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Editorial

On the transitivity of functional parthood

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1. Introduction

This paper aims to give an analysis of some aspects of the relation of "functional parthood". Assuming there is such a concept as "... parthood" entails adopting the view that there are several part-whole relations. This view has been defended in linguistics (Lyons, 1977; Cruse, 1986) and psycholinguistics (Winston, Chaffin, & Herrmann, 1987; Iris, Litowitz, & Evens, 1988). It has been acknowledged as well in formal ontology (Simons, 1987; Casati & Varzi, 1999), even though this discipline focuses on mereology, that is, the study of general parthood.

Functional parthood departs from general parthood in requiring that there is some sort of functional link between the part and the whole. This relation has been called in a number of ways, e.g., "component-integral object" in Winston, Chaffin, & Herrmann (1987) or "functional component" in Iris, Litowitz, & Evens (1988). Most descriptions focus on the facts that the part "plays a role" in the whole and that both part and whole are conceived as "integral objects" – i.e., as presenting a clear unity due to a specific function and/or topological properties.[1] Examples are usually given in the domains of artifacts (e.g., *the engine is part of the car*) or biological entities (*this cell is part of the heart*). In this paper, the discussion will be restricted to relations between material objects, as are biological organisms and many artifacts, although it is by no means clear that functional parthood does not apply to other ontological domains as well.[2]

My analysis of functional parthood (*FP*) follows the ϕ-part pattern introduced in Casati & Varzi (1999): $FP(x, y) \equiv P(x, y) \wedge \phi(x, y)$, that is, functional parthood is P, the mereological relation, restricted in some suitable way. A few comments on P are in order before we proceed. I will assume very few properties, so that there is no need here to specify which mereological theory I choose for P. I certainly need transitivity, but I do not use antisymmetry.[3] On the other hand, for reasons that will

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[1]For other properties of "componenthood", which is arguably a very similar relation, see (Bittner & Donnelly, 2005).

[2]For instance, it could be argued that there are functional links between substances (yeast and dough), perdurants (a battle and a war), and even immaterial objects (the interior of the drawer and the interior of the closet).

[3]It can be argued that interpreting P as spatio-temporal inclusion instead of general parthood would do. In that case, identity has to be substituted with an equivalence relation of co-location in the antisymmetry axiom.

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become clear in Section 3, I insist on adding a third argument, time.[4] The general pattern is thus $FP(x, y, t) \equiv P(x, y, t) \wedge \phi(x, y, t)$. We will nevertheless see in Section 3.1 that I will technically work with a quinary *FP* relation. However, this increase in arity does not stem from an argumentation similar to that of Johansson in (Johansson, 2004). In fact, the relation studied in the present paper would probably still be considered along with binary relations by Johansson, because none of the additional arguments are of the same type as the part and the whole.

The focus of this paper is on the transitivity of functional parthood, an old standing issue. It is suggested in Casati & Varzi (1999) that according to the nature of the ϕ-constraints imposed on top of the mereological relation, each ϕ-part relation may be transitive or not. The ϕ-part relation corresponding to functional parthood is not analyzed any further and is simply assumed not to be transitive. However, as we will see shortly, matters are more complex. Studying what exactly is the relation ϕ in the definition of *FP*, and the analysis which explains the transitivity patterns exhibited by functional parthood is the object of this paper.

Generally, I tend to take many insights from linguistic observations, which can be seen at best as a bias and at worst as having nothing to do with ontology. Some take "is a part of" as the characteristic expression for this relation. Genitive constructions, like *the handle of the door*, *the carburetor valve* or *John's nose*, and other possessive constructions based on "has a" are also very much used. Nevertheless, I do not intend to focus on any specific kind of linguistic expressions, and will usually use the more neutral "is part of" for giving examples of functional parthood. For a general study of expressions describing part-whole relations in English and French see Iris, Litowitz, & Evens (1988), Aurnague (2004).

