NATURAL KIND TERMS DEFINED BY CONVENTION: FAMILY RESEMBLANCE AS A BETTER WAY OF UNDERSTANDING KIND TERMS INCLUDING SEX AND GENDER TERMS

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1.

Abstract

Essentialism on natural kind terms holds that there is an essence by virtue of which all instances of a given kind belong to the same category and are named by the same kind term. This thesis aims at criticizing essentialism on natural kind terms. There are various types of essentialism, the main focus here is to argue against Kripke's views on natural kind terms and suggest a better way of understanding kind terms by Wittgenstein's notion of family resemblance. This thesis also includes a case study to show that a more inclusive way of using sex-gender terms is available if we give up the essentialist assumption.

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Metaphysics first attracts me to contemplate truth and existence in Platonic philosophical heaven, then feminism leads me to reflect on our society. I am really glad that I have this opportunity to combine my philosophical interests and make my first attempt to do a semi-independent research on this topic.

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Introduction

Essentialism has been a dominating view in philosophy from ancient to contemporary times, but those attempts are doomed to be a failure. To explain the meaning of a word or concept, philosophers tend to seek a definition which consists of necessary and sufficient conditions, this means they have to find one or some properties in common for all and only instances of that given concept denoted by the corresponding term. Essentialism holds that there *are* some commonalities in every instance and it is by virtue of the commonality that all instances are named by the same kind term. However, they presuppose unjustified hidden essence while there may not be such commonality in all and only instances of a given kind, and also, it is not *because of* the potential common property that instances are referred to by the same term. Essentialists ignore the fact that we *need not* know the hidden essence to successfully refer to objects in ordinary language practice. I support Wittgenstein's family resemblance theory that there *need not* be an essence that predetermines a sharp and fixed boundary for concepts. Instances being called by the same name because we see them sharing overlapping similarities. I argue that most empirical concepts including "natural kind" terms are used and understood in this way.

The plan of the discussion is as follows. In chapter one, I criticize Kripke and Putnam's views on natural kind terms, I argue that natural kind terms are not rigid designators and the way of naming them involves conventional stipulation. In chapter two, I defend Wittgenstein's notion of family resemblance. I argue that kind terms can also be understood as vague terms, the meaning of a term comes from the use of language instead of a hidden essence. In chapter three, I present a case study on biological kind terms about sex and gender to show that family resemblance theory is more applicable in ordinary language practice.

Chapter 1 – Stipulated Nature: Is essence purely discovered in nature?

1.1 Introduction to natural kind terms

In this chapter, I argue against Kripke's view on natural kind terms in *Naming and Necessity*. I think natural kind terms shall not be considered as rigid designators, and the theoretical identification statements with natural kind terms are not necessarily true. Though there is still controversy about what count as natural kinds, i.e., whether natural kinds are contrary to social kinds or artificial kinds, it is generally believed that natural kinds reflect the natural divisions independent of convention or human intervention. I will show that Kripke's view on natural kind terms presupposes an essentialist ontology of kinds and involves stipulation[1].

Kripke attempts to extend rigidity of proper names to natural kind terms to reject the descriptivist theory of kind terms. Kripke argues that natural kind terms function in a similar way to proper names, and that the meaning of natural kind terms are determined by the internal structure which can be empirically discovered. Kripke thinks that natural kinds could not possibly be other than what they are discovered to be, theoretical identity statements such as "Gold is an element with atomic number 79." represent the real essence discovered by scientists and is necessarily true in the strictest possible sense. Once the internal structure of a kind is discovered, it will be a part of its nature or essence and will be a necessary condition to determine individuals' kind membership.

[1] There is no direct citation in the final draft in this chapter, but many ideas and views were inspired by Ben-Yami's arguments (2001, 2020) on Kripke and Putnam's views on kind terms. I include them in the references.

However, I think Kripke need not suppose a hidden internal structure for us to identify or refer to instances of natural kinds. The semantic function of natural kind terms is to refer to members of the kind without ascribing essential property to them, and the users of natural kind terms need not implicitly commit themselves to an essentialist ontology. Kripke argues that scientific discovery tells us the essence of each natural kind objectively, but I think the way that he fixes the extension of natural kind terms with the discovered internal structure has already redefined the original meaning of the kind term and this process involves stipulation. I will show that Kripke's account of natural kind terms involves unjustified assumptions and lacks sufficient explanatory power.

1.2 Stipulated rigidity of natural kind terms

Kripke suggests that natural kind terms[2] have a close kinship with proper names and are also rigid designators. According to him, propositions such as "Water is H_2O" are identity claims and are necessary truths: "Theoretical identities are generally identities involving two rigid designators and therefore are examples of the necessary a posteriori (Kripke, 1980, 140). " Rigidity is the most important feature that distinguishes Kripke's theory of names from descriptivism and guarantees the truth of such identity claims. Something a rigid designator if it designates the same object in every possible world (ibid. 48). In order to know whether a term in question is rigid, we need to know whether this term may refer to other entities in other possible circumstances. We know that for Kripke, possible worlds and counterfactual situations are just stipulated (ibid. 49), then what can count as a solid foundation that grounds the rigidity of a term? Kripke indicates that for proper names it actually depends largely on

[2] The standard natural kind terms Kripke mentions include at least species names, countable nouns (cat, chunk of gold), mass terms (gold, water) and terms for natural phenomena (heat, sound) (Kripke, 1980, 134).

our intuition and natural language practice (i.e., ibid. 14). Moreover, Kripke thinks demonstratives can be *used* as rigid designators, even free variables can be *used* as rigid designators of unspecified objects (ibid. 49). We can see that rigidity of proper names and other terms involves some stipulation, and we can choose to use a non-rigid term as rigid designator under certain circumstances. It is straightforward to fix the reference of proper names as the reference is one single object, we just need to tag the name with the object across possible worlds. Would this also work for kind terms? I think there are at least three difficulties for natural kind terms to be considered as rigid designators.

1.2.1 The ambiguous designation

Kripke does not specify what exactly the fixed designation is for natural kinds terms. There is a crucial asymmetry between the semantics of proper names and kind terms. Kind terms do not directly refer to any specific individual as proper names, instead, each kind term has extension which is a set of instances of the kind. It is clear that what a proper name rigidly designates in all possible worlds is one same object, but it is difficult to make an analogy to let any kind term designate the same set of objects in its extension because the individual instances constantly vary in all possible worlds. For example, one condition for the kind term "cat" to be rigid is that it designates same entities in all possible worlds, but the set of all cats contains different elements in all possible worlds.

Since the entities being rigidly designated cannot be all the instances of the natural kind term, it is unclear what exactly natural kind terms rigidly designate. Kripke once indicates the kind itself as a candidate, as he mentions in *Reference and existence*: "These considerations have led me to conclude that a natural kind term in ordinary discourse has some function like that of a proper name—that it refers to the things of the same substance or

species or whatever is in question, as "the kind of animal given by this original sample.' (Kripke, 1973, 45)". It seems most plausible to take the abstract entity, namely the kind itself as the fixed designation regardless of the changes in extension and instances of a natural kind term. However, this approach requires a supposition of essentialist ontology for natural kind terms. For example, Kripke once argues that "Heat", like "gold", is a rigid designator, whose reference is fixed by its "definition" (1980, 136). If we provide a definition for each kind, there has to be one or some necessary and sufficient properties as the essence to fix the definition, otherwise the kind itself lacks stability and may not be considered the same abstract entity in all possible worlds which rigidity requires. However, this interpretation has a risk of circularity and will weaken the explanatory power of theoretical identity.

1.2.2 Hypothetical baptism and inconsistency

Second, I will continue to argue that Kripke's own account of the original introduction and later adoption of scientific kind terms involve conceptual change, and natural kind terms sometimes also fail to designate the same kind concept.

Let's remind ourselves of why proper names are rigid designators. As Kripke advocates, proper names are rigid through "baptism" and passed down by certain historical causal chain. Proper names are first arbitrarily assigned to individuals, but the language users *decide* to keep the reference fixed so that it is easier to refer to the same individual in daily communication. Rigidity is one of the fundamental properties of proper names and corresponds to our ordinary language practice. However, natural kind terms were initially used for objects with similar properties, they are not rigid designators by default and they were not precisely defined or baptized before. We can see the dissimilarity between natural

kind terms and proper names, as Kripke admits, the baptism for natural kind terms is imagined, hypothetical and artificial.

