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The Grooves of Nature: Dispositions and Natural Kinds

by

Barrett M. Wolski

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- Medieval 0297
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Philosophy 0422
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Theology 0469

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Anthropology
- Archaeology 0324
- Cultural 0326
- Physical 0327

Business Administration
- General 0310
- Accounting 0272
- Banking 0770
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- Marketing 0338

Canadian Studies 0385
Economics
- General 0501
- Agricultural 0503
- Commerce-Business 0505
- Finance 0508
- History 0509
- Labor 0510
- Theory 0511

Folklore 0358
Geography 0366
Gerontology 0351
History
- General 0578
- Ancient 0579
- Medieval 0581
- Modern 0582
- Black 0328
- African 0331
- Asia, Australia and Oceania 0332
- Canadian 0334
- European 0335
- Latin American 0336
- Middle Eastern 0333
- United States 0337

History of Science 0585
Law 0398
Political Science
- General 0615
- International Law and Relations 0616
- Public Administration 0617

Recreation 0814
Social Work 0452
Sociology
- General 0626
- Criminology and Penology 0627
- Demography 0938
- Ethnic and Racial Studies 0631
- Individual and Family Studies 0628
- Industrial and Labor Relations 0629
- Public and Social Welfare 0630
- Social Structure and Development 0700
- Theory and Methods 0344

Transportation 0709
Urban and Regional Planning 0999
Women's Studies 0453

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Agriculture
- General 0473
- Agronomy 0285
- Animal Culture and Nutrition 0475
- Animal Pathology 0476
- Food Science and Technology 0359
- Forestry and Wildlife 0478
- Plant Culture 0479
- Plant Pathology 0480
- Plant Physiology 0817
- Range Management 0777
- Wood Technology 0746

Biology
- General 0306
- Anatomy 0287
- Biostatistics 0308
- Botany 0309
- Cell 0379
- Ecology 0329
- Entomology 0353
- Genetics 0369
- Limnology 0793
- Microbiology 0410
- Molecular 0307
- Neuroscience 0317
- Oceanography 0416
- Physiology 0433
- Radiation 0821
- Veterinary Science 0778
- Zoology 0472

Biophysics
- General 0786
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Geochemistry 0996
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Geology 0372
Geophysics 0373
Hydrology 0388
Mineralogy 0411
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Paleoecology 0426
Paleontology 0418
Paleozoology 0985
Palynology 0427
Physical Geography 0368
Physical Oceanography 0415

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Environmental Sciences 0768
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- General 0566
- Audiology 0300
- Chemotherapy 0992
- Dentistry 0567
- Education 0350
- Hospital Management 0769
- Human Development 0758
- Immunology 0982
- Medicine and Surgery 0564
- Mental Health 0347
- Nursing 0569
- Nutrition 0570
- Obstetrics and Gynecology 0380
- Occupational Health and Therapy 0354
- Ophthalmology 0381
- Pathology 0571
- Pharmacology 0419
- Pharmacy 0572
- Physical Therapy 0382
- Public Health 0573
- Radiology 0574
- Recreation 0575
- Speech Pathology 0460
- Toxicology 0383

Home Economics 0386

PHYSICAL SCIENCES
Pure Sciences
Chemistry
- General 0485
- Agricultural 0749
- Analytical 0486
- Biochemistry 0487
- Inorganic 0488
- Nuclear 0738
- Organic 0490
- Pharmaceutical 0491
- Physical 0494
- Polymer 0495
- Radiation 0754

Mathematics 0405
Physics
- General 0605
- Acoustics 0986
- Astronomy and Astrophysics 0606
- Atmospheric Science 0608
- Atomic 0748
- Electronics and Electricity 0607
- Elementary Particles and High Energy 0798
- Fluid and Plasma 0759
- Molecular 0609
- Nuclear 0610
- Optics 0752
- Radiation 0756
- Solid State 0611

Statistics 0463

Applied Sciences
Applied Mechanics 0346
Computer Science 0984
Engineering
- General 0537
- Aerospace 0538
- Agricultural 0539
- Automotive 0540
- Biomedical 0541
- Chemical 0542
- Civil 0543
- Electronics and Electrical 0544
- Heat and Thermodynamics 0348
- Hydraulic 0545
- Industrial 0546
- Marine 0547
- Materials Science 0794
- Mechanical 0548
- Metallurgy 0743
- Mining 0551
- Nuclear 0552
- Packaging 0549
- Petroleum 0765
- Sanitary and Municipal 0554
- System Science 0790

Geotechnology 0428
Operations Research 0796
Plastics Technology 0795
Textile Technology 0994

PSYCHOLOGY
General 0621
Behavioral 0384
Clinical 0622
Developmental 0620
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Art 0273
Collèges communautaires 0275
Commerce 0688
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Enseignement bilingue et multiculturel 0282
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Enseignement primaire. 0524
Enseignement professionnel 0747
Enseignement religieux 0527
Enseignement secondaire 0533
Enseignement spécial 0529
Enseignement supérieur 0745
Évaluation 0288
Finances 0277
Formation des enseignants 0530
Histoire de l'éducation 0520
Langues et littérature 0279
Lecture 0535
Mathématiques 0280
Musique 0522
Orientation et consultation 0519
Philosophie de l'éducation 0998
Physique 0523
Programmes d'études et enseignement 0727
Psychologie 0525
Sciences 0714
Sciences sociales 0534
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- Généralités 0679
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- Anciennes 0294
- Comparée 0295
- Médiévale 0297
- Moderne 0298
- Africaine 0316
- Américaine 0591
- Anglaise 0593
- Asiatique 0305
- Canadienne (Anglaise) 0352
- Canadienne (Française) 0355
- Germanique 0311
- Latino-américaine 0312
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- Généralités 0501
- Commerce-Affaires 0505
- Économie agricole 0503
- Économie du travail 0510
- Finances 0508
- Histoire 0509
- Théorie 0511

Études américaines 0323
Études canadiennes 0385
Études féministes 0453
Folklore 0358
Géographie 0366
Gérontologie 0351
Gestion des affaires
- Généralités 0310
- Administration 0454
- Banques 0770
- Comptabilité 0272
- Marketing 0338

Histoire
- Histoire générale 0578
- Ancienne 0579
- Médiévale 0581
- Moderne 0582
- Histoire des noirs 0328
- Africaine 0331
- Canadienne 0334
- États-Unis 0337
- Européenne 0335
- Moyen-orientale 0333
- Latino-américaine 0336
- Asie, Australie et Océanie 0332

Histoire des sciences 0585
Loisirs 0814
Planification urbaine et régionale 0999
Science politique
- Généralités 0615
- Administration publique 0617
- Droit et relations internationales 0616

Sociologie
- Généralités 0626
- Aide et bien-être social 0630
- Criminologie et établissements pénitentiaires 0627
- Démographie 0938
- Études de l' individu et de la famille 0628
- Études des relations interethniques et des relations raciales 0631
- Structure et développement social 0700
- Théorie et méthodes. 0344
- Travail et relations industrielles 0629

Transports 0709
Travail social 0452

SCIENCES ET INGÉNIERIE

SCIENCES BIOLOGIQUES
Agriculture
- Généralités 0473
- Agronomie. 0285
- Alimentation et technologie alimentaire 0359
- Culture 0479
- Élevage et alimentation 0475
- Exploitation des pâturages 0777
- Pathologie animale 0476
- Pathologie végétale 0480
- Physiologie végétale 0817
- Sylviculture et faune 0478
- Technologie du bois 0746

Biologie
- Généralités 0306
- Anatomie 0287
- Biologie (Statistiques) 0308
- Biologie moléculaire 0307
- Botanique 0309
- Cellule 0379
- Écologie 0329
- Entomologie 0353
- Génétique 0369
- Limnologie 0793
- Microbiologie 0410
- Neurologie 0317
- Océanographie 0416
- Physiologie 0433
- Radiation 0821
- Science vétérinaire 0778
- Zoologie 0472

Biophysique
- Généralités 0786
- Medicale 0760

SCIENCES DE LA TERRE
Biogéochimie 0425
Géochimie 0996
Géodésie 0370
Géographie physique 0368
Géologie 0372
Géophysique 0373
Hydrologie 0388
Minéralogie 0411
Océanographie physique 0415
Paléobotanique 0345
Paléoécologie 0426
Paléontologie 0418
Paléozoologie 0985
Palynologie 0427

SCIENCES DE LA SANTÉ ET DE L'ENVIRONNEMENT
Économie domestique 0386
Sciences de l'environnement 0768
Sciences de la santé
- Généralités 0566
- Administration des hôpitaux 0769
- Alimentation et nutrition 0570
- Audiologie 0300
- Chimiothérapie 0992
- Dentisterie 0567
- Développement humain 0758
- Enseignement 0350
- Immunologie 0982
- Loisirs 0575
- Médecine du travail et thérapie 0354
- Médecine et chirurgie 0564
- Obstétrique et gynécologie 0380
- Ophtalmologie 0381
- Orthophonie 0460
- Pathologie 0571
- Pharmacie 0572
- Pharmacologie 0419
- Physiothérapie 0382
- Radiologie 0574
- Santé mentale 0347
- Santé publique 0573
- Soins infirmiers 0569
- Toxicologie 0383

SCIENCES PHYSIQUES
Sciences Pures
Chimie
- Généralités 0485
- Biochimie 487
- Chimie agricole 0749
- Chimie analytique 0486
- Chimie minérale 0488
- Chimie nucléaire 0738
- Chimie organique 0490
- Chimie pharmaceutique 0491
- Physique 0494
- PolymÇres 0495
- Radiation 0754

Mathématiques 0405
Physique
- Généralités 0605
- Acoustique 0986
- Astronomie et astrophysique 0606
- Électronique et électricité 0607
- Fluides et plasma 0759
- Météorologie 0608
- Optique 0752
- Particules (Physique nucléaire) 0798
- Physique atomique 0748
- Physique de l'état solide 0611
- Physique moléculaire 0609
- Physique nucléaire 0610
- Radiation 0756

Statistiques 0463

Sciences Appliqués Et Technologie
Informatique 0984
Ingénierie
- Généralités 0537
- Agricole 0539
- Automobile 0540
- Biomédicale 0541
- Chaleur et ther modynamique 0348
- Conditionnement (Emballage) 0549
- Génie aérospatial 0538
- Génie chimique 0542
- Génie civil 0543
- Génie électronique et électrique 0544
- Génie industriel 0546
- Génie mécanique 0548
- Génie nucléaire 0552
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- Mécanique navale 0547
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Psychologie du développement 0620
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Psychologie sociale 0451
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Abstract

A metaphysics which includes natural kinds can be rationally supported. Rational support requires a clear articulation of the defended position, and so, the first half of this thesis is aimed at providing such an articulation. This account both extends and narrows previous renditions of natural kinds, both in light of the intuitions of those who would deny them, and those who vie for them. I argue that natural kinds are sets whose members share dispositional profiles and are always in complete act. From this articulation I defend natural kinds from Mellor, de Sousa and Churchland. This defense rests on the observation that natural kinds do not depend upon essentialist doctrines and are fundamentally different from functional and historical kinds. Furthermore, natural kinds can be rigidly designated just in virtue of our intentions to refer to such a set—even when we lack the epistemic wherewithal to determine set membership.

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DEDICATION

I dedicate this work to the memory of my mother, Louise Edna.

Table of Contents

1. INTRODUCTION

PART I: THE PROJECT

This project is meant to provide a rational basis for taking the possibility of natural kinds to be a serious thesis, one that is continuous with, perhaps constitutive of, the basic tenets of chemical science. What needs rejecting are several arguments which collectively appear to make beliefs about natural kinds rather tenuous at best, or come to metaphysical silliness at worst. It is my intent to show that these arguments only seem to reach their intended conclusions by relying on incomplete and/or badly conceived notions about what natural kinds are.

The project first, then, is to come to a robust articulation of what the intention of speakers is when they entertain the possibility of natural kinds. If this account is different from the notions articulated by the likes of Mill, Pierce and Russell, its difference lies in its unswerving gaze at the heart of speakers' intentions. This first part of the project is facilitated, in part, by gleaning what expectations are held of natural kinds, expectations held both by those who deny them as well as those who affirm them. It is also facilitated, in part, by concentrating on one kind of kind, namely, physico-chemical kinds, which are particularly and quite possibly solely amenable to this rendition of natural kinds. What other kinds of natural kinds there might be and whether, indeed, there are other kinds of natural kinds is not taken up here. What natural kinds

requires first is *one* clear and unambiguous rendition.

The purpose of such an articulation, it should be stressed, is not so much to establish what things are natural kinds, but rather, what sort of thing natural kinds are presumed to be. In particular, I am not motivated to defend any one putative natural kind with regards to its natural kind status, nor even to determine that there is at least one set of things which forms a natural kind.

The second part of the project is to show that the objections typically brought to bear on essentialism and hence on natural kinds, are brought up short as long as *this* articulation is borne in mind.

The philosophical importance of natural kinds turns on how one conceives of them. If one takes natural kinds to be sets whose extensions are determined by "nominal essences", real, but arbitrarily chosen, properties, then very little of importance will turn on them—they will be just one of the many language games we play. If we take them to be sets whose extensions are determined by "real essences", then any contributing role they might have played is confounded by the controversies which have persistently dogged the doctrines of essentialism; those controversies should be able to be settled or discarded by a successful theory of natural kinds. If we take natural kinds to be sets whose members share dispositional profiles, as I will argue, then their philosophical appeal consists in their economy—two or more members of the same kind are expected to behave the same under similar circumstances.

It will be argued here that it is this identity of *dispositional*

profiles across members of a natural kind which binds them, and that it is a fundamental error, a category mistake, to think that it is essential properties which bind them. The so-called "essential properties" are rejected on the grounds that they are not properties at all, but rather, the very candidates for being natural kinds themselves.

This dispositional theory of natural kinds has, as a consequence, a strain of realism which incorporates aspects of both realisms and anti-realisms. Unlike Leplin's contention that "[r]ealism is either warranted by the impressive record of scientific success, or refuted by the discontinuities of theory change or the substantive findings of quantum mechanics,"[1] on this construal, realism is neither warranted by an impressive record nor is it refuted by discontinuities in theory change or the findings of quantum mechanics. Underdetermination of theory, guaranteed by an incomplete dispositional account of the universe, denies that warrant and discontinuities of theory change are indicative of a realist concern of deeper relevance than the preservation of an intellectual lineage. It is this concern which forms a primary ingredient in rigidly designating a natural kind without the attendant epistemic wherewithal to pick out other members and only other members of the kind so designated.

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[1]Leplin, Jarrett. (ed.) *Scientific Realism.* (University of California Press: Berkeley, 1984), 7.

PART II: THE BACKGROUND

The resurgent enthusiasm for natural kind essentialism was triggered by new theories of reference championed by Putnam and Kripke in the 1970's. These causal or direct theories of reference relied upon sets held together by some extra-intensional glue such that, if some or all of the manifest properties normally attributed to members of a "natural kind" set were absent, the members lacking these intensional aspects would still be perceived as belonging to the set just so long as they possessed the extra-intensional glue. The complimentary claim; the claim that even if some thing/sample were to completely satisfy the *intensions* normally governing membership in a natural kind set, but did not possess the extra-intensional glue, and so that thing/sample was not admissible as a part of the set, dragged the essentialist debates and the possibility of natural kinds along with them, alive and kicking, into the philosophical arena of the latter part of this century.

For it is essential properties which have traditionally been thought to be the extra-intensional glue holding certain sets together, namely, the extensions of natural kind terms. This resurrected skeleton of Aristotle's directly challenged the then prevailing[2] Fregean-type theories of reference, what have also been referred to as indirect theories of reference.[3]

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[2]Varieties of this theory of reference may yet prevail.

[3]On these theories the general term is shorthand for some full descriptional definition (intension) or a suitable subset thereof (cluster theories, cf. Searle). It is this descriptional definition which subsequently determines the extension of the general term (including natural kind terms) at hand and

The "modern essentialists", as Michael Ayer calls them, conducted several *gedankenexperiments* (of which I restrict myself to Putnam's Twin Earth example) on natural kinds to test what things or samples we would still include in the extension of a natural kind term when their descriptive definitions (which had hitherto held them together) faltered and/or stumbled onto unfamiliar Earths. With a certain headiness, these philosophers found that recent empirical breakthroughs in the physical sciences turned out to be discoveries of just the long-sought-after essential properties. Since then defenders of Fregean-type theories of reference and anti-essentialists have released a spate of literature to battle this new Aristoteleanism.

My intent, here, as indicated above, is to show that there is still a viable way to conduct natural kind talk without essential properties. With "permutations of dispositions" in hand, it is not necessary to appeal solely to the so-called *essential* properties (which is, as I will argue, a bit of a misnomer) to show that certain extensions, i.e., those that turn out to be natural kinds, are yet extra-intensionally bound.

1.1 NATURAL KINDS: SOME INTRODUCTORY REMARKS

It is perhaps best to begin by introducing some ancestors of the sort of thing that I will be defending here. The notion of natural

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hence, the indirectness of reference. This, of course, relieves the so-called 'natural kind' extensions of any need for extra-intensional glue since, *these* sets can be entirely determined by the full descriptional definition.

kinds depicted and defended here is very similar to those described by Mill and Pierce below.

Russell's otherwise defective characterization of natural kinds has the virtue, says Hacking in his historical sketch of natural kinds, "of making plain how *ordinary* the idea is." The characterization in mind was Russell's: "The essence of a 'natural kind' is that it is a class of objects all of which possess a number of properties that are not known to be logically interconnected."[4]

The chief flaw of this characterization consists in its permissiveness, i.e., any subset[5] of an established kind would also form a natural kind. A real motivation behind the classification of natural kinds is this "teaming-up" of *shared* properties across the different samples of a kind. If we take, for instance, just the set of liquid things, we assume that there are many different reasons or causes for each of these things being liquid. Lava might be liquid, hydrogen might be liquid, water might be liquid, and so on. Though each of these things/samples might be liquid, the accompanying properties and causes are radically divergent from sample to sample. Few are impelled, therefore, to proffer the set of liquids as a respectable natural kind. Those that do are normally antagonistic to the notion of natural kinds and generally offer such deficient candidates for strategic reasons alone.

Also worthy of note is the lack of a logical interconnectedness

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[4]Ian Hacking, "A Tradition of Natural Kinds," *Philosophical Studies* **61** (1991), 112.

[5]Presumably, any subset consisting of more than one member, that is.

between each of the array of properties normally attributed to a natural kind. If there are no logical necessities which hold between the properties of a thing, then universal correlativeness seems to indicate a necessity of the de re sort: perhaps, as C.B. Martin claims, "[n]ature comes in package deals."[6]

The Mill-Kinds are partly a product of Mill's contention that there are two distinct sorts of classification. "Members of one type of class share a single property, while members of the other type of class share a manifold of properties."[7] It is this divide which separates the "real kinds" from those that are spurious:[8]

> White things are not distinguished by any common properties, except whiteness: or if they are, it is only by such as are in some way connected with whiteness. But a hundred generations have not exhausted the common properties of animals or plants, of sulphur or phosphorus, nor do we suppose them to be exhaustible, but proceed to new observations and experiments, in the full confidence of discovering new properties which were by no means implied in those we previously knew.[9]

Mill-Kinds are similar to Russell-Kinds in that they both appeal to aggregates of properties which are not implied by each other. Their main difference, as Hacking[10] points out, consists in the implied

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[6]C.B. Martin, "Need for Ontology: Some Choices," *Journal of Philosophy* (1993) 18.

[7]Hacking, (1991), 117.

[8]Of course, *any* arbitrary group of things has at least one property which all members share.

[9]J. S. Mill, *Systems of Logic*, p. 122; gleaned from Hacking, (1991), 118.

[10]Hacking also points out that Mill-Kinds are amenable to a solution regarding the permissiveness of kinds.

volume of shared properties under Mill's version.

Pierce, whose characterization of kinds depends largely upon Mill, inserts some essentialist overtones into some closing remarks on natural kinds in the following proposal:

> Any class which, in addition to its defining character has another that is of *permanent interest, and is common and peculiar to its members*, is destined to be conserved in that ultimate conception of the universe at which we aim, and is accordingly to be called 'real'.[11]

It isn't clear how the "defining character" is different or why it ought to be different from the one of "permanent interest". What is clear though, is that this character of permanent interest has all the earmarks of an essential characteristic. If all and only members of a kind have a particular feature, then we are here speaking of necessary and sufficient conditions.

In addition to these two formulations there are some desiderata or requirements normally made of natural kinds. Below is a list of desiderata as compiled by de Sousa.[12] A theory of natural kinds need not adopt all eight, and, as de Sousa suggests, they may not even be jointly satisfiable. But a theory which employs none of them will not be a theory about natural kinds. So, although the dispositional conception of natural kinds does not necessarily displace these traditional criteria, it is not compelled to endorse any one of them,

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[11]Hacking, (1991), 119; emphasis added; from Baldwin's *Dictionary of Philosophy and Psychology* Volume I, (1901) p.600.

[12]This list is largely verbatim and its reproduction is somewhat of a forward-looking strategy since de Sousa's objections to natural kinds, those which will be contested here, are wrung from this very set of requirements.

come what may. Here then are the eight requirements of natural kinds as compiled by de Sousa:

(i) Objectivity: a natural kind must be so intrinsically if at all: an object's membership should not be relative to anything else, especially not to any knower's epistemic position.

(ii) Explanatory Primacy: the defining property (or properties)[13] of a natural kind is expected to provide explanations at a basic level for some other properties of its members, and not to admit of explanation in terms of other properties.

(iii) Multiplicity of Kinds: [I]t would presumably be a *reductio* if it transpired that there was only *one* natural kind.

(iv) Sharp Boundaries: natural kinds do not shade into each other.