2. The transitivity issue

In the famous work of Winston, Chaffin, & Herrmann (1987) it is held that each part-whole relation is transitive; intransitivities are supposed to occur when two different relations are mixed. Although attractive, this thesis is too simple, as several relations are not themselves transitive (e.g., "member–collection" is never transitive) and "mixed transitivities" do exist (e.g., between "member–collection" and "subcollection–collection"); the case of functional parthood analyzed in the present paper also shows that the situation is far more complex. In Winston, Chaffin, & Herrmann (1987), functional parthood, named "component–integral object", was thus assumed to be transitive, although this was already controversial at the time. As early as 1977, Lyons had shown that *FP* is in some cases transitive and in others not, comparing the two examples (1) and (2) (Lyons, 1977):

(1) *The house has a door and the door has a handle but the house does not have a handle.*
(2) *The jacket has a sleeve, the sleeve has a cuff, and the jacket has a cuff.*

Cruse tried to explain this difference on the basis of the notion of "functional domain": the functional domain of the handle is restricted to the door, while that of the cuff, by its embellishment role, encompasses the whole jacket (Cruse, 1986). To explain similar cases, Moltmann introduces the somewhat related idea of contextualizing the notion of "integral whole" (Moltmann, 1997). If, in a given "situation" s in which both x is part of y and y is part of z, y (e.g., in (2), the sleeve) is not considered as an integral whole, then the inference goes through and x is part of z in s. On the contrary, if y is considered as an integral whole in s (e.g., in (1), the door), the inference is blocked. Such explanations are not totally satisfactory because, apart from the fact that it is not trivial to formally characterize the notions

[4] The temporal argument is redundant in a 4D perspective, but I want to remain neutral on this issue here.

of functional domain, integral whole[5] or situation, they appear to fail to explain examples in which the transitivity goes through:

(3) *The carburetor is part of the engine, the engine is part of the car and the carburetor is part of the car.*

In (3), there is no obvious reason for a carburetor to have a functional domain including the car, nor for the engine to be a non-integral whole, or at least a "less" integral whole than a door in the situation in which the door is part of the house.

I follow Cruse and Moltmann in trying to acknowledge the fact that there are both cases of transitivity and cases of non-transitivity of *FP*, but propose a new account. Before getting into the details, let us observe that there is a simple way to turn the famous example (1) into a case of transitivity:

(1′) *The house has a door, the door has a door handle, and the house has a door handle.*

This observation suggests that *FP* holds when it is possible to recover from the terms used what is the functional link between the part and the whole. Here, changing "handle" in "door handle" contributes to specifying what is the role of the handle with respect to the house, i.e., a component of a door, which is (assumed to be) a component of the house.

3. A formal account of functional parthood

3.1. The approach

The first key idea is therefore to consider that the notion of function involved in *FP* is in fact attached to the terms – or the lexical categories – used to denote the part and the whole. This has several implications:

(i) The actual functional properties of the entities related by *FP* are less relevant than the functional properties typically associated to the lexical categories. This explains why the truth of a statement like *the engine is part of the car* does not depend on the fact that the engine or the car could be broken;

(ii) *FP* does not simply relate the entities that are the part and the whole, but "entities-as-a-lexical-category", i.e., entities from a given descriptive point of view. To implement this, I use a first-order framework in which lexical categories are reified (Masolo et al., 2004) and assume that the relation *FP* is not binary (or ternary, considering that time is taken into account), but quaternary (or in fact, quinary). For instance, the logical form of *the engine is part of the car* is $FP(x, Engine, y, Car, t)$;

(iii) Changing the terms used to denote the part and the whole changes the acceptability of the phrase or sentence. This explains why from the acceptability in French of *la tête du lit* (*the bed-head*), the acceptability of ??*la tête du meuble* (*the head of the piece of furniture*) does not follow, as required.[6]

[5] Simons proposes for instance to rely on some dependence relation between the parts to define an integral whole as a maximum sum of interdependent entities (Simons, 1987). With such a definition, simply no integral whole can be part of another integral whole.