Natural kind terms were more likely to be introduced by ostension or description of paradigmatic instances. For example, the original concept of cat is "that kind of thing, where the kind can be identified by paradigmatic instances" (1980, 122), and Kripke also mentions that certain substance is defined as *the kind* instantiated by (almost all of) a given sample (1980, 135). Meanwhile, Kripke argues that kind terms may be passed from link to link, exactly as in the case of proper names, and their reference is determined by a causal historical chain (ibid. 139). The origin and causal chain of natural kind terms entail that if something was considered as an instance of a kind and passed from pre-scientific times, we shall accept the use of it. I think Kripke also agrees that we should respect the original use of a term. For example, he says one could introduce a new term "Schmunicorn" with a definition consisting of merely surface characteristics, and then one could refer to some individual as schmunicorn iff it satisfies the conditions in the definition, but he emphasizes that, this is not unicorn because people in medieval did not use it in this sense (1973, 48). Here he traces back to the original meaning and definition through the historical chain, for something to be unicorn, it has to be the same kind as it was introduced.

I think the dilemma is that, if Kripke really sticks to this rule, he shall not change the original meaning and usage too much, but rigidity of natural kind terms and scientific essentialism lead to an inevitable consequence that Kripke needs to keep modifying the original meaning of the natural kind terms once new discoveries are made. The original baptized sample of gold main contain some other substances: "Gold is the substance instantiated by *the items* over there, or at any rate, by almost all of them. (1980, 135)", but Kripke thinks the later discovery of the components of *this items* should rule out part of them because those are not real instances of gold but just fool's gold. There is an inconsistency

between Kripke's causal chain theory and the potential modification of the extension of natural kind terms. Some philosophers believe that it is sufficient, according to Kripke's picture, for successfully referring that they are part of an adequate 'historical' or 'causal' chain of language users which goes back to the first users (i.e., Raatikainen, 2021, 4). However, we have seen that if the original paradigm consists of some other substance which has always been included in the extension of the kind terms passed by the causal chain, then to claim the discovered pure essence would have changed the original meaning and extension of the kind term.

When empirical investigation shows a kind has multiple structures, we sometimes rule out the minor components as in the fool's gold case, while sometimes we allow them both to be instances without modifying the use of the kind term, for example, jadeite and nephrite are found to be different but are still both considered as jade. I think scientific discovery can only tell us what the instances include, which is a matter of fact, but it is a matter of choice that we *decide* what to include as the instances of a natural kind. Certainly we could redefine each kind more precisely, but that is our choice, not what the scientific discovery directly shows.

1.2.3 The presupposed hidden essence

As I have briefly discussed above, the most plausible candidate which might be unchanged in all possible worlds to be rigidly designated by natural kind terms turns out to be the concept of kind itself. And also, an identity claim with two proper names is a *de re* modal claim which expresses something essential of the object, so there has to be some essential properties for us to define the kind. For Kripke, the essence of a kind is the internal structure which may be unknown but can be discovered. He argues that, "If there were a reptile which looked just like this, but had a different *internal structure* (in fact, David Lewis told me that there is something

called a marsupial tiger), the animals of the species would not be tigers no matter how good they were as dead ringers for tigers (1973, 44)." and "Any animals which aren't of the same kind—that is, don't resemble, say in *internal structure*, the things in this original sample—are not tigers no matter how much they resemble tigers (ibid, 46)."

I have explained that rigidity involves stipulation, or at least partly determined by the language user or baptizer arbitrarily, especially for scientific kind terms as H_2O which was initially used as an abbreviation of the description for something with two hydrogen and one oxygen atoms. One the one hand, the rigidity of natural kind terms requires some fixed entities to be rigidly designated across possible worlds, and I have explained that Kripke is likely to take the kind itself and the essence as such entity. On the other hand, the necessity of theoretical identification which identifies certain natural kind with its essence requires natural kind terms rigidity. Kripke presupposes a fixed internal structure for natural kinds to maintain rigidity, but it is rigidity that allows us to suppose the essence without knowing what they are and to identify instances in other possible worlds.

I think there is a circularity since rigidity and essence presuppose one another, and at least one is unjustified. Kripke's supporters may argue that, even though these two presuppose each other, Kripke could argue for three relations independently and together they entail that there are kinds with essence. Take water as an example and this requires the relation R1 between kind term "water" and the kind water, R2 between scientific term "H_2O" and the kind water, R3 between the kind itself and any particular instances of water in the real world. I would accept R2 since scientific terms rigidly designate the molecule by scientists' definition and arguably the corresponding substance or kind, but Kripke does not provide justification for R1, and I have argued in previous section 2.2 that R1 is by stipulation, I do not see how there

could be such independent justification for natural kind terms to be rigid designators without presupposing essence.

Kripke thinks to justify the internal structure is merely a matter of biological investigation, but I doubt it. It's still not fully clear what counts as the internal structure of species, species keep evolving and mutating, and many biologists and philosophers (i.e., LaPorte, 2004, 61) agree that individuals can belong or not belong to a species contingently, there is no current account of species which is strictly according to essentialism. It is possible that future biologists discover the internal structure of each species, but how do we determine species membership nowadays? After Kripke admits that "it is true that we wouldn't know what internal structure is", I find his answer "we can say that to be a tiger you have to be the same kind of animal as *this*. (1973, 46)" to be question begging. For example, suppose the tiger kind *K* has some fixed but unknown internal structure *S* as its essence, it is necessary and sufficient for all individuals of this kind to have this internal structure: $\forall x\ (Kx \leftrightarrow Sx)$. Now that we still don't know what this structure *S* is, how could we know what it means to be the same kind *K*[3]? How does this essentially differ from committing ourselves to a Platonic idea of tiger or an Aristotelian form of tigerhood? One may object that, this is not unjustified old-fashioned metaphysics, we know there *is* such an internal structure for each natural kind, as scientists have already discovered some for chemical substance. I will argue later that, though it is true that we have discovered some main chemical components of some substance, but it is our deliberate choice to regard them as the essence and secretly refine the initial concept of the natural kind.

[3] I do not ask Kripke to provide a set of properties to identify instances as a descriptivist, actually he needs not do so, but I think he needs to provide more solid arguments for the existence of such internal structure and what they might be. For example, the chromosome as the internal structure for biological kinds is different as molecular structure for chemical kinds, just presupposing an internal structure is too vague.

1.3 Trivial theoretical identity statements

I have argued above that rigidity of natural kind terms involves stipulation, and presupposes the unknown internal structure as the hidden essence. Some may argue that even rigidity is stipulated and unjustified, it only undermines the necessity, the scientific discover in our actual world is still true. I think one may suggest that we could interpret the standard modal operator of necessity as a notion in tense, namely, claims such as "Water is H_2O" is true in the actual world, and will always be true in past and future. And they would argue that my objection to the unknown internal structure may be one concern for biological kinds, but it would not undermine the truth for essence of substances discovered by scientific investigation. I disagree with such views and I argue that theoretical identity statements are not real identity statements, it is true that science does not discover the essence, but only the main component of certain substances, and this process also redefines the concept of kind. Natural kind terms are not purely natural and is not fully independent of conventional intervention.

1.3.1 Macroscopic natural kinds and microscopic main components

I argue that macroscopic natural kinds are not identical to microscopic main components. I take water as a standard example to examine Kripke's argument in detail. Let's compare these two propositions:

(1) Water is H_2O.

(2) Hesperus is Phosphorus.

The truth of proposition (2) depends on its being an identity claim about the same object Venus. If the semantics of natural kind terms are similar to proper names, then the condition for (1) to be true is to be an identity claim, and the kind term water and the scientific term H_2O to refer to same entities. Kripke says that such identity statements express scientific discoveries and is necessarily true (1980, 128). However, I think strictly speaking the identity statement "Water = H_2O" is false. For identity claims with proper names, there has to be one same object being designated, but it is unclear whether the term "water" and "H_2O" have exactly same referent even in our actual world.

I think it's helpful to first make a distinction between scientific terms with strict definition and natural kind terms in ordinary language. For example, the term "gold" used as a chemical element with the symbol "Au" refers to the microscopic entity which may have isotopic variation while "gold" as a general natural kind term refers to macroscopic objects, they share most but not all properties. We are confident to claim that "Gold is the element with atomic number 79." but would be hesitant to claim that "Diamond is the element of atomic number 14." because there are other substances such as graphite with the same component. Kripke's theoretical identification argument seems correct because he chooses Gold as the example, the term "Gold" happens to be used both in scientific and ordinary sense, while many others are not. I think Kripke's gold example only shows that "Au" is the element with atomic number 79 and Carbon with 14, but in that case it fails to explain the essence of natural kind terms in ordinary discourse. One may argue that, kind terms are used in ordinary language in such a loose and vague way that they are not *real* natural kind terms at all. I think this view is misleading. I would remind them that our interest in natural kinds is mainly about reveling the real kinds in nature and reflect the structure of natural world. When we speak of objects in real world instead of in laboratory, we unavoidably deal with unpurified samples and they are instances of natural kind terms. To insist that natural kind

terms must be scientific terms in the strict sense implies that natural kind terms do not exist in pre-scientific times, which is wrong.

