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1. Systematize and exemplify the main changes in Kuhn's conception of science on:

(a) Paradigms and their constitutive role

First of all, let me make a list of the change from Kuhn's early view 'paradigm' to later one 'lexicon'.

(1963) Paradigm: Achievements that the members of community share are considered as a paradigm. There is a total incomparability of paradigms between different communities.

(1983) Lexicon instead of paradigm: A structured vocabulary that provides access to a variety of possible worlds.

(1983) Different lexicons relate us to different sets of worlds that never entirely intersect.

(1990) Lexicon – Lexical Taxonomy – Conceptual scheme.

(1990) A conceptual scheme is conceived not as a set of beliefs, but as a mental module conceived as a requisite for having beliefs

According to this list, I describe the difference between Kuhn's early (1960's) and later (since 1983) views in detail.

According to Kuhn's early (1960's) view, each paradigm picks up each view. A paradigm changes concepts, the meaning of words, and so on. Each paradigm has each exemplar which a member of the scientific community depends on. As exemplars change radically according to a paradigm shift, our ways of observing the world (i.e, our perceptions of the world) would also change. Different communities have different practices of their activities because they have different exemplars under different paradigms. On Kuhn's early view, there is a total incomparability of paradigms between different communities.

On Kuhn's view, in normal science, scientists do not look for novelties. They try to improve interpretation of empirical facts under their paradigm. The paradigm is used for puzzle-solving potential in paradigms. The solved problems in the framework of the paradigm work for further puzzle-solving problems in the paradigm. Normal science does not advance by using theories and laws to new technical contexts beyond the current dominant paradigm. Normal science advances by applying the puzzle-solving resources within the prevailing theories and laws in the paradigm. In normal science, the scientific community uses the achievements for its further practice. Achievements that the scientific community shares are considered as a paradigm.

“Achievements that share these two characteristics I shall henceforth refer to as ‘paradigms’, a term that relates closely to ‘normal science’”(Kuhn,10)

Achievements involve rules and standards for scientific practices in the community. A paradigm has to be more successful than its competitors in puzzle solving efficacy. Normal science consists in the actualization of the paradigm's potential by improving the knowledge of the empirical facts that the paradigm provides.

“Paradigms gain their status because they are more successful than their competitors in solving a few problems that the group of the practitioners has come to recognize as acute”(Kuhn, 23)

The activity in the paradigm is something like the solving of crossword and jigsaw puzzles. Every move for solving puzzles is rule-governed by the rules of the games such as crossword and jigsaw puzzle. Likewise, every activity in normal science is rule-governed by the paradigm. Normal science works in the rule bound way, but when its puzzles are not solved by the resources under the paradigm, normal science has a problem. As normal science loses puzzle-solving efficacy in the paradigm, the scientific community has a crisis of the paradigm, then the

scientific community comes to share a new paradigm under which it has new puzzles and rules for the solution of the problem. That is, the rejection of one paradigm always leads to the introduction of new paradigm. According to Kuhn, the old paradigm does not gradually change into new one. That is, the old and new paradigms are incommensurable. Scientific revolution happens when one set of structures completely supersedes another. That is, ‘complete replacement’ happens between paradigms. There is an incommensurability between paradigms.

Since 1983, Kuhn stopped to use ‘paradigm’. He rather used ‘lexicon’. There is an incommensurability between lexicons (i.e, scientific theories), but different lexicons share many of the terms. Only a small subgroup of terms have problems of translatability between different theories. This modest version of incommensurability is called “local incommensurability”. According to Kuhn, the term ‘incommensurability’ functions metaphorically. That is, the claim that two theories are incommensurable is the claim that there is no common language in which both theories can be translated. There is a term which two communities share, but not a same language or lexicon which interrelates the terms in a certain criterion between different theories.

“Most of terms common to the two theories function the same way in both...

Only for a small subgroup of terms and for sentences containing them do problems of translatability arise” (Kuhn, 36).

The lexicon provides members of the community conceptual access to an infinite set of possible worlds described by the lexicon. Only a small fraction among the possible worlds is compatible with the actual world. As scientific research is improved, it gets rid of possible worlds which are incompatible with the actual world. Science progresses when it approaches the actual world by excluding more and more possible world.]