[6] When there is a clear taxonomic relation between categories, as between *bed* and *piece of furniture*, there is no doubt that the entities denoted are identical, as opposed with cases like *bed* and *piece of wood*. That **la tête du morceau de bois* (*the head*

The second step is to analyze the functional link between "entities-as-a-lexical-category" involved in *FP* in terms of some kind of dependence relation (of the part on the whole or of the whole on the part), which I call "functional dependence". Functional dependence between a part and a whole states that the part plays a role within the whole, but does not explain what exactly is this role. This yields quite a weak notion of function,[7] but as we will see, it is powerful enough to explain transitivity patterns.

Studying dependence between parts and wholes is certainly not a new idea, as it dates back at least to Husserl (1970). The notion usually invoked is specific or generic existential dependence. I take it that in most examples under consideration here, parts are not essential to their wholes (but see Chisholm, 1973; Simons, 1987). In addition, there are cases in which there is no generic existential dependence between parts and wholes: *FP* may hold between a handle and a door while handles can exist without a larger whole, e.g., as detached parts in a store, and doors can exist without handles. I hold that what we need to consider is whether the entity-as-a-X to be "functioning as a X", requires the existence of some entity which is a Y and is "functioning as a Y". "Functioning as a X" refers to the fact that, at a given time, the entity is actually displaying a X function, the function generally expected for it to be described as a X. As explained in Cummins (1975), function is to be distinguished from local behavior: an engine "working" flawlessly on its own, e.g., while laying on some workshop table, is not functioning as an engine; to be functioning, the working power produced by the engine needs to be used by some larger machine. In addition, functioning does not refer to the disposition of being "functional as a X", that is, the modal property that an entity has on the basis of regularities in behavior under certain circumstances. For instance, while my car is parked on the street, it is not functioning as a car, whereas while I drive it, it is functioning as a car. Referring to the function actually displayed avoids dealing with the nature of modalities and conditionals involved in dispositions (Mumford, 1998).[8]

We then get two possible functional dependences: the dependence of the part on the whole, as in *the cuff is part of the sleeve* (all cuffs functioning as cuffs require some sleeve functioning as a sleeve), and the dependence of the whole on the part, as in *the wall is part of the house* (all functioning houses have functioning walls). The picture gets more complex as we also need to consider "indirect" functional dependence. For instance, *FP* between a handle and a door refers to the functional dependence between handles and, not doors, but more generically, "objects that can be moved or used by hand", a category[9] subsuming *door*. Similarly, engines are not directly functionally dependent on cars, but on machines. There are thus four different cases of *FP*: direct1 and indirect1 for part dependent on whole, and direct2 and indirect2 for whole dependent on part. The four categories are often combined, as in *the engine is part of the car* (both *FP-I1* and *FP-D2*, taking *car* in its sense of *automobile*).

of the piece of wood) is ruled out can be explained by the fact that different referents, of different ontological categories, are involved.

[7] This notion surely is much weaker than what is proposed in the literature on function in philosophy of biology (Allen, Bekoff, & Lauder, 1998). Reusing such notions for our purpose is not straightforward. Etiological approaches (e.g., Millikan, 1989) have difficulties in getting extended beyond organisms to artifacts, while it can be argued that *FP* applies indifferently to both domains. Behavioral approaches (e.g., Cummins, 1975) assume a notion of component within a system, which makes it dubious to be able to define *FP* on this basis on pain of circularity.

[8] A weakness of this proposal arises if one needs to take into account complex functions. It is very unlikely that a Swiss knife displays at the same time all dispositions that it has to possess for it to fall under the description "a Swiss knife". Similarly, birds do not fly and lay eggs simultaneously, and motorhomes are not generally used for cooking and driving simultaneously. Defining expected behavior may also be difficult. I can consider that my car is properly working while its CD player is off or even broken; the issue is less clear when I am driving with a flat tire, although I am still being transported by the car. Although "Functioning as" is clearly a vague concept, it surely requires further investigations, and this proposal further refinements.