I think water here shall not be understood as a chemical substance, but as its original meaning in ordinary language which refers to the kind of liquid, while the term H_2O refers to each molecular with certain microstructure. Then let's check whether this two terms refer to the same entities. On the one hand, there are other entities even in pure water, i.e., the H+ and OH- ions, due to the fact that combined molecules are constantly dissociating and combining[4]. It is misleading to claim that water is identical to massive H_2O molecules while ignoring other particles. Notice that I use H_2O in a charitable way as a rigid designator as Kripke insists, actually if we use H_2O in a descriptivist way to describe some substance with Hydrogen and Oxygen atoms, the problem with H+ and OH- particles may be avoided. But when H_2O has the molecules with that structure as its fixed referent, the identity claim easily fails. On the other hand, one single H_2O molecule lacks many properties of being water, and not all entities consisting of H_2O molecules are "water" used in the ordinary sense. Ice and vapor have the very same chemical component, but ice is not exactly what water refers to in ordinary language practice, for example, we say "70% of human body consists of water or H_2O", but we would not say 70% of our body is ice or vapor though they are both H_2O. This shows that there's certain gap between micro and macro scopes and natural kind terms are not simply reducible to chemical components, being H_2O is not identical to being water.

1.3.2 Universal generalization

A potential modification is to claim that theoretical identity statements need not involve the identity sign, biconditionals or even just conditional with universal quantifier would be

[4] The polymerization and ionization rates are influenced by temperature, pressure and other factors.

sufficient. Some also argue that universal generalization is a broad identity statements, for example to say all cats are animals is to identify each cat as animal (i.e., Soames, 2005, 6). I think this proposal already shows that the Kripkean theoretical identification is not genuine identity statements, which is contrary to Kripke's claim that natural kind terms bear a close kinship with proper names. I will continue to argue that the universal generalization interpretation can maintain the truth of the theoretical identification only trivially, natural kind essentialism is doomed to failure.

Kripke himself seems to agree with the biconditional interpretation, in one example about gold he claims that he takes the biconditional to indicate strict necessity in the identity statements: "a material object is (pure) gold if and only if the only element contained therein is that with atomic number 79. (1980, 138)" I think it is merely a contingent fact that all and only substance with such atom is gold according to the current discovery, but this empirical fact cannot rule out other theoretical possibilities that some substance undiscovered has the same atomic number but somehow turns out to be considered a completely different kind. I think natural kind terms have potential open boundaries, it is highly possible that we discover or even create variants which have some inner difference inside the nuclear.

1.3.3 Beyond scientific discovery

I will turn back to water as a standard case study. I support LaPorte's modified twin earth thought experiment and argue that there might be substance which is water but with components other than H_2O. We only need "Possibly, X is water but not H_2O." to object the strict universal quantification and necessity claim.

Putnam argues that the liquid which resembles water but consists of XYZ would not be water. However, we shall not presuppose that water is necessarily H_2O when we run the

check across possible worlds. We are not asking whether H_2O could turn out to be XYZ, instead, we wonder whether for every drop of liquid called water in the actual world, could there have been some other components in it.

LaPorte (2004, 104) presents us a new story where earth explorers go to Deuterium earth and find some substance similar to water but consists of D_2O[5] instead of Putnam's XYZ. They soon realize that this substance is not drinkable and find that it contains a "new" atom different from hydrogen, both have the atomic number 1 but Deuterium contains one more neutrally charged particle which does not influence its atomic number but makes the mass greater. They decide to name this atom "Deuterium" because it is found in Deuterium earth, and this substance "dwater" because they think this is not water. They finally travel back to earth after decades, claiming that they have found a new substance, earth scientists disappointedly told them that this is not a new kind for earth because it has been found recently on earth, and is just a variant of water with hydrogen isotope. LaPorte shows that there could be disagreements on which kind certain substance shall belong to, he suggests that neither explorers are completely wrong in denying D_2O to be water, nor the earth scientists are completely correct in admitting it as a variant of water. LaPorte thinks in this scenario we could say *some* H_2O, namely D_2O ($_2H_2O$), is not the stuff that we used to call water, because they do not bear the relation *same microstructure kind* to the majority of water. In fact, D_2O is still called "heavy water", but we know that normally we use "water" to refer to "light water" H_2O. There is no factual disagreement but we did use "some water" to refer to D_2O when we deny that it is the normal water.

[5] "Heavy water (deuterium oxide, $_2H_2O$, D_2O) is a form of water that contains only deuterium (2H or D, also known as heavy hydrogen) rather than the common hydrogen-1 isotope (1H or H, also called protium) that makes up most of the hydrogen in normal water. On Earth, deuterated water, HDO, occurs naturally in normal water at a proportion of about 1 molecule in 3,200. This means that 1 in 6,400 hydrogen atoms is deuterium, which is 1 part in 3,200 by weight (hydrogen weight). Deuterium is a hydrogen isotope with a nucleus containing a neutron and a proton; the nucleus of a protium (normal hydrogen) atom consists of just a proton. The additional neutron makes a deuterium atom roughly twice as heavy as a protium atom." (wiki)

This is an example of closely related overlapping kinds which cause indeterminacy and vagueness. I agree with LaPorte that in such cases we could go either way. As LaPorte concludes, this is not a change in meaning of kind term but a change in theory about the kind (2004, 109-111). I think when new vague instances arise, it is a matter of choice whether we include it as a variant of the original kind or claim that they are two different kinds. It is one fact that we did discover the main components H_2O of the natural kind water, but it is another thing to claim that H_2O is the essence or is identical to water, Kripke redraws the boundary of the natural kind water by claiming theoretical identification.

I have shown above that Kripke's theoretical identification involves arbitrary choices and redefinition of the original term by scientific discovery. I mentioned above that some may try to defend the modal claim of such theoretical identities by interpreting the box modal logic operator not as necessarily true but as it has always been true in temporal logic. I think such claim as "Water is H_2O" may not even be always true all the time in the actual world. To make it clearer, I present the following three possible scenarios:

(1)Scenario one: Past

Suppose we were in over a century ago, when both explorers and earth scientists have not discovered the internal structure inside the atom. The Hydrogen and Deuterium atoms appeared to be indistinguishable, they were taken to be the same kind of element Hydrogen, and they still believed that the essence of water *is* H_2O, so the substance dwater is H_2O and *is* water for them, and they would say the substance the explorer find is water, but also be surprised to know that some water is not drinkable. What would we say about the case? I think we could maintain the truth of the proposition "Water is H_2O", but both designates different entities as Kripke believes, the theoretical identification fails to explain the essence or necessity of natural kind terms.

(2) Scenario two: Present

Contemporary scientists discover the difference between hydrogen isotope, they know normal water consists of protium oxide H_2O while H_2O is deuterium oxide. At this point, the earth explorers and earth scientists in Laporte's story just need to make a decision of how they want to fix the extension of water. Kripke makes his choice to fix it with protium oxide, but it is not necessarily so. In the original sample or even in the pure water sample scientists used to baptize "water" and "H_2O", there naturally exists about 0.015% D_2O. Kripke could claim that H_2O rigidly designates only the protium oxide, but the original extension of water is naturally a mixture of both together with some other variants. The way Kripke fixing the reference of water also redefines water, then "water is H_2O" is true but only in the trivial sense by the new definition.

(3) Scenario three: Future

With the development of chemistry, scientists find out that in the standard H_2O molecules sample, deep inside the proton of Hydrogen (protium), there is some never detected particle α and β, α is toxic to animals by itself but is harmless if they are mixed with β. It turns out that half of our water sample consists of Hydrogen-α and half Hydrogen-β, they are evenly distributed in the standard Hydrogen atom, so we always drink a combination of both. The future scientist managed to purify Hydrogen-α, we tend to think that this substance is not water, but they exist in our water sample naturally and has been in the extension of the kind term water throughout history, they are also what "H_2O" has been rigidly designated in Kripke's sense, and for the current scientist there is no difference in the known microstructure. If the term H_2O rigidly designates *that* kind of molecules which contain both H_2O-a and H_2O-β with all the internal structures we currently know, then the H_2O -a *is* H_2O and is water, but they are more similar to XYZ and probably would not be considered as water for Kripke and Putnam. If H_2O designates whatever drinkable substance among H_2O, so it actually designates only H_2O -β, then the concept of H_2O is open to changes and need to

be redefined. I think this shows that the internal structure is always be open to new discovery, and the current claims can be easily falsified. We shall not be so confident to claim that water *is* necessarily H_2O or will always be H_2O once discovered, given that the H_2O only designates the current level of microstructure.

