

# Structuralism as a Grounding Thesis

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**Structuralism:** “the structure is in some sense prior to the individuals”.

Even the identity and individuality of objects depends on the relational structure of the world (Ladyman and Ross, *Everything Must Go*, p. 130).

Individuals are nothing over and above the nexus of relations in which they stand (*ibid* p. 138).

Relational structure is ontologically more fundamental than individual objects (Ladyman, *On the Identity and Diversity of Objects in a Structure*, p. 24).

## 1 Structuralism and Ground

**Structuralist motivation:** if the individuals were prior to the structure they would be “superfluous structure”.

*Individualistic facts* are those that concern particular individuals. *Qualitative facts* are those that concern the distribution of qualitative properties and/or relations without concerning which individuals instantiate them.

**A structuralist template:** Individualistic facts (if such there be) are *grounded in* qualitative facts (but in such a way as to make sense of symmetries!)

What structuralism is *not*:

- Individualistic facts supervene on qualitative facts.
- Individuals are individuated by their role in the structure (if individuation is understood modally).
- Individuals ontologically depend on the structure.

## 2 What Are the Qualitative Grounds?

If structuralism is a claim about what grounds what, it's absolutely vital that we are given a theory of *what the grounding facts are like*.

### Algebraic Structuralism:

- The fundamental ontology is a collection of primitive n-place relations. It includes  $I^2$ , the 2-place relation we ordinarily understand as holding between  $x$  and  $y$  if and only if  $x$  is identical to  $y$ .
- Complex n-place relations are then built as follows. Let  $P^n$  be the n-place relation we ordinarily understand as holding of individuals  $x_1 \dots x_n$  if and only if  $\phi(x_1 \dots x_n)$ . And let  $Q^m$  be the m-place relation we ordinarily understand as holding of individuals  $y_1 \dots y_m$  if and only if  $\psi(y_1 \dots y_m)$ . Then
  1.  $\sim P^n$  is the n-place relation we ordinarily understand as holding of  $x_1 \dots x_n$  if and only if it is not the case that  $\phi(x_1 \dots x_n)$ ;
  2.  $(P^n \ \& \ Q^m)$  is the  $\max(n, m)$ -place relation that we ordinarily understand as holding of  $x_1 \dots x_k$  if and only if  $\phi(x_1 \dots x_n)$  and  $\psi(x_1 \dots x_m)$ , where  $k = \max(n, m)$ ;
  3.  $\sigma P^n$  is the n-place relation we ordinarily understand as holding of  $x_1 \dots x_n$  if and only if  $\phi(x_n x_1 x_2 \dots x_{n-1})$ ;
  4.  $\iota P^n$  is the n-place relation we ordinarily understand as holding of  $x_1 \dots x_n$  if and only if  $\phi(x_2 x_1 x_3 \dots x_n)$ ;
  5. If  $n \geq 1$ , then  $cP^n$  is the  $(n-1)$ -place relation that we ordinarily understand as holding of  $x_2 \dots x_n$  if and only if there is something  $x_1$  such that  $\phi(x_1 \dots x_n)$ ; otherwise  $cP^n$  is the 0-place relation  $P^n$ ;
  6.  $pP^n$  is the  $(n+1)$ -place relation that we ordinarily understand as holding of  $x_1 \dots x_{n+1}$  if and only if  $\phi(x_2 \dots x_n x_{n+1})$ .
- The fundamental facts of the world are all of the form

$P^0$  obtains

where  $P^0$  is constructed out of primitive relations in the above way.

**Interesting Consequence:** There is only one fundamental fact, the World Fact!

**Limitation:** If there are infinitely many objects, the above approach would need an algebratizations of an infinitary logic. (Help!)

### 3 How Are the Individualistic Facts Grounded?

Logical form of grounding facts:

the X ground Y

where X and Y range over facts and X is a plural variable.

*Singularism:* Y is a singular variable.

*Pluralism:* Y is a plural variable.

**Structuralism:** Let  $I$  be the set of all individualistic facts. Let  $Q$  be the set of all fundamental qualitative facts (i.e. the singleton containing the World Fact!). Then:

The members of  $I$  are grounded in the members of  $Q$ , though no member of  $I$  has a ground on its own.