[9] Such categories are not really "lexical", at least in English, since there is no noun denoting them. However, they are *lexically relevant* categories, since they are involved in the semantic characterization of some noun.

Let us now see how such a functional dependence can be formally characterized and the four types of *FP* defined.

3.2. Functional dependence and the four cases of FP

I start from a definition of generic existential dependence (*GD*) between categories, modifying slightly[10] the proposals of Simons (1987), Fine (1995) and Masolo et al. (2003): the category X is generically dependent on the category Y if and only if necessarily the existence of a X implies that of some Y. For example, human beings are dependent on carbon atoms, holes and shadows are dependent on material entities. The precise nature of the alethic modality and that of the existence predicate (the existential quantifier will obviously not do here) is certainly debatable, but here, I assume a S5 modality $\Box$ and a temporalized existence primitive E. I use the "classified as" predicate *CF* as axiomatized in Masolo et al. (2004) to represent the fact that an individual exists and is an instance of a category at a given time.

$$\begin{aligned} \mathit{GD}(X,Y) \equiv \Box\forall x,t\ \big(\mathit{CF}(x,X,t) \rightarrow \exists y\ \mathit{CF}(y,Y,t)\big) \wedge \Diamond\exists x,t\ \mathit{CF}(x,X,t) \\ \wedge \neg\Box\forall t\exists y\ \mathit{CF}(y,Y,t).^{11} \end{aligned}$$

A few comments on *CF* are in order. The time involved in *CF* is a time at which x satisfies the conditions for it to be (or to be described as) a X. *CF* does not depend on an observer or anyone who decides to classify x as a X;[12] no classification event/time is therefore involved. No assumption is made regarding the fact that for X to classify x, x must be capable of functioning as a X; the proposal is compatible with the view that a broken car is a car. Finally, in the axiomatics of *CF*, classification implies existence, i.e., $\mathit{CF}(x,X,t) \rightarrow E(x,t)$.

Inserting a predicate "functioning as" into the definition of *GD* yields generic functional dependence *GFD*. As argued above, *GFD* is involved in *FP*, but it can be found as well in other cases, e.g., radio receivers functionally depend on radio emitters and compasses on magnetic fields:

$$\begin{aligned} \mathit{GFD}(X,Y) \equiv \Box\forall x,t\ \big((\mathit{CF}(x,X,t) \wedge\ \mathit{Functioning}(x,X,t)\big) \rightarrow \exists y\ \big(\mathit{CF}(y,Y,t) \\ \wedge\ \mathit{Functioning}(y,Y,t)\big)\big) \wedge \Diamond\exists x,t\ \big(\mathit{CF}(x,X,t) \wedge \mathit{Functioning}(x,X,t)\big) \\ \wedge \neg\Box\forall t\exists y\ \big(\mathit{CF}(y,Y,t) \wedge \mathit{Functioning}(y,Y,t)\big). \end{aligned}$$

I assume the following simple axioms on the primitive *Functioning*, where $\subseteq$ is the mereological parthood on times[13] and *Subclass* is defined on *CF* by: $\mathit{Subclass}(X,Y) \equiv \forall x,t(\mathit{CF}(x,X,t) \rightarrow \mathit{CF}(x,Y,t))$.

$$\big(\mathit{Functioning}(x,X,t) \wedge t' \subseteq t\big) \rightarrow \mathit{Functioning}(x,X,t'),$$

[10] One modification is a weakening into a reflexive relation, not requiring that y be different from x. Avoiding trivial cases of dependence, as does the standard definition, is not required for our purposes, though it of course might be in other cases.

[11] The language used is a sorted first-order logic with one modality. Uppercase letters are variables ranging over reified categories, and lowercase letters over standard individuals. $\equiv$ is the syntactic relation of definition.

