So the internal content, i.e. all internal properties and relations which play roles in a theory can be used as a criteria of choice between two theories, but the relation that links names in an old theory with other names in new theory can be used as a criteria of choosing between two history of theories i.e. revolutionary histories or rational continuous histories. These are not important relations for a scientist who believes that his descriptions for natural kinds are true. So using a description instead of a name, or a name instead of a description is only a simple choice.

Priestley, Cavendish and every scientist have two options for linking terms with objects or kinds. The first is naming the same object that is discovered; and the second is using descriptions (or naming the descriptions) that they attributed to the discovered entity in light of a theory. CTR explains stability of issue of science by considering the first item. It works because there will be a permanent connection between speakers and the entity.

⁸ It does not mean that we can replace names with description in every scientific theory. My claim is that if a scientist discovers an entity then she will be able to choose a description instead of nondescriptive name.

7. Causal Theory of Reference and Kuhn's Incommensurability

There are some options for explaining this. The first option is that we refuse Kripke and Grice's distinction between semantic reference and pragmatic reference. Taking this approach, we can assume that sentences which contain definite description also can be a kind of subject-predicate form. And in contrary to Russell's and Kripke's arguments, descriptions can be known as referential terms like proper names and indexical terms. So there is no any difference between pragmatic reference and semantic reference. But the result of this approach is approximately equal to accepting a context dependence theory of reference which Causal theorists do not accept it.

The second approach is refusing distinction between names and descriptions. In this case names could be descriptive. So choosing description or name does not make any problem for naming a kind. But it is defending a version of descriptive theory of reference which is not also acceptable for causal theorists.

Another approach is using natural kinds' causal roles for fixing the theoretical terms. The causal role of phlogiston is burning and the causal role of oxygen is burning too, so "phlogiston" and "oxygen" refer to the same substance. But the result is not persuadable because the reference of "dephlogisticated air" will become nitrogen⁹. It is too much costly because on one hand in this

⁹ As it is explained in Footnote of 5, in the case that we fix reference by causal roles, if "dephlogisticated air" is a description, then this term will refer to nitrogen. But if we suppose "dephlogisticated air" is a name then it will refer to oxygen. Since "phlogiston" also refers to oxygen, these two intuitively opposite terms will be synonym.

case the connection of concepts can not remain consistent, and on the other hand, the continuity that produced here is more liberal than our intuition permits¹⁰.

So the only option for a causal theorist is accepting that the scientists' simple decision for choosing between grammatical types of terms can change the destiny of rationality in science.

8. Conclusion

In this paper, I tried to show that by accepting causal theory of reference the type of terms chosen by a scientist plays some roles in interpreting history as continues or discontinues. I can summarize the argument in two premises:

1- The semantic roles of definite descriptions and non-descriptive terms in causal theory of reference are different. Firstly, I supposed that descriptions are theory dependent and names are independent of theories, and secondly, it is argued that when speaker's reference of some tokens of a non-descriptive term is different to its semantic reference, it is possible for semantic reference to shift to speaker's intended object. However when speaker's reference of a description is different to its semantic reference, shifting the reference is impossible.

2- The second part is dedicated to show there are some cases in which a scientist can choose a description instead of a name (or vice versa) and her choice does not change the content of her theory. When a scientist discovers a substance which fits the descriptions given by her, she can use either a description or she can name it by a non-descriptive name for referring to its samples. Therefore, the scientist's simple choices play some role in blocking conceptual incommensurability.

¹⁰ This case is liberal because by accepting it we must also accept (for example) "Natural place of objects" in Aristotelian physics and "gravity" in Newton's physics and "space time curvature" have the same reference.

But this unintuitive result will be not so undesirable if we count fixing reference as a process. Michael Devitt, for explaining Evans' shifting reference, uses the concept of "multiple grounding. He mentioned: "In our original sketch our name fixed in a dubbing. All subsequent uses of a name are parasitic on that dubbing. All d-chain trace back to that one grounding. What this account misses is that many uses of the name relevantly similar to the dubbing. They are similar in that they involve the application of the name to an object in direct perceptual confrontation with it" (Devitt1999/62).

Kind terms, according to Devitt, are also multiple grounded. For a kind term not only there is a borrowing chain, but also there is grounding chain. The grounding chain which is used in two different scientific paradigms makes the reference of the term stable. Scientists' choices have a crucial role in forming grounding chain. According to Putnam's argument against individualism i.e. Division of linguistic labor, the reference of a term cannot be determined by an individual's mental states. It will be determined in society and by resorting to scientists' mental states and their intentions.

References:

Donnellan, Keith 1966. "Reference and Definite Description" In *Philosophy of Language*, Ed. Martinich. Oxford University Press, third Edition 1996.

Devitt, Michael and Kim Sterelney 1987 *Language and Reality: an introduction to the philosophy of language*, Cambridge, Mass: MIT Press

Grice, H. P. 1957. "Meaning" In *Analytic Philosophy An Anthology*, Blackwell 2001.

Hughes, Christopher 2004. *Kripke, Names Necessity and Identity*, Oxford university Press

Kitcher, Philip 1982. "Genes", *British Journal for the Philosophy of Science* 33

Kitcher, Philip 1993. *The Advancement of Science*, Oxford University Press.

Kripke, Saul 1977. "Speaker's Reference and Semantic Reference" In *Philosophy of Language*, Ed. Martinich. Oxford University Press, third Edition 1996.

Kripke, Saul 1980. *Naming and Necessity*, Cambridge MA. Harvard University Press.

Kuhn, Thomas S. 1970. *The Structure of Scientific Revolutions*, The university of Chicago press.

Psillos, Stathis 1999. *Scientific Realism, How Science Tracks Truth*, Routledge

Putnam, Hilary 1973. "Meaning and Reference", in *Analytic Philosophy An Anthology*, Blackwell(2001)

Putnam, Hilary 1974. "Corroboration of Theories", In *The philosophy of Carl Popper*, (The Library of living philosophers) ed. P.A. Schilpp

Reimer, Marga 2003. "Reference", *The Stanford Encyclopedia of Philosophy* (Spring 2010 Edition), ed. Edward N. Zalta,

URL: <<http://plato.stanford.edu/archives/spr2010/entries/reference/>>.

Salmon, Nathan 2005. "Are General Terms Rigid?" In Linguistics and Philosophy, Volume 28, Number 1, February(2005) URL:www.springerlink.com/index/M002372472H36006.pdf

Salmon, Nathan 1982. *Reference and Essence*, Princeton University Press.

Soames, Scott 2002. *Beyond Rigidity : the unfinished semantic agenda of Naming and necessity*, Oxford University Press