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How an Aggregate View of Social Roles Meets Dispositions

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Abstract

Social roles remain nebulous, although they are vital for an accurate understanding of the socio-economic world. In this paper, we sketch out a dispositional approach to social roles by leveraging F. Loebe's account of social roles that is based on his tripartite classification of roles (relational, processual, and social): that is, social roles "aggregate" various relational and processual roles. More specifically, we articulate the thesis that socially relevant processual and relational roles are intimately connected with intrinsic and extrinsic dispositions, respectively. This aggregate and dispositional view of roles will serve as an initial step towards a full-fledged analysis of social roles and their contexts ("social contexts").

Keywords

social role, social context, processual role, relational role, disposition

1. Introduction

The socio-economic world is replete with roles: money, students, professors, and presidents, to borrow Masolo et al.'s [1] examples, are all based on role. Roles are thus crucial for social ontology. For instance, in the analysis of multiagent systems, enterprise modeling, as well as in formal ontology, it is now well-established to model organizations (whether totally or partially) in terms of interrelations among roles (see Toyoshima's [2] survey of related work). Closely related is the active discussion about status or status entities in social ontology [3][4][5]. Roles nevertheless remain elusive entities and Boella et al. [6] list several open questions about roles, including whether there can be a single overarching definition of roles or not.

Social roles are notoriously difficult to analyze in formal ontology. According to Loebe [7], the challenge of understanding social roles is partly due to the intricacy of the so-called "social contexts" from which they emanate. As Boella et al. [6] point out, one of the most frequently discussed examples of (social) roles is the role of being a student. The social context for this role is often taken to be schools, but it is not clear what it really means to say that schools can serve as a social context for student roles. Moreover, the issue of social contexts is closely connected with the broader problem of how to understand the complicated notion of context, as its relevance to roles in general is widely acknowledged (see, for thoughts, Baclawski et al.'s [8] general discussion on contexts and Toyoshima's [2] meta-ontological (grounding-based) approach to contexts *vis-à-vis* roles).

This paper aims to propose a promising way of considering social roles and their contexts. To achieve this purpose, we take full advantage of Loebe's [7] tripartite classification of roles: relational, processual, and social roles. For one thing, he explicitly theorizes upon roles, their contexts, and their relationship and his approach will be helpful in considering social contexts. As Loebe points out "[t]he contexts of social roles are much harder to grasp" than relational and processual roles (*ibid.*, p. 137), and he concedes that social roles "appear to be the least understood role type" in his model (*ibid.*, p.

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136). At the same time, he propounds the view (which will be detailed below) that “social roles rather aggregate various relational and processual roles” (ibid., p. 137). We call this an “aggregate view” of social roles. This aggregate perspective will suggest one way of explicating social contexts: social contexts can be further elucidated in terms of the contexts for relational and processual roles. We will also utilize an ontology of dispositions [9][10] because they will be useful for scrutinizing the relationships among these three kinds of roles. This dispositional investigation into this aggregate account of social roles can be expected to lay the groundwork for their full-fledged ontology.

The paper is organized as follows. Section 2 introduces Loebe’s [7] tripartite classification of roles: relational, processual, and social roles. Section 3 develops a dispositional formulation of a Loebe-style aggregate view of social roles. Section 4 is devoted to the discussion on related work. Section 5 concludes with the paper with some brief remarks on future work.

2. F. Loebe’s Tripartite Classification of Roles

Loebe [7] provides a general account of roles, including social ones. It is built in alignment with the upper ontology General Formal Ontology (GFO) [11][12], but its general value for considering roles is recognized, e.g., by Guarino [13]. In his basic schema, an entity (*player*) bears the *playing* relation towards a *role* such that the role bears the *role-of* relation with a *context*: for example, Mary (player) plays a role of being a student that bears the role-of relation towards the XYZ school (context) (see Toyoshima’s [2] discussion on different interpretations of the phrases “have a role” and “play a role”). According to Loebe’s classification, roles fall into social roles and abstract roles, the latter being in turn classified into relational roles and processual roles. These three different kinds of roles are individuated according to the different kinds of player categories, playing relations, “role-of” relations, and context categories (see Table 1). Relational, processual, and social roles are briefly explained as follows:

- A *relational role* corresponds to the way in which an entity participates in some relation. As Toyoshima [2] says, the notion of relational role can be understood in connection with a “positionalist” account of relations: roughly, relations have “positions” or “places” or “roles” for the relata. For instance, Abelard’s loving relation towards Heloise can be said to have as part (albeit in a broad sense of the term) the “lover role” occupied by Abelard and the “lovee role” occupied by Heloise.² A relational role is part (in this broad sense) of some relational property and it is a kind of property (refer to Loebe [14] for more thoughts on relations and relational roles). It also depends existentially on the player (the “non-migration principle” about relational roles). *Example*: When the number 2 plays a relational role of being a factor of the number 4, the number 2 bears that property of “being a factor” that is part of the “being a factor of” relation between the number 2 and the number 4. The role is here identified with the property of “being a factor”; playing this role is identified with bearing that property; the context is identified with the relation “being a factor of”; and the relation between this role and this context is a relation of parthood (in a general sense of the term).
- A *processual role* corresponds to the way a single participant behaves in some process. (The term “process” is used in the GFO sense, but it can admit of an intuitive reading.) *Example*: When John plays a processual role of moving his pen, he participates in that “pen-moving process” that is part of the process of John moving his pen. Loebe [7] explains: “When John moves his pen, he and the pen form participants of that process, and the processual role which John plays captures what John does in that participation. Thinking of a mime who moves an imaginary pen should be a good illustration of the notion of a processual role” (ibid., p. 135). The role is here identified with John’s pen-moving process (the “miming-like process” mentioned by Loebe, which does not have the pen as a participant); playing this role amounts to participating to this process; the context is identified

