Why must a duplicate of an electron be an electron?

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What is a nominalist theory of properties?

Nominalism about properties:
 Fundamentally speaking, nothing is a property.

What might a nominalist "theory of properties" be?
- An explanation of (non-fundamental) talk about properties.
- An alternative strategy for explaining the things opponents of nominalism use properties to explain.

What might properties explain?

Realist analyses of some kinds of similarity:

(D) x and y are duplicates $=_{df}$ there is an isomorphism π from the parts of x to the parts of y, such that $\pi(x) = y$.

(Q) x and y are qualitatively indiscernible $=_{df}$ there is a *global* isomorphism π such that $\pi(x)=y$.

(R) π is an isomorphism $=_{df}$

  (i) $\pi(x) = x$ whenever x is a property or relation

  (ii) $\pi(x)$ instantiates $\pi(p)$ iff x instantiates p

  (iii) $\pi(x)$ bears $\pi(r)$ to $\pi(y)$ iff x bears r to y, etc.

What can nominalists offer in place of these?

Why should we want an analysis at all? To explain necessities like (E1) and (E2):

(E1) Necessarily, whenever x and y are duplicates and x is an electron, y is an electron.

(E2) Necessarily, whenever x and y are qualitatively indiscernible and x is an electron, y is an electron.

For the Realist, there is a wide range of conceivable analyses of 'electron' which, together with (D) and (R), would explain (E1):

> To be an electron is to instantiate *electronhood*

> To be an electron is to have two parts which instantiate *P* and stand in relation *R*.

The range of conceivable analyses which would explain (E2) is even wider.

The list strategy

(L) π is an isomorphism $=_{df}$
   (i) π(*x*) is an electron iff *x* is an electron
   (ii) π(*x*) is straight iff *x* is straight
   (iii) π(*x*) intersects π(*y)* iff *x* intersects *y*
   ... and so on.

Two versions of the list strategy

Short List: All the predicates on the list apply to some things and not to others. (Maybe they are the predicates of some ideal physics.)

Long List: the list is infinite; most of the predicates on it apply to nothing or everything. (They include the predicates of merely possible physics.)

Short List and some surprising necessities

Alien Properties Premise: Things could be discernible without being discernible in any respect in which things *actually* are discernible.

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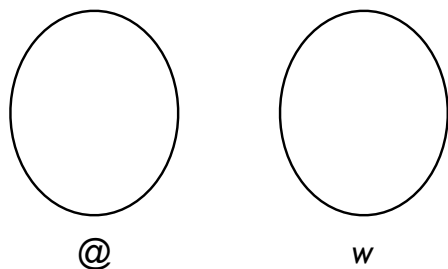
Two worries about Long List

(i) *Strong Alien Properties Premise: Necessarily,* the respects in which things are discernible are such that possibly, things are discernible without being discernible in those respects.

   (There is no 'maximally variegated world'.)

- What explains this impossibility?
- Can we really understand predicates whose analysis can only be given in a language that it's in principle impossible for anyone to speak?

(ii) Necessarily, no matter how many things there are, it is possible that there be that many things no two of which are duplicates.

The structural strategy (natural class version)

(N) π is an isomorphism $=_{df}$ for every natural class C and object x, $\pi(x) \in C$ iff $x \in C$.

How do we use this to explain necessities like (D) and (Q)?

- x is an electron $=_{df}$ x belongs to a natural class that "plays the electron role".

Surprising necessities and the structural strategy

Whatever "the electron role" is, it will turn out to be necessary that if there are any electrons, the class of electrons plays the electron role.