(v) Stability: if x belongs to kind K in this world, then x belongs to K in every world where it exists. In other words, if something were to lose the properties definitive of its kind, it would cease to exist.[14] If this doctrine is true, we might say that natural kinds are perfectly *stable*.

(vi) Uniqueness of Membership: nothing is a member of two natural kinds at once: kinds do not overlap.

(vii) Equipollence: Natural kinds are all *equally* stable: if any can be destroyed then they all can. If not, then there will be a *hierarchy* of kinds, some of which will be more stable than others.

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[13]These I take to be the putative essential properties.

[14]I take this to mean,'to exist as a member of that kind'.

(viii) Perspicuity: natural kinds ought to *seem* natural. They should turn out to be such things as species; or earth, fire, water, air; or matter conceived of as extension.[15]

What is not offered by the above desiderata nor by the above authors, is a mechanism by which putative natural kinds might be entertained as such, candidates which might be run through the mill of eight requirements. Putnam offers a mechanism which operates like indexicals; the putative kind is "baptized",[16] by some kind of pointing be it physical or theoretical gesturing[17] in conjunction with a naming event, and then anything which stands in the same$_K$ relation with the named thing is of-a-kind with it.

1.2 Natural Kind Essentialism

In order to demonstrate his semantic thesis that "meanings ain't in the head" Putnam devised his now famous thought experiment which asked us to imagine another Earth just like ours with a single exception. This orb, Putnam referred to it as "Twin Earth", would be populated with similar things so that for every stone here on Earth there would be a stone (as like as you would have it) on Twin Earth. This duplication would be exhaustive enough to include speech communities, persons, and psychological states. So, on Twin Earth

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[15] Ronald de Sousa, "The Natural Shiftiness of Natural Kinds", *Canadian Journal of Philosophy* **14** (1984), 564-565.

[16] This is Kripke's term.

[17] That is, some theory may posit some particle or planet, presently unconfirmed such as W particles or Pluto, to render the theory consistent with data. If subsequent confirmation ensues then the preconfirmation gesturing counts as theoretical gesturing.

there would be a Twin Putnam who spoke English and wrote philosophical essays on meaning, just like our Putnam here. Just how precise the duplication is to be is not an overriding concern for Putnam. Whether Twin Putnam's entire molecular structure, vocabulary, or musings were precisely duplicated is a matter dictated only by the readers' ability to perform the thought experiment unimpeded. What is important is that the reader should be able to imagine a Twin Putnam who is in the exact same psychological state as Putnam is when referring to 'water', water being the single exception to reduplication.

Twin Earth water would possess all the superficial properties of water, that is, it would be wet, tasteless, thirst quenching, etc., but it would not *be* H_2O! The molecular structure of Twin water would be something else say, XYZ.

Since Putnam and Twin Putnam are, by hypothesis, in the same psychological state when they use the word 'water' in a referring manner, and since their respective words refer to different extensions (Putnam's refers to H_2O and Twin Putnam's refers to XYZ) then psychological states cannot determine the extension of natural kind terms (where, that which determines the extension is taken to be, contentiously I think, the meaning of the word). If Putnam happens to know that water is H_2O and Twin Putnam knows that water is XYZ then they are not in the same psychological state. But we can easily imagine another set of twins existing prior to the discoveries of H_2O and XYZ that would allow us draw the desired

conclusion: meanings just ain't in the head.

Because water on earth is, on the macroscopic level, indistinguishable from "water" on Twin earth, and because they are functionally equivalent *ex hypothesis*, then the only difference between the two liquids is their difference in microstructure. Furthermore, we could imagine conditions under which any one of the descriptional definitions that normally accompanies H_2O fails to obtain, and yet we would maintain that this stuff (the H_2O) is still the same stuff that our water is. It may be frozen, for example, and therefore not wet, or our taste receptors could change so that H_2O elicits the taste we currently identify with the taste of honey. Indeed, of the full descriptional definition (the list of macroscopic properties), all of the attributes could, conceivably, be no longer true of H_2O under present conditions and yet this stuff would still be the same stuff that our water is. So, being H_2O turns out to be an essential property of the substance we refer to as 'water'.

That water *is* H_2O is an empirical state-of-affairs and not one which obtains analytically. Prior to finding out that the "water around here" was, in fact, of the molecular structure H_2O, it was *conceivable* that water had variously many microstructures and that the extension of 'water' could continue to be determined by its intension, i.e., in a nonnatural kind way. The *discovery* that all water around here shares the same microstructure turns on a bit of epistemic fortune; but, once the discovery has been made, it becomes

necessary that for something to be water it must be H_2O.[18]

1.3 Some Objections to Natural Kinds/Essentialism

As indicated earlier, the essentialism thesis is not one which enjoys a lack of controversy. From the multitude of objections to both essentialism and natural kinds I have selected those which I take to be the most problematic for theories of natural kinds, and as those requiring some sort of resolution by any such theory as a minimum requirement for its acceptability.

The first set of objections are derived from D. H. Mellor's incisive paper entitled *Natural Kinds.*[19] Mellor's primary motivation is to deny Putnam and Kripke their much heralded natural kind *essences*. What is left of natural kinds after the denial of essences, though, presumably casts a very pale metaphysical shadow.

1. It is Mellor's contention that, upon the discovery that Twin Earthians drank XYZ, we would have merely discovered that "not all water has the same microstructure; why should it?"[20]

There are perfect precedents which support this view in the discovery of isotopes. There are two isotopes of chlorine, for instance, which means that there are two microstructures for the natural kind chlorine. And even though we have discovered that there are two microstructures of chlorine we still use the natural kind term

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[18] cf. S. Kripke. *Naming and Necessity.* pp.118-134.
[19] D.H. Mellor, "Natural Kinds", *The British Journal for the Philosophy of Science* **28** (1977),
[20] Mellor (1977), 303.

'chlorine' to refer to both of them. A very similar story can be told about water itself, and has, with respect to the so-called "heavy water" and "heavy heavy water".[21]

There are two possible readings of this objection. On the one hand, Mellor could be read as making a claim about how our language functions here and now. Just as we use the term 'chlorine' to refer to both isotopes of element number 17, we would similarly use the term 'water' to refer to both H_2O and XYZ upon the discovery of Twin Earth. On the other hand, he could be read as making a metaphysical claim about the relationships which hold between the stuff we call 'water', the molecular configuration H_2O, and the rest of the concatenated particles of the universe. Because it is conceivable that there is some substance XYZ, there is no apparent necessity which holds between water and H_2O. The role played by water *qua* H_2O in the universe can be equally played by water *qua* XYZ. Since the required necessity does not hold between water and H_2O, H_2O is not an essential property of water and, therefore, water is not a natural kind, at least not as Putnam needs to conceive natural kinds in order to bring off his semantic thesis.

2. Another failing of the Putnamian scheme, Mellor points out, is that "[n]o reason is given why *particular* properties must be common to all things in all possible worlds that are of the kind as the archetype."[22] Perhaps all the samples/instances of a natural kind

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[21]Eddy M. Zemach, "Putnam's Theory on the Reference of Substance Terms", *Journal of Philosophy*, **73** (1976), 116-127.

[22]Mellor, (1977), 306; emphasis added.

share ten "important" properties. Perhaps only sufficiently many of these properties would be enough to establish membership in the kind. What Putnam needs here are some supplementary arguments to establish that the sameness of kind is an equivalence relation of the sort he offers. "To claim that the relation is an equivalence relation, so that archetypes have to share the same properties with all possible samples of the kind, is just gratuitously to assume the essentialist conclusion."[23]

3. If the macroscopic properties of a natural kind are deducible from its microstructure,[24] "then they occur in any possible world the microstructure occurs in. So if the microstructure is essential for this reason, so are all the macroscopic properties it explains."[25]

Ronald de Sousa's argumentation against natural kinds in *The Natural Shiftiness of Natural Kinds,*[26] as alluded to above, consists in taking a set of desiderata of natural kinds and then proceeding, desideratum by desideratum, to show that there is nothing in the world which remotely satisfies these collected desiderata. de Sousa begins by pitting the requirement of explanatory primacy (ii) against the requirement of multiplicity (iii).[27]

1. Because the "most fundamental and *objective* explanations of the

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[23]Mellor, (1977), 306; emphasis original.
[24] Presumably, Mellor muses, that is why they are the "important" physical properties.
[25]Mellor, (1977), 311.
[26]de Sousa, (1984)
[27]See page 7, above, for more detailed descriptions of these principles.

properties of things are to be found at the physical level,"[28] and since at this level everything can be theoretically transmuted into anything else, there must be only one absolute natural kind.

Since there is not much sense left in natural kind talk once the requirement of multiplicity is violated, in order sustain the viability of such talk, we must relax, at minimum, the requirement of explanatory primacy.

2. de Sousa goes one better. He suggests that we might relax both requirements (i)[29] *and* (ii) in order supply the world with sufficiently many kinds so as to keep the notion alive. We might, de Sousa suggests, generate some kind-candidates along functional properties.

Because this exercise of de Sousa's is just a ploy, and because the suggestion that natural kinds could be picked out along functional lines is *prima facie* implausible, perhaps not too much weight should be misplaced upon this leg of enquiry. But it does provide a welcome opportunity to show how a functional account of natural kinds fails by responding to de Sousa's suggestion that what is needed is a "conclusive reason for rejecting functional accounts of the nature of natural kinds."[30]

3. Anent to the above considerations de Sousa notes that there might be a functional-structural relationship in the case of

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[28]de Sousa, (1984), 572; perhaps it should be noted here that this is premised on the "common faith in the unity of science" which I consider problematic, but which I will not here contest.

[29]This is the requirement of objectivity.

[30]de Sousa, (1984), 573.

toothbrushes which parallels the one which holds between water and the various isotopes of its component parts. "[t]he different isotopes of oxygen or hydrogen can be viewed as providing different structural realizations of the functional stuff *water*."[31] A conclusive reason for rejecting the above functional accounts must show why the functional stuff "water" forms a natural kind while the functional things "toothbrushes" do not.

Paul Churchland's concern about natural kinds stems from a different sort of consideration. It is his contention that the relationship between a general term and the extension of that term is always mediated by the latest scientific theory. This is due to the theory-ladenness of the "sameness relation" which holds between samples/things of a kind. That the extension of 'water' is the stuff that is H_2O or that the extension of 'gold' is the stuff that is element 79 is a function of our current scientific theories.

In the past, the extensions of these same terms differed because our theories about what gold was and what water was were different. Some terms such as phlogiston and caloric fluid lost their extensions altogether. Because of the ongoing changes in scientific theories, we can only assume the possibility that any candidate term for natural kindhood will eventually refer to a different set of things or samples, we cannot blithely offer up anything which might serve as an example of a "permanent" natural kind.

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[31]de Sousa, (1984), 574; emphasis original.

1.4 SAME$_K$ OBJECTIONS?*

One thing to notice is that at the bottom of all these positions against natural kinds are epistemic concerns, in particular, the epistemic concern that surrounds the identity relation that holds between things/samples of a natural kind set.

In the case of Putnam's essentialism, the disagreements turn finally, not on his contention that water has to stand in the appropriate same$_L$ relation with the stuff we call "water" around here,[32] but rather, on his contention that "...is H_2O" is the appropriate same$_L$ relation. Reasons offered in support of this contention are notoriously absent, and several authors have pointed out that to assume that "...is H_2O" is the appropriate same$_L$ relation is just to assume the essentialist thesis.[33]

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* The relation same$_L$ is introduced by Putnam (1975) to indicate the *relevant* relation which is deemed to hold between the members of a natural kind. For instance, "[M]y 'ostensive definition' of water has the following empirical presupposition: that the body of liquid I am pointing to bears a certain sameness relation (say, x is the same liquid as y*, or x is the same$_L$ as y[*I am taking Putnam to here mean that x is the same *kind* of liquid as y] to most of the stuff I and other speakers in my linguistic community have on other occasions called 'water"..."(Putnam. "The Meaning of 'meaning'", p.225). According to Putnam this same$_L$ relation is finally a "...*theoretical* relation: whether something is or is not the same liquid as *this* may take an indeterminate amount of scientific investigation to determine"(Ibid. p.225). The reason that 'water' on Twin Earth is not water is simply because "it doesn't bear *same$_L$* to the *local* stuff that satisfies the operational definition..."(Ibid. p.232). Subsequent authors such as Salmon (1981, pp.161-216) have picked up on this terminology and extended the range of its use by substituting 'L' with 'K' so that the same$_K$ relations indicates a more general relation, namely, a same kind relation.

[32]Perhaps, in other possible worlds, water need only stand in the same relationships with the rest of that possible world as water does with the rest of the actual world. But, this may be yet be construed as a variation on "the appropriate same$_L$ relation".

[33]Mellor (1977) above for one, and in particular, Nathan U. Salmon, *Reference*

To demonstrate the above observation, witness how each of the proffered arguments contesting the natural kind essentialism of the "modern view" proponents comes down to a challenge of the thesis that "...is H_2O" is the appropriate $same_L$ relation that holds between samples of water.

Mellor has three such challenges above: **1** the discovery of Twin Earth does not force us to posit "Twin Water" for there are no conclusive reasons for supposing that XYZ is not also water (i.e., "...is H_2O" is not necessarily the appropriate $same_L$ relation); **2** there is no reason given why a particular property (being H_2O, for example) must be common to all things in all possible worlds that are of the same kind; **3** macroscopic properties of a natural kind are just as essential (i.e., just as ubiquitous) as the microstructure (in this case, H_2O), and hence, there appears to be little or no compelling reason to single out the micro-structure as the essential property.

There is a similar homogeneity of criticism underlying de Sousa's challenges: **1** there are more fundamental and objective levels of explanation than (for example, "...is H_2O"), and so, for what compelling reason would we stop at the molecular level when more fundamental levels are to be had? **2** further, why should we restrict ourselves to classes determined by microstructure in our search for natural kinds, when classes determined by function also offer interesting candidates? (i.e., what is it about the molecular structure, H_2O of water say, which makes it specially suited for determining a

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and Essence. (Princeton: Princeton University Press, 1981).

natural kind?); 3 this question can be made more pressing by the consideration that the *functional* stuff water has several structural realizations, just like all good functional stuff should have (i.e., classes could equally well be determined along functional criteria, the specified function would serve just as well for determining the relevant sameK relation).

Similarly, it is Churchland's contention that this celebrated $same_L$ relation holds no especial status for determining the extension of natural kind terms, since the important $same_L$ relation is a function of the latest scientific theory. Since theories change we have no reason to suppose that "...is H_2O", being inherently a theory bound construct, will continue to function as a determiner of an extension at all, much less that of a putative natural kind.

A concomitant of any articulation of natural kinds, then, had better be a specification of just what the $same_K$ relation is that holds between members of a natural kind.

2. Dispositions and Natural Kinds

Introduction

Dispositions, like natural kinds, are not mysterious, or, at least, the ways in which disposition terms function in our language are not overtly mysterious. There are a host of synonyms such as "power", "potential", "capability", "capacity", and so on, which roughly indicate the same notion. Taken simply, to *say* of something that it has disposition S is just to say of that thing that it would manifest a set of such and such properties consistent with S (not necessarily different from the properties currently manifested by the thing) if the appropriate conditions were to obtain. Even so, there are several questions, often asked confusingly in unison, which surround talk of dispositions. They are: (1) what does it *mean* for something to have a disposition S? (2) how do we *know* when something has disposition S? (3) what is the *basis* of the disposition S? Clearly (1) is a philosophical question and (3) is not. It is not the aim of this project to determine any of the empirical responses to (3); that task I take to be, as Mellor and most others have, the province of the physical sciences. Any empirical content that is appealed to here will be done largely so as to facilitate a philosophical characterization of dispositions which permits an answer to question (1), and perhaps a partial consideration of the current answers to question (2). The aims of this overall project do not depend on a response to (3), nor even to (2). They are, however, intimately tied to (1), for it is the contention

of this thesis that the intentions which support talk of dispositions are the same ones which support our intuitions about what natural kinds would be like—whether there are any natural kinds is an entirely separate question.

What needs rejecting are the arguments put forth by Mellor, de Sousa, and Churchland above, and central to this rejection will be a re-working of the conception of natural kinds. If this conception of natural kinds is tenable then it can be shown that all of the above arguments singularly and collectively do not dislodge the cogency of natural kind talk. This conception will not only demonstrate the cogency of such talk, but will also demonstrate a harmony of intuitions with both those who would accept natural kinds and those who would deny them. Furthermore, the intuitions which support this conception of kinds will be shown to be an integral part of the intuitions which support both the methodological and theoretical *cum* metaphysical aspects of physico-chemical science itself. Then we must defend such a conception.

Let us begin with a brief sketch of how people have talked about dispositions leaning first upon Mellor's sketch from which he defends a realist notion of dispositions and then upon the work of Martin and Fetzer.[1] Where it is Mellor's intent to show "the offending features of

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[1] D.H. Mellor, "In Defense of Dispositions", *Philosophical Review* **83** (1974).
C.B. Martin, "Power for Realists" in J.B. Bacon, K.K. Campbell. & L. Reinhardt (eds.), *Ontology, Causality and Mind.* (Cambridge University Press: Cambridge, 1992).
J.H. Fetzer, A World of Dispositions" in Raimo Toumela (ed.), *Dispositions.* (D. Reidel Publishing Company: Dordrecht, 1977) 163-187.

dispositions to be either mythical or common to other properties of things,"[2] and it is Martin's and Fetzer's to establish dispositions as "ontic primitives", it is mine simply to argue for a minimally realist position on dispositions, namely, that we can talk about them in a meaningful way, in just the same way that we can talk about the relatively less problematic manifest properties. Though I take Martin and Fetzer to be largely right in their strong, realist ontological attitude regarding dispositions, it is sufficient here to adopt the minimally realist position for the purposes at hand.

The paradigms of dispositions are 'fragility' and 'solubility', and there are good reasons. In ordinary language, for example, the suffix '-[b]ility' indicates, an ableness or an inclination towards some other state (i.e., having a different set of properties), were the thing so predicated to be involved in a specifiably different set of circumstances. To be fragile, then, is to be able to be shattered given a certain range of circumstances; e.g., accelerated or decelerated within certain parameters.

Dispositional predicates form a distinct subset of predicates, and they are distinct in virtue of their subjunctive mood. 'Fragile' and 'forty', for instance, differ in how much they commit the things which they are true of to past and/or future manifest states.[3] To say of someone that he or she is forty is to commit him or her to being thirty ten years ago. A person who is mortal is committed to die

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[2] Mellor, (1974), 157.

[3] These are Mellor's examples.

(else the predication does not hold). On the other hand, to say of something that it is fragile is not to commit it to any past, present, or future *manifest* states. A glass may come into existence and go out of existence without ever being dropped or otherwise decelerated. But throughout its existence, the glass, if it *had been* dropped (on some height-gravity-hardness-of-impact-surface-etc.-quotient, hereafter assumed), *would have* shattered.[4] Dispositional predicates, if true, commit the things they are true of to certain manifest states *only if* certain conditions obtain. In many instances the appropriate conditions (C.B. Martin calls these "reciprocal dispositional partners for mutual manifestations")[5] do not obtain, and so the thing never manifests the properties governed by the predication. It is even possible for the reciprocal partners not to exist and for it still to make sense to say of a thing that it is disposed to some other, not-now-nor-ever manifest state, which it might have attained *had* the appropriate partner existed.[6]

2.1 DISPOSITIONS VISITED

Talk of dispositions has the misfortune of being preceded by the explanatory likes of dormitive virtues, though those of a behaviorist bent are not likely to forgive the possibility of real unmanifested

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[4] The glass would have shattered, that is, at the times which the glass was fragile. Perhaps it is not true of the glass that it is fragile throughout its existence.

[5] Still others call these the principal and the instrumental causes: see, for instance, Ian J. Thompson's, "Real Dispositions in the Real World", *The British Journal for the Philosophy of Science,* 39 (1988) 67-79.

[6] C.B. Martin, "Power for Realists," 17-18.

things anyways. For the most part, the "offending features" of dispositions—features which Mellor successfully shows, I think, to be problems which are not special to dispositions—arise out of the inscrutability of umanifested dispositions.

To say something has a disposition, on most accounts, amounts to saying something like: saying "*a* is soluble" (S*a*) is just to say that "whenever *a* is put in water it dissolves":

I. $Sa \leftrightarrow (t)[W(a,t) \supset D(a,t)]$[7]

where "$W(a,t)$" means "*a* is put in water at t′ and "$D(a,t)$" means "*a* dissolves at t′."

This formulation, however, has the unfortunate consequence of rendering everything that is never put in water soluble and so, a less inclusive formulation is required:

II. $(t)[W(a,t) \supset (Sa \leftrightarrow D(a,t)]$[8]

This formulation restricts the ascription of solubility to those things which dissolve in water and of which it is anyways counterfactually true that *had* they been in water they *would have* dissolved.

Although (II) escapes the "inclusion error" endemic to (I), it lands one into what Mellor calls the "problem of mutability". Suppose that had *a* been placed in water at t_1 it would have dissolved, but, at t_2 (where $t_2 > t_1$) for some reason (e.g., it has been kiln-fired since

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7 Mellor, (1974), 160.

8 This is Carnap's formulation, adapted in Mellor, (1974), p. 160. Carnap's original formulation uses the slightly less transparent sentence letters Q1 and Q2 such that; $(x)(t)[Q_1(x,t) \supset (Q_3(x) \leftrightarrow Q_2(x,t)]$ in R. Carnap, "Dispositions and Definitions" in Raimo Toumela (ed.), *Dispositions*. (D. Reidel Publishing Company: Dordrecht, 1977), 4.

t_1), it would not. Since a is soluble at t_1, then, according to (II), it is soluble for all time including t_2.