Our language or lexicon is adapted to the world in which we live. Kuhn considers “Different languages impose different structures on the world”(Kuhn, 52). Such criteria tie some terms together and distance them from others, and build a multidimensional structure within the lexicon. What homologous structures mirroring the same world preserve is the ‘taxonomic categories’ of the world. What people share in a community is homology of taxonomic structure. Our ways of observing the world depend on our taxonomic structure of the world.

“That structure mirrors aspects of the structure of the world which the lexicon can be used to describe, and it simultaneously limits the phenomena that can be described with the lexicon’s aid”(Kuhn, 52)

Kuhn explains the lexicon by taking an example of a historian. The historian becomes bilingual when he/she faces untranslatable statements in the old book. The historian needs to learn the lexicon to which the untranslatable statements belong. By getting the past and current lexicons, the historian can compare them. Both of the lexicons share most of the terms, and the shared terms are used in both lexicons. However, to understand what untranslatable statements mean, the historians have to consider the statements in the lexicon to which the statements belong because the statements are understood or evaluated only within the framework of the lexicon to which the statements belong

“Evaluation of a statement’s truth values is, in short, an activity that can be conducted only with a lexicon already in place, and its outcome depends upon that lexicon”(Kuhn, 77)

The historian cannot understand what meaning of untranslatable statements is in his own lexicon. The phenomena described in the untranslatable statements do not belong to the possible worlds to which historian’s own lexicon gives access. These phenomena belong to another set of

possible worlds to which the older lexicon underlying the statements gives access. To solve the problem of untranslatable statements, according to Kuhn, the historian has to be reeducated such as “the recovery of the older lexicon, its assimilation, and the exploration of the set of words to it (the older lexicon) gives access”(Kuhn, 85). That is, the historian can understand the untranslatable statements only in the system of the lexicon underlying them.

In conclusion, a lexical taxonomy must exist before the members describe the world. It also has to exist before the members of the community communicate one another. A taxonomy is placed in the community prior to any activity in the community, and any relationship is formed under taxonomic categories.

“Shared taxonomic categories, at least in an area under discussion, are prerequisite to unproblematic communication, including the communication required for the evaluation of truth claims”(Kuhn, 93)

Different taxonomies form different speech communities. Although different speech communities have different statements, these communities share the terms that overlap beyond different communities. In Kuhn’s early view, a paradigm shift is considered the change of everything. There is nothing which different communities share because of incommensurability between them. However, in later view, it seems that Kuhn gradually revise his view by accepting the terms overlap over different lexicons of different communities. Kuhn stresses that there is not literal incommensurability such that everything changes between different paradigms but “local incommensurability” between such that a small subgroup of terms has problems of translatability between different lexicons. Most of the terms remain the same throughout the transformations, but the changes of the membership of the sets to which the enduring terms belong affect not only the referents of an individual term but of an interrelated set of terms. It seems that a lexical

taxonomy is a conceptual scheme. As a conceptual scheme changes, the module which interrelates the terms changes, but most of terms are shared by different communities.

Incommensurability between paradigms is no longer applied to Kuhn's later view. Thus, Kuhn rarely uses the term 'paradigm' later.

2. Explain:

(b) Kuhn's view of scientific rationality

According to Kuhn, when we evaluate criteria for theory choice, our evaluation depends on the prospect of the goals to be achieved by the choice. Selecting theories, scientists aim to maximize efficiency of them in 'puzzle solving'. That is, scientists evaluate scientific theories by considering whether theories work at most for puzzle solving. If scientists replace a traditional theory with a new theory, and the goal of the theory choice is rational, a new theory maximizes efficiency to solve scientific problems. On the contrary, if the new theory which replaces the old one decreases the accuracy and simplicity of puzzle solution, and works less efficiently than the old one, the theory choice is irrational. That is, scientific rationality of theory choice is to adopt theories which improve the accuracy and simplicity of puzzle solving over the traditional theories.