- If the role is abstracted from some physical theory T, it will be necessary that if there are electrons, T.
  For example: it is necessary that electrons generally repel each other.
- Conflicts with widely-endorsed "Humean" claims about possibility.
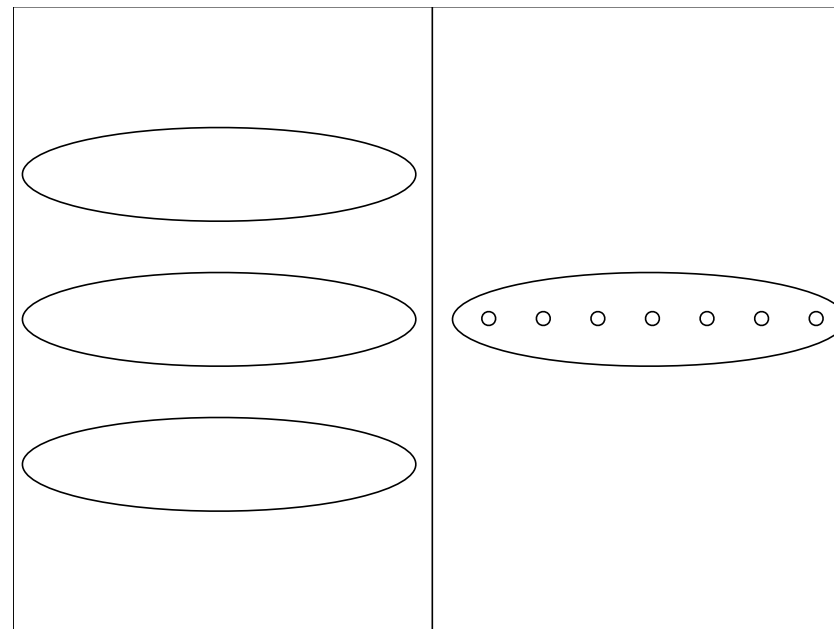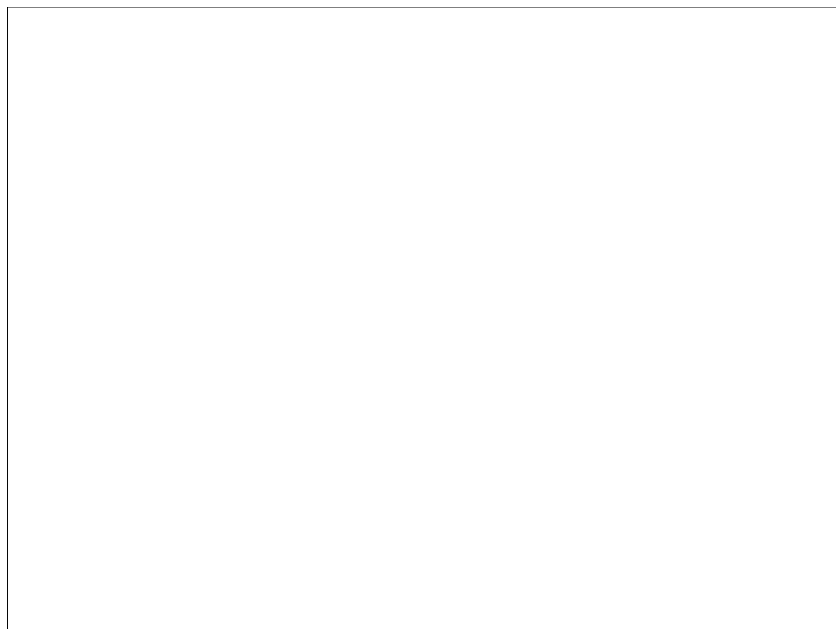
Worry 1: symmetric laws

It would be nice if we could set up the analyses so that the truths that turned out to be metaphysically necessary were all uncontroversially *nomologically* necessary.

- But if there are natural classes that play symmetric roles in the laws of nature—e.g. the electrons and the positrons—this won't be possible.
- To distinguish electrons and positrons, we may need to include facts like 'there are many more electrons than positrons' in the theory from which we read off the 'electron role'.

Worry 2: ontology of classes

What are 'classes', and what are they doing in a 'nominalist' theory?

- Solution: replace talk of classes-as-entities with plural talk. *Some things* are, collectively, natural.
- G. Boolos: plural talk is not talk about some special *entities* like 'classes'.

Worry 3: relations

Much of the interesting structure of the world, which isomorphisms must preserve, is *relational* structure. This is not captured just by specifying which things are and are not collectively natural.

- Solution 1: Let 'natural' apply to terms which stand to plural terms as polyadic predicates stand to monadic predicates.
- Solution 2: Let 'natural' apply to terms which stand to plural terms as plural terms stand to singular terms.

- Problem with solution 1: It seems necessary that if Natural(R), then Natural(converse of R). How is this to be explained?

- Problem with solution 2: isn't it unacceptably arbitrary to stop at the third order? Or anywhere else?