[12] The possible dependence on a cognitive or social entity lies in the existence and definition of the category X itself. Once this category X is defined, that x is classified as a X, i.e., that X classifies x, is an objective fact; it depends only on x having or not the properties required by the definition.

[13] I assume extended times (intervals or sums of intervals). Any version of mereology is adequate for parthood on times. Only the concern of not making unnecessary assumptions justifies the use of $\subseteq$ instead of P.

$\big(\textit{Functioning}(x, X, t) \wedge \textit{Subclass}(X, Y)\big) \rightarrow \textit{Functioning}(x, Y, t)$[14].

On the basis of the properties of the modal operator $\Box$ and these axioms, it can be proved that *GFD* is transitive and that *GFD* propagates from classes to superclasses – provided the superclass is not necessarily always instantiated.

(T1) $\big(\textit{GFD}(X, Y) \wedge \textit{GFD}(Y, Z)\big) \rightarrow \textit{GFD}(X, Z)$,

(T2) $\big(\textit{GFD}(X, Y)\big) \wedge \textit{Subclass}(Y, Z) \wedge \neg\Box\forall t\exists x\big(\textit{CF}(x, Z, t)\big) \rightarrow \textit{GFD}(X, Z)$.

The functional link involved in a *FP* relation between an entity x-*as-a*-X and an entity y-*as-a*-Y refers to the generic functional dependence between their lexical categories X and Y, but in addition, there is some specific link between x and y that needs to be introduced. "Individual functional dependence" between x-*as-a*-X and y-*as-a*-Y at some time t is thus defined:

$$\textit{IFD}(x, X, y, Y, t) \equiv \textit{GFD}(X, Y) \ \wedge \ \textit{CF}(x, X, t) \ \wedge \ \textit{CF}(y, Y, t) \\ \wedge \forall t'\big(\big(t' \subseteq t \ \wedge \ \textit{Functioning}(x, X, t')\big) \rightarrow \textit{Functioning}(y, Y, t')\big).$$

IFD requires that x and y are respectively classified as a X and a Y at time t, but it does not imply that x and y must be functioning (as a X and as a Y respectively) at time t; the conditional only states that if x is functioning at some time during t, y must be functioning as well. So a car can be individually functionally dependent on its engine even though it is at times parked with the engine off, or even if the engine is broken and the car cannot run.[15]

Then, "indirect individual functional dependence" is defined:

$$\textit{IIFD}(x, X, y, Y, t) \equiv \textit{CF}(y, Y, t) \wedge \exists Z\big(\textit{Subclass}(Y, Z) \wedge \textit{IFD}(x, X, y, Z, t)\big).$$

Of course, we have as a theorem:

(T3) $\textit{IFD}(x, X, y, Y, t) \rightarrow \textit{IIFD}(x, X, y, Y, t)$.

We are now in the position to define the four cases of the *FP* relation. In all cases, a *FP* between x-*as-a*-X and y-*as-a*-Y at time t requires that both x and y are material objects[16] and that x is a proper part of y during t.[17]

$$\textit{FP-D1}(x, X, y, Y, t) \equiv \textit{PP}(x, y, t) \wedge \textit{Obj}(x) \wedge \textit{Obj}(y) \wedge \textit{IFD}(x, X, y, Y, t),$$

[14]This axiom should be adapted to deal with typicality and non-monotonicity correctly. For instance, to accommodate the existence of penguins, if functioning as a bird entails flying.

[15]This account of functional dependence is in principle not restrictive enough, since if x is flawed and never functions as a X during t, the conditional is true for any y. Some kind of causal connection between x and y is missing. However, for our purposes – the definition of *FP*, a connection will be partially guaranteed by a mereological relation *PP* between x and y. This is not a causal connection, but it excludes most irrelevant entities.

[16]The focus in this paper is on material objects. If it turns out that the analysis is also valid for other ontological categories, then to account for the category segregation of part-whole relations (cross-category relations have to do with constitution or location instead of parthood), we could simply replace the second and third atoms by *Same-Category*(x, y).