Science is rational activity. Theories that scientists use should maximize the attainability of their ends. The theories work at most rationally for scientific ends. Scientists use theories which maximize efficiency of puzzle solving. If new scientific theories work more accurately and with more simplicity than the traditional theories, the new theories are more rational than the traditional ones. The accuracy and simplicity in theories are standards of rational theory choice.

Scientific rationality is taken by their values, not decisive rules, and scientists make different choices even if they share their values in the same community. Scientific theories are not totally

correct. We need to improve them so that the theories work well for the interpretation of natural phenomena. Scientific rationality is not ultimate rationality because it does not cover rationality of all ends of science. When we believe that some scientific theory works well to explain natural phenomena, our beliefs depend on values, rules, and so on by which we judge something. In other words, these values and rules are standards of our judgment. Although we usually judge something on standards of our judgment such as our values, rules, and so on, these standards are majority ones, not the ultimate ones. Rationality on our scientific activity is not a total one that covers the ultimate goal in science, but a temporary one that maximizes the efficiency of puzzle solvability.

Scientists consider that the criteria such as accuracy, simplicity, consistency, and so on are important when they decide which theories work for solving scientific problems. Scientists need scientific theories which increase quality of these criteria. The criteria are necessary characteristics for scientific theories to solve puzzle in science, and the theories maximize the criteria more than existing competitor ones. That scientists choose theories that work less well than the competing ones in that the chosen theories decrease accuracy, simplicity, and so on is self-defeating. The self-defeating action is considered as irrational one. We evaluate scientific theories and laws by the criteria such as accuracy, simplicity, and so on.

“Accuracy, precision, scope, simplicity, fruitfulness, consistence, and so on, simply are the criteria which puzzle about the match between phenomena and belief has been solved”(Kuhn, 251)

In sum, science is basically activity based on instrumental rationality. By maximizing the attainability of a certain goal, scientists take rationality of science. According to Kuhn, the goal is to improve puzzle solvability. We can say that normal and revolutionary sciences are both

rational in that scientists always aim to improve puzzle solvability in both of normal and revolutionary sciences. When puzzle-solvability does not work well in normal science, there is a transition from normal science to revolutionary science. Scientists try to find out a new lexicon in revolutionary science so that puzzle solvability functions well under the new lexicon.

The standards (accuracy, simplicity, etc) themselves for proceeding rationally are also rational. Since those standards operate not as rules but as values, scientific rationality cannot be reduced to any algorithm. That is, Kuhn's rationality is a broader rationality than the empiricist one in which it is reduced to logicality. Although something rational for one scientific community might not be rational for another, both of the communities share the same broader conception of scientific rationality (accuracy, simplicity, etc).

Kuhn rejects the idea that all knowledge is local and relativistic. Although there is a revolutionary transition between paradigms on Kuhn's view, and it seems to be relativistic implications of his view, there are fundamental criteria or values such as accuracy, simplicity, and so on which are definitive of scientific activity. The fundamental values are shared by different paradigms, and are necessary to rationality of all scientific activity beyond the difference of paradigms.

“Such values are constant or permanent across scientific revolutions or paradigm-shifts, and this is all we need to secure the (non-paradigm-relative) rationality of scientific progress”(Friedman, 182)

3. Classify into True-False and justify your answer

(b) Contextualism is the non-dichotomizing alternative to relativism and absolutism about justification (Longino)

True

The rational-social dichotomy is taken by three major binaries (1) individualism versus non-individualism, (2) monism versus non-monism, and (3) relativism versus non-relativism. In general, the binary of individualism and non-individualism talks about how agents relate their knowledge, that of monism versus non-monism is about what character the known objects have, and that of relativism versus non-relativism is the difference of the characteristics of justificatory warrant of knowledge.

There are two modes: a dichotomizing and a non-dichotomizing mode. Both of rationalizers and sociologizers depend on the dichotomizing mode. Philosophical dichotomizers (rationalizers) take individualism, monism, non-relativism as an integrated set while sociological dichotomizers (sociologizers) take non-individualism, non-monism, relativism as the one. According to Longino, there is another constructive set such as non-individualism, non-monism, and non-relativism alternative to either the dichotomizer's way so that we have multiple interpretations which are conceptually distinct from the dichotomizer's way. It's called 'the non-dichotomizer's way'. The set is non-individualism, non-monism, and non-relativism.