I propose the three scenarios to criticize the essentialist account of natural kind terms, we have no justification to claim that the current scientific discovery already tells us all the internal structures of the substance, or the substance could never undergo changes such as radioactive decay. It is not an epistemic question of whether or not we can know the ultimate chemical substance, we may or may not in the future, but it does not seem correct in both modal sense and temporal sense to claim the theoretical identification and the essence. The difficulties in fixing the referents indicate that the extension of terms is indeterminate, vague and partly conventional.

I suggest that the term water is similar to jade which may designate more than one substance since there is actually no sharply closed boundary. Scientists discovered that jade includes at least two different substances, and named them jadeite and nephrite, the original kind term jade is kept in ordinary language and separated from scientific terms of components. It is true that scientists discover some main components with relatively stable internal structures, but that does not follow that they have discovered the hidden essence and justified Kripke's supposition of essence. It is more of a contingent convention that he deliberately links the chemical terms to natural kind terms, theoretical identification seems to be necessary and objective truth but actually involves certain arbitrariness of redefining the theory or concept of natural kind.

1.4 Conclusion

I have argued above that the rigidity of natural kind terms is stipulated and does not really explain necessity of theoretical identification, instead, it presupposes an essence as the fixed extension of natural kind terms. Kripke's account involves stipulation and redefines natural kind terms in ordinary language, the nature of kinds is not purely scientifically discovered.

It is true that scientific discovery contributes our knowledge of natural kinds, but empirical discovery does not necessarily exhaust all the theoretical possibilities of the essence of a kind. There is no need to commit oneself to unknown essence, even if there were a hidden essence, it need not always determine a sharp boundary of the kind. It is possible that the hidden essence leaves borderline cases where it's upon our decision to assign their kind memberships. In next chapter, I will introduce Wittgenstein's notion of family resemblance as an alternative way to understand kind terms. I argue in the third chapter that (some) natural kind terms have vague meanings based on both nature and the convention of language use.

Chapter 2 – An alternative way of understanding natural kinds: family resemblance concepts

The aim of this chapter is to provide a positive account after criticizing essentialism, and to provide an alternative way to understand kind terms better by Wittgenstein's notion of family resemblance. Wittgenstein's original examples of family resemblance terms in his Philosophical Investigation (PI) are concepts such as "game" and "number". I first explain his notion of family resemblance in more detail, and then I articulate the main features of family resemblance terms and concepts. Finally I reply to potential objections and defend his view as it provides a more natural way of understanding and using terms in ordinary language practice.

2.1 Introducing Wittgenstein's notion of family resemblance

Different from the essentialist tradition of trying to find necessary and sufficient conditions in vain, Wittgenstein shows us that the meaning of words can be understood without presupposing essence, and we have no difficulty successfully referring to various instances of a general term.

Wittgenstein introduces this notion in *Philosophical Investigation* that, "I can think of no better expressions than 'family resemblance'; for the various resemblances between members of a family: build, features, color of eyes, gait, temperament, etc. overlap and criss-cross in the same way (PI § 67)." He explains what family resemblance concerts are like by

giving us a paradigm of a family resemblance concept "game". He convinces us that there is no one property in common for all things that we call "game", instead, they have overlapping similarities that form a "family". If we compare different games, such as ballgames, chess, noughts and crosses, etc., each has some properties of being amusing, competitive, or cooperative, etc., but there is no one common feature for all. If we keep trying to find more common features between each pair, we will see similarities between groups of games crop up and disappear (PI § 66). For a family resemblance concept, "these phenomena have no one thing in common which makes us use the same word for all,—but that they are related to one another in many different ways. And it is because of this relationship, or these relationships...(PI § 65)." Baker and Hacker explain in the commentary that: "The adducing of relevant similarities justifies applications of 'game', since it is on account of the relationships among games, especially on account of similarities with the paradigmatic examples, that we correctly call certain activities 'games' (Baker and Hacker 2005a, 213)." This means we use general terms for various instances because each instance is a part of the web relating to other instances, Wittgenstein also gives a vivid analogy of how we extend a concept, he says: "We extend a concept as in spinning a thread we twist fibre on fibre. And the strength of the thread does not reside in the fact that some one fibre runs through its whole length, but in the overlapping of many fibres (PI § 67)."

Suppose that the explanation of "game" convinces us that there is really no essence or one common feature for all and only those we all agree to be games, one may still ask: But you haven't told me the criteria to determine whether or not a concept is a family resemblance one? I would not answer this question by a more "precise" definition consisting of necessary and sufficient conditions for being family resemblance concepts. Why? Because there is no such thing embedded in the notion of family resemblance. Notice that the way Wittgenstein introduces the notion of family resemblance is by giving a typical paradigm or instance "game",

together with few other examples to explain what family resemblance means. However, the question itself presupposes the essentialist way of understanding family resemblance concepts, which is exactly what we are trying to escape from. Wittgenstein answers a similar question about what knowledge is where he says he would just "enumerate instances of knowledge and add the words 'and similar things'" (Ben-Yami 2017, 408), so I assume he would answer the question by saying: those similar to "game" would count as family resemblance concepts. I think Wittgenstein intentionally chooses not to specify the boundary of family resemblance concepts, his examples and explanations are sufficient to show what family resemblance concepts are like, and serve his purpose to reject the essentialism assumption that we use the same terms for different instances only because they have something in common.

Number, for instance, is a family resemblance concept according to Wittgenstein. This surprises us since mathematical concepts are believed to be the most precise and crystal clear, how would the concept of number lack a precise definition consisting of necessary and sufficient conditions? I think Ben-Yami gives a thorough explanation to this doubt: "We call something 'number', he suggests, because it has a direct affinity with several things that have hitherto been called 'number', and thus an indirect affinity with other things that we also call 'numbers'. Complex numbers have this affinity with the real numbers, the real numbers have it with the rational, the rational with the natural, the transfinite with the finite, and so on. Thus, the kinds of numbers also form a family (Ben-Yami 2017, 411)." Moreover, though "number" in general as a family resemblance concept has fluctuating uses in ordinary language, it is not incompatible with our first impression that the concept of number is precise, because what we had in mind is "number" in the narrow sense that has already been sharply defined, but it *need not* necessarily be so. As Wittgenstein says: "I *can* give the concept 'number' rigid limits in this way, that is, use the word "number" for a rigidly limited concept, but I can also use it so that the extension of the concept is *not* closed by a frontier (PI § 68)." This shows us there are

different ways of understanding some concepts, it's neither necessary nor natural to understand all concepts in the essentialist way. The point is that the boundary of family resemblance concepts is by itself vague and open, though we *can* also draw a sharp one with specific purpose or justification in certain circumstances.

2.2 Vague and open boundaries

Family resemblance concepts are vague and open. The idea that a concept can be vague strikes many philosophers as incomprehensible. For example, Socrates keeps seeking for precise definitions which "exist" only in the Platonic heaven; Frege thinks that a concept must be sharp otherwise it's wrongly termed as concept. However, family resemblance concepts are typically vague, and this draws our attention to examine whether concepts with borderline cases or blur boundaries are proper and useful concepts. Philosophers are so used to sharp concepts and precise definitions that they are skeptical about vagueness. Essentialists attempt to draw clear boundaries and find necessary and sufficient conditions, but Wittgenstein shows that their effort is in vain. For no matter how thin the line is, there is or may always exist borderline cases which blurs the sharp boundary. I will continue to argue for Wittgenstein's insight that some concepts are inherently vague and open, and this puts no difficulty in our understanding and using those terms.

There are some interesting relations between vagueness and openness due to the blur boundary of family resemblance concepts. I agree with Friedrich Waismann's viewpoint that these two features can appear independently. There are vague terms, open-textured terms, terms of both or neither, I suggest that family resemblance concepts have both features. Let's first

consider vagueness. I think a concept can be considered as a vague concept if there is at least one borderline case. As Ben-Yami writes, "A concept is vague if it has indeterminate boundary cases, namely cases where its usage and explanation provide reasons for as well as against applying it, without these reasons being sufficient either way (Ben-Yami 2017, 412)." Family resemblance concepts are one kind of vague concept, but there are other kinds of vague concepts that are not family resemblance concepts. Colors, for example, are vague but not family resemblance concepts. The reason is as Timothy Williams argues, colors may have borderline cases, but all shades of blue resemble each other in the same respect (Williamson 1994, 88). Ben-Yami makes it clearer that colors are vague but not family resemblance because they do not have a plurality of criteria or of dimensions of resemblance that determine their application, while family resemblance concepts tend to have fluctuating ways of using (Ben-Yami 2017, 412).