[17]As stated earlier, any version of mereology can do for our purposes. The relation used is proper part for the simple reason that part-whole expressions in natural language generally exclude identity cases. *My car is part of my car* cannot be uttered in a standard context.

$$\textit{FP-D2}(x, X, y, Y, t) \equiv \textit{PP}(x, y, t) \wedge \textit{Obj}(x) \wedge \textit{Obj}(y) \wedge \textit{IFD}(y, Y, x, X, t),$$

$$\textit{FP-I1}(x, X, y, Y, t) \equiv \textit{PP}(x, y, t) \wedge \textit{Obj}(x) \wedge \textit{Obj}(y) \wedge \textit{IIFD}(x, X, y, Y, t),$$

$$\textit{FP-I2}(x, X, y, Y, t) \equiv \textit{PP}(x, y, t) \wedge \textit{Obj}(x) \wedge \textit{Obj}(y) \wedge \textit{IIFD}(y, Y, x, X, t).$$

4. (In)Transitivity of *FP* explained

On the basis of the transitivity of the mereological relation *PP* and the formal properties of functional dependence – in particular (T1) – the following theorems can be proved:

(T4) $\big(\textit{FP-D1}(x, X, y, Y, t) \wedge \textit{FP-D1}(y, Y, z, Z, t)\big) \rightarrow \textit{FP-D1}(x, X, z, Z, t),$

(T5) $\big(\textit{FP-D2}(x, X, y, Y, t) \wedge \textit{FP-D2}(y, Y, z, Z, t)\big) \rightarrow \textit{FP-D2}(x, X, z, Z, t),$

(T6) $\big(\textit{FP-D1}(x, X, y, Y, t) \wedge \textit{FP-I1}(y, Y, z, Z, t)\big) \rightarrow \textit{FP-I1}(x, X, z, Z, t),$

(T7) $\big(\textit{FP-I2}(x, X, y, Y, t) \wedge \textit{FP-D2}(y, Y, z, Z, t)\big) \rightarrow \textit{FP-I2}(x, X, z, Z, t).$

In contrast, the following formulas are not theorems:

(i) $\big(\textit{FP-I1}(x, X, y, Y, t) \wedge \textit{FP-D1}(y, Y, z, Z, t)\big)$
$\rightarrow \big(\textit{FP-I1}(x, X, z, Z, t) \vee \textit{FP-I2}(x, X, z, Z, t)\big),$

(ii) $\big(\textit{FP-D2}(x, X, y, Y, t) \wedge \textit{FP-I2}(y, Y, z, Z, t)\big)$
$\rightarrow \big(\textit{FP-I1}(x, X, z, Z, t) \vee \textit{FP-I2}(x, X, z, Z, t)\big),$

(iii) $\big(\textit{FP-D1}(x, X, y, Y, t) \wedge \textit{FP-D2}(y, Y, z, Z, t)\big)$
$\rightarrow \big(\textit{FP-I1}(x, X, z, Z, t) \vee \textit{FP-I2}(x, X, z, Z, t)\big),$

(iv) $\big(\textit{FP-D2}(x, X, y, Y, t) \wedge \textit{FP-D1}(y, Y, z, Z, t)\big)$
$\rightarrow \big(\textit{FP-I1}(x, X, z, Z, t) \vee \textit{FP-I2}(x, X, z, Z, t)\big).$

(T4) and (T5) tell us that *FP-D1* and *FP-D2* are transitive, but *FP-I1* and *FP-I2* are not (because of ¬(i), ¬(ii) and (T3)). There are also two cases of "mixed transitivities" (T6) and (T7).

So, because of (T6) we can explain why (2) and (3) are examples of transitivity of *FP*, seen as a global relation: any cuff functionally depends on a sleeve, any sleeve functionally depends on a garment, e.g., a jacket, therefore any cuff functionally depends on a garment, e.g., a jacket; any carburetor functionally depends on an engine, any engine functionally depends on a machine, e.g., a car, therefore any carburetor functionally depends on a machine, e.g., a car. Similarly, (4) is an example of transitivity because of (T4), (5) because of (T5), and (6) because of (T7) (any wall depends on some building material, e.g., a brick).

(4) *My hand is part of my arm, my arm is part of my body*, therefore, *my hand is part of my body.*
(5) *This electron is part of this atom, this atom is part of this molecule*, therefore, *this electron is part of this molecule.*

(6) *This brick is part of this wall, this wall is part of the house*, therefore, *this brick is part of the house.*

On the other hand, illustrating the fact that (i) is not a theorem (using (T3)), (1) and (7) are examples of non-transitivity (handle/door is a *FP-I1* case, with "*object that can be moved or used by hand*" subsuming *door* as the required category; door/house is a *FP-I1* case, with "*building, room, vehicle or cupboard*" subsuming *house*; valve/carburetor is a *FP-I1* case, with something like "*fluid-holding device*" subsuming *carburetor*; carburetor/car is a *FP-I1* case, with *machine* subsuming *car*). Similarly for (8) with (iii) (nucleus/cell is a *FP-D1* case, and cell/heart a *FP-D2* one). As for (9), even though the dependence goes both ways for the second premise, the inference does not get through, which corresponds to the fact that (ii) and (iv) are not theorems (heart/circulatory system is a *FP-D1* as well as a *FP-I2* case, with *pump* subsuming *heart*).

(7) One says *the carburetor valve* and *the carburetor of the car,* but not *??the valve of the car*, nor even, avoiding the uniqueness assumption of the definite, *??the car has a valve* or *??this valve is part of the car*.
(8) *This nucleus is part of this cell*, *this cell is part of the heart*, but not *??this nucleus is part of the heart*.
(9) *This cell is part of the heart*, *the heart is part of the circulatory system*, but not *??this cell is part of the circulatory system*.

5. Conclusion

Functional dependence goes a long way in explaining the behavior of functional parthood with respect to transitivity. It accounts at a suitable level of generality for a variety of phenomena. In fact, faced with the apparently chaotic behavior, one could have been tempted to conclude that there is no such a thing as general functional parthood. This would have led to consider many specific ϕ-part relations, of the form "X/Y-part" (e.g. handle/door-part, door/house-part), whose study falls out of the scope of formal ontology proper.

Nevertheless, the notion of function used here is perhaps too general and arguably weak, simply relying on a "functioning as" primitive predicate, very lightly axiomatized. The real functional role of the part within the whole, surely coming in different flavors according to the corresponding pair of lexical categories, remains unanalyzed in this proposal. On the other hand, what is proposed here can be useful to focus a future study of such functional roles on relevant phenomena, eliminating the noise introduced by generic dependences in inferential patterns.

The whole proposal is committed to the existence of some sort of universals. Even though my approach is linguistically-oriented, and I have accordingly proposed to use lexical categories, I believe the proposal can be generalized to socially-dependent categories, that is, not necessarily linguistic. The reference to a society seems needed because of the normative aspects in "functioning as a X". But what exactly are the categories involved surely requires more attention from an ontological point of view, to examine if the reference to some kind of society can be escaped or not (as one may claim that all boils down to laws of nature), and to make clear the relationship between such universals and fundamental ontological categories. At the same time, such a study would probably shed some light on the relationship between functional dependence and notional dependence (Simons, 1987). Finally, I would like to point out that I have separated the arguments in the relations intentionally, referring independently to individuals and

lexical categories, since one may question the existence and the nature of derived individuals such as "entities-under-a-description", i.e., "entities-as-a-X", also called "entities-qua-X" (Anscombe, 1979). If such individuals were given ontological citizenship, as in Fine (1982), FP could be considered a binary relation (with time, ternary).

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