2.2 Ontology of Dispositions

A frequently raised question is one regarding the appropriate ontological attitude towards dispositions. One response is to strip them of any pretense of belonging to the world or things in the world by handing dispositions their ontological pink slip. Another response is to insist that they must inhere in or be based upon some manifest or other unproblematic properties while they are not being displayed. These responses are the product of taking the existence of dispositions to be an epistemological problem, one which, in the hands of a behaviorist methodology, takes on an inflated ontological importance.

Ryle, for instance, in his swinging behaviorist style, claims that "dispositional statements are neither reports of observed or observable states nor yet reports of unobserved or unobservable states of affairs."[9] In other words, dispositions have no ontic status whatsoever; they are merely "inference tickets". For instance, the claim "'a is soluble' states no fact; it merely licenses the inference from 'a is put in water' to 'a dissolves'."[10]

> He [Ryle] is concerned only to deny any extra feature of the world that makes "a is fragile" true, over and

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[9] Mellor, (1974), 161.
[10] Mellor, (1974), 161.

> above those that make true such statements as "*a* is being dropped" and "*a* is breaking".....The display of a disposition - say a glass breaking- is an event; hence observable and so admissible into Ryle's behaviorist ontology. The disposition itself, however, is a property a thing may have without the occurence of any event, hence *not* observable, and so not admissible"[11]

But what, Mellor asks, "gives the license its authority?" For "[I]t is obviously not a logical authority[12] and, as Ryle insists, it does not derive from the present occurrence of any event."[13] One is reminded of the Putnamean line regarding the success of science; either realism prevails or that success is a miracle.[14] In the absence of a realist's interpretation of dispositions it is completely miraculous that the glass dropped *and then* it broke!

Armstrong takes up the other possibility that there must be some "nondispositional property which provides a 'categorical basis' for applying the dispositional predicate,"[15] for "unless a disposition has a nondispositional basis there can be no grounds for ascribing it between its displays."[16] This position, however, immediately involves problems of its own which are as philosophically shaky as the

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11 Mellor, (1974), 162-163.

12 There is a non-accidental parallel here between the absence of logical authority and the absence of logical interconnectedness between the properties of a natural kind; see Mill-Kinds; above p. 5.

13 Mellor, (1974), 164.

14 I am not wed to this exclusive disjunction regarding the success of science nor does this account of dispositions depend on it. The disjunction is far more intuitive with respect to dispositions I hold, but will not here argue, than it is with respect to the success of science.

15 Mellor, (1974), 164.

16 Mellor, (1974), 164.

"invisible dispositions". Which categorical basis of a sugarcube, for instance, supports the disposition of being soluble? Being cubic, perhaps? Granular? White under daylight conditions? Sweet tasting? Or is it a "property array", i.e., a conjunction and/or disjunction of necessary and sufficient properties which could serve as a basis for its solubility?

Armstrong's own suggestion is that the molecular structure of the sugarcube is responsible for its solubility. But this suggestion again raises problems of its own which must be met. In the first place, this is to suggest that the molecular structure of a thing is nondispositional. What evidence do we have for this? Secondly, we might ask, "in what sense is the molecular structure a categorical basis?"[17]

Quine and Goodman, in a similar fashion, offer a "similarity criterion" across manifest properties for determining that a set of things might all have a particular disposition. The problem consists in knowing how to "project" from a relatively unproblematic manifest predicate like "breaks" to a dispositional predicate like "fragile".

What we can say about the glass fragments that drop is different from what we can say about those that do not drop, or at least, have not. Goodman's projection problem, of course, does not apply to glass fragments of the first case, those fragments simply break or do not.

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[17] Since by 'categorical basis' one generally means something like 'a basis which is not merely hypothetical', it seems strange to suggest that molecular structure, something that seems unavoidably hypothetical, could serve as a categorical basis.

But what of the undropped? According to Goodman and Quine, the fragile ones are simply those which are "relevantly similar" to those which dropped and broke: "We need to "round out" the set of dropping glass fragments that break into a *natural kind* by adding sufficiently similar glass fragments that are not dropping."[18]

Thus far the various responses have been with respect to dispositions: Ryle dismisses them, Armstrong demands a categorical basis with which to legitimize them, as, finally, do Goodman and Quine.[19] Mellor also feels they require some kind of basis, but argues that this basis need not be nondispositional.[20] Most contend that it is up to physical theory to provide the basis that supports, for example, "fragility".

Martin and Fetzer take a completely different tact. It is the dispositionality of the world which is ontologically prior to and which supports, for instance, the likes of cause and effect:

> [O]ne can see that just as dispositions can exist without their manifestations so a disposition can exist without the manifestation that would be the relevant cause-effect. Yet a cause-effect cannot exist without the relevant dispositions for which it is a set of manifestations. So one can see that one must explain cause-effect in terms of the evidently more basic notions of dispositions and manifestations.[21]

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18 Mellor, (1974), 166; emphasis original.

19 Though Quine and Goodman appear to be inclined towards ontic whimsy with regards to the status of dispositons; theirs is primarily an epistemic gesture.

20 Mellor, (1974), 174-181.

21 Martin, "Need for Ontology", 18.

Similarly Fetzer argues towards an ontological priority for dispositions such that:

> (a) every structural property of the world is a dispositional one, (b) a physical object is a specific ordered set of dispositions, and (c) every event that occurs during the course of the world's history is a manifestation of some dispositional property of the world.[22]

In a similar way I want to adopt such a priority for dispositions in natural kind talk, but this is to get ahead of myself. First we need to fine tune what it is to be a disposition.

2.3 DISPOSITIONS REVISITED

When I complained to C.B. Martin[23] that the philosophical excavation of dispositions was like scratching at Kant's noumenon he offered the following advice: "attend first to the manifest properties and realize that they enjoy no special status."[24] I understood by this that—if one were to examine a sugarcube, say, the following things could be said of it: it is cubical, white, granular, tastes sweet, etc., and these manifest properties, which are seemingly unproblematic, are just dispositional properties that just happen to be, here and now, manifest and observed. So at least a subset of the dispositional

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22 Fetzer, (1977), 163.

23 Though I shall impart no blame upon him for anything said here and have since come to understand that what he meant to convey is not what I understood him to say.

24 Not exactly rendered.

properties of a thing command ontic parity with the manifest ones, because they are, here now, manifest and observed.

To claim that the manifest properties of a thing are, in fact, the only properties which could hold of the thing would be equivalent to claiming that no matter what conditions could be brought to bear on this sugarcube, it would retain all its current manifest properties for the rest of eternity, and even, perhaps, that it has always been thus. But nothing, C.B. Martin will tell you, can be in the state of pure categoricality.[25]

Certainly, a number of alternate displays of the thing could be both derived from and true in virtue of its manifesting properties. But there also are a significant number of alternate manifestations which are not belied by any of its manifest properties nor even all of its manifest properties. For instance, at what temperature does the sugarcube spontaneously ignite under such and such conditions? Some answers must be wrested from the thing empirically.[26]

Mellor makes the following point regarding the suggestion that dispositions present problems for truth claims over and above those present for manifesting properties:

> Ryle thus complicates the special question (for example, how to tell if a glass is fragile) by confounding it with a general question about the empirical basis of relatively theoretical knowledge

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[25] Nothing can be manifesting all the properties that it could be true of it, i.e., expressing all its dispositions; at a singular time. See Martin, "The Need for Ontology: Some Choices", p.15 and Martin, "Power for Realists", p.15.

[26] Some might be theoretically derived also, but see below, p107ff.

> (whether of events or things). The special question, once distinguished, is easily answered: drop the glass and see what happens, just as one would count the corners of a thing to settle a doubt about its triangularity. But what about the glass when it is not being dropped? Well, what about the supposed triangle when its corners are not being counted? All properties of things are unobserved most of the time; so, come to that, are most events. The problem of induction, such as it is, is neither peculiar to dispositions nor to properties of things...[27]

Things change, that is true (glasses break, for instance), but is this sufficient to establish that dispositions exist or to justify the metaphysical stance which affirms them? Perhaps there is no amount of change which suffices as conclusive evidence for an affirmative answer here. But, given that these changes have their directionality empirically mapped more and more precisely, and given that we want to keep our theories miracle-free, it becomes increasingly difficult to imagine the ontological attitude which denies them. If one believes that a sugarcube cannot ever, under any set of conditions or string of such sets, manifest all the properties of a rocket ship or of Gilbert Ryle, or if one believes that the glass will break and the cannon ball will not, under some identical conditions, then, whatever else one holds, one subscribes to something like this standard account of dispositions.

So at least one point seems rationally assured, this sugarcube *has* dispositions; some of them are now manifest, whereas others are not. This is strictly an ontological point; namely, one made towards the

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[27] Mellor, (1974), 163.

existence of dispositions, irrespective of what they might happen to be and irrespective of our epistemological situations regarding them. Of course, our *enumerated* ontology will depend on our epistemic conditions, and thus will doubtlessly remain open-ended.

The *existence* of dispositions, or at least securing the rationality of the ontological attitude which includes them, is sufficient for an articulation of natural kinds. But we must pick up a discussion that began earlier, one which surrounds the paradigms of dispositions of "fragility" and "solubility". Dispositional predicates have two parts,[28] and an understanding of the relationship between the parts is critical to understanding dispositions in a way amenable to an articulation of natural kinds as well as to answering question number one from above.[29]

2.4 WHAT COUNTS AS A DISPOSITION?

A discussion of dispositions can quickly lead one to question the adequacy of these well-worn examples of dispositional properties. The shortcomings of these dispositions appear to be twofold, though in the end they turn out to be just two sides of the same coin. The first consists in their pretense at separating all objects into one of two classes or kinds along the line of a particular disposition (for instance, the class of solubles and the class of things which are not

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[28] If a subjunctive conditional may be described this way: the first part of the predicates names the conditions under which the second part, the manifest properties, become manifest.

[29] "What does it mean for something to have disposition S?"

soluble). However, most, if not all, nonliquid/nongas things are soluble given the appropriate medium (and perhaps very few are soluble in water). If something were not soluble under any conditions, then of course this would constitute an important dispositional fact about the thing. To deem something soluble or not, simply according to whether it dissolves in water (as formulations I & II do, for instance) is somewhat negligent. On the above account salt belongs to the set of soluble things and gold does not, and this forces a false dichotomy.[30] This is particularly problematic if one subsequently attempts to derive natural kinds from dichotomies of this sort.

This leads directly to the second aspect of the shortcoming, namely, that what is left too far in the background in this kind of dispositional talk is the third,[31] and arguably the most dispositionally revealing, factor—i.e., what C.B. Martin calls the "reciprocal disposition partner for the mutual manifestation,"[32] namely, the dissolving agent.

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30 Gold is soluble in the appropriate medium (reciprocating disposition partner for the mutual manifestation) such as *aqua regia*. It is true, especially on the account of natural kinds, that no two things could belong to the same natural kind if one would dissolve in water and the other would not, *'ceteris paribus*.

31 The other two other being; the thing in question and the property arrays it may subjunctively assume.

32 Mostly referred to hereafter simply as the 'conditions' but, this normally obscures the mutualness of the manifesting display, e.g., not only does the sugarcube have the disposition to dissolve in water but, water has the disposition to dissolve sugarcubes and the resulting solute is a display participated in by both equally.

The negligence first mentioned is perhaps better exposed by exploring the disposition "fragility". The single manifest property which confirms fragility is "breaks".[33] But everything which is the size of an atom or bigger can be broken given the appropriate conditions. Those things that are both breakable and fragile just fall within certain arbitrary limits on a continuum of ease of breakability. Because most things we want to talk about *can* break, it is not very dispositionally revealing to say merely that something broke. What makes the state of being broken dispositionally relevant, then, are the *conditions* which make this state manifest, i.e., the reciprocal disposition partners which participate in the manifest state "broken".

It is true, of course, that to say that something is fragile is to say that it is *easily* breakable. And one could quite possibly operationally cash out what "easily breakable" means on a hardness-of-impact-surface, size-of-impact-area, force-of-impact, etc. quotient. But, the cut-off point, whatever it is, will force a false dichotomy between the fragile and the not fragile. In the set of things which are deemed fragile there will be a greater "breaking distance" between the most

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[33] It has since been pointed out to me that fragility has a technical sense, that in order for something to be fragile it must break in a certain way, that is, it must shatter. I have kept this section more or less intact though, in the belief that the general pursuit is unsullied by this realization and by the further, possibly unsubstantiated belief that all things might still be broken in the appropriate way (shattered) given appropriate circumstances (perhaps at 0° Kelvin?). The thrust of this section should not be affected since, given the possibility of transmutation, it is hard to accept that the lack/possession of a single disposition should split all things into two discrete classes (or worse, natural kinds) on such a basis.

fragile and the least fragile than there will be between the least fragile and the most nearly fragile of the set of things which are not fragile. The false dichotomy consists in the impression that two "fragile" things are somehow related (according to "breaking distance"?) in a way that a fragile thing and a not-fragile thing are not. To be a member in the class of fragile things falsely suggests that there is something about those members (easily breakable) which, as Quine is not loathe to say, permits us to "round [them] out" into a *natural kind*!

The same sort of thing may be said with regard to solubility. For a thing to be soluble, Carnap suggests, is for it to be vulnerable in the following way: if it were placed in sufficient *water* it would dissolve (see formulations I &II, above). But this is just a description of the disposition "*water* soluble". To be fair, to be "soluble in water" is only partly analogous to "break easily". Whereas different things may require different levels of the "force-quotient" before they would break, different things may require different solutions before they dissolve. This is clearly not the same, since the different levels of the "force-quotient" will have a linear relationship and the same cannot be said of different chemical solutions. For example, if something does not dissolve in some, sufficient amount of water, adding more water will rarely change the situation. Notwithstanding this, there are important parallels between the "clumsiness" of fragility and solubility.

Just as things that break easily do not form natural kinds, nor, for that matter, do those things that simply break, things that are soluble do not form natural kinds, nor even do those things that are water soluble. At least they don't simply in virtue of being water soluble. There may yet be something significant in the difference between being something that is soluble only in hydrochloric acid, say, and being something which is soluble in both water and hydrochloric acid. That trail, however, will be pursued in the next section.

To make some final points about the primary importance of the reciprocal disposition partners, let us consider the physical state of being liquid. Every item on the elemental table and every permutation thereof has a liquid state. Just as all objects are break*able*, there is no dispositional distinction in simply being *able* to adopt the liquid state. Second, at least in the case of breakability, there is no clear and nonarbitrary way of dividing up the objects into natural kinds along the continuum of a single disposition. So the paradigmatic dispositions, namely fragile and soluble, as such, have inadvertently obscured the nature of dispositions as well as edifying them. The imprecision consists in taking these dispositions to be more monolithic than we can afford to take them. They are merely subsets of "broader dispositions" such as breakability. These subsets are selected from the "broader disposition" according to their ability to manifest the appropriate properties (broken) in conjunction with arbitrary and loosely determined mutual manifestation partners

which happen to be of a concern to us here and now. These partners may be determined along any number of lines. In the case of fragility, for instance, we might say that something is fragile just in case it would break, were it to fall off this table and onto *that* floor. "To fall off this table and onto that floor" is not a disposition of the thing at hand, or at least it needn't be;[34] it is an accidental set of conditions. There are an indefinite number of such conditions by which we might determine something to be fragile. On the other hand, there is only one outcome (property) which is acceptable, namely, broken. So, fragility should not be confused with what is above called a "broad disposition". The broad disposition at hand is "breakable", and "fragile" is simply a conjoining of "breakable" with a set of arbitrary, limiting conditions (narrowly specified reciprocal partners for the mutual manifestation) which includes only a fraction of the conditions that render things, in general, broken.

This points to an asymmetry between the number of conditions that will manifest the same property array and the number of property arrays that might be subjunctively claimed of a thing under any one set of conditions. A glass that is broken when dropped a distance of one meter from a surface would likely have broken if it had been dropped from two meters, from three meters, and so on, as well as from any of the distances between them.

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[34] It might not have been on the table, the floor might have been covered with a spongy material, etc..

What, then, to get back to the question in hand, would count as a good and philosophically useful articulation of a disposition? The answer is that there are no such precise articulations. To borrow Martin's turn of phrase, any attempted articulation offered will turn out to be just a "clumsy linguistic gesture".[35] This is not to say, however, that examples such as "fragility" and "solubility" have no use, nor to say that they have led us utterly astray. With all their imprecision, which probably lends them their viability in everyday language affairs, they have yet pointed us in the right direction. The cautionary mood applies largely to the notion that one could somehow build *natural* classes based solely upon such arbitrary segmentation of "broad dispositions" which hold of most things anyway.

2.5 On Referring to Dispositions

A thing or a sample (since we are here defending a notion of chemical kinds) never manifests a single property all by itself. A piece of gold never manifests just the colour yellow. It also has a certain weight, belongs somewhere on a malleability index, has a certain texture, etc. in addition to its "Cambridge properties".[36] But let us imagine that we could isolate a "single dimension" of the

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35 C.B. Martin, "Dispositions and Conditionals", *Philosophical Quarterly*, forthcoming.

36 By such 'properties' I mean such things as spatiotemporal coordinates and relative trajectory (for instance) which might hold of a thing but which seem to be less informative about the thing than the space (for instance) which the thing happens to occupy.

"property array" of a thing/sample and talk about *it*. Suppose, further, that we could talk about each of the dispositions of a thing or sample in that sort of way.

Let us return to the example of fragility, in this case, the breakability of, say, a drinking glass. As mentioned above, there are indefinitely many conditions in which a glass would be broken, and there are, likewise, indefinitely many conditions in which the glass would remain unbroken. What we end up with is an indefinitely long list of ordered pairs, the first part of each pair being a set of conditions and the second part being either "broken" or "unbroken". The list looks something like: {(C_1: falling from one meter onto ceramic tile floor at sea level, etc; B_1: broken), (C_2: resting on shelf; B_2: unbroken), and so on}.[37]

Typically, we have focussed on the threshold where the conditions which result in unbrokenness are very similar to the conditions which result in brokenness. When this threshold is relatively close to one end of the "force-quotient" spectrum (or even presumed to be), at the lower end say, we call the thing "fragile". But *each* of these ordered pairs, whether they are near the threshold of interest or not, are equally descriptions of one small segment of the "breaking disposition" of the glass at hand. Altogether, the exhaustive set of such ordered conditions/property pairs, form the full breaking disposition of the glass.

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37 Where C would more or less exhaustively describe prevailing conditions and B would refer to the 'breaking status' of the glass.

And just as the relativists' charge that we, in fact, selectively attend to certain aspects of the world should not affect the reality of *those* aspects,[38] our attending to the threshold of interest ought not to affect its objectivity. That threshold is still one of the many partial descriptions of the glass, most of those descriptions are simply not attended to. How could they be?

There is an epistemic tunnel that gives rise to what Mellor calls the "problem of inscrutability"—which inheres in our inability to simultaneously attend to an indefinite number of possible conditions, since many of the conditions of possible interest, if not all, are mutually exclusive.

But this inability should not affect our intentions to refer to such a list of ordered pairs. Either this piece of gold (or, for that matter, any indexically isolated handful of the universe) would continue to manifest all the properties it now manifests throughout all possible conditions or it would not. If it would, then those properties will form the latter half of all the ordered pairs (conditions, properties) which hold of that piece of gold.[39] If not, the ordered pairs would reflect any changes in the property profiles across the appropiate conditions. This leads directly to our next topic.

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38 cf. "The romantic anti-realist notes that there can be alternative ways of classifying nature and falsely concludes to the non-determinacy and classification-dependence of the world." C.B. Martin, "The Need for Ontology: Some Choices", p.13.

39 Though we have summarily dismissed the possibility that something could manifest all that it was capable of manifesting at once (above p.27).

2.5 DISPOSITIONAL PROFILES

The dispositional profile of an object, or, in this case, a sample, will simply be a list of ordered pairs, like those above, consisting of conditions and properties cast in the subjunctive mood. The primary difference will consist in the breadth of the descriptions, which themselves fully describe both the conditions and the properties. Any and all properties found in the latter half of the ordered pairs may be construed as a function of both the dispositionality of the stuff at hand and the specified conditions.

For instance, if we take a sample water, w, at some time, t, a description of its dispositional profile might look like the following set of ordered pairs for $D(w,t)$: [(C_1:below 0° C, at sea level, on Earth, below a certain salinity, below a certain motion threshold, etc.; P_1: commence cooling, continue cooling, remain frozen {according to C_i and P_i}, etc.), (C_2: above 100° C, at sea level, on Earth ....; P_2: approach boiling, continue boiling, remain steam {according to C_i and P_i}...), and so on]; where $D(w,t)$ means the "dispositional profile of w at t, C_1, $C_2 \ldots C_n$ are sets of external conditions which prevail around w, P_1, $P_2 \ldots P_n$ are sets of properties which describe w under the corresponding conditions C_1, $C_2 \ldots C_n$, and C_i and P_i indicate the initial conditions and properties, respectively, at t. There are otherwise no temporal implications made by C_1, C_2, P_1, etc.. At any time t', where $t' > t$, the sample w may be subjected to any of the conditions; C_i (the conditions stay the same) or (in the exclusive sense of the disjunctive, hereafter or[e]) any one of C_1 through C_n and assume P_i

or^{e} any one and only one of P_1 through P_n in accordance with the condition C_i, or^{e} $C_1 \ldots C_n$. In other words, from (C_i, P_i) sample *w* may and will assume ($C_{t'}$, $P_{t'}$), where $C_{t'}$= only one of $C_{i \ldots n}$; and $P_{t'}$= only one of $P_{i \ldots n}$.