Second, let's examine the features of being open-textured. Waismann (1951) points out that openness is a fundamental characteristic of most empirical concepts because they are not delimited to all possibilities and cannot be conclusively verified. He gave the example of "gold" which is believed to be precisely defined. He argues that even though the actual use of gold is not vague, for example, if we take it to rigidly designate all and only those composed by chemical element with atomic number 79; however, it still leaves the possibility open that we may find new substance that fits all chemical tests of gold but emits a new sort of radiation. I agree with him that since we can never rule out all the possibilities of some unforeseen situations, new instances may occur and the concept is open to these new instances. Waismann thinks that a concept is vague if borderline cases already occur, and is open if borderline cases *could* occur. I think this is because openness is a possibility of having new instances different from the standard ones, openness is a fundamental feature for general terms of empirical objects. Therefore, we *can* draw a more specific boundary to fix vagueness of a term, but there

is no way to eliminate new borderline cases occurring in the future on this new boundary. As Waismann argues, definitions of open terms are always corrigible and emendable. I think his view is correct that no definition of empirical terms can cover all possibilities due to the incompleteness of empirical description and definition (Waismann 1951, 118-131).” This shows that though closely related, openness differs from vagueness in the sense that openness entails the possibility of vagueness. Moreover, vagueness can be fixed by stipulation or drawing boundaries for specific purposes, while open texture cannot be fixed since it is a systematic ambiguity for empirical concepts and terms which cannot be conclusively verified.

Third, borderline cases are one important feature but we shall not try to take it as a necessary or sufficient condition for being family resemblance concepts. Sometimes there is no already known borderline case, a concept can still be a vague family resemblance concept if there is no common property shared by all and only its instances. For example, Wittgenstein does not provide any borderline case for his original example “game”, all kinds of game in his example are already called game in ordinary language, but they simply do not share any common properties. Family resemblance concepts usually have both features of being vague and open since they lack sharp boundaries, and this does not make it inferior to other sharply defined concepts, instead, I will argue later that they are better and more applicable in our language practice.

2.3 Understanding the meaning without definition

The main worry about family resemblance concepts is whether we can still understand their meaning and use them correctly. Opponents argue that we cannot understand the meaning of a

concept without clear definition, moreover, we cannot guarantee that we use it correctly without necessary and sufficient conditions drawn by sharp boundaries. For example, many general concepts are used to sort things into groups by setting clear boundaries. How can we classify and determine whether certain objects can be a proper instance of a concept and correctly referred to by a term? To clarify these doubts, I will first argue that understanding the meaning does not necessarily require a definition. Then I address the doubts about usefulness by a case study on natural kind in the next chapter.

Wittgenstein thinks the meaning of a word is through its use in practice. We would agree with him if we ask ourselves: do we not understand what we mean when we talk about "cats" without knowing the biological definition in terms of some Latin terms such as F. catus (species) and Felis (genus)? The worry that we may not be able to grasp a proper understanding of a word's meaning arises from the wrong essentialism belief. I will continue to argue that understanding does not require a sharp definition or knowing the "essence", rather, understanding the meaning is a matter of knowing how to use language correctly.

The confusion between understanding, explanation and definition traces back to ancient times. For example, Socrates criticizes his interlocutors for lacking knowledge of what "beauty" is, only because they fail to give him a perfectly and complete definition of "The Beauty". However, we have no difficulty understanding what interlocutors mean when they say the flower or the boy is beautiful in the dialogues. When we read the dialogues, we can see that the interlocutors actually give their examples to explain successfully what their understanding of being beautiful is. It is true that their opinions could be wrong or incomplete, but it does not undermine the fact that they do know what they are talking about when they utter a word or give an example to explain their understanding. The interlocutors' explanation of "beauty" by examples may not cover what the word means in all circumstances or contexts,

but it expresses their knowledge of a given concept or term for that particular case and this kind of explanation successfully serves the purpose for ordinary communication. So I think Wittgenstein's objectors have the same confusion about understanding as Socrates does, the interlocutors always face difficulty because Socrates is asking for something non-existent in our world, i.e., a complete definition according to the essence of "The Beauty". I think giving a definition is not necessary for proving one's understanding. For some concepts that have no common properties or sharp boundaries, it's impossible to define them. As we see, Socrates himself cannot provide a satisfactory definition either, it's not merely because of the interlocutors' ignorance that they fail. Actually, nobody has the ability to define concepts like "game" to include all and only its instances, but it does not follow that nobody knows or nobody can explain what it means. If there is no common property shared by all instances, we *need not* force a precise definition *by virtue of* which we call them by the same term.

One of the main aims of defining concepts sharply is to help us understand each other by a standardized criterion in communication. But definition is not the only way of explaining and achieving mutual understanding, there are more valid and useful approaches available, for example, by paraphrase, analogy, and exemplification, etc. Understanding a word is a matter of knowing how to use it correctly, and using it correctly is one of the most important criteria of understanding. If we reflect on our ordinary language practice carefully, we would realize that we *need not* search for definitions independent of the use of the term. I think definition is just one means of achieving understanding, other ways of explanation are used more often and broadly. In ordinary language practice, many people buy gold and talk about it without knowing that it is a chemical element with atomic number 79; most people can tell a blue shade without knowing that blue is the light observed with a dominant wavelength between around 450 and 495 nanometres. One can also correctly say two things are both blue, without first noticing something in common among them. As Wittgenstein points out: "To say that we use

the word “blue” to mean “what all these shades of colour have in common” by itself says nothing more than that we use the word “blue” in all these cases (Baker and Hacker 2005a, 163).” As Baker and Hacker says, “Socrates distorts the concept of understanding by refusing to acknowledge giving any explanations apart from definition as a criterion of understanding (ibid., 159)” Explaining what a word means by definition is one criterion of evaluating our understanding, but failure to define it is not a criterion for not knowing what it means (ibid.). Actually, it is not definition but explanation that is most closely associated with understanding. An explanation can be given in many ways, for example, giving an ostensive explanation is one legitimate way. For a family resemblance concept, instances and similarities explain the meaning of a term no less than a lexical definition. There is no linguistic or ontological foundation to privilege one way of explanation over another, understanding terms without definition is not an inferior second best compromise in many cases.

Some may object by asking: How can you justify that you are *actually* using the word correctly and justify that people achieve mutual understanding? This raises doubts about whether we can verify the correctness of using certain words without knowing necessary and sufficient conditions. I take this as a legitimate worry, however, it is no less a problem for explanation by definition. How can they know the definition is complete and correspond to real use of the term? As I argue above, you *can* draw a sharp boundary or give seemingly precise definitions, however, it is very hard (if not completely impossible) to provide a set of necessary and sufficient conditions to define certain vague concepts such as “beauty” or “game”. I believe giving a definition that fails to include all and only its instances is not better than one correct explanation by examples and similarities for given circumstances. When we abandon rigid and fixed definitions, one may have wrong opinions or misunderstandings, but they have the freedom to give further explanations until they achieve mutual understanding and agreement on what they are actually talking about. In short, we need not have that worry, as Ben-Yami

argues, “Explanations not by means of definitions are no obstacle to the coining of useful concepts; and if, with Wittgenstein, we identify meaning with use (PI § 43), it also shows that such explanations are no obstacle to the coining of meaningful concepts (Ben-Yami 2017, 409).”

2.4 Potential objections and reply

I believe family resemblance is a better way of explaining why various instances of a vague concept are called by the same term. However, Wittgenstein’s insight has received some objections, I will continue to illustrate some of them and defend family resemblance theory.

First, Wittgenstein himself mentions two objections in terms of conjunction and disjunction. The interlocutor proposes that the general concept “number” can be defined as a logical sum of each well-defined sub-concept such as rational number, complex number, rational number, etc. (PI § 68). However, this approach fails to set a determined sharp boundary to define what number is because the sum of sub-concepts is never exhaustive. Trying to fix a closed list of all the current sub-concepts we call numbers will face problems when new types of numbers are introduced in mathematics. Since we all know the fact that historically the concept number has been extended and it is likely to endorse new instances in the future, the sum of the concept cannot exhaustively determine a sharp boundary. A similar objection is to give a disjunction of all common properties among all the instances. As Wittgenstein replies, this is just playing with words, because this disjunctive definition does not have more explanatory power than saying there are similarities among them. Even if all instances under the same concept share one or more properties in a set of disjunctive properties A or B or C or

D, etc., this definition is only vacuously true because the range is too broad and will include instances of other terms. Since objects in different categories may always have at least one property in the disjunctive set, for example, war shares some properties such as being competitive with some games, and will be included as one instance of game if we adopt the disjunctive approach, but this is against our intuition and obviously wrong.

I think the fundamental reason that the conjunction and disjunction attempts are wrong is that they still fall in the essentialist trap by looking for each single potential common property, and ignore the most important insight of family resemblance theory that the explanatory power of family resemblance does not come from the properties owned by each instance, but lies in the relationship between them. Wittgenstein emphasizes that the strength of the thread does not reside in the fact that some one fibre runs through its whole length, but in the overlapping of many fibres (PI § 67). Our understanding of terms and concepts is not a mere collection of irrelevant properties instantiated by objects, rather, we make inferences and acquire knowledge through the entire relational web built by all instances.

Second question is, how much resemblance is sufficient for something to be a member of a "family" since similarities in different perspectives have different importance? I would reply as follows: the degree of similarity or what *exact* similarity counts shall be determined by circumstances, as long as there is an overlapping and criss-crossing network of similarities. Wittgenstein acknowledges both overall similarities and similarities of details (PI § 66). It's a bit misleading to ask which single similarity would make the object count as a member, because we abstract and form our concept from all cases where we successfully use the term to refer. Again, it is not because of one or two most important similarities, instead, it is because of the whole web. We do not have a predetermined concept or strict definition which we use as a standard ruler to measure and determine membership, rather, the vague concept is a collective

of abstraction from initial paradigm instances but also open to change with new instances joining. Our concept is not a dead fixed condition, but lively changing with our use. The only way to determine whether a reference is successful is to check whether the communicators mutually understand, not to check whether they fit in a definition by non-existent hidden essence. In addition, there are some natural ways to roughly divide vague conceptual boundaries. Ben-Yami mentions that, we normally have several mutually exclusive concepts to make distinction (Ben-Yami 2017, 412). For example, we know clearly that game and war, playing and quarrelling are different from each other, so even though a fight bears certain similarities (i.e., being competitive) with games, we normally do not call it a game.

Third, opponents find the claim that there is *nothing* in common for all and only instances of a term too risky. They may think of it as another extreme contrary to essentialism that there is an essence shared by all and only instances. I think family resemblance is not incompatible with the possibility that there is some deeply hidden commonality undiscovered yet that all and only those instances share. However, even though there exists such a common property, it does not undermine Wittgenstein's argument. Because the most important diagnosis Wittgenstein makes is that we use terms in a certain way not *by virtue of* their hidden essence or definition. Ben-Yami points out accurately that "we do not *see* any such common element and that we use the same name for all instances not *because* they have something in common. This formulation is not committed to the non-existence of a common essence but rather to the *irrelevance* of such a commonality to the use of an expression and therefore to its meaning (Ben-Yami 2017, 411)." That is to say, Wittgenstein mainly objects the essentialist view that there is something in common *by virtue of* which we call them by the same term. Potential objectors need to find at least one property which has the explanatory power for our actual using of the word. And also, Wittgenstein only needs to defend that *currently* there is no common property *known* to us which justifies the use of the word. He needs not exhaust the

possibility of finding common properties or hidden essence, because even one might be found in the future, that does not help explain why we use one word in this way from the past till present. It is sufficient to object that there is something in common since Wittgenstein does not object essentialism by finding some rare or abnormal variants as counterexamples, instead, he starts from examining instances of game that we all have no hesitation to call games, then just "look and see" (PI § 66) the similarities and differences.

2.5 Overall reflection on family resemblance

In this chapter, I argue that family resemblance theory is a better alternative way of understanding general terms and concepts. As I have mentioned in the previous chapter, the "essence" of kinds may not be a purely objective nature without any arbitrary interpretation. For some vague terms and concepts, it is their "nature" that they cannot be defined by necessary and sufficient conditions.

Essentialism attempts to find relations among all and only its instances of a given concept by articulating the common properties shared by all, while family resemblance guides us to see the similarities as the real natural relation among the instances. Essentialism ignores the fact that successful reference in ordinary language practice simply does not require knowing a rigorous and precise definition. If we reflect on the way we use language, we would realize we do not first define a concept and then examine instances by taking a dictionary all the time, instead, we notice the vague similarities and make generalizations upon them. However, we have the tendency to look for commonality to justify our use of terms, but our craving for generality brings philosophical confusion. As Baker and Hacker point out, "Craving uniformity

and context-independent regularity, we overlook the fluidity, flexibility, forms of context-variability and distinctive uses of our language and its instruments (Baker and Hacker 2005a, 136).” Wittgenstein helps us to get out of the fly bottle, and makes us realize the fact that language denotes objects and gets its meaning by conventional language practice. I think it’s merely because our brain has the ability to draw connections between similarities and then stipulate the essence that we assume exists undiscovered. However, understanding and meaning is not by virtue of a given nature, and there probably is nothing mystic hidden under instances referred to by the same term.

Chapter 3 - A case study on binary sex-gender terms

In this chapter, I present a case study analysis on how to better understand binary sex-gender terms in ordinary language practice to show that the essentialist approach fails to draw sharp boundaries between "man" and "woman"; "male" and "female". By examining the biological and medical research on intersexuality, I argue that the wide-accepted "natural" kind terms do not have ontological implication of essence, i.e., a person assigned with female sex does not necessarily instantiate any generally believed essential property of femininity. I argue that there is no necessary and sufficient condition for a person to be a man or woman, and no such nature or essence *by virtue of* which we use binary sex-gender terms (man, woman, male, female), instead, people are called by one of the four terms only share overlapping similarities. Finally, I suggest Wittgenstein's notion of family resemblance as a more natural and more useful way of understanding sex-gender terms including "women".

3.1 Philosophical Investigation on "women"

The aim of this case study is to show that Wittgenstein's notion of family resemblance can have a wider application to kind terms in general. I think some "natural" kinds are also vague family resemblance concepts, and there is no essence or nature in virtue of which all instances are called by the same kind term. I do not deny that objects are natural, however, various natural instances lack the commonality that essentialists claim. It is very difficult (if not impossible)

to give an exhaustive definition for a kind term, because there are borderline cases in natural kinds and new instances may be discovered in the future. Even if no new instance that makes us extend the concept is discovered, it is merely by luck that none exists, but it is not part of the nature of the concept. Vague terms are in some sense necessarily and inherently vague, to impose a precise boundary is arbitrary. We should understand kind terms as only bearing similarities instead of commonality. I will show in the case study about binary biological sex category that accepting vagueness is not evasive to hidden essence, but faithful to the reality of human sexuality. The boundaries between "male" and "female" are neither sharp nor correspond to a natural given, and the definitions of these widely accepted natural kind terms are not completely separable from social influences. I will illustrate how to understand "men" and "women" as family resemblance concepts later.

I start by substituting "game" with "women" in Wittgenstein's *Philosophical Investigation*:

> Consider for example those people that we call "women". I mean middle-class Asian women, poor catholic European women, rich lesbian American trans women, and so on. What is common to them all? — Don't say: "there *must* be something in common, or they would not be called 'women'."— But *look and see* whether there is anything common to all. —For if you look at them you will not see something that is common to *all*, but similarities, relationships, and a whole series of them at that. Are they all gentle and quiet as the traditional stereotype for women? Do they all have feminine bodily features? Are they all heterosexual and able to bear children? As we go through many individuals that we already call "women", we can see similarities crop up and disappear. And the result of this examination is: we see a complicated network of

similarities overlapping and criss-crossing: sometimes overall similarities, sometimes similarities of detail (PI § 66).

Some may immediately object: "Don't you see that all women have common bodily features? And science has discovered that all their physical commonalities are determined by their chromosomes." In their opinion, the term "women" is used in an exclusive way to refer to all and only having XX sex chromosomes. One obvious mistake is that they exclude trans women in their category. I believe it's a general consensus nowadays that trans women and trans men should be included in women and men category separately, but that is not my main criticism here. I want to make a stronger claim that even though we leave transsexual aside for further argument and consider only cisgender women whose sex assigned at birth is female, all those female do not necessarily share any property in common. Furthermore, I argue that they are assigned with female sex and grow up as women not necessarily *by virtue of* possessing XX sex chromosomes.