We can consider non-individualism from three interpretations: (1) wholist, (2) eliminativist, and (3) social ones. According to wholist view, only a group, not an individual, knows. That is, our knowledge is not just personal but social. On eliminativist view, nobody knows. Knowledge is a detached product from us. Knowledge is the product acquired independently of any individual. Socialistic view emphasizes the interdependence of cognitive agents. These views of non-individualism avoid the view of individualism such that individuals know independently of their relation with others.

Non-monism denies the existence of only one account about the content of knowledge. We can consider non-monism from three interpretations: (1) the antirealist interpretation, (2) the

eliminationist interpretation, and (3) the realist interpretation. The antirealist interpretation is referred to as constructivism. On the view of constructivism, many accounts can be applied according to empirical facts, but none of them explains anything real. The eliminationist interpretation also shows that there are no correct accounts. There is a difference between the constructivist and eliminationist interpretation in that the eliminationist position admits that there is a real-world, but there are no accounts which correspond to it. On the one hand, according to the realist interpretation, there is no single account to capture all things in a real world, but each account captures some aspect in the real world. Thus, the realist interpretation of non-monism is pluralistic.

Third, non-relativism denies that warrant of justification is arbitrary. Non-relativism is also considered from the three interpretations: (1) the absolutist interpretation, (2) the eliminationalist interpretation, (3) the contextualist interpretation. According to the absolutist interpretation, justification is independent of context. The eliminationalist interpretation considers that there is no justification of belief. According to contextualist interpretation, justification relies on criteria immanent in the context. On contextualism, justification is neither relative nor absolute. That is justification is conditioned by rules in the context of inquiry, but is not absolute.

“ Finally, the contextualist interpretation holds that justification is neither arbitrary nor subjective, but is dependent on rules and procedures immanent in the context of inquiry. Contextualism is the nondichotomist’s alternative to relative and absolutism regarding justification ”(Longino, 92)

The multiple interpretations of the non-dichotomizer’s way alternative to that of the dichotomizer’s way points out the possibilities of new interpretations. Multiple combinations of

our interpretations free from dichotomy's way are viable. Longino tries to make new combination of interpretations in non-dichotomizer's way such as an interdependence interpretation of non-individualism, a pluralist interpretation of non-monism, and a contextualist interpretation of non-relativism. In other words, she looks for the possibility of a new interpretation of knowledge by reuniting interdependence of cognitive agents, a plurality of content, and contextuality of justification.

(d) Logical constructivism leads to irrationalism (Kukla)

Yes

Logical constructivism is the view that there are no independently valid rules of logic. It reminds us of strong constructivism that there are no independent contingent facts. On the one hand, rationalism is the view that there are some independently valid rules of logic. It is clear that there is a crucial difference between logical constructivism and rationalism. Thus, we might consider that logical constructivism and irrationalism which is contrary to rationalism are similar. However, logical constructivists try to distinguish their position not only from rationalism but also from irrationalism because they believe that there are some valid rules in logical constructivism and thus their position is different from irrationalism one which neglects any rules. Unlike rationalists, logical constructivists just do not believe that there are valid rules independent of human.

“Unlike the irrationalists, logical constructivists are willing to say that some inference rules are valid. They just disagree with the rationalist theses that the validity of logic is independent of human activity”(Kukla, 119)

If there are no independently contingent facts, truths depend on socially constructed facts. The truth regarding our decisions and evaluation are not decisive but provisional because they

change as socially constructed facts change. Thus, socially constructed truths are not normative constraints. Likewise, if there are no independent valid rules of logic, truths depend on provisionally constructed rules of logic. So constructed truths are not normative constraints on our epistemic activities. Thus, logical constructivism falls into irrationalism in that it has no epistemic constraints like irrationalism.

“When this general point about constructed truths is brought to bear on the thesis of logical constructivism, it precipitates the latter’s collapse into irrationalism”(Kukla, 120)

On logical constructivism, there are no independently valid rules of logic. But, if any logic is negotiated, for negotiating it, we have to employ another negotiating-logic. For example, when first-order logic is negotiated, we need higher-order logic to break first-order logic. This one has to be the outcome of a negotiation, and so on. Kukla also has another argument. According to Kukla, the logical rule we need to negotiate is itself negotiable. Higher-order rules break the first-order rules. But these logical rules which we need are negotiable. So you can break these. And, consequently, “the result is that there are no epistemic constraints on the moves that logical constructivists allow themselves to make. Therefore, logical constructivism reduces to irrationalism”(Kukla, 122) The absence of epistemic constraints reduces to irrationalism.

Moreover, if logic is socially constructed, what happens when two societies create two different logics? We cannot say that both are valid because one of them might generate the conclusion that the other one is invalid. Suppose that one society (S1) constructs logic L1, and another society (S2) constructs logic L2. L1 and L2 are incompatible. L1 is valid for S1, and L2 is valid for S2. Logical constructivists would look for the rudimentary rules of inference by

jumping from one boat to another, but they fall into no restriction in the reference practice. So that is irrationalism.

4. (a) Show that Kuhn is not a social constructivist (compare his views with mainly Latour's own ones)

Science proceeds from facts gained through observation. The facts are objective in a sense that they are interpersonal. These facts are prior to scientific laws and theories in that the facts serve as the raw data for the scientific laws and theories. Scientific laws and theories are not simply given because we have to interpret the facts and construct the scientific laws and theories from interpretations. The interpretation is the byproduct gained through a human process. Thus, different people interpret the facts differently, and invent different laws and theories.

The facts of observations are pliable in that the facts achieved by the observations of different people differ from one another. That is, the facts are not mere facts (in the sense they are not purely objective). Individuals might observe the same phenomena differently by virtue of their personal custom and sense. There might be a difference between the beliefs of individuals from their observations. While we admit the difference, we make a consensus of different beliefs within the community. These processes within a scientific community refer to as 'negotiations'. According to social constructivism, negotiations in science are governed by interest, politics and power in a society, and those social matters play a significant role in science. On the view of social constructivism, there are all power and interest in scientific life and development, and nature does not play an important role in the development of science), but, according to Kuhn, not only changeable social matters regarding power and interest but something else is related to scientific development..

“Nothing along that route has suggested replacing evidence and reason by

power and interest. Of course, power and interest play a role in scientific development, but there is room for a great deal else besides”(Kuhn, 115)

Social constructivism is inspired by ethno-methodology and cultural anthropology. Social constructivists carefully observe the behavior of people in the laboratory. Part of people’s methodology such as the discourses used in their laboratory requires a process of selection under interaction with a society. Their discussions are the byproducts gained through the process of negotiating their claims and arriving at agreements about them. The process of negotiation and agreement among people in the laboratory transforms subject matters of study into facts. The facts are facts constructed by social consensus in the laboratory.

It is a process of construction of facts starting from statements initially proposed, then negotiated, and commonly shared by a certain group. The process involves persuading others with agreements of majority of a group. There are no actual facts not laden with social matters as far as they are matters of negotiation and agreement under the social process in the laboratory. The acceptance of the performed tests of facts as conclusive is the outcome of negotiation among the members in the community. Thus, since scientific facts are social constructs as far as their credibility depends on the social consensus among the members of the scientific community, scientific development should be considered in the social context.

“Indeed, I think an argument could be made to show that the existence of the macrolevel itself, the famous “social context”, is a consequence of the development of many scientific disciplines”(Latour, 274)

Scientific theories and models are the byproducts gained through the complex process of displacements and translations in the community rather than the mediation between the subject (recognizer) and the object (the world). According to Latour, the construction of scientific facts

is a collective process rhetorical persuasion. The process of persuasion is the process of transformation from ‘science in the making’ to ‘ready made science’. Scientific facts are not pure facts socially unalloyed but social facts. No scientific facts transcend the network of our practices in our community. That is, scientific facts depend on customs, conventions, norms, and so on. Latour considers that the laboratory is something like an institution of scientific activity involving communication, persuasion, and the use of apparatuses that transform phenomena into written documents as ‘inscription devices’. According to Latour, “science stops or begins at the laboratory walls”(Latour, 274). It seems to me that, on Latour’s view, the world where scientific facts inhere is constructed by the social processes of laboratory.

On Kuhn’s view, social constructivism is absurd. Sociological approaches are not sufficient in explaining scientific knowledge as far as it sticks to the explanation that all of our knowledge is influenced by social matters. Sociological formulation of science would fail to notice that nature lies between negotiations in the community.

“But they (sociological and historical formulations) remain almost totally uninformative about that role about the way , that is, in which nature enters the negotiations that produce beliefs about it”(Kuhn, 110)

According to Kuhn, scientific practices have evolved, and the development is like an evolutionary tree. In the evolutionary development, social characteristics such as power, authority, interest, and so on play a role, but they do not necessarily influence all scientific development. Other characteristics such as accuracy, consistency, breadth of application, simplicity, and so on are shared by the members of the different generations and communities. As scientists get incremental accuracy, consistency, and simplicity of scientific facts, science develops. These criteria are necessary for the continuous development of scientific knowledge.

“I again have in mind such characteristics as accuracy, consistency, breadth of application, simplicity, and so on- characteristics that are passed, together with illustrations from one generation of practitioners to the next”(Kuhn, 118)

Kuhn considers that the world is not a byproduct invented or constructed by a social decision of the members of the community. The members have the foundation to recognize the world innately, and then understand incrementally the actuality of the world through social life. Thus, unlike the view of social constructivism, the world does not change according to people’s intentions, desires, and so on. The world itself is solid, not fluid. Kuhn describes, “As such it (the world) is entirely solid: not in the least respectful of an observer’s wishes and desires”(Kuhn, 101). If you are born in a certain world, you are imputed to find the world within your framework. In other words, your world is characteristic of your place of birth. Kuhn’s scientific communities are isolated, and the members of the communities are not involved in a trade of displacements and translations. The members in the community never invent their world because the world is inherent with them. The members in the community invent not the world but changes in some aspects of the world. The world where you live is inherent in your nature. Likewise, what you evaluate is not belief but change in some aspects of belief. What the members in the community produce is not belief itself but change of belief.

“...there, what required evaluation was not belief but change in some aspects of it, the rest held fixed in the process: here, what people can effect or invent is not the world but changes in some aspects of it, the balance remaining as before”(Kuhn, 102)

It is not true for Kuhn that everything in science is socially constructed and resolved. If everything is socially resolved, rationality as rigid, transcendent, and non-contextual would not play any role because rationality is assumed as something not having any social connotation. Kuhn takes a wider conception of rationality of criteria such as accuracy, precision, scope, simplicity, and so on than the one reducing it to algorithmic logicity, and denies that everything is socially resolved. It seems that Kuhn's view is beyond the dichotomy between the rational and the social. According to Kuhn, the lexicon gives the members in the community categories to recognize their world. In other words, lexicon categories provide the members in the community preconditions of possible experience in the world. The members rationally work under logicity of the lexicon categories. But lexical categories change according to the shift from one community to another. So the lexicon is not solid. Kuhn tries to find out that there is something permanent, fixed and stable underlying all changeable matters. Kuhn describes, "But, like Kant's *Ding an sich*, it is ineffable, undescribable, undiscussible"(Kuhn, 104).

It seems to me that something permanent, fixed and stable is the real world, not invented one, and also a broader conception of rationality, not a logical one of it. Contrary to Kuhn, Latour dose not accept that there is something permanent, fixed and stable. Latour describes, "...it is impossible to dominate nature and to dominate society separately"(Latour, 287). On his view, there is no independent world. We just recognize the world socially invented. It is impossible for us to believe the existence of the real world not laden by social matters. On the other hand, according to Kuhn, we invent not the world but the change in some aspects of the world because the real world is detached from social matters, and inherent with us. Also, a broader conception of rationality involving accuracy, precision, simplicity and so on which is shared by different

communities is also not a socially constructed rational rule but the principle of reasoning beyond the lexical-changes.

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