It may be the case, though, that a mere continuance of C_i yet results in a change in *w* from P(*t*) to P(t'). Substitute, for instance, C_2 with C_i, where the water, due to previous conditions, is not yet boiling. The external conditions could remain the same, e.g., a pot of water could continue to remain on the same element on the same setting, etc., yet the water's physical description, P, could change from lukewarm to boiling/steam. Therefore, we need to consider two possibilities when attending to a thing as something separate and yet co-dependent with its surrounding conditions for the properties P which are true of it; either those properties P are the final, stabilized properties a thing could manifest under those conditions (a sort of property resting point, where the relationship between the thing and its surrounding conditions are such that no more property change would occur under those same conditions), or they are not. This localized sort of entropy I will hereafter refer to simply as "entropy", and the states in which the properties of the thing have not yet so stabilized I will refer to with the non-word "disentropy" or its adjectival counterpart "disentropic".

If the set of properties which correspond to C_i are only artificially frozen by our "time slicing"—that is, the sample *w* at *t* is currently undergoing a change of properties under the conditions C_i,

even when the surrounding conditions are unchanging at time t, and the properties of w are changing only in virtue of the reciprocal dispositional relations inhering between w and C_i towards $P_{entropy}$— then there must be a way of indicating the possibility of some slack between C_i and P_i, should C_i be sustained and $P_{entropy}$ not be attained.

One way of indicating this possibility is the following: let us take $(w,t)(C_i; P_i)$ to be either in stasis or^e not. If it is in stasis, then the ordered pair $(C_i; P_i)$ will be just a part of the dispositional profile that can be treated as a possible subsequent state of (w,t); $(w,t)(C_i; P_i) \gg (w,t')[(C_i; P_i), v^e (C_1; P_1), v^e (C_2; P_2).....]$, where "»" has both a temporal sense and a subjuntive sense, indicating "changes to" in the former sense and "would change to, were..." in the latter sense,[40] and "v^e"

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[40] In which case "t'" would have to be substitutible for some subjunctive/modal analogue, such as, "in possible world T'".

It might be noted that the expression ">>" has had no formal introduction. Though it is here meant merely to stand as a shorthand expression for the above phrases, it seems that it might have some unbidded intimacies with various logics (especially, relevance logics), which I have, as yet, only just barely entertained. Be that as it may, my sense of the expression ">>" is that it behaves like a "double conditional", where the primary antecedent refers not to some *conditions* obtaining around a thing but the ontically primitive dispositional base of the thing itself—*in its fullness*. The consequence consists of indefinitely many subjunctive conditionals in tandem and indefinitely many material conditionals serially.

The truth of each of the consequences built around the latter half of the expression ">>" is inviolate—it is a metaphysical given. The consequential conditionals are *a priori* true due to the mood in which one refers to the dispositional profile of a thing—it is a reference to **all** that is true (manifestly instantiated and otherwise) of the thing and all that is true of a thing is so in virtue of the nature or dispositionality of the thing at hand. This, of course, has an air of circularity.

The phrase 'all that is true of a thing' is just an operational interpretation of the dispositional profile of the thing. Of course, each conditional that is subjunctivally (or otherwise) true of a thing is true of it. This way of speaking gives us a way of cashing out what we could rationally mean by "natural

simply means "or^{e}". If it is not in stasis, then the possibility of changes in P(of w) from t to t′, even without a change in C, need to be enumerable, i.e., D(w,t) must include the possibility of such a change in P even if there is no corresponding change in C. As we have seen above, each of the $P_1 ... P_n$ contain the proviso {according to P_i}. This proviso, however, is not necessary in cases where the subsequent conditions C′ are specifiably different from C_i, for the alternate (or not) display P′ can be construed simply as a *function* of (C_i, P_i), the alternate conditions C′, as well as the dispositionality of the thing at hand. The subsequent conditions C′ can be conceived broadly enough to include (C_i, P_i) considerations, but P′ cannot be conceived broadly enough to include property changes under disentropy conditions. We cannot ask of P′ that it contain contradictory properties (e.g., not boiling and boiling) for the same thing under identical conditions.

We could indicate this possibility of a change from P_i without a change in C_i by altering the ordered pair (C_i; P_i) to (C_i; $P_{\Delta i}$), where $P_{\Delta i}$ may or may not be the same as P_i and where any difference is a function of the disentropy obtaining at (C_i; P_i). We may now express the dispositional profile, D, of (w,t) in the following ways:

[A] $D(w,t) = [(C_i; P_{\Delta i}), (C_1; P_1), (C_2; P_2)...]$

[B] $(w,t)(C_i; P_i) \gg (w,t')[(C_i; P_{\Delta i}) \vee^{e} (C_1; P_1) \vee^{e} (C_2; P_2)...]$

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kinds" (and also indicates wherein lies the guarantor of the so-called counterfactual truths). For a more comprehensive discussion of the relations between conditionals and dispositions see C.B. Martin's "Dispositions and Conditionals"

[A] and [B] differ in that [A] merely enumerates all the possible surrounding conditions for w and subsequent properties of at t', whereas [B] indicates that one and only one of these states will be assumed by w at t'.

Alternatively, we could conceive of any conditions C' subsequent to C_i broadly enough so that for any pair of condition/property sets $(C_i; P_i)$ in which entropy had not yet obtained, C' would be construed as a different set of conditions from C_i (C' would be temporally distinct from C_i; and since actual change is inextricable from temporality, this seems to follow) and P' would ensue. On this alternative construal we get the simpler expressions:

$[A_2]$. $D(w,t) = [(C_i; P_i), (C_1; P_1), (C_2; P_2)....]$

$[B_2]$. $(w,t)(C_i; P_i) \gg (w,t')[(C_i; P_i) \vee^e (C_1; P_1) \vee^e (C_2; P_2)....]$

Either construal seems equally transparent, but $[A_2; B_2]$ has the additional virtue of isolating entropic[41] states of affairs, which will be of critical importance when delineating between natural kinds and other kinds.

As can be readily seen, this set of ordered pairs is limited only by the number of conditions that could be brought to bear upon the sample; and this is to say that the set is indefinitely long and limited in practice only by practical concerns.

There are strong parallels, it might be noted, between this account of the dispositions of a thing and Frege's account of functions which, like a mathematical operator (eg. "+ 3"), relates *at least* one

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41 "Entropic" is to be here construed as the adjectival form of "entropy".

thing to *at most* one other thing (eg. "2" "+3"="5"). For instance, C_1 and $(C_i; P_i)$ might be construed as the argument of P_1. Similarly, and conversely, P_1 could be construed as the value of the function of C_1 and $(C_i; P_i)$. Moreover, where a function can have the same value for several arguments, it must generate exactly *one* value for one argument. Like Frege's functions, each of the dispositions in the dispositional profile of $(w,t)(C_i; P_i)$ has exactly one value [e.g., P_1, or perhaps exactly one pair of values $(P_1; D_1)$—see below] for each condition (in this case C_1). There might, on the other hand, be several different conditions which bring about the same set of properties ($P_1 = P_2$ and $C_1 \neq C_2$).

2.6 The Mutability Problem

In answer to question (1) posed at the beginning of this chapter ("What does it mean for something to have a disposition S?"), Carnap responds by giving an operational account of what it is for something to have disposition. This results, as we have seen, in a formula that is vulnerable to what has been deemed the "mutability" problem. And although Mellor thinks that Carnap's formula suffers because it does not account for mutability, he also rejects Storer's tensing of the formula in a way which would avoid Mellor's concerns. Storer's formula

(III) $(t)[W(a,t) \supset (S(a,t) \leftrightarrow D(a,t))]$

clearly has the advantage of not being vulnerable to the mutability problem, but Mellor contends that it is trivial because it is a "no

news" formula.[42] This formulation does not, as Mellor also contends, offer much in defense against the objections to dispositions. However, both it and Carnap's versions do articulate something about what it is that we *mean* when invoke the term "soluble". It simply means that there is a specifiable set of conditions (C_S; put *a* in water* at time *t* [*or some other soluble]) sufficient to bring about a set of specifiable physical properties (P_S; *a* is dissolved). Perhaps this subjunctive conditional is trivial,[43] but that does not affect what we mean here. This, of course, would be just one dispositional pair (conditions/ properties) of many that are true of *a* at *t*. Furthermore, should (C_S; P_S) obtain, then, like Turing's machine, perhaps not only will the manifest properties change, but so might the dispositional profile, so that, $(a,t_1)(C_i; P_i; D_i) \gg (a,t_2)(C_S; P_S; D_S)$—where "$D_i$" means "the dispositional profile at time t_1, and "D_S" means "the dispositional profile at the subsequent state 'dissolved', i.e., P_S". This possibility of a changed dispositional profile at t_2 can occur with the adoption of any subsequent state, perhaps even when there are no manifest changes from $P(t_1)$ to $P(t_2)$. This disposition to change dispositional profiles is not captured by Carnap's formulation. His account suffers because it cannot simultaneously accommodate both the possibility of a sustained disposition and the possibility of its mutability in the very same thing, and neither, it turns out, can [A] and [B]. We must, therefore, make the following revisions to [A] and [B]:

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42 Mellor, (1974), 161.

43 Though I and Fetzer, J. "On Mellor on Dispositions," *Philosophia* 7, (1978), 651-660. take this formulation as not trivial.

$[A_3]$ $D(w,t_i) = [(C_i; P_{\Delta i}; D_{\Delta i}), (C_1; P_1; D_1), (C_2; P_2; D_2)...]$

$[B_3]$ $(w,t_i)(C_i; P_i) \gg (w,t_2)[(C_i; P_{\Delta i}; D_{\Delta i})\ v^e\ (C_1; P_1; D_1)\ v^e\ (C_2; P_2; D_2)...]$

Like Storer's account, this formulation tells us nothing "new" about (w,t). It does, however, articulate our concepts of dispositions in a way which stipulates how empirical (i.e., "new") information might be coherently sorted.

2.7 DISPOSITIONS, IDENTITY, AND NATURAL KINDS

As mentioned above in chapter I, at the bottom of all the problems which beset natural kind talk sits the "relevant similarity" problem.[44] Determining in what ways members of a kind are in the appropriate $same_K$ relation *equals* determining in what ways members of a kind are identical. This "relevant similarity" problem has both a stipulative and an epistemic problem of identity. The first is concerned with the way different samples of a kind *could* be identical and poses the question "What is the appropriate $same_K$ relation which holds between two or more members of the same kind?" The epistemic problem of identity is similar to the problem of re-identification which occurs across different displays of the same individual and poses the question "How do tell that two or more things stand in the appropriate $same_K$ relation to each other?" Let us begin to tackle these.

As can be seen, these questions parallel those posed at the beginning of this chapter. There is a complication involving the

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[44] This has been expressed in the Putnamean "$same_K$ relation" above.

epistemic question #2 from above (How do we know when something has disposition S?), which impels us to first face its obverse; once a new set of manifest properties are true of a thing [e.g., a sample of water w freezes: $(w,t_1)(C_i; P_i) \gg (w,t_2)\ (C_f; P_f; D_f)$],[45] how do we determine whether or not *this* thing, picked out by, more or less, an entirely new set of properties, is in fact the *same thing*, i.e., *is* (w,t_2)? Perhaps this problem of identity may not appear particularly pressing[46] in the case of alternate displays of a sample of water (say, w), but this changes when we entertain the possibility that the sample w in question is *transmuted* from t_1 to t_2.

Let us take, for example, a sample of gold, g, at t_1 which undergoes a process by which it becomes a sample of lead. Let us, further, call this process, this extended set of conditions, C_L, the subsequent state of properties P_L, and the subsequent new dispositional profile D_L. So, $(g,t_2)(C_L; P_L; D_L)$ would be just one of the ordered triples which hold of $D(g,t_1)$. We seem *prima facie* to be committed to the notion that $(g,t_2)(C_L; P_L; D_L)$ is still a sample of gold, i.e. (g,t_2)!

This is the sort of mistake de Sousa accuses Kripke of making when he derives natural kinds by rigid designation.[47] Rigid designation takes the proper name of an individual to refer to that same individual in all possible worlds, come what may. "Barrett"

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45 Where C_f = a set of conditions such that P_f obtains, P_f = all the properties which hold of w frozen under C_f, and D_f = the new dispositional profile of w governed by C_f and P_f.

46 Perhaps, for instance, spatiotemporal continuity will suffice here.

47 de Sousa, (1984), 569-570.

refers to me in this world and it picks out an individual in the actual world with all the properties that hold of me. There are possible worlds, though, in which I am, for instance, shaven or bald. In those possible worlds the name "Barrett" still refers to the same person that the name refers to in the actual world. This is because rigid designation does not rely upon accidental descriptors in its picking out the designated individuals. It relies, perhaps, on spatiotemporal continuities between the person baptized "Barrett" and any subsequent person occupying the appropriate historical relations to the person so baptized. However, there are many events that could have happened in the actual world such that I became bald or decided to shave, and so there are many possible worlds in which Barrett is bald or shaven.

Let us take "G" to be the proper name of the aforementioned piece of gold, g, at t_1 and "L" to be the subsequent piece of (lead?) at $(g,t_2)(C_L; P_L; D_L)$ from above. What needs enumerating are the different relationships which hold between G and L. Under rigid designation, "G" and "L" may or may not refer to the same thing depending on what level of description the stuff indexed by "G" was intended to designate. On one interpetation "G" could refer to the mass of *gold atoms* indicated at the baptism, on another, it could refer to the mass of *subatomic particles* indicated at the same baptism. On the first interpretation, "G" no longer refers to an existing thing at t_2 just as "Barrett" would no longer refer to anexisting thing, had I been rendered dust and ashes. An integral

part of the designatum of "Barrett", on most interpretations, is being a live human being.

On the second interpretation, though, "G" might just name the collection of subatomic particles (say, the protons, electrons, and neutrons), in which case L, being that same collection, would be the same thing as G. In other words L is the same stuff, at one level of description anyways, that G was. If some of these atoms were disassembled into their more fundamental elements such as protons, electrons, and neutrons, and then used to build up the remaining atoms into element number 82s[48], then clearly L is made up of the same stuff that G was. The subatomic relation between G and L is one of identity; that is, the subatomic particles of G are identical with the subatomic particles of L—they are the same ones. No such relation holds between the atomic *structures* of G and L.

Deriving natural kinds by rigid designation is characterized by the following tension: the term "gold" is presumed to rigidly designate all the stuff that is element 79, and yet the proper name "G" rigidly designates something that was once gold and is now lead. Since rigid designation typically tracks individuals through property changes, it seems more appropriate that "G" be construed as surviving a kind change which "gold" presumably could not. This raises the question "In what sense are we claiming that "gold" rigidly designates?" for clearly it must be a different sense than the one in

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[48] Let's assume that there are no remaining particles.

which proper names rigidly designate. This is a puzzle we must solve.[49]

Let us consider an similar story, one about our homely water which, Putnam argues, can take up various macroscopic properties, and yet remain in the extension of our "water"—so long as it is still H_2O, despite being clearly discernible from other, ordinary samples of water. Let us, for the sake of this exercise, take two samples of water (H_2O),w_1 and w_2, at t_1 which have the same property profiles, i.e., have the same properties of tasteless, transparent, liquid, etc. By hypothesis, then, w_1 and w_2 are indistinguishable[50] (unlike XYZ and H_2O) from one another *except* for their respective space-time coordinates. Suppose we then take one of these samples, say w_1, and change the set of conditions around it (let's call these new conditions C_f) at t_2 so that w_1 manifests a completely different set of properties, and at the same time, keep w_2 in its initial conditions C_i (those initially shared by w_1), so that its properties remain unchanged from t_1 to t_2. What kind of relations might be said to hold between (w_1,t_1), (w_1,t_2), (w_2,t_1) and (w_2,t_2)?

It is clear that the relations that hold between these four pairs can no longer be one of Leibnizian identity of indiscernibles. But it is perfectly reasonable for us to understand——and this is the central claim of this thesis——there is an identity relation between the *dispositional profiles* ofw_1 at t_1 and w_2 at t_1, *and this relation has not*

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49 This is pursued below, p107ff.

50 Let us assume, for the sake of the thought experiment, that they have even the same isotopes for their component parts.

changed at t_2! This is why (w_1,t_1) and (w_2,t_1) are said to be of the same kind, and *that* is the appropriate same$_K$ relation which holds between them. The identity between members of a kind consists not merely in any minimum or even maximum disjunction of their accidentally manifesting properties[51], but in an *identity* of dispositional profiles.

This identity of dispositional profiles has certain parallels with another of Leibniz' notions of identity—the "principle of substitutablility" which has received poor press because it does not survive opaque contexts.[52] However, proving its semantic inapplicability in opaque contexts should not affect the intuitions surrounding its metaphysical applicability. Where it is difficult to imagine two things being the very same thing, it is not difficult to imagine that two things might be substitutable in the following way:

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[51] Accidental because the conditions which prevail at C_i are not necessary and because H_2O is never in a state of pure categoricality (that is, manifesting all the properties which could be true of it, eg. solid, liquid, gas, etc., simultaneously).

[52] Stated simply, the principle of substitutablility says that something is identical with some other thing just in case you could substitute one for the other in any sentence without changing the truth value of that sentence. "Cicero" apparently refers to the same person that "Tully" does. If the principle of substitutability were sound then in any sentence in which the word "Cicero: appeared "Tully" could be substituted without the sentence changing its truth value. Aside from sentences like ""Cicero" has six letters" there are those which are referred to as being opaque contexts, because substitution does not preserve the truth value of the sentence. "Mary believes that Cicero is Cicero" is an example of an opaque context. While this sentence is almost certainly true the sentence "Mary believes that Cicero is Tully" may well not be. What is maintained here is simply that whatever Mary believes of Cicero, and likewise of Tully, is *not a property* of Cicero. They are properties of "the world" and they are properties of Mary's belief system—they are not properties of an individual who has long since expired.

for all conditions $C_1...C_n$, the resulting manifest properties of x and y are indistinguishable.

At time t_2 it becomes apparent that part of the dispositional profile of w_1 consists of P_f, and those properties become manifest under conditions C_f (one of many conditions). What is not apparent, or at least not actual, is that if w_2 *had been* under conditions C_f, then it too would have manifested P_f. Further, at t_2, while w_2 is yet manifesting the properties P_i and w_1 is manifesting the properties P_f, it is still true that for all conditions, once entropy has obtained, w_1 and w_2 would manifest the same set of properties; that is, they will maintain the same dispositional profiles. This, I claim, is just what we mean when we claim natural kindhood between two things or two samples.[53] Our epistemic conditions notwithstanding, what we mean when we claim that two things are of the same natural kind is, roughly, that whatever is dispositionally true of w_1 is also dispositionally true of w_2. This may turn out to be an inaccurate claim about w_1 and w_2. We might be humbled by some hitherto unencountered set of conditions which demonstrates a dispositional disparity between the two; but that possible (and often actual)

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53 At least the kind of natural kind championed here namely, those of the physico-chemical sort. There are certainly other kinds of kinds and there may be other kinds of *natural* kinds such as biological kinds. These other kinds of natural kinds would almost certainly require other sorts of important $same_K$ relation criteria. Things of a biological kind perhaps would have to stand in a certain ancestral relation to some common ancestor to be construed as a member of that kind. The joy of physico-chemical kinds is that they are relatively easy to work with and, most importantly, they command a high degree of ontological commitment, at least at this level of discussion here, on the part of those who work in the field.

embarrassment should not affect what we mean when we presume that two things are of the same natural kind. It is *precisely* this possibility of embarrassment which confirms what we mean.

This conception of natural kinds is continuous with that offered by Mill and Russell above. Mill emphasizes the expected continuation of discoveries of commonly manifested properties across members of a kind, and this proposal emphasizes the maintenance of common dispositions between members of a kind even when they are not sharing common manifest properties (which, I submit, comes down to the same thing).

The current responses to question #2, "How do we know that something has a disposition S?", the epistemic problem, most often do not come from philosophy. In the cases examined here the questions are answered by the theoretical physico-chemical sciences. And the same is true of the related questions: "How do we know when two things have the same disposition S?" and "How do we know that all the dispositions which hold of one thing also hold of another?" What is appealed to here, in the actual world, are the micro-structures in question. These, arguably, are akin to the Piercian characters of permanent interest that are common and peculiar to its members.[54] The relationship between natural kinds, as construed here, and micro-structures is one which is pursued below, under the discussion of Mellor's objections.

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[54] See p.4, above.

Churchland challenges the stability of our natural kinds because their extensions are reliant upon science in the way stated above. The picture painted here is one which has two concerns which surround sameness of kind—the stipulative and the epistemic. On the one hand, the pre-theoretical hand, we are concerned with the intuitions governing what it would mean for two things to be of the same kind, namely, that the two things are intersubstitutible under all conditions without a change in properties. This is the stipulative aspect which any and all theory is subordinate to.[55]

The perception and conception of sameness necessarily predates theory. It is a basic ingredient of recognition, learning, and, hence, intelligence itself. Pavlov's dog did not salivate randomly, but rather, at the recognition of the same sound or the same light. What must lead scientific theory, or for that matter any discourse which takes for its content explanation or prediction, are the samenesses, differences, and changes in the world, for these are *of necessity* the subject of explanation and prediction.[56] What else could be? H_2O is a theoretical construct which explains and predicts (or does not, as the case may be) the behavior of water, and which explains why it is different from hydrogen peroxide, air, and why it changes to ice

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55 I shall argue this contentious point more fully below.

56 Most other epistemic virtues appealed to in science, e.g., simplicity, internal and external coherence, etc., are subordinate to predictive and explanatory power, for example, no matter how simple or coherent a theory might be, if it has absolutely no predictive power then it lacks all epistemic virtue.

under certain conditions, and so on. For a theory to exist, there must first be something for the theory to be about.