I want to clarify that I use "women" in an inclusive way including biological females, trans women, and anyone who bears certain similarities to women depending on circumstances. I intend not to adopt the sharp distinction between sex and gender, because I think sex is not a purely natural category separatable from social convention. The sex and gender distinction says that sex refers to the biological and physiological characteristics such as chromosomes, and hormones, these objective and natural differences draw a sharp boundary and divide human into two natural kinds: male and female; while gender refers to socially constructed characteristics such as same gender norms, common experiences, these contingent differences divide people into two social kinds: men and women. Therefore, they believe that there is at least one thing in common for all and only females, namely, the XX chromosomes which is the essential and fundamental property that distinguishes them from males that have XY

chromosomes. The binary sex category implies that a person is either male or female, and there are mutually exclusive fixed conditions given by nature in terms of chromosomes. As a result, they think there are sexed bodies existing before any social convention was imposed. I will argue against such biological essentialists that there is no clear boundary between male and female drawn by biological nature, I will show that having XY chromosomes for example, is not a necessary and sufficient condition for an individual to be assigned male sex at birth.

3.2 Intersex as borderline cases

I will give real life examples of genital surgery practice on intersex babies to show that binary sex categories exclude many individuals and marginalize them as borderline cases. The binary sex categories fail to capture the biological reality of diverse human sexuality, and intersex people are compelled to change their naturally born bodies to fit in the ridge binary categories.

Let us take a look at how biological sex (male or female) is assigned in medical practice. When a baby is born, doctors would check their genitalia and tell their parents whether it is a boy or a girl. Usually the baby's sex would be assigned as male if they have "normal" testicles and penis, and as female if they have vagina and clitoris. However, sometimes the baby has ambiguous or mixed genitalia, doctors would do further examinations such as checking their sex chromosomes (XX or XY), internal reproductive anatomy (whether they have ovaries) and so on. It turns out, some are naturally intersex as they do not fall in either strictly defined male or female category, some have neither XX nor XY chromosomes, some have normal chromosomes but unmatched external genitalia. There are several common types of being intersex: congenital adrenal hyperplasia (CAH), androgen insensitivity syndrome (AIS),

gonadal dysgenesis, hypospadias, and unusual chromosome compositions such as XXY (Klinefelter Syndrome) or XO (Turner Syndrome) (Fausto-Sterling 2000a, 51). Dr. Anne Fausto-Sterling, a Professor in the Department of Molecular and Cell Biology and Biochemistry at Brown University, argues that the binary sex system is too simplistic and inadequate to represent the full spectrum of human sexuality found in nature. She shows with experiments that the sharp boundary between male and female is hard to draw because the inherent biological structure is much more complicated. She argues that binary sex is a result more of "nurture" than "nature" though it has been deeply embedded in our society. Fausto-Sterling suggests that there should be five sexes, besides male and female, she adds "herms" (named after true hermaphrodites, people born with both a testis and an ovary); "merms" (male pseudohermaphrodites, who are born with testes and some aspect of female genitalia); and "ferms" (female pseudohermaphrodites, who have ovaries combined with some aspect of male genitalia) (ibid., 14).

It is still controversial what counts as "intersex", but the term "intersex" already implies the assumption that only male and female are normal and natural while intersex is merely abnormal borderline case that can be ignored or corrected. However, I think intersexuality is not a disorder of sex development, in fact, they exist all the time just as male and female. The term "hermaphrodites" is from Ancient Greek and intersex people's existence has been recorded throughout history. Moreover, Intersex infants are not so rare, according to Fausto-Sterling's experiments and calculation, there are probably 1.7% potential infants: "Our figure represents all chromosomal, anatomical and hormonal exceptions to the dimorphic ideal, the number of intersexual who might, potentially, be subject to surgery as infants is smaller—probably between one in 1,000 and one in 2,000 live births (ibid., 14)." We have evidence to believe that this phenomenon is natural and is equally one possibility of human conformation no inferior to the two majority categories. People have an incorrigible belief that male and

female (XY, XX chromosomes with corresponding genitalia) are the only two natural possibilities. But if we think about the justification of "being natural", an intersex person with XXY chromosomes is no less natural in the sense that they are all born as such. The only reason I can think of is the fact that the majority is either male or female, and they define what being "normal" and "natural" are. As Kessler says, "The genital ambiguity is remedied to conform to a 'natural', that is, culturally indisputable, gender dichotomy (Kessler 1990, 24)."

Even though the existence of intersexuality shows the sex dimorphism that we take for granted could be wrong, the change did not happen in concept and category but in intersex people. Medical professions still suggest and perform surgery to intersex babies whose have ambiguous genitalia to "fix" them, including feminising and masculinising surgical and hormonal interventions and gonadectomies, etc. Kessler points out that: "Although the deformity of intersexed genitals would be immutable were it not for medical interference, physicians do not consider it natural. Instead they think of, and speak of, the surgical or hormonal alteration of such deformities as natural because such intervention returns the body to what it 'ought to have been' if events had taken their typical course. The nonnormative is converted into the normative, and the normative state is considered natural (Kessler 1990, 47)." To make Kessler's point more convincing, I compare different real cases of intersex diagnosis, decision on sex assignment and treatment to show that the medical intervention does not actually correct their sex or make them a "normal" male or female. If essentialism holds that biological sex is determined by chromosomes, then genital surgery does not fix some intersex babies' sex, their sex chromosomes remain neither male nor female after surgery, it only makes them appear to be "normal" in the sacrifice of their health.

On the one side, physicians generally do not advocate medical intervention if the baby's external genitalia and gonads are the same as either a normal male or female, even though their

chromosomes are unusual (i.e., XXY) (Fausto-Sterling 2000b).This means there are male and female individuals who do not share the necessary and sufficient condition of sharing the common property (XX or XY chromosomes) as essentialists claim, but they are indistinguishable from "normal" male and female in the sense that they identify as, live as, and are recognized by everyone as male or female, some would not even know the fact that they have unusually chromosomes and would have been excluded if the biological essentialism was true. On the other side, some babies would be diagnosed as intersex or disorder of sex development even though they have usual XX or XY chromosomes. For those who have XY chromosomes, physicians would wait and spend weeks to test whether the genetic male body can make testosterone and also respond to the testosterone it makes. If either condition is not satisfied, their phallus will not develop, and the Y-chromosome infant will not be considered as a male (Kessler 1990, 11). Instead, they are more likely to be assigned as female and may have to undergo painful surgeries to build female genitalia. These examples verify Kessler's criticisms. It turns out the principles underlying physicians' decisions are cultural rather than biological, largely based on social expectation and the way their genitals look or could be made to look (Kessler 1990, 13), and we can see that, such surgery is intended to deconstruct an intersex physiology and construct a "normal" body that conforms with stereotypical binary sex categories (Carpenter 2018, 489).

It is expected that those intersex children would develop a gender identity in accordance with the gender assignment regardless of their original genetical sex chromosomes after surgery (Kessler 1990, 7). However, is this really beneficial to them? Would they really live a "normal" happy life after their body is reconstructed? The answer is disappointing. Lots of evidence shows that such clinical practices on intersex people have caused loss of sexual function and sensation, repetitive surgeries, infertility and lifelong need for hormone replacement, genital examinations, loss of bodily integrity, and trauma (Carpenter 2018, 492).

Moreover, as Fausto-Sterling points out: “Infant genital surgery is cosmetic surgery performed to achieve a social result—reshaping a sexually ambiguous body so that it conforms to our two-sex system. This social imperative is so strong that doctors have come to accept it as a medical imperative, despite strong evidence that early genital surgery doesn’t work: it causes extensive scarring, requires multiple surgeries, and often obliterates the possibility of orgasm (Fausto-Sterling 2000a, 80).”

It is shocking to see negative and harmful interventions on those naturally born bodies are not based on medical necessity but on social norms to reinforce a binary sex assignment. Fausto-Sterling says, “the concept of intersexuality is rooted in the very ideas of male and female. In the idealized, Platonic, biological world, human beings are divided into two kinds: a perfectly dimorphic species (Fausto-Sterling 2000b, 19).” When this becomes a belief endorsed by the whole society, intersex people are compelled to be corrected and normalized, primarily not because their existence threatens their own life, but that firm cultural and social belief.

As is shown above, the process of intersex treatment is imposed, constructed and strengthened the binary sex categories. I agree with Kessler that in this process, “first the doctors regard the infant’s gender as an unknown but discoverable reality; then the doctors relinquish their attempts to find the real gender and treat the infant’s gender as something they must construct (Kessler 1990, 24).” I think more and more evidence has shown that intersexuality is a part of the natural spectrum of human sexuality. It is not through scientific discovery that they find the nature of binary sex with a sharp boundary hidden in our chromosomes, but they use science to intervene some natural bodies in order to maintain the binary sex categories. Moreover, from the examples of sex assignment in medical practice we can see that, if “being born female” is the criterion of “being women”, it excludes those intersex

people who were constructed by surgery as female perinatally and then live their whole life as women, while include trans men who have female body but identify and live as men. Therefore, there is no clear biological justification to draw a clear boundary between binary sex-gender categories. I think it is time to reflect on the false essentialist assumption that binary sex is natural and fundamental. Instead of changing people's bodies born naturally, why not consider changing our understanding of the concepts and kind terms?

3.3 Family resemblance understanding of sex-gender category

I have shown that there naturally exist borderline cases between male and female, and the medical practice on intersex people shows that having XY or XX sex chromosomes is not a necessary and sufficient condition for a person to be assigned and live as male or female in both medical and legal sense.

I think the false belief that essentialists hold of binary sex categories as natural kinds comes from a confusion that language carries ontological commitment of essence. Essentialism implies that there *must* be something in common (exist though perhaps undiscovered yet) *by virtue of* which we use kind terms in such ways. With this assumption in mind, they try to find justification from science. Science has shown the objective fact that there *are* diverse sex chromosomes and human sexualities, so there is a mismatch between reality and the essentialist assumption. However, science leaves the choice of interpretation open. There are at least two ways to interpret the mismatch: the inclusive way is to modify or give up the essentialist assumption to include intersex or other potential instances as men or women; while the

exclusive way is to maintain the assumption of sharp boundaries by disregarding the existence of intersexuality. As Heyes argues, "we cannot simply point to reality to make *objective* claims about the similarities and differences that unite and divide women (Heyes 2000, 100-101)." Essentialism hides its choice under the objective fact and I cannot see any obvious reason to justify the exclusive interpretation. On the country, I think biological essentialism on binary sex fails to represent the nature of human sexuality, and it is arbitrary to normalize the majority (with XX or XY chromosomes) and compel intersex people to fit in the binary categories by reconstructing their natural bodies. I suggest we take the inclusive interpretation, and acknowledge the fact that language does not carry ontological commitment, the meaning of sex-gender kind terms is also constructed through rather than prior to language practice.

I think we should abandon the essentialist assumption and try to seek other alternatives to understand the meaning of kind terms such as "female" and "women". I suggest that we understand them as family resemblance terms and reconceptualize them to be more inclusive to avoid a misleading essentialist ontology that fixes two mutually exclusive categories with sharp boundaries. If we take "women" or "female" or other kind terms on sex and gender to be family resemblance terms, they have characteristics such as being vague and open. All women share overlapping similarities but no necessary and sufficient condition can determine their membership.

Applying the notion of family resemblance to sex categories is not to turn a blind eye to biological facts, but to unmask the social factors hidden under the essentialism claim. As Heyes mentions, "The notion that male and female bodies create two discrete groups that are biologically bounded and exist prior to any use of category labels is both empirically inaccurate, and obscures the fact that the terms 'man' or 'woman', 'female' or 'male' and 'boy' or 'girl' are not attributed by unequivocal reference to primary or even secondary sexual

characteristics. In fact, to the extent that physical sex cues are real, they can be overridden to a remarkable degree by social context (ibid., 89)." Family resemblance is a theory of meaning that sincerely respects how nature is. Family resemblance understanding does not deny that there are biological differences between male and female, but more importantly, it invites us to reflect on why the sharp boundary is necessarily drawn according to this particular property, and why those similarities have more significance over others. My answer is that, essentialism *can* choose to draw the line here, but that is not accurately in correspondence with nature and reality. That is merely one way based on an elective foundation strengthened by social practice, but it need not be so, we can also draw the boundary for other purposes, or leave the boundary open for new potential instances. I agree with Heyes that we do not need to specify what the concept " women" is at all. In fact, specifying might not be to our advantage (ibid., 80). If we are uncertain about some particular individuals, we can discuss case by case, leaving them the freedom and power to choose their pronouns and gender identities.

In brief, The importance of Wittgenstein's notion of family resemblance is as Baker and Hacker concludes: it shakes us free from the illusions of real definitions, of the mythology of analysis as disclosing the essences of things; And it powerfully challenges the dogma of supposing all univocal concept-words to be applicable in virtue of common characteristics shared by all the things that fall under them (Baker and Hacker 2005a, 226). I think family resemblance theory teaches us that the boundary, meaning and use of kind terms are not purely natural, it returns us the rights to deconstruct and reconstruct meaning of kind terms through our use of language, which is more practical, flexible and natural.

Conclusion

I think both family resemblance theory and essentialism aim at articulating the relationship among all instances sharing a common name under one same concept. Essentialists try to find commonalities among all and only the instances while Wittgenstein suggests that some terms are inherently vague and instances only share overlapping similarities. I think essentialists have an illusory belief that classificatory concepts have to decisively include all and only instances that accurately fit in the hypothetical definition, and exclude all that do not. However, if we apply this rule strictly, it will rule out many instances that could have belonged to the kind or include many that are not considered as members. No matter how thin the boundary line is, there may always be some borderline cases standing exactly on the boundary. The failure of essentialism indicates that sometimes the philosophical craving for generality and exploring the ultimate truth goes too far and turns out to be misleading. Imposing non-existent essence leads us to make wrong inductive inferences and overgeneralize the diversity of reality.

My viewpoint is that family resemblance theory is a weaker but more faithful approach to understand the actual relationships between kind members. I agree with Baker and Hacker that, some concepts and categories are initially vague, we reserve the right to refine them by extending or narrowing the scope of such concepts for specific purposes. Meanwhile, we should keep in mind that the concept and corresponding terms in their common use do not require that much rigorousness and precision. And also, since resemblance with paradigmatic examples is a matter of degree and the boundary is flexible, it gives us freedom to discuss and decide whether new instances can be included or not (Baker and Hacker 2005a, 225-226).

I think the classification of objects under different terms is an historical process which has both backward and forward aspects. Since there is no hidden essence and the boundary is

drawn for certain purposes, we can use terms with more flexibility and even leave the boundary open. The objects which fall under certain concept have emerged and been subsumed under the corresponding term, and nothing prevents new objects from being included in the future. The concepts and meaning of terms are not a natural given that is fixed forever, we need not set a strict and sharp definition because language use is always changing and developing, it can adjust new members in new circumstances. We can always examine new instances and negotiate when disagreement and ambiguity arise.

References

Baker, G. P. and P. M. S. Hacker. 2005a. *Wittgenstein: Understanding and Meaning*. Part I: Essays. Second, extensively revised edition by P. M. S. Hacker. Oxford: Blackwell.

Ben-Yami, Hanoch. 2001. The semantics of kind terms. *Philosophical Studies 102 (2),* 155-184.

Ben-Yami, Hanoch. 2017. Vagueness and Family Resemblance. In Hans-Johann Glock (ed.), *A Companion to Wittgenstein*. Oxford, UK: Wiley-Blackwell. 407-419.

Ben-Yami, Hanoch. 2020 (forthcoming). Kind Terms and Unknown Essences.

Carpenter M. 2018. The "Normalization" of Intersex Bodies and "Othering" of Intersex Identities in Australia. *Journal of bioethical inquiry*, *15* (4), 487–495.

Fausto-Sterling, Anne. 2000a. *Sexing the body : gender politics and the construction of sexuality*. New York: Basic Books.

Fausto-Sterling, Anne. 2000b. The Five Sexes, Revisited. *The Sciences*, *40 (4),* 18–24.

Heyes, Cressida. J. 2000. *Line Drawings: Defining Women Through Feminist Practice*. Cornell University Press.

Kessler, S. J. 1990. The Medical Construction of Gender: Case Management of Intersexed Infants. *Signs*, *16* (1), 3–26.

Kripke, S. 1973, 2013, *Reference and Existence.* Oxford University Press.

Kripke, S. 1980. *Naming and Necessity*. Harvard University Press.

LaPorte, J. 2004. *Natural kinds and conceptual change*. Cambridge University Press.

Raatikainen, P. 2021. Natural kind terms again. *European Journal for Philosophy of Science 11*, 19. https://doi.org/10.1007/s13194-020-00344-3.

Soames, S. 2005. *Philosophical analysis in the twentieth century, vol2 : The age of meaning*. Princeton University Press.

Waismann, Friedrich. 1951. Verifiability. In Flew, Antony (ed.) *Logic and Language (First Series)*. Oxford: Blackwell, 117–144.

Wittgenstein, Ludwig. (1952) 2009. *Philosophical Investigations*. G. E. M. Anscombe, P. M. S. Hacker and J. Schulte, trans., revised 4 th edition by P. M. S. Hacker and J. Schulte. Oxford: Blackwell.

Williamson, Timothy. 1994. *Vagueness*. London and New York: Routledge.

Wikipedia contributors. 2021. Water. In *Wikipedia, The Free Encyclopedia*. From https://en.wikipedia.org/w/index.php?title=Water&oldid=1060706650