² “The view of *role-of* as subsumed by a general notion of part-of may appear debatable in particular for relational roles and relators, due to the question of what a part of a relator should be. We consider relational roles as homogeneous, “indivisible” entities which form “atomic” parts of relators. Moreover, we conjecture that relators are mereologically extensional with respect to their roles. (...) In spite of this possibly uncommon view, relational roles have definitely found their place in modeling and representation, and there they exhibit the character of parts with relations as their wholes” ([7], pp. 134-135). Note that our discussion below will not hinge much on this potentially contentious view of relational roles as parts of relations.

with the larger process of John moving his pen (which has not only John, but also the pen as a participant); and the relation between the role and the context is a relation of process-parthood.

- A *social role* corresponds to the involvement of a material object within some society. Loebe builds his conception of social roles upon Searle’s [3][4] analysis of social objects to elucidate the playing and role-of relations concerning social roles. (We will henceforth treat the terms “social role” and “social object” synonymously.) For Searle, material objects offer a foundation for social objects and a social object emerges when a new “status-function” is imposed on the material object. He creates a general formula of this “constitutive rule” for social objects: “X counts as Y (in context C)” where X is a material object and Y is a social one. A material entity playing a social role that bears the role-of relation (as Loebe calls it) towards a context would correspond to the material entity “counting as” the social role “in” the context. A social role is, very roughly, a kind of object that has all properties of the player, but that also has some additional properties which the player does not. As said, a context for a social role is difficult to analyze and Loebe categorizes loosely as a “social individual”, as illustrated by the XYZ school. For example, when Mary plays the social role of being a student of the XYZ school, she “counts as” that student “in” the XYZ school. Here, the role is the object that has the same properties (e.g., shape) as Mary does but that has additional properties (which would be grouped under the name of “student-ness”) which Mary does not have; the relation of Mary playing this role is identified with the relation of Mary “counting as” this object; the context is the XYZ school; and the “in” relation between the role and the context is still unclear because so are social roles and their contexts, as Loebe says: “Currently, we stick to the phrase ‘belonging to a (social) context’ for role-of in the social case” ([7], p. 136).

Table 1

Relational, processual, and social roles (based on Loebe’s [7] Table 2 on p. 137)

Player category	Playing relation	Type of role	Role category	role-of relation	Context category
entity	property-bearing	relational role	property	part-of	relation (instance)
object	participation-in	processual role	process	part-of	process
material object	“(X) counts-as (Y)” [3][4]	social role	object	“in (Context C)” [3][4]	social individual

As for social roles, Loebe [7] discusses an intimate connection between social roles and abstract roles, while surmising that a meticulous analysis of social roles will require a full-fledged theory of social ontology (see Section 3.4 for preliminary thoughts). Social roles are often defined with their own properties, relations and processes in which they (may) participate. For example, Mary’s social role of being a student of the XYZ school would pertain to Mary’s inherent properties (e.g., her abilities), her “student-teacher relation” towards schoolteachers, and processes of her taking classes at school. In other words, Mary’s playing this role of being a student is underpinned by her playing relational roles whose contexts are student-teacher relations and processual roles whose contexts are class-taking processes. Accordingly: “social roles rather aggregate various relational and processual roles” (ibid., p. 137; and see also Boella et al.’s [6] statement that relational roles can be “intermingled with” social ones).

To explore this aggregate view of social roles, we will assume that social roles are characterized by a selected group of relational and processual roles that have social import, as exemplified by student-teacher relational roles and class-taking processual roles. Being inspired by Loebe, we say that social roles aggregate “socially relevant relational roles” and “socially relevant processual roles”. Furthermore, we will aim for a minimal characterization of social roles from the viewpoint of an ontology of roles, while leaving serious engagement with their social dimension for future work (see Section 3.4 for a brief discussion).

We will also presuppose that socially relevant processual roles are prior to socially relevant relational roles in the sense that the latter can be elucidated (or may be sometimes defined) in terms of the former, but not *vice versa*. Loebe [7] puts forward the idea that “one route to a stronger theory of contexts could be to reduce certain types of roles to others” and “[r]elations and relational roles may appear suitable in this respect” (ibid., p. 144) because relations can be further analyzed by dint of their “constituents”, namely their *relata* (unless one advocates the very specific idea of “relations without *relata*”, which is off the table in this paper). Certainly, not all relational roles could be connected with processual roles: for instance, a relational role of being a factor of some number would have nothing essential to do with any