The other concern is regarding our epistemic problems of sameness. It is here, of course, that the theory machines are hard at work. And it is the resulting theories which postulate what sorts of things satisfy our *stipulations* of sameness, and how to tell which things belong to which sets. Again, they are often mistaken—and the reason we *can* know this is we have occasion to measure the offerings of the theory machines with our pre-theoretical notions of sameness.

This conception of natural kinds does not, therefore, rely on the infallibility of current science, nor should displaced theories be construed as counterexamples to this conception. If anything, these displaced theories can be cited as evidence for both this conception and for the subsequent search for these "joints of nature".

The discovery of the likes of heavy water is just one example of how dispositional profile expectations keep theories accountable.[57] It was discoveries of macroscopic discrepancies (what other kind could?) which eventually lead to the hypothesis of isotopes.

But to return to our original worry, if we want to say that (w_1,t_1), (w_2,t_1), (w_1,t_2), (w_2,t_2) all remain the same kind of stuff, namely "water", and that they all remain in the set of "samples which are water" in virtue of sharing a dispositional identity with the other

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[57] Insofar as they are accountable, and I think they still are, ultimately, regardless of the relativistic findings which suggest otherwise. This, unfortunately, is another topic for another time.

members of the set, then we must account for the "gold » lead" case above. We do not typically, nor do we here want to, take the position that there are no dispositional differences between gold and lead. Yet if the parallel experiment is run between two samples of gold, g_1 and g_2, then, by analogy, (g_1,t_1), (g_2,t_1), (g_1,t_2), (g_2,t_2) are all the same stuff—gold. But (g_1,t_2) is lead!

What this thought experiment demonstrates is the need for an account of natural kinds that allows for the possibility of a thing changing its dispositional profile, and hence, its kind. Hence the need for ordered triples which permit the expression of a thing's mutability with respect to its dispositional profile. If we take D_L to stand for the dispositional profile of lead, and D_G for the dispositional profile of gold, we have the following characterizations for g_1 and g_2:

$$(g_1,t_1)(C_i,P_i) \text{ » } (g_1,t_2)[(C_i,P_i,D_i) \text{ v}^e (C_1,P_1,D_1) \text{ v}^e (\mathbf{C_L,P_L,D_L})...]$$

$$(g_2,t_1)(C_i,P_i) \text{ » } (g_2,t_2)[(\mathbf{C_i,P_i,D_i}) \text{ v}^e (C_1,P_1,D_1) \text{ v}^e (C_L,P_L,D_L)...]$$[58]

So, while both (g_1,t_1) and (g_2,t_1) initially have identical dispositional profiles, which include the same mutation possibilities, circumstances conspire.

This allows us say, then, that it is possible for G (from above) both to be the *same* thing as L and to be a different *kind* of thing than L from t_1 to t_2. The possibility of some one thing changing kinds should not be seen as problematic for the possibility of kinds in general. What is maintained here is simply that nature is grooved, that, under sufficiently many circumstances G would simply slide

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58 Where the **bold** type indicates the state assumed at t_2.

along the same, narrow dispositional path as would the rest of the stuff that we call "gold".

Perhaps there is a distinction to be drawn between sets of conditions which alter the micro*structure*—which seem to be so causally important to dispositional profiles—of the sample at hand, and those that do not. But this would align a theory of natural kinds too closely with current science—maybe the current sciences are wrong, in which case it would be prudent not to be so deeply committed to them. And as van Brakel points out, "In order to understand what 'natural kinds of matter' are, there is no need for a 'structural' theory of matter. The theory may change, but the melting point of gold will always remain higher than that of lead."[59]

Nonetheless, this articulation of natural kinds provides good reason for claiming the importance of microstructure. It is extremely successful at grouping bits of the universe into sets in which the members do indeed have the same dispositional profile.

2.8 An Embarrassment of Natural Kinds?

The above picture of natural kinds is yet defective in the same sort of way that Russell's version is. It is far too permissive, i.e., far too many things would qualify as a natural kind. Thus far, for any handful of the universe, that handful will have a dispositional profile. If all that is required of a natural kind is that all and only its

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59 Van Brakel, J., "The Chemistry of Substances and the Philosophy of Mass Terms," *Synthese* **69**, (1980), 305.

members have the same dispositional profile, then *that* handful of the universe will form a natural kind.

It does not help much to implement a requirement similar to the "requirement of multiplicity", namely, that a kind must have more than one member to qualify as a natural kind. For any handful of the universe, it is physically possible that there are other handfuls which share the same dispositional profile. We must hone our criteria for acceptance.

A further requirement might be that a proffered kind must be *homogeneous*. That is, in order to be considered a good candidate for being a natural kind the handful must be constituted by the same kind of stuff throughout. If a handful consisted of equal parts of gold and lead, then, although it is true that every other similar handful would have the same dispositional profile as that one (by definition), each part of the handful would not; the gold parts would have a different dispositional profile than the lead parts. But this does not resolve any of the difficulties here.

What reason could one give for choosing the molecular or the atomic description as the legitimate one? If by "parts" one could equally as well mean the subatomic particles, then it seems the above criticism made of the gold and lead mixture could be made of what we take to be the natural kinds at hand, the gold and the lead. Presumably, their subatomic components will also display similarities and dissimilarities of dispositional profiles to and from each other; protons will act just like other protons, electrons will act

just like other electrons and different from protons, and so on. Just like the handful of gold and lead, the subatomic parts of gold and lead also have different dispositional profiles.

If we accept that protons and electrons are natural kinds, does it follow that the atoms, of which they are constitutive and dissimilar within, are not natural kinds in their own right, even though similar atoms share dispositional profiles with each other and with nothing else? Rejecting handfuls, while accepting the likes of atoms and molecules, demands another story.

Fortunately, there is one. It is told at the molecular and atomic levels of description, where, presumably, a *stability of dispositional profiles** begins to emerge out of an otherwise variegated universe. This is meant to be an empirical report. If a handful of the universe consists of some parts gold and some parts lead, then the parts that are gold will have a different dispositional profile than the parts that are lead. Similarly, the separate parts of molecules and atoms have different dispositional profiles, or at least, some are different from others. The units of concern, the handful, the lead parts, the gold parts, the lead atoms, the gold atoms, the parts of the gold and lead atoms, differ widely in terms of the dispositional stability of the unit under scrutiny.

The relative instability of the handful's dispositions *qua* unit for consideration as a natural kind is revealed by peering more

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*I am indebted to C.B. Martin for stressing the importance stability has for an ontology which recognizes natural kinds, even though I suspect that we understand something quite different by stability.

steadfastly at its dispositional profile. Recall the intuition that a set of samples displaying disparate manifest properties might still form a natural kind. This intuition amounts to the following claim: each of the samples would exhibit the same manifest properties as each of the other samples were it the case that the same conditions obtained. This is equivalent to claiming of a single member of such a natural kind that it might well manifest different properties under different conditions, but that it *would* manifest the same properties that each other member of the kind would exhibit under the same conditions—and this, *regardless of what properties it now happens to be manifesting*. This, it will be argued, is generally not true of the arbitrary handful.

Many, and, I dare say, most, of the condition/property array pairs[60] of the handful have the following characteristic: once the handful (H) assumes (C′, P′) (that are not C_i, P_i), were it to re-assume C_i, it would not re-assume P_i. This is not to say that H would not or could not, under some conditions, re-assume P_i once C_i has been reinstated. But under conditions C′ such that P′ are in some way qualitatively different from P_i, then the following difference may be observed between things which are members of a natural kind and things which are not: Things which are members of a natural kind would spontaneously re-assume the properties P_i from any other condition C′ were C′ » C_i (once entropy obtains), whereas things

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[60] For sake of simplicity let us temporarily ignore that these are actually triples.

which are not natural kinds cannot. This tendency to assume P_i , or for that matter, any set of properties C´, just in virtue of the reciprocating partnerships C_i and C´ is just what is meant by sharing dispositional profiles.

This point may be made clearer with the following example. A compact disc (cd) seems as though it could be a member of a natural kind on this account of natural kinds, for it seems that the set of compact discs is such that each member has the same dispositional profile as every other member.[61] But take an imaginary subset of the set of cd's, each member of which underwent a string of conditions such that they manifest very different properties from those possessed by "cd's around here". Perhaps they more closely resemble Descartes' melted ball of wax than they do the flat silver discs around here. The following question is raised "Were they to be placed in the same conditions as the 'cd's around here', would their manifest properties *change* so that their manifest properties would become the same as those displayed by the 'cd's around here', just in virtue of being in the same conditions as the 'cd's around here'"? Now it might be the case that, for some reason or other, all cd's just happen to be in the same or similar enough conditions so that they all happen to be manifesting the same set of properties. Natural kinds, as spelled out above, do not depend upon such happy circumstances.

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[61] I owe and thank Dr. M. Osler for this example. Presumably, if cd's qualify as a natural kind under this construal then this construal is in serious disrepair.

Take, for example, a sample of pure gold, *g*, and list all the manifest properties which hold of it under some set of conditions, C_i, not unlike those conditions which obtain at the earth's surface. Let us say, for sake of brevity, that the properties, $(g)P_i$, are yellow, metallic sheen, opaque, and solid. Suppose there are some other sets of conditions, C′ and C″, in which any one of those manifest properties may not hold of *g*. Let us suppose that C′ is sufficiently hot, say, so that *g* would have the following *qualitative* manifest properties, (*g*)P′: red, liquid, and translucent.[62] Suppose further that C″ consists largely of hydrochloric acid so that (*g*)P″ consists of yellow, solute, and translucent. What is dispositionally true of *g* under C_i is dispositionally true of *g* under C′ and is dispositionally true of *g* under C″. This is no different than saying of two things that they share a dispositional profile; they belong to the same kind, even while they manifest different properties.

Observe that the same does not hold of non-natural kinds like cd's. Take any number of qualitative manifest properties that hold of a cd, and then imagine some conditions in which at least one of those properties is changed, and what you will find, I submit, is that a return to the initial conditions will not be sufficient to reinstate the

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[62] (*g*)P′ can be read as "the properties of *g* under the conditions C′". By qualitative, I mean here to draw a distinction between qualitative and quantitative changes. For instance, since everything has a temperature, and since the subtlest change in temperature technically involves a change in (*g*)P it would be easy to get distracted by the infinite number of subtle changes a cd could undergo without changing its dispositional profile and gloss over some important differences that separate natural kinds from non-natural kinds.

changed property. Let us take $(cd)P_i$ to be circular, flat, shiny silver on one side, some various colours on the other, and so on. A change in any one of these properties will result in the following observation: a return to C_i will not result in a resumption of P_i.

For *any* conditions/properties pair (C′; P′) belonging to the dispositional profile of *cd*, where P′ is qualitatively different from P_i in some respect, the dispositional profile of *cd* at (C′; P′) is different from the dispositional profile of *cd* at (C_i; P_i). This observation is sufficient to establish that *cd* cannot be a member of a natural kind (on this conception of kinds), since each qualitatively different manifest display, P′, of the selfsame thing yields a different dispositional profile.

It may be pointed out that the gold sample, *g*, itself has transmuting conditions in which the guilty conditions/properties pairs result in a new dispositional profile for *g*.[63] While this seems relatively indisputable, there remains a significant difference between the conditions of transmutation for *g* and those for *cd*. The transmutation conditions for *g* are only a *proper subset* of the conditions in which *g* manifests different properties, whereas the transmutation conditions for *cd* are a *subset* of the conditions in which *cd* manifests different properties.

But the distinction is beginning to look a little clumsy, perhaps even a little *ad hoc*. Furthermore, the original reason for maintaining the distinction appears a little hasty. The shape of *cd* might, in fact,

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[63] See above, p. 48 ff.

re-assert itself if, for example, it is only slightly flexed but not broken. The same might be said of other properties. What is required is some other, unfettered, desiderata of natural kinds which both delineates the relationships that natural kinds enjoy with their counterfactual instantiations, *instantiations that inhere in the kinds' dispositional profiles*, and distinguishes these from those that hold between non-natural kinds and *their* counterfactual instantiations.

This description will constitute the second, and clinching, criteriological difference between a set that is a natural kind and a set that is not, though it is perhaps derivable from the first. It is simply this: a natural kind is such that, for all conditions, each member manifests all that it is capable of manifesting under those conditions. In other words, members of a natural kind are perpetually in complete act or are maximally manifest——*they have no alternate displays under identical conditions.*

A cd, on the other hand, rarely (never?) manifests all that it is capable of manifesting under whatever set of conditions it happens occupy. It might be heated and warped so that a resumption of C_i results in a different display from P_i, even once entropy considerations are exhausted.

Transmutation worries are easily allayed. A member of a natural kind is not presumed to belong eternally to that kind—a change in dispositional profiles via transmutation simply indicates that the individual or collection of stuff has changed kinds and quite

possibly continues to be in complete act. Alternatively, the stuff is annihilated, but that should not affect this account.

Perhaps it will be argued that the warping of the cd constitutes a transmutation, that each warping would constitute a change of kinds for the cd, and that each would introduce a new kind since there are indefinitely many ways in which the cd could warp. But surely this would be *ad hoc*. This sharply contravenes the intuition that kind membership survives property changes whilst retaining the same dispositional profile.

There are other reasons, though, for supposing that cd's and "handfuls of the universe" have what I refer to as "unstable" dispositional profiles, profiles which preclude their being natural kinds.[64] Part of the array of manifest properties which hold of *cd*, it is argued, is its shape. This is not normally attributed to some intrinsic nature inhering in the stuff that constitutes the cd. The shape of the cd, though perhaps an important property for being a cd, is only one possible configuration of the stuff that constitutes the cd, and that is merely *sustained* under C_i. A fundamental difference between natural kinds and other kinds is that, in the case of natural kinds, the cause of a property array is precisely the same as the cause of its sustainedness. This is not to say that similar reciprocal disposition partners could not be traded while effecting no change in the manifest properties of a thing. Rather, it is to say that the cause

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[64] By "unstable dispositional profile" I mean something like the inability to re-assume the original manifest properties simply in virtue of being in the original set of conditions.

of a mutual manifestation lies deep in the relationship between the reciprocating partners, and, as long as the mutual manifestation is maintained, it is a continuous causing. The shape of *cd,* on the other hand, has for its cause some other, historical set of conditions prior to, and not the same as, C_i, which is instrumental to its shape.

Natural kinds are pastless creatures, and that is *why* they can share stable dispositional profiles.[65] The dispositional profiles of members of a natural kind are unaffected by any actual state-of-affairs. One sample of H_2O might be in the form of ice, another in the form of boiling water, and yet, both samples would exhibit the same properties, once local entropy has obtained, under new and similar conditions. And once local entropy has obtained, the "memories" of the respective samples are the same—vanished.

These considerations should go a long ways towards discounting the all-too-ready-at-hand notion that cd's are not natural kinds simply because they are human artefacts. Handfuls of the universe also have shapes which are not intrinsically stable parts of their dispositional profiles. The same is true of the gold parts and the lead parts of the handful discussed above. Though the gold parts and the lead parts might be collections of things which belong to the same natural kind, they themselves, like gold rings and lead balloons, are not members of a natural kind. Cd's and handfuls of the universe

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65 By "stable dispositional profile", I mean just able to resume a property array P_i simply in virtue of a return to C_i. This may not seem quite right, there is that period of localized "disentropy" referred to earlier and which had to be factored into the discussion of dispositional profiles above; we may need to stipulate that P_i is assured only once local entropy has obtained.

are generally the wrong sort of *unit* capable of a stable dispositional profile. The array of properties manifested by these sorts of units is not just a mutual manifestation of reciprocating dispositional partners; between the thing at hand and the conditions it is in—there are always some other, historical events that play a causal role.

3. NATURAL KINDS AND SOME OBJECTIONS TO THEM

3.1 THE DESIDERATA FOR NATURAL KINDS

This dispositional account of kinds makes the following two claims about our intentions regarding natural kinds:

(1) Anything deemed a natural kind will, regardless of its currently manifesting properties, be presumed to share its dispositional profile with all and only those samples of the same kind;

(2) Each member/sample of a natural kind continuously manifests all that it is capable of manifesting under its prevailing conditions.

Any additional claims made by various proponents of natural kinds namely, that this sharing of dispositional profiles is due to a sharing of the relevant structure, is one made in the wake of the epistemological fortunes of the physico-chemical sciences. One does not need such epistemological fortunes, however, to stipulate what *would* constitute a natural kind; unicorns need not exist in order that they may be described. Singular epistemological *misfortunes*, even many of them, likewise have little impact on the core notion in question. To presume that a set satisfies our intentions only to subsequently find that the set does not has little bearing on the validity of these intentions.

In addition to the two criteria of natural kinds set out above, the characterization offered here will retain only three of the eight

traditional desiderata compiled by de Sousa.[1] Perhaps it is presumptious to be satisfied by such an attenuated account of natural kinds,[2] but as de Sousa himself suggests, any theory of natural kinds might only adopt a subset of these desiderata. The only restriction is that a theory of natural kinds must appeal to *at least one or more of the desiderata.*[3] The presumption alluded to consists in selecting which set of desiderata adequately captures the notion of kinds. This is forgivable, I think, in light of the general aim here: that there be at least one such characterization of natural kinds which can survive the criticisms put forth by Mellor, de Sousa and Churchland. To this end, then, I suggest that only three of the eight traditional desiderata, as proffered in de Sousa, be adopted. Let us examine them in turn.

(3) Objectivity is at the very heart of the notion that a set of things could form a natural kind. It has also seemed the most problematic since it seems that any set of things, so conceived, is the product of classifying creatures such as ourselves. Using the dispositional profile to determine natural kind sets, however, allows us to refer to those putative sets without appealing to any criteria which are bound to our epistemic conditions. If any x belongs to a

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[1] See pp.7-8, above.

[2] Alternatively, though, it is perhaps a bit underhanded to demand more desiderata than are reasonably required (not unlike the fallacy of 'too many questions')—demanding sufficiently many desiderata of any theory will render it unsatisfiable. I think de Sousa is guilty of a 'too many desiderata' fallacy, but this is not a line I intend to pursue.

[3] de Sousa's words are, "...but a theory that incorporated none of them could not be about natural kinds." de Sousa, (1984), 564.

natural kind K, then it does so simply because it shares a dispositional profile, *whatever it is*, with the rest of the members of that kind. That we do not know what the full dispositional profile is should not affect the intent. Whenever we suffer the embarrassment of deeming a set a natural kind only to find later that some members differ in regard to some others, we can be sure the intent is hard at work.[4]

Furthermore, whenever we make such a discovery, as in the case of isotopes say, this contention that the members of a natural kind share dispositional profiles with each other and nothing else is often reinforced by those who would deny natural kinds and essentialism. Unfortunately, they subsequently often falsely conclude that the epistemic blunder is evidence for the unsatisfiability of the intent—whilst ignoring the rigour and tenacity of the intent. When it was discovered, for instance, that H_2O comes in a variety of isotopic arrangements giving us heavy water and heavy heavy water, it was the said detractors who responded with enthusiasm. Some H_2O is different from other H_2O and, consequently, some water is different from other water. Does this mean that one of our paradigmatic natural kinds, water, is not a natural kind, in the strictest sense, after all? Probably. Does this mean that the concept of natural kinds is bankrupt? If anything, the rejection of water *qua* natural kind shows

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[4] The embarrassment must indicate a failure to meet some expected requirement of natural kinds. If we are embarrassed by "heavy water" then it must be because we expected all water to behave the same. When experience shows up our paradigms of natural kinds we can be sure that the reasons for giving them up will be close to the intuitions we have about natural kinds.

how deeply the core intention of kinds is entrenched in empirical methodologies.[5]

Objectivity may appear to be too ambitious a goal for limited creatures. It is true that each proffered set's natural kindhoodness will be underdetermined, but that is an epistemological condition which ought not to have any bearing on our metaphysical intuitions.

(4). Multiplicity of kinds: As de Sousa claims, it would be a *reductio* if it turned out that there were only one kind, and so it is reasonable to stipulate this desiderata given the desire for a sensible notion of kinds.

(5). Uniqueness of membership: This simply stipulates that nothing can be a member of two natural kinds at the same time. This is no different than saying that something belongs to a kind just in case it shares its dispositional profile with the remaining members of the kind and with nothing else.

It is held here that these five desiderata collectively determine the line between sets which are natural kinds and those which are not. This account of natural kinds immediately eliminates the possibility that the *very* superficial of the nominal kinds could form natural kinds, where by the "very superficial", I mean those sets of things (samples) which convene under a single property or function. All red things or all things within a one kilometer radius of the White House, for instance, do not form natural kinds in any meaningful

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[5] This suggestion promises to be another project in itself, and therefore, can only be mentioned in passing, though it is discussed more under the heading "Churchland" below, p. 99ff.

way. This is not to say that these are nonnatural *sets*-they just are not sets which are intended to form natural *kinds*. This is due to a lack of any "dispositional identity" between the members of the set of red things, which is here deemed to hold between all the members of a natural kind.

Though it is possible, I suppose, that the set of all red things could have turned out so as to include only and all iron, for instance, there was no other red things in the universe and all iron in the universe is oxidazed and is, therefore, red. Even in *that* possible world, however, there is no reason to suppose that the predication "...is red" could support counterfactual claims about the things of which the predication is true. For example, for any x, if x were red then x would be *i*[6] for the simple reason that there are red things in the actual world which deny this lawlikeness to "red things".[7]

In the case of Cambridge properties such as "within one kilometer of the White House" any problems which confront "red things" is exacerbated by the lack of any predicable properties which might hold between the things which happen to be within one kilometer of the White House.

Between the extremes of these above examples and samples which belong to a set in virtue of sharing a full dispositional identity, a line between natural kinds and mere sets must be, if it can be, drawn. It is about this line that the disagreements over the

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6 Where i is just any other property of iron.

7 This may not be true, though, of redness.

possibility of natural kinds and essentialism turn. Armed with the notion of dispositional permutations, I now turn to these disagreements.

3.2 ACCOMMODATING MELLOR'S OBJECTIONS

1. Upon discovering Twin Earth and XYZ, Mellor maintains that, we would have discovered merely that water can have more than one microstructure. There are precedents, after all, which support this view, the discovery of isotopes, for instance. There are two isotopes of chlorine, which means that there are two microstructures for the putative natural kind "chlorine", and hence, it might be added, two slightly variant dispositional profiles. Even though scientists discovered, presumably via the variant dispositional profiles, that there are two different microstructures of the stuff we call 'chlorine', we continue to use the same natural kind term 'chlorine' to refer to both of them. A very similar story can be told about water itself, and indeed has, with respect to the so-called "heavy water" and "heavy heavy water".[8]

It is difficult, however, to determine here whether Mellor is making a metaphysical claim or merely a semantic one. To be sure, it is not clear that the two could be sufficiently disentangled so as to facilitate a neat bifurcation, but let us presume this possibility for the sake of tending to each of the possible interpretations.

If by this "mere discovery" Mellor is making a semantic claim

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[8] Zymach, (1976).

then I take him to mean that the word "water" has a nominally determined extension, i.e., its extension is determined by some full descriptional definition. Because both XYZ and H2O satisfy this notion then they are, and for precisely the same reasons, water. That is, the term "water" would refer equally to both of them.

But this claim is only an empirical one (as is the essentialist counterclaim). It *looks* philosophical, and perhaps it is nominally philosophical, but really it is a claim about the behavior (or, more precisely, the dispositions/counterfactual behavior) of the English-speaking community (ESC). Structurally, it is no different than any other disposition claim; it has the same subjunctive air to it. To say that the word 'water' would operate in precisely[9] the same way in the English-speaking community (ESC) upon the discovery of XYZ as it does today is analogous to claiming that substance x would manifest such and such properties under such and such conditions.[10] Furthermore, what is dispositionally true of the English-speaking today may be different than what is dispositionally true of the ESC a hundred years hence. Perhaps it is true that during Frege's life the ESC would have adopted all XYZ simply as water, and also true that it would not in the twenty-first century. These possibilities are not incompatible. These counterfactual roles for the term "water", it should be stressed, whatever they would be, are not philosophically

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9 Perhaps some changes in scientific knowledge and metaphysics would inevitably follow.

10 There would not be, of course, the benefit of any linguistic laws in the former, and there would be the benefit of physico-chemical laws in the latter, but I trust the point is sufficiently clear.

uninteresting or unimportant, they simply are not philosophically soluble.

If such a world is discovered (Twin Earth with XYZ, that is), then, as Mellor suggests, there is the real possibility that we would proceed to use 'water' to refer to either H_2O and XYZ. Perhaps, as in the chemical history of jade,[11] we would merely lose another putative natural kind *term*. It does not follow from this that we have lost another natural kind, that is to say, we have not necessarily lost a natural kind with the microstructural configuration H_2O simply because the hitherto putative kind term 'water' now refers to things other than H_2O. Indeed, perhaps we have gained one, namely XYZ.

More importantly, for this thesis, is the question of what kind of metaphysical treatment XYZ would receive. Ostensibly, Mellor's primary target is "only" the essentialism lurking in natural kind talk, even though this does not seem to leave much interesting for natural kinds to be.

Thus far, Mellor has entertained neither of the following: "H_2O is not a natural kind" and "XYZ is not a natural kind". It is yet possible, though, to be committed to, or even ambivalent about, his semantic thesis that we would call both H_2O and XYZ 'water', and still hold the following:

1. Water is *not* a natural kind,[12] and

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[11] Jade apparently comes in two radically different microstructures, "jadeite' and 'nephrite' which, by all sculptors' accounts, are macroscopically indistinguishable.

[12] It is by contrast, merely a nominal kind; i.e. anything which satisfies the full descriptional definition of water *is* water.

2. H_2O *is* a natural kind.

Whether XYZ is a natural kind or not should not matter, especially since it is only a hypothetical construct. Let us, for the moment, assume the possibility that both (1) and (2) hold. Under this dispositional thesis then we have the following interpretation:

$D_h = [(C_e,P_e), (C_n,P_n)...]$ and $D_x = [(C_e,P_e), (C_n,P_n)...]$[13]

This is just to say that the dispositional profiles of H_2O and XYZ are such that H_2O and XYZ have precisely the same macroscopic properties (P_e) under conditions C_e and these properties (P_e) coincide with our full descriptional definition of water. Water is not a natural kind under this construal since $D_w = (D_h \vee D_x)$ and $\sim(D_h = D_x)$.

That D_h and D_x are not identical is implied by the original thought experiment in Putnam.[14] Perhaps we can supply some of the ordered pairs which comprise the dispositional profile of H_2O, but the thought experiment includes no such pairs for XYZ. However, since we ultimately find out that water on Twin Earth is XYZ (or even just not H_2O), by hypothesis, there must be a set of conditions in which the macroscopic properties of H_2O and XYZ are different! This is a necessary condition for the thought experiment's coherence. Since we are, *prima facie,* not directly privy to microstructural states of affairs, there must be *some* macroscopic upshots by which we can

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[13] Where D_h and D_x stand for the dispositional profile of H_2O and XYZ respectively, C_e stands for earthlike conditions (or as like as necessary), and P_e is just a full descriptional definition of water. No further dispositions are presumed (i.e., Pn might look entirely dissimilar in the formula Dh from the formula Dx) except that there is at least one set of conditions Cd such that Pd under Dh is different than it is under Dx.

[14] Hilary Putnam, "The Meaning of 'Meaning", 1975.

conclude that XYZ is not H_2O. Since we must *ex hypothesis* be able to eventually differentiate the two waters, and since this differentiation will ultimately be on macroscopic grounds, it seems difficult to satisfy at least one of the three conditions demanded by the original thought experiment. The three conditons are (a) that H_2O and XYZ are macroscopically indistinguishable, (b) that H_2O and XYZ are micro-structurally different, *and* (c) that we ultimately determine that they are micro-structurally different.

This difficulty is easily solved along the lines of the dispositional analysis of natural kinds. There is of necessity at least one set of conditions which are not C_e such that the property arrays of H_2O and XYZ differ under those conditions. This pair of conditions/properties is sufficient to determine that H_2O and XYZ are different, even if we cannot specify the micro-structural differences, despite the fact that they exhibit the same properties under C_e. It is also sufficient to determine that H_2O and XYZ cannot belong to the same kind.

So, even if we were to grant Mellor his semantic intuitions there is no compulsion to thereby assent to a metaphysics free of natural kinds or even the "essences" that bind them. Similarly, Putnam's and Kripke's insistence that "water is necessarily H_2O" amounts to two claims about speakers' intentions: first, that the way ESC uses 'water' is to refer to all stuff which stands in the appropriate $same_L$ relation to some indexically indicated stuff; and secondly, that this $same_L$ relation *is* "...is H_2O". Perhaps Mellor is right about our semantic plasticity (after all, we still call jade "jade" even

after we discovered that jade has two distinct microstructures). Since H_2O and XYZ are dispositionally distinct, *some* semantic distinction may yet be forced (as in "nephrite" and "jadeite", the two terms which refer to the two distinct micro-structures of jade). However, if H_2O is the only physically possible microstructure[15] which satisfies the descriptional definition of water at C_e, then water is necessarily H_2O and this necessity is of the de re sort. There is no argumentation which can change this, for a refutation of the semantic convictions of Putnam and Kripke does not guarantee the existence of any XYZ.

2. Mellor points out further that "[n]o reason is given why *particular* properties must be common to all things in all possible worlds that are of the same kind as the archetypes."[16] Perhaps, he surmises, the extension of water is determined by ten "important" properties any one of which may be presently absent. The conjunction of any nine of the ten might suffice to include a sample in the kind "water".

A dispositional theory of natural kinds offers good reasons for supposing that particular "properties" might be common to all things participating in a natural kind. In the end, however, it is argued here

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15 Whether there is some possible *physical* structure, molecular or otherwise, XYZ, is a question rarely, if ever, raised. Putnam's thought experiment was designed to test our intuitions about where to place the meaning of a general term. The contents of the experiment ought not to be confusedly imbued with metaphysical realizability simply in virtue of philosophical *conceivability*. A hypothetical metaphysics may lead to semantic clarity, but it is difficult to see how *this* exercise could have any metaphysical import. Natural kinds, since they are metaphysical creatures, should remain unaffected by such thought experiments regardless of the semantic upshots of the experiments.

16 Mellor, (1977), 306; but cf. Searle's "cluster theory", emphasis added.

that the essentialist program, insofar as it pursues those particular "essential" properties with which to unify natural kinds, is poorly conceived. These said properties are not essential properties, not because they are not essential, but rather because they are not properties of, water say, in the same way that our more familiar properties of water are properties of water. Moreover, it will be argued that the so-called essential properties are not only not properties of natural kinds but that they *themselves* are currently the most promising candidates for natural kindhood status. To this end, it should first be asked "In what sense is H_2O a *property* of water?"

It is not immediately apparent that the 'is' in "...is H_2O" is a different sort of 'is' than the 'is' in "...is wet". But an initial clue might be espied in the realization that the phrase "...is wet" has direct empirical confirmability in the form of sensory qualities, whereas the phrase "...is H_2O", *qua* predication, does not. Rather, "...is H2O" is better construed as an explanatory and theoretical microlevel description (as opposed to a partial macroscopic description) of what we take (rightly or wrongly) to be pure water. Perhaps there are macroscopic qualities *implied* (as Mellor himself argues below) by the theoretical microlevel description, e.g. via some theory-observation translation formulae, but one does not "see" that something is H_2O with sensory apparati alone.[17]

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[17] This ought not to be construed as toeing some van Fraassen line regarding the realism of theoretical entities.

The tendency to overlook the distinction between the sorts of predication facilitated by the different senses of the copula "is" is the culprit which makes the likes of Putnam vulnerable to the question "Why must a particular property be common to all instances of a kind?" The "is" in "...is wet" indicates that some property (wet) is a property which holds of water, whereas the "is" in "...is H_2O" indicates that something is *identical* with water.

For instance, we might say of Hesperus both that it is white and that it is Phosphorous. It might be tempting to think that "Hesperus is white" and "Hesperus is Phosphorous" are the same sort of predication; they both claim that some property holds of Hesperus, but it is not the case that whatever is true of Hesperus is true of white (or whiteness). That they are different sorts of predication is shown by the following consideration: whatever is true of Hesperus is true of Phosphorous. This does not mean that whatever is true of "Hesperus" is true of "Phosphorous", that is, the *terms* are not inter-substitutable,[18] but rather, whatever is true of the object referred to by "Hesperus" is true of the object referred to by "Phosphorous". This is simply not the case with the predicate "...is white" when applied to Hesperus. Whatever is true of Hesperus is not necessarily true of white or whiteness and *vice versa.* There are other considerations, but this distinction is sufficient for our purposes here.

A similar distinction holds for the predications "water is H_2O"

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[18] For instance, Mary could well believe that Hesperus is Hesperus and at the same time not believe that Hesperus is Phosphorous.

and "water is wet", except in this case we are crossing levels of description and this makes it harder to see the fault. To see this one merely needs to see that the macrolevel predication "...is wet" also has a corresponding microlevel description that stands in the same identity relation with "...is wet" as H_2O does to water. This microlevel description of "...is wet" (M_W) is, in turn, a predication applicable to H_2O (under certain conditions). Just as "...is wet" is one of many predicates which hold of water, M_W is just one of many that hold of H_2O. There are two levels of discourse, the macroscopic and the theoretical *cum* microstructural, which are being blurred when they should be seen as running parallel to one another. These might be depicted as follows:

macrolevel description	Noun: Water	Predicates: (1) wet	(2) transparent	(3) tasteless
microlevel description	Noun: H_2O	Predicates: (1) smoothly tumbling molecules	(2) photon permeable ?	(3) corresponding microlevel description of tasteless[19]

This macrolevel/microlevel depiction of parallel descriptions of the selfsame stuff indicates a significant difference between the predicates "...is H_2O" and "...is wet", and, it hints at why one "property" might be more important than others. The suspicion

[19] The corresponding microlevel descriptions of "...is transparent" and "...is tasteless", as microlevel descriptions are wont to do, are too protracted to do sufficient justice to here.

begins with the realization that the former is a noun, i.e., H_2O too has a set of predicates which are true of it, whereas the latter is an adjective about which naught is predicable. This suspicion is confirmed by the symmetry that holds between water and H_2O and that does not hold between water and wet.

So, to answer the question "Why do some particular properties have to be common to all samples of the same kind?", we have begun by pointing out that some "properties", in particular those referred to as "particular properties", are perhaps not really properties in the way that "...is wet" is a property, but are really just equivalent microlevel descriptions of the same stuff. In the case of M_W this equivalent microlevel description of wet happens also to be a property of H_2O just as wet is a property of water. But, if water is not normally construed as a property, then H_2O likewise should not be construed as a property.[20] To make the discovery that ice is frozen

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[20] Perhaps some would insist upon the following claim: "x is water" is a case in which water is just a property, possibly amongst others, that holds of x. I think this is misleading. I think this is misleading because water, though perhaps predicable of a thing, is not a *singular* property predicable of a thing. The significance of this lack of singularity can be demonstrated by imagining two things, say, x and y, of which the following can been said: x is water and y is water. Let us further imagine that x is a moon of some faraway planet and y is a sample of hitherto unidentified substance, perhaps gleaned by spaceprobe from a faraway galaxy. We need to imagine a third thing, z, about which the following is true: z is wet.

It seems unproblematic that Moon x be partially described by the phrase "x is water" (suppose that it is 97% water and 3% something else), and similarly, it seems relatively unproblematic that y be fully described by the phrase "y is water" (assuming one can ignore y's 'Cambridge properties' such as spatio-temporal/trajectoral history or the shape of the space which y currently occupies and focus solely on y—as separate from that which forms its boundaries). There is a fundamental difference here between the predication "is water" and "is wet" and it consists in the following: "is wet", though surely a partial description of z, *it cannot be a full description of z—even if one could*

water is not to make a discovery about a *property* of ice. The "is" in this case denotes identity, and hence the symmetry, i.e. that ice is frozen water and frozen water is ice. Water is H_2O and H_2O is water.[21] This symmetry does not hold between predicates and the things predicated even though sense can be made of the attempt.[22]

It is true, of course, that any one of the properties to the right of the noun "water" (in the chart above) may not hold, and yet the sample could still be water. Putnam even argues that it is possible that *none* of the properties listed on the right of "water" hold and that the sample still could be water.[23]

What makes these contentions tenable is the notion that all the properties that hold of water are just the macroscopic correlates of H_2O under C_e. If all the properties that are normally attributed to water are present in a sample of H_2O, then that sample is construed

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ignore z's 'Cambridge properties'. This is because there is *nothing* which can be fully described by the predication "is wet"—there will always be further descriptional properties held by any thing which is described as "is wet".

This, I argue, is sufficient to drive a distinction between properties which are rather like single dimensional "objects", such as wetness, and those that have some metaphysical autonomy (cf. four dimensional objects) such as "is water". This distinction is sufficient to block the supposition that "is water" is a property which holds of things just like "is wet" does.

21 There are, of course, conditions, but the same is true of the identity between water and ice: ice is *frozen* water; water is *melted* ice. It should be stressed that this example assumes for the sake of this argument only (i.e., as an answer to, "why is a *particular* property more important than others?") that "water is H_2O" holds.

22 cf. 'water is wet' and 'wet is water'; in both cases 'wet' is predicated of water. To see this one might utilize the principle of substitutability, one of Leibniz' tests for identity, and compare 'water is liquid' with 'ice is liquid' and 'water is H_2O' with 'ice is H_2O'.

23 Perhaps it would be more accurate to say that the sample would be the same *stuff* as water is.

as being supported by ideal conditions[24] which form a proper subset of the set of ordered pairs that are constitutive of D_h, namely, (C_e, P_e), where C_e describes those conditions and P_e describes all the said properties. When only a proper subset of the properties obtains, then two possible explanations present themselves: either a different set of conditions (C_e') is at hand or a different kind of stuff is at hand.[25] If a sample manifests none of the properties that are normally present with water, and yet Putnam and company insist on calling such a sample 'water', then what they must mean is: C_e is not now obtaining, but were it to, then this sample would exhibit all the properties P_e normally attributed to water.

If this is right, that is, if in all the instances where we agree that something is water, it turns out that our decision to deem it water is based upon something like the above formula, i.e., the stuff is just H_2O albeit under varying conditions, then *that* is the reason for making this particular "property" essential.

Better still, we might consider H_2O as the probable natural kind at hand as suggested by possibility #2 above.[26] If all and only H_2O shares a certain dispositional profile (whereas water shares its dispositional profile with ice, steam, etc.) which shares its dispositional profile with all and only other H_2O, then water[27] would

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24 That is, the conditions are ideal for manifesting a certain array of properties, in this case, all the properties normally attributed to water.

25 If, under conditions C_e, this substance is indistinguishable from H_2O, we have encountered XYZ.

26 p.56.

27 That is, water denoted by a full descriptional definition would more simply

be better construed merely as a subset of the dispositional profile of H_2O.

There are good reasons for supposing that H_2O is the kind at hand and not water. If it turns out that there is a substance XYZ, then there are two kinds (and possibly more) which satisfy P_e under C_e. As alluded to above, each set consisting of the particular microstructures H_2O and XYZ will be a better natural kind candidate than the more inclusive set "water", since each will have diverse dispositional profiles, else we could not know that one sample of water was H_2O, that another was XYZ, and that their macroscopic property arrays just happen to converge at C_e.

And if all water is H_2O, it is H_2O only under certain conditions. Under other conditions, H_2O has other manifest properties referred to by other terms such as "clouds", "steam", or "ice". We do not under ordinary circumstances use the word "water" to refer to alternate displays of H_2O. Surely, when we order a glass of water, we expect nothing else but H_2O under certain conditions and not others. It is better perhaps to interpret phrases like "ice is water" as; ice and water are different manifestations of the selfsame stuff (H_2O) under variant conditions.

Alas, it turns out that H_2O itself comes in a variety of isotopic configurations. At first blush, this seems somewhat embarrassing for advocates of natural kinds. Quite the contrary! This is just further evidence that the concept of natural kinds, as spelled out above, is

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be the property array P_e of H_2O (and XYZ, should it exist) under C_e.

alive and well.

This response to Mellor's objection to the priority of micro-structural properties is twofold. The first consideration is whether there are good reasons for this priority. If, as it has been argued here, the property of being H_2O is one of identity (in the case of water), then this seems reason enough to suggest some sort of special status. Where the properties of a thing may come and go according to varying conditions, a thing is always identical with itself. Since identity is transitive,[28] on the heels of this consideration comes the possibility, that we ought to construe water merely as a special case of the natural kind H_2O. This construal is more consistent with the dispositional conception of natural kinds, though it has the consequence of rendering the original question, as well as the original essentialist's claim, as misconceived and hence, unanswerable.

3. "[I]f they (macroscopic properties of a kind) are deducible (from the microstructure), then they occur in any possible world the microstructure occurs in."[29] Hence, Mellor concludes, "if the microstructure is essential for this reason, so are all the macroscopic properties it explains."[30]

But, of course, the macroscopic properties are not deducible

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[28] The identity at hand, though, is not "water = H_2O", but rather, "water = H_2O under a disjunction of conditions", which lends weight to the consideration that H_2O is the kind at hand and water is just part of the dispositional profile of H_2O.

[29] Mellor, (1977), 311.

[30] Mellor, (1977), 311.

from the microstructure *all by itself.* They are derivable from the microstructure *and* the prevailing conditions! Under certain conditions H_2O manifests all the properties attributed to ice, under others it manifests all the properties of water, and so on. Since possible worlds are notoriously multifarious there are no macroscopic properties which occur in all possible worlds, and hence, there are no essential *macroscopic* properties simpliciter. Nor, therefore, is there any set consisting of a minimum disjunction of *macroscopic* properties which could usefully determine a kind. The dispositonal options of a thing contain no maximum amount of property change from one set of conditions to another.

This suggests further reasons for supposing that H_2O[31] ought to be entertained as the natural kind at hand and not, as has been traditionally held, water.

3.3 ACCOMMODATING DE SOUSA'S OBJECTIONS

Ronald de Sousa's strategy, as shown in Chapter I, begins with listing some desiderata for natural kinds. Any theory of natural kinds, he claims, ought to adopt at least a subset of these desiderata, if indeed, it is to be a theory about natural kinds. He then proceeds to show that nothing in the world compels us to conclude that, for any such theory, there would be a reasonable number of kinds which *uniquely* satisfy all the desiderata, i.e., where one theory might

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[31] Perhaps in light of the discovery of isotopes, each of the isotopic configurations of H_2O might form separate kinds.

generate an inordinate number of kinds, which renders the notion of kinds meaningless, another might leave us a world with just one kind. Any attempt to restrict the number of natural kinds within a reasonable range, according to de Sousa, violates the penultimate desideratum of natural kinds, *objectivity*. Interestingly, de Sousa does not follow his own (perhaps only implied) suggestion that a theory of natural kinds need not adopt all eight of the desiderata. His rejection of natural kinds only works if one takes each of the eight desiderata to be necessarily assumed by a theory in order that it be about natural kinds.

It is not my intent to follow de Sousa down each of his paths of destruction, but rather, to closely examine what I consider to be the central ones, ones which, if they weren't wrongheaded, might destroy all cogency for natural kind talk, even when not all eight requirements are deemed necessary.

1. The following are de Sousa's premises:

a: the most fundamental and *objective* explanations of the properties of things are to be found at the physical level.

b: at the physical level everything can conceivably be transmuted into everything else.

c: there is only one absolute natural kind, and it is whatever underlies the primary properties of Lockean matter.[32]

So, de Sousa contends, we emphasize the requirement of

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[32] de Sousa, (1984), 572.

explanatory primacy (ii) at the expense of the requirement of multiplicity (iii).[33] But (iii) is necessary for a cogent construal of natural kinds, and so, if there is to be a theory of natural kinds, (ii) must be eliminable and eliminated. This, according to de Sousa, creates more havoc for natural kinds further down the trail, but let us leave that for later.

Let us tend first to these two desiderata and the soundness of collapsing levels of description. By (ii) de Sousa means:

> The defining property (or properties) of a natural kind is expected to provide explanations at a basic level for some other properties of its members, and not to admit of explanation in terms of other properties.[34]

What de Sousa seems to be putting forth here is the not uncommon view that H_2O, for instance, is just one of many other properties which hold of water.[35] The predicate "...is H_2O" is here presumed to be perfectly analogous to "...is wet", "...is tasteless", etc.. As argued above, there are significant differences between these predicates. This, however, will be presumed to be old ground not to be retrod. There are some additional contentions to be met here.

The imperfection of the above analogy, is further supported by what I take de Sousa to mean here, namely, that being H_2O explains some of the other properties of water. Being wet or tasteless, however, does not explain why water is H_2O. Being H_2O somehow has

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33 "There are, if there are any, at least several natural kinds", de Sousa, (1984), 565.

34 de Sousa, (1984), 564.

35 See above, for instance, pp.67-74.

more causal primacy to water than being wet does, for instance.

As argued above H_2O also has "properties", and for the sake of clarity let us just call them "lower-level descriptions", which explain some of the other, macroscopic properties of H_2O, and this explaining is not reciprocated. If the advocates for the unity of science are right, then this ladder of explanation will finally reach the ultimate building blocks of the universe, that of which everything is ultimately composed.[36] If this is right, the question becomes "Does this mean that there is one and only one (absolute) natural kind?"

I see no reason to suppose that this is so. If gold and lead are natural kinds[37] *and* they are both made of the same ultimate substance, then what could possibly differentiate their disparate dispositional profiles other than the disparate *arrangements* of these ultimate particles? What de Sousa must show is that such concatenations cannot serve as the bases for natural kinds,[38] for on what else would the elemental table, with its dispositionally distinct members, depend if it is not such differences in arrangements?

To deny that the arrangements of atomic particles can support the bases for natural kinds is to beg the question. To simply affirm it would likewise beg the question. There are, however, good reasons

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36 de Sousa, (1984), 572. It should be noted that it is de Sousa who appeals to those who believe in the unity of science, and not I.

37 That is, they satisfy the criteria as set out above: all the members share a stable dispositional profile with each other and not with anything else.

38 It might be added here that the stability and dispositional profiles of these concatenations are part of the dispositional profile of "basement level particles". This should not detract from the varying dispositional profiles across varying concatenations, but see below.

for claiming the latter and these consist in the disparate dispositional profiles across different such concatenations and similar dispositional profiles across similar such concatenations. Further, the particular dispositional behavior of water, for example, is not explained simply by the fact that it is ultimately composed of the ultimate particle, nor even that it is composed of a certain number of these wonderful particles. If all things are ultimately constructed of the same wonderful particles, then the differences between the dispositional profile of gold and those of other stuff must be explained by these differing arrangements, if indeed, as is supposed, these are the only accompanying differences.

This problem for natural kinds is generated largely by de Sousa's rendering of the requirement of explanatory or causal primacy, which admits of ambiguous readings and which he subsequently capitalizes on, wittingly or otherwise. This ambiguity lies in the latter part of the final sentence which stipulates a non-reciprocal relation between what de Sousa calls "defining" properties and others he simply refers to as "others". These defining properties are "not to admit of explanation in terms of *other* properties." On a first reading, it would seem that these other properties would be none other than the rest of the properties true of the kind in question. If H_2O is a defining property and wetness, transparency, tastelessness, etc. are some of the other properties of water, then H_2O might explain the wetness and transparency of water, though the converse would not be true.

This is not the reading one gets in de Sousa's attempt to eliminate this requirement of explanatory primacy. The "other" properties he turns to are not the ones normally attributed in the intension of water at all, but ones which ultimately underpin the behavior of H_2O qua micro-level player. *This* reading of the explanatory primacy requirement, had it appeared initially, would have resulted in its outright rejection, since it would require both an ontological commitment to these wonderful particles and the accompanying view of explanation, namely that an explanation based on anything other than these wonderful particles was not an explanation.[39] Before our theories are endowed with a correct account of these wonderful particles (such as now, for instance), we could not possibly be in the business of explaining. I take this implication to be highly contentious.

Of course, one could also take de Sousa to simply mean that there is only one *absolute* natural kind and that there are some other natural kinds which are not absolute. But, on this reading, it would be difficult to see how he had attained his desired conclusion here (that there is only one natural kind and this constitutes a *reductio* for any natural kind thesis), and this would undermine his subsequent argumentative efforts,[40] since those begin with the tension between requirements (ii) and (iii).

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[39] I derive this attitude from de Sousa's identification of "emphasizing (ii)" with pursuing the "most fundamental and *objective* explanations" (p.572) i.e. at the physical level.

[40] Not all attended to here.

It is perhaps best to discount the requirement of explanatory primacy altogether, as is done here,[41] because as it stands, that requirement depends upon the misconceived relationship between a natural kind and its essential property. The essential or "defining" property, under this requirement, is supposed to provide an explanation for properties which hold of the putative kind. However, if we take the proposed explanatory property (that is, the micro-structure) to be the kind at hand, and if we take the putative kind to be just the micro-structure under certain conditions, then the kind, with its dipositional profile, becomes part of the explanans for some segment of the universe.

And if some micro-micro-structure (MMS) is subsequently found to serve as an explanation for the micro-structure (MS) does *this* MMS not supplant MS as the kind at hand? If so, then do we not end up at some de Sousian-type criticism after all? If not, then what grounds do we have for supplanting the initial natural kind with its "defining" property?

1.1 These questions are related to a question posed by de Sousa at the heading of his discussion, "At what level are kinds natural?",[42] which, while indicating the overall structure of his discussion, is also an interesting question in itself and one which is not yet sufficiently addressed.

Let us take some samples of water, as an example of a

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41 This requirement is not included in the desiderata of the dispositional account of natural kinds.

42 de Sousa, (1984), 572.

"wannabe" natural kind, and assume that these samples all have the same dispositional profiles, and so attain the coveted status of "natural kind". Now, at the molecular level the description of water[43] is "H_2O". At the atomic level, the description of H_2O is "eighteen protons, eighteen (give or take a few) neutrinos, and some number of electrons which fluctuates with the environment[44] bound by some natural forces." After this, we enter the subatomic level(s) where the ignorant author ought not to tread. These few "levels" ought to suffice for the job at hand.

At first blush, it would seem that both water, being a natural kind, and oxygen, being a natural kind, would contravene requirement (vi).[45] If a significant part of all the stuff that is water also belongs to another natural kind, namely, oxygen, and the rest belongs to yet another, i.e., hydrogen, then we have not one acclaimed natural kind at hand (H_2O), but two, maybe three, depending on the level of description we are discussing. This problem can only multiply as we descend the descriptive/explanatory ladder into the level of subatomic particles.

Talking about H_2O at a molecular level necessarily involves talking about its constitutive parts, hydrogen and oxygen, since little sense can be made of the molecule otherwise. The reciprocal disposition to enter into a valence bonded partnership with hydrogen

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43 I here refer to ordinary earth water.

44 This is not intended to be a technical description.

45 Nothing is a member of two natural kinds at once: kinds do not overlap. See p.8, above.

to form the water molecule is certainly part of the dispositional profile of oxygen, as is the converse. But the subsequent molecule is *not* part of the dispositional profile of either oxygen or hydrogen. This is not to say that the molecule's properties, etc. are not reducible to, nor explicable by, these parts and their dispositions. It is just to say that the scope of the referring terms "water" and "oxygen" is different; "water" carves out bigger pieces of the universe than does "oxygen".

When the referent is the H_2O molecule, for example, as opposed to its constitutive concatenations of atoms or subatomic particles, the level of discussion is simply one which takes larger chunks of the universe as the object of discourse. When one talks about the dispositions of the atom, say, one talks about the behavior or the counterfactual behavior of the atom as distinct from, but in relation to, its environment which includes, of course, the rest of the molecule. When the unit of reference is the H_2O molecule, talk is conducted over the special dispositions of the oxygen and hydrogen atoms as they obtain in this valence bonded condition only.

Whether some set of things/samples *is* a natural kind, according to the view championed here, depends *only* upon whether each of the members share stable dispositional profiles. It matters little what level of description we are operating on just so long as the things we speak of can stand in the appropriate identity relation.

Answers to the above prefatory questions (p.88) are: to the first, MMS does not necessarily supplant MS as the kind at hand, and

this response obviates the need to answer the second question. The third question is answered by the above considerations: so long as the putative kind exhibits a stable dispositional profile, then it need not be supplanted, it may be simply identified with the MS. Sometimes, the putative kind is semantically constrained to only a small subset of a kind's dispositional profile; for example, "water" normally refers to H_2O only within a narrow range of conditions, and so is not a good natural kind.

2. A salient part of de Sousa's strategy, as illustrated above, is to bring two or more of the desiderata of natural kinds into conflict (at whatever cost) with each other. He then offers some dubious remedies which allow him to call the satisfiability of further desiderata into question. The rejection of his first "divide and conquer" manoeuver (de Sousa **1**, above), in addition to the refusal to accept all that eight desiderata must be satisfied, disrupts the whole chain of argumentation which constitutes the bulk his essay.[46] Still there are some fragments I would like to pick up on, simply because they offer potential criticisms of the conception of natural kinds along the line of dispositional profiles.

If at the most fundamental (and objective and important) level we are left with a single kind, then the heart of the natural kinds concept has been stopped.[47] "Resuscitation" by de Sousa takes the

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46 de Sousa, "The Natural Shiftiness of Natural Kinds", (1984).

47 I, of course, feel that the antecedent of this conditional has been soundly refuted, but still take the ensuing discussion to be a good proving ground for a

form of relaxing the requirements (i)-(ii) so that we might once again expand the natural kind population. We could do this, de Sousa suggests, "by relativizing natural kinds to the interests that happen to be guiding our inquiries."[48] We could generate interesting classes along functional properties; but alas, though this approach reinstates water as a natural kind it also offers up such counter-examples as artefacts. de Sousa suggests that perhaps we should not be so hasty to dismiss artefacts from the possibility of natural kind status, that they may be not so very different from what we normally construe as natural kinds anyways:

> Whether it makes sense to think of artefacts as natural kinds depends on your *epistemic* status. If you haven't been warned ahead of time that these are objects demanding special criteria of identity and classification, you will simply pick out a sample in the usual way and look for some underlying property that they all have in common. A Martian anthropologist might well adopt the same strategy as an ordinary scientist faced with some naturally occurring stuff: take a sampling, and assuming the individuals or chunks of stuff have some property in common in virtue of which they are all of a kind, attempt (and why not succeed?) to discover that property.[49]

And why not succeed? As de Sousa points out, "artefacts are typically defined *functionally* and not *structurally*."[50] What is needed is a "conclusive reason for rejecting functional accounts of the nature of

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dispositional account of natural kinds nonetheless.

[48] de Sousa, (1984), 572.

[49] de Sousa, (1984), 573.

[50] de Sousa, (1984), 573; emphasis original.

natural kinds,"[51] and this is precisely what the dispositional account of natural kinds can provide.

The reason that natural kinds cannot be defined along a functional criterion is very similar to the reason that natural kinds cannot be gathered under a single macroscopic property[52] (as opposed to micro-level description). Any set bound by a functional criterion or by a single property cannot meet the requirement of objectivity even in the most minimal of the senses of objectivity.

Let us take the set of all toothbrushes[53] and the set of all red things. If we imagine there to be toothbrushes in other possible worlds (as de Sousa asks us to do), then they might be completely different than the toothbrushes we are accustomed to. "[T]hey might work on different physical principles; they might be designed to clean 'teeth' so different from ours (in their *accidental* properties), as not to be toothbrushes as we know them at all."[54] So we imagine the set of all toothbrushes laid out before us. Of all the properties each possesses, of all the unmanifesting dispositions each possesses, and of all the microstructures each possesses there is but one thing which collects these objects into a set. That single attribute is the functional property, the ability to clean 'teeth'-yet another functionally described set.[55]

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51 de Sousa, (1984), 573.

52 Unless there exists that which can be fully described by a single property.

53 This is de Sousa's example.

54 de Sousa, (1984), 573; emphasis original.

55 Here I am not opposing the possibility of some looser "functional kind" rather, I oppose the suggestion that these could fill the ranks of what I have

Assuming that each of these toothbrushes might have indefinitely many different manifest and dispositional properties from any other one, it is clear that this set is united in an exceptionally tenuous fashion-it is only one step from being the most arbitrary of all, namely, one collected with no unifying principle at all. The same can be said of the set of all red things.

It could be said here that to suggest that all red things form a natural kind simply in virtue of being red is to misapply the concept even as understood by de Sousa himself. These sets sharply contravene the requirement of objectivity[56] by relying on criteria that clearly rest upon our epistemic, social, physical, etc. conditions, and this is a conclusive enough reason for rejecting a functional account of natural kinds.

These sets also contravene the requirement (vi) of "uniqueness of membership."[57] If one member of the set of toothbrushes is red, then this same member belongs to both of the abovementioned sets. At least one of these sets, therefore, cannot constitute a natural kind.

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deemed the "natural kinds", things which belong to a set only in virtue of their natures.

56 Well, of course this is bound to happen since de Sousa has prefaced this whole discussion with the supposition (S), "[b]ut suppose we relax requirements (i)-(ii)", where (i) is the requirement of objectivity. One is left to wonder why he would suppose S, which, *prima facie*, undermines the integrity of the very notion of natural kinds [i.e., by dismissing (i)], and then feign innocence by suggesting the possibility that "there is no conclusive reason for rejecting functional accounts of the nature of natural kinds" when that 'possibility' is admissible only under the natural kind-denying supposition S! Perhaps de Sousa is gallantly trying to save some semblance of natural kinds in the absence of a robust version. Natural kinds needs no such savior, and besides, a dispositional account is far more robust.

57 "Nothing is a member of two natural kinds at once: kinds do not overlap," p.565.

Perhaps red things could be rejected without implicating toothbrushes.

But just as any thing has many properties, any thing has many functional descriptions. A toothbrush might function just as well as an archeologist's tool, a doorstop, a drumstick, and so on. Each time these functional sets converge, they converge on some narrowly defined criteria, which both allows the members to belong to any number of such functional kinds and forever divides these sets, so conceived, from natural kind sets.

These functional sets cannot distinguish between the disparate dispositional parallels of the members. It would be, that is to say, a rather clumsy epistemic blunder to presume of any two random red things or of any two random toothbrushes that they might manifest the same properties under the same conditions for all conditions, given the parameters of their sethood. Again, these are just the *wrong sorts of units* to be entertained as natural kinds; there would not be much point in *natural kind* talk, as distinct from talk of other kinds, if no such expectations of substitutability could be made of the proffered sets.

Imagine a set of perfectly substitutable members, a set K which had the following characteristics: *each* member shares *all the same* macro-scopic properties, *all the same* dispositions, and *precisely the same* micro-structure. There is a sense in which this set could be said to be objectively[58] determined, since it does not depend on anyone's

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58 By objective here I mean something like, each member of the set could be

epistemic conditions. The possibility of talking about set K depends, perhaps, on someone *intending* to refer to the set of things which is just like this thing (how*ever* "this thing" might be picked out) in every respect with the exception of occupying a different set of spatio-temporal coordinates. That act of intending may be motivated by certain interests that are external to the particular set in question, indeed, it almost certainly is. But these interests *per se* (whatever they are) do not automatically undermine the objectivity of the set, since *that* obtains only when epistemic considerations are invoked, and these need not accompany the state of intending to refer in a certain fashion. In other words, one need not *prima facie* specify, or even have in mind, a method for knowing *which* stuff in the universe belongs to the same kind as the stuff indicated in order to intend to refer to the set of all stuff just like it.

To see this one needs only to consider a common notion of identity: a thing is identical to itself and not to anything else. There is no epistemic baggage which accompanies this axiom, nor is any needed. Just as every predication which is true of L is also true of L every predication which is true of one member of K is also true of every other member of K (with the aforementioned exception of spatio-temporal coordinates), our imaginary set.

This set, though fictional, is a useful fiction in the same way that frictionless planes are. It helps to articulate a "Semantic

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exchanged with any other and if it were not for the knowledge of the exchange i.e., other than some spatio-temporal interuptions, no one would be, nor could be, the wiser.

Conception" of a natural kind.[59]

According to the Semantic Conception of scientific theories, scientific theories are not empirically true, that is, nothing strictly instantiates them in the physical world.[60] They are, rather, counterfactually true if they are true at all. So it is with an idealized notion of natural kinds. If all gold *were* in identical conditions and *were* isotopically similar, then what was manifestly true (as *well* as dispositionally true) of one sample would also be true of the rest.

What de Sousa and company need to show first is that there are no such sets whose members each have the same dispositional profile.[61] I take the project of science to be in the business of

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59 cf. the *Semantic Conception of Scientific Theories* by Frederick Suppe in which the following claims are made of scientific theories: scientific theories, if they are true, are only counterfactually true. This is simply to say that nothing precisely instantiates the laws of the theory. Take, for example, the 'law of gravity' which stipulates the force exerted on two objects in accordance with their combined masses and the inverse of the distance between their centers squared. From something like this calculation of force, one ought to be able to derive the real rate of acceleration of a dropped object near the surface of the earth. However there are other, nonnegligible influences which are outside the domain of the theory, such as considerations of friction, in this case air resistance, which confound the derivation. And so it goes for each and every true theory and their laws: they correctly describe the events within their domain, and if it weren't for the nonnegligible influences from outside their domain the predictions would be precise without the invocation of the correction procedures (those which adjust predictions based upon the law of gravity alone, with considerations from any 'laws of friction') required to rectify the overlap of said influences. So, the theories are only counterfactually true, they would be true if the nonnegligible influences were not at play.

60 cf. Nancy Cartwright's *How the Laws of Physics Lie.*

61 Normally the burden of proof lies upon those seeking to establish rather than those seeking to negate. But de Sousa has already appealed to the "ultimate particles" (in de Sousa 1) of the universe and presumably these would all be dispositionally alike, else there would be more than one kind of ultimate particle-contradicting the object of his argument. I have taken the additional step of suggesting that concatenations of these ultimate particles, even though I find them suspect, might also form sets whose members share

providing such sets, and presume that stuff like elements or maybe their isotopes are just the sort of candidates we seek. Sometimes they (the scientists) are wrong.[62] This does not imply that they are always wrong, nor even mostly wrong. Nor does it imply that even if they were always wrong that we need the likes of "functional kinds" to fill the gap. If there are no *natural* kinds then we must simply accept that there are no natural kinds.

2.1. But, de Sousa claims, the "functional-structural distinction...is a relative one."[63] If we take the chemical properties of water to be underwritten by its physical structure, and we take those properties that hold of water to be functional descriptions of the "stuff" that water happens to be, then a "functional" story similar to the toothbrush story can be told about water. "The functional level of a system admits of several realizations in terms of different structures. So the different isotopes of oxygen or hydrogen can be viewed as providing different structural realizations of the functional stuff *water.*"[64]

Although de Sousa has argued here that some of the component

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dispositions. Theoretical science has already done the work, de Sousa must work towards showing we should not think that two samples of aluminum (which has no isotopes) are perfectly substitutable, *ceteris paribus.*

[62] If they are wrong, though, they will shown to be wrong by a methodology based upon the same intuitions which support the dispositional profile account of natural kinds. That is, two things deemed to be the same kind will be proven to be different by demoonstrating divergent dispositions and two things deemed ot be of different kinds will be shown to be the same kind by demonstrating parallel dispositions.

[63] de Sousa, (1984), 573; I take de Sousa to mean by "relative" as 'there is a relationship which holds between the function of a thing and its structure but there is a certain looseness' here.

[64] de Sousa, (1984), 574.

parts (number of neutrinos) of parts (atoms) of the structure H_2O may vary without seriously affecting the functionality[65] of the stuff water, he has not shown that the putative *essential structure* in question, two hydrogen atoms valence bonded with an oxygen atom, can be compromised without affecting the functionality of the subsequent molecule (or whatever is left). If anything, he has drawn our attention, once again, to how central *that* structure is to the "functional stuff *water*".

What is clear is that de Sousa cannot make the parallels he needs to make in order for his analogy between toothbrushes and water *qua* functional entities to work. Where the functional stuff water seems to require a minimum structural similarity between its members, toothbrushes have no such requirement. Furthermore, if he *could* make the analogy then he would prove only that water (something conceded in Mellor **2**) is not a natural kind, and not that toothbrushes are.

In the actual world, toothbrushes can be realized in a number of structurally different ways. In actual world water comes in a single structure, with variations that can and do exist within the confines of that structure. As far as we can tell, there is no water that is not H_2O and there is no H_2O that is not water or, at least, of-a-kind with water. To suggest that, by hypothesis, water could also assume non-H_2O structures is to beg the ontological question. And if water

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65 There are, though, subtle differences which obtain from the different isotopes of oxygen and hydrogen, this need not affect the point at hand.

were a natural kind, then the following would be true of it: for all x, and for all y, if x is a sample of water and y is a sample of water, then whatever functional description holds of x holds of y and vice versa. Functional descriptions are just a proper subset of the dispositional profile of a thing and should not be confused with this dispositional profile. Similarly, a set whose members are functionally similar should not be confused with a natural kind set.

3.4 ACCOMMODATING CHURCHLAND'S OBJECTIONS

Churchland makes a different sort of claim about the pursuit of natural kinds. It is his contention that the relationship between our natural kind terms and the extension of those terms are always in flux because the mechanism which determines the extensions, that is, our current scientific theories, are always undergoing change.

1.This persistent epistemic shuffling does not necessarily affect the ontic possibility of natural kinds,[66] but rather, it raises questions regarding the *viability* of natural kind talk. So long as the medium of extension determination, scientific theories, are changeable, kinds are bound to the fates of the everchanging theoretical landscape. Because the relationship between the general term and its extension is vulnerable to such scientific changes, and because such theoretical changes are expected to continue, natural kind terms refer (if they refer at all) to nothing more than passing extensions at best.

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[66] Though this is not ruled out and is even a suggestion proposed by Churchland, (1985), 16.

If we accept de Sousa's requirement of objectivity, (i), then this criticism does not seem to get off the ground. If what we *mean* by "natural kind" is something not bound by epistemic or theoretical considerations, then we were previously just wrong about a particular term and its extension. Churchland's point, however, is that there are no such terms which we are not currently wrong about, or, at least, that there are no such terms which are guaranteed to be stably fixed. There is the real possibility of a "massive referential disconnection"[67] between the natural kind bits of our language and the world.

At the heart of Churchland's grievance is his opposition to the notion that the advance of science consists in explicating our "common-sense taxonomy" of natural kinds with "a new and more penetrating account of what *unites* [those] already palpated class[es]."[68] Instead, these new and penetrating accounts change the membership of the classes, sometimes rendering these general terms completely extensionless.

In order to defend his thesis from a resolution via some "Putnamean indexical/recursive formula", Churchland offers several examples from the history of science are meant to show that this formula does not endanger his general claim. It is my contention that none of *these* examples show this, and that his general claim thus remains vulnerable.

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67 Churchland, (1985), 5.
68 Churchland, (1985), 3.

These are Churchland's examples:

A>"Phlogiston is whatever bears the 'same spirit' relation to the phlogiston right here (pointing to the vaporous outpouring above the fire).

B>"Caloric fluid is whatever bears the relation 'same substance' to the caloric I feel right here (holding up a warm coffee cup)

C> "Heavenly crystal is whatever bears the relation 'same substance' to the crystal up there (pointing to the crystal sphere that divides the superlunary from the sublunary realms)

D>"Party-drink is whatever bears the relation 'same liquid' to the party-drink in my hand (holding up a glass of Grandma's randomly concocted pink party-punch)"[69]

What is immediately evident, and one of the reasons for trotting out all of Churchland's examples, is that half of these proffered natural kinds do not even look like authentic candidates for natural kind status. Fire or phlogiston might be candidates, but heavenly crystal, party drink? Even if the heavenly crystal was sufficiently substantiated how would *that* be a natural kind? But let us never mind this.

Presumably, what Churchland wants to show here is that the history of smooth intertheoretic reduction[70] is not very smooth. Not only is it not smooth but there is no test which determines success,

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69 Churchland, (1985); gleaned from pp. 6&7.

70 That is, our less sophisticated classes are not neatly mapped onto our progressively more sophisticated classes.

i.e., one which could guarantee that any particular theory would not eventually be superceded by another, more sophisticated theory which again would readjust the extensions of our natural kind terms.

Presumably, phlogiston on Churchland's account, is not a natural kind. This is true primarily because phlogiston is not anything at all. There is nothing (let's say) in the world which corresponds to the intension of "phlogiston"-it has no extensionand never did. It was/is a theoretical construction that was posited as a partial explanation of the phenomenon of fire and other phenomena. If there is/was no extension, then whatever *was* pointed to when the indexical formula was "intoned" could not have been phlogiston. This does not mean that there was, therefore, nothing which was pointed at when the "intonation" occurred. Indexicality doesn't work that way. Probably, as Churchland suggests in this incarnation story, there were some vaporous outpourings (smoke, steam, etc.?) which were pointed at during the intonation.

There is an analysis which usefully picks out an ambiguity not apparent in Churchland's version, one which points out that we really have two stories here, conflatingly being told as if they were one. One story is the straight ahead indexical/recursive one and goes like this: "that stuff* there (*plug in any term you like) is just like all the other stuff* which is the same stuff* that *it* is." Story two goes like this: "(a) that stuff there is "phlogiston*", (b) for all x, x is phlogiston* iff x bears the "same stuff" relation to "phlogiston*", and (c) phlogiston* has such and such (p,r,q...) theoretical properties." There

are no temporal implications made in story two; (a), (b) and (c) might occur in any order.

Story one is just parts (a) and (b) of story two and these comprise the full story of reference by the indexical formula. Part (c) of story two has absolutely nothing to do with the indexical formula, and it has everything to do with the current contention that phlogiston does not exist. The point here is that there was no such *indexical* inauguration of phlogiston or caloric fluid. These were theoretical constructs built to explain other phenomena *which have not disappeared*! The same is basically true of the 'crystal sphere' and as for party drink, well, I suppose *that* example was only used to ridicule those who might think that an indexicality formula might play a role in natural kind discourse. So far, Churchland claims to have to have refuted this possibility without offering a single, seriously relevant counterexample.

The problem, he continues, is that "[E]xpressions such as 'same substance' and 'same spirit' are obviously laden with theory, and the sameness-relation there invoked will vary from one period of scientific history to another."[71]

But on the dispositional equivalence reading of natural kinds, Churchland's claim confuses two utterly different aspects of natural kinds: the stipulative or conceptual notions are confused with epistemological problems of determining which sets satisfy the notions of natural kinds. It is not obvious that the *concept of identity*

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71 Churchland, (1985), 7.

is theory-laden, at least, that is, laden with *physical* theory. Any "same stuff" relation is a relation of identity, which is stipulated prior to and separately from the physical-theoretical contentions that determine which extensions go with which terms. It does not seem overly problematic to stipulate that the set $\{x,y,z\}$ constitutes a natural kind just in case the members (x,y,z) are mutually substitutable; i.e., that they share dispositional profiles, without invoking any *particular* physical theory whatsoever.[72]

Physical theories, on the other hand, right or wrong, tell us *which* things share dispositional profiles and tell a theoretical story to support these contentions. They are wrong when two things are theoretically deemed the same sort of stuff and empirically this is relation not borne out. *Therein* lies the value of natural kind talk.

The phrase "same stuff" and any of its kindred can function quite independently of physical theory as in the contexts of (a) and (b) just so long as (c) is not invoked. There are, of course, many reasons for wanting to be able to pick out which things belong to the same natural kinds. It would seem a rather pointless task to simply iterate the indexical recursive formula.

Churchland's conclusion in this matter is that the "extensions of our terms are stably fixed neither by analytic truths, as in the orthodox empiricist tradition, nor by indexical recursive pointings, as

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[72] We might have to have some concept of the physical, what x and y's parameters are, and so on. But these also lie outside the scope of physical theories; cf. the Semantic Conception of scientific theories, p.96, above.

in the Putnam/Kripke alternative."[73] This is so because "[T]hey are not stably fixed by anything, since they are not stably fixed at all."[74] Some further examples, like the ones quoted above, also do not lead one to this conclusion. These are the further examples of gold and water.

Churchland asks the reader to recall our ancestral notions of gold. In medieval times gold was "conceived primarily in phenomenological terms that admitted sundry alloys and ersatzes of gold into the class."[75] These inclusions, Churchland claims, were not *mistakes* because their conceptions of gold *included* notions of grades of gold which tapered into the baser metals. This was consistent with alchemical theory because the "hidden principle for the characteristics of high-grade 'gold' was thought to be a spirit that displayed varying degrees of maturity."[76]

Consistent with his aforementioned conclusion, Churchland makes the following observation:

> Conceived within medieval common-sense, the extension of their term was wider than ours. Conceived within alchemical theory, it had no extension at all. In neither case did it have the same extension as our term 'gold'.[77]

Two questions that come to mind are: 1. How is it that the term 'gold' came to refer to a different extension? 2. Given that we think it did,

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73 Churchland, (1985), 8.
74 Churchland, (1985), 8.
75 Churchland, (1985), 3.
76 Churchland, (1985), 3-4.
77 Churchland, (1985), 4.

how are we able to keep up the narrative (as some might put it), when, though the term 'gold' still plays roughly the same roles *within* the language, economics, goldsmithery, etc.,—all the while thinking that its *extension* had completely changed? I don't think that it is possible to give consistent answers if one adopts Churchland's position.

I suspect that consistent answers are to be found by exposing part (c) of story number two above, and these answers demonstrate how primary and deeply entrenched our concepts of sameness, and subsequently, the indexical/recursive formula—which is just an expression of sameness, are. Bearing in mind that the passé notions that gold comes in grades and is underwritten by variously matured spirits are just theoretical notions (cf. part (c) of story two, above), we might ask, "generated for what?" Explanatory purposes perhaps, perhaps to facilitate the alchemical venture. Whatever the reasons were, whilst their philosophical graves claimed them, somehow the sameness of stuff notions still successfully tracked at least some of the ostensively defined things,[78] even when successive theoretical notions *cum* epistemic tools failed, that is, even when our *acceptance*

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[78] How else can we make sense of the claim that "our 'gold'" (G_0)has a different extension than "their 'gold'" (G_t) did, without lapsing into semantic games of ambiguity? That is, either G_0 and G_t overlap or they do not. If they do not, then we are in the presence of a term like "bank". Such terms have utterly distinct extensions according to their intended usage and should be taken to be different terms which accidently sound alike. If this is Churchland's concern about G_0 and G_t, then it is no different than possible concerns about the different extensions of "gold" and "lead", and one does not normally construe this as problematic for natural kinds. If, on the other hand, G_0 and G_t overlap, we have the problem of explaining the overlap.

patterns (as opposed to "extension") fluctuated. How?

The answer, I think, is that though the intensions and acceptance patterns of speakers' natural kind terms may change with a change in scientific theory, speakers' *intentions* need not necessarily follow suit. By intending to refer in the wide content mode[79] in accordance with (a) and (b), the extension of the term 'gold', for example, is *already* stably fixed, rigidly designated, whenever there is an extension which happens to satisfy the intention at hand—*and this occurs whether we have the epistemic wherewithal to pick out the remainder of the extension or not*![80]

The rigid designation of kinds, analogous to our ability to rigidly designate an individual without the concommitant commitments to any of the definite descriptions of the individual, is utterly separate from any theoretical notions such as in (c). Those notions are merely part of our epistemic flounderings which collectively constitute our pursuit to determine i) *whether* there is an extension which satisfies our intentions, and ii) suspecting that there is such an extension, what things belong to that extension.

Churchland denies that natural kinds can be stably fixed by the indexical recursive formula. This seems at least partly right—the indexical recursive formula only contains the stipulative seeds of referring to natural kinds. That some indexed thing *be* a member of a

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79 By "wide content" what is meant here is our ability to refer to the body of true predicates of a thing without knowing all of them.

80 cf. referring to the largely unmanifesting dispositional profile of a thing, pp.37-39.

natural kind, as spelled out by the intuitions appealed to above, is also required for referential success of the sort intended. Since all indexable things are constituted by one or more *natural* kinds, this requires only one additional component—that the speaker refer in the appropriate way, one in which the indexed stuff is separable *in the intention* to a set whose members share dispositional profiles. For example, the gold *ring* does not qualify as a member of a natural kind, nor even does the stuff of which it is constituted (since that is usually some alloy) normally count as belonging to a single natural kind, but the atoms of gold therein might. So, unless the speaker happens to point out something in the indexical/recursive mode that is remarkably homogenous or the speaker has an inkling regarding the lack of homogeneity, the reference usually fails.

The elements required for a successful rigid designation of a kind are simply: (1) we intend to refer to a set of things in the wide content/natural kind mode, (2) such an intending is satisfiable; the indexed object is conceived in a way that is amenable to fulfillment, i.e., at an appropriate level of description so that there is such an extension. Pointing to a lead balloon, and intending to refer to all such objects in the above manner might not go over very well, whereas pointing to the balloon and intending to refer to the stuff constitutive of the balloon might.

Perhaps we should note some of the parallels and divergences between the rigid designation of individuals (I) and the rigid designation of natural kinds (K).

First, let us explore some epistemic parallels: (I-1) At the time of baptism, the individual named presents the epistemic difficulty of ascertaining the parameters of the individual named, i.e., where the individual spatio-temporally begins and ends. (K-1) Similar to (I-1), baptizing the kind has the difficulty of ascertaining what the intended kind would be—we may not intend to take gold rings, nor even *all* that they are constituted by, to be in the sameness relation of interest. It might appear that the rigid designation of kinds has an additional worry, we cannot be sure at the time of baptism that the set we intend to refer to exists, though, perhaps Kripke has showed that this may be true also of some individuals, those who are theoretically baptized, as in the case of Neptune, for instance. (I-2) There is the difficulty of re-identification of the afore-indexed individual, we may know who we intend to refer to, but how do we later pick out that individual in the world? (K-2) Rigid designation of kinds has the related problem of ascertaining the extension of the referred to set.

There are significant contrasts between the stipulative notions of a natural kind and an individual, and hence, these significantly affect their respective designations. (I-3) A rigidly designated *individual* survives changes in parts and properties; the same is true of natural kinds. (We must not take the "G transmutes into L" story, from above, too seriously—it has an ambiguous set of individuating parameters. G is not the kind, it simultaneously participates in the kind in virtue of its constitutive parts, analogous to being a part of an

individual, *and* it is an individual.) (K-3) The kind can survive a loss in parts (members) as in G>>L and additions of parts as in L>>G, and also survives property changes as in P_i>>P'. (K-4) The kind, the set whose members all share the same dispositional profile and are in complete act, acts very much like an individual. Unlike an individual, though, it survives extinction and rebirth. The set may be not empty at one time t_1, empty at time t_2, and again not empty at time t_3. The members at t_1 and t_3 still, on this analysis, belong to the same kind. (I-4) On the other hand, it appears that individuals can survive changes in kind, but cannot survive extinction. G might survive the transmutation G>>L, but, subsequent to an utter annihilation of G, there can be no individual which is the same individual as G.

In order to have "conceptions of gold [which] included notions of grades of gold which tapered into the baser metals," or, for that matter, any conception of a mass term, one must first have a *conception* of 'gold' as having an extension to begin with! Things might become gold and things might stop being gold, but it must *mean* something for something to be gold and not something else, else the conception makes no sense. Just as surely, this conception had a primitive indexical/recursive beginning, something like "stuff like the stuff here."

This construal is supported by our ability to shift allegiances from extension to extension according to the prevailing theory of the day.[81] In order to do this we must be able to declare something like

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[81] That is, we might *accept* something as belonging to the natural kind gold

"at t_1, we took x and y to be the same sort of stuff, and at t_2 we do not." This possible embarrassment is only possible with a secured conception of sameness already in place, one which is ultimately violated by some faulty epistemological/theoretical conjecture.

Furthermore, the necessity or even the likelihood of similar mistakes in the future does not follow from the mistakes of the past. Given the increasing precision, scope, etc. of physical theory and despite the rejection of some past theories and the possible rejection of current theories, it would be difficult to mount a very convincing inductive argument to such a conclusion.

A "massive referential disconnection" does not necessarily obtain between a natural kind term and the world. In the cases in which the referential intentions turn out to be satisfiable, i.e., where the sample of stuff which is referred to in the indexical recursive mode is composed homogeneously of the right sort of unit (they are in complete act) such that they are dispositionally equivalent to each other, the disconnection occurs between that which was previously *accepted* within the extension of the term and what is currently *accepted*, and this does not support Churchland's thesis. He knows no better than anyone else whether or not some such referred-to set fails to satisfy the dispositional notions of a natural kind.

Better theories are *better* because they secure an extension more consistent with the original intention, one which parallels the

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that does not actually belong (i.e., it has a different dispositional profile) or vice versa, but these errors are errors of judgement arising out of the lack of omniscience regarding the respective dispositional profiles of things.

notion of natural kinds supported here. One more of Churchland's examples serves to illustrate:

> The extension of the term 'water' has presumably undergone a similar evolution, as very primitive peoples came to experience phase transitions, came to see the poverty in a notion of 'water' that holds 'wetness' to be an essential feature, and came to a broader notion of water that included ice and steam as variant forms of the stuff.[82]

What is confused here are the ontological referent picked out by (a) and (b) (plug in the term 'water'*) and the epistemic conditions which determine acceptance patterns of the ESC *regarding* the extension of 'water'*. There is no necessary evolution in the *extension* of 'water'. What evolves are *acceptance patterns* in response to the term 'water', or better, the *stuff* that is actually referred to by 'water', and this evolution is a product of changing epistemic conditions. That is the answer to question #1, above.[83]

This evolution is just the evolution of acceptance patterns which themselves become the linguistic mapping of the dispositional profile for the stuff we called 'water'. Those terms such as 'party-drink' and 'heavenly crystal', which resist such an evolution (not that they were seriously entertained as possible natural kinds), turn out not to have been natural kinds—they were not referred to in the appropriate way, that is all.

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82 Churchland, (1985), 4. cf. Mellor 2 discussion, above, pp.

83 p.105. This response obviates the need tc respond to question #2.

Concluding Remarks

The task of this thesis has consisted primarily in articulating a robust notion of what it is that we could mean when we talk about natural kinds. This robust notion is, as it ought to be, compatible with notions in the literature; however, it should also be defensible against the anti-essentialist arguments that have hitherto denied the possibility of natural kinds. We have ended up with an account that does not conceptually rely upon essential properties (aka theoretical micro-descriptions) to support the extensions of putative natural kind terms;[84] natural kinds are *natural kinds* in virtue of the fact that their members participate in the same dispositional profile and that they are continually in complete act. These dispositional profiles are relatively non-mysterious and should not frighten even the most positivistic at heart. It is, after all, the mystery, which I suspect motivates the authors cited here to combat essentialism and its concomitant, natural kinds.

As long as this dispositional conception of natural kinds is borne in mind, the arguments presented here do not dislodge the possibility of natural kinds nor even the rationality which takes their possibility seriously:

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[84] Though, in the end, it is supposed that it is microstructures which are the most likely candidates to meet the requirements of being a natural kind, mostly because macroscopic entities are just manifesting a fraction of the dispositional profile of the thing at hand (as are the microstrucures), and alternate displays are not adequately included in the meaning of the term. For instance, 'water' does not normally refer to all the alternative displays which the stuff, namely H_2O or whatever, is prone to display under various conditions.

(Mellor **1**) {a} If XYZ is discovered then 'water' will just refer to more than one microstructure. So be it: a theory about natural kinds does not need 'water' to refer to a natural kind. {b} If XYZ is discovered then it and H_2O together make up the natural kind 'water'. This is necessarily false under this conception: XYZ might be a natural kind and H_2O might be a natural kind, but 'water', if {a} obtains, is definitely not a natural kind.

(Mellor **2**) {a} A particular, "essential" property (microstructure) might necessarily be present for all instances of a kind, but the force of necessity comes from the nature of identity, a thing is necessarily identical with itself. Other, macroscopic, properties are not identical with the kind they predicate. {b} There are good reasons, though, for rejecting the essential property/natural kind relationship, if only to clear up the above confusion, and to simply construe the essential property as the kind at hand, and to then understand the hitherto construed kind as only a special case of the kind.

(Mellor **3**) Manifest macroscopic properties do not necessarily accompany a kind across all possible circumstances because they are only part of the dispositional profile of the kind, whereas the micro-structure (on the current interpretation) just is the kind.

(de Sousa **1;1.1**), Because micro-structures (MS) themselves might have explanatory micro-micro-structures (MMS) it does not follow that MS do not constitute a natural kind. All that is required is that, for all members of specified MS, each must stably have the same dispositional profile. It just so happens that at the MS level of

description the right sort of unit in which the members can stably share dispositional profiles begins to emerge.

(de Sousa **2;2.1**) Functional kinds might form interesting and explanatorily useful sets, but they should not be confused with natural kinds. More to the point, they need not, and should not, be construed as the same kind of kind. Such a construal is bound to be a "strawkind" and not very useful for a serious discourse on natural kinds. Showing a putative natural kind to be merely a functional kind does not affect the conception of natural kinds; it can only show that the putative kind is not a natural kind.

(Churchland **1**), Churchland argues, or rather presumes, that the notion of "same substance" is theory-laden,[85] and so, a change of theory gives rise to a whole new catalogue of natural kinds. But it is argued here that the notion of "same substance" is separable from any particular physical theory, and that, indeed, it is this very notion of sameness which serves as an integral component for the possible discovery that a theory might be wrong.

So, not only are natural kinds objects worthy of rational belief, the intuitions which underwrite this worthiness are entrenched in the project of empirical knowledge generally.

I do not presume that the natural kinds postulated here are the only kinds of kinds that populate the world, but think that they are a special kind of kind. Membership in such a kind requires that the

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85 That is, in any theory which contemplates the notion "same substance", the notion is inextricably imbedded in that theory.

entire nature of each member be the same as every other member. It has been hitherto commonplace to think of theories of natural kinds as "carving nature at its joints" in an objective way.

This account neither requires nor appeals to any such procedure or metaphor. All that is needed is that we take "natural" in "natural kind" to refer neither to nature *holus bolus*, nor to some "natural" account, but to the *nature* of the members, in their entirety, as being the sole guarantor of membership in a set. It is this "entirety" aspect which the dispositional profiles are meant to capture. All other kinds will have at least one of the following aspects: either their members will have an historical component, i.e., part of their manifesting properties, P, will be due to some past dispositional reciprocation, as in the case of cd's, or the membership of their members will be determined by only a subset of the dispositional profiles of each of its members, as in the case of functional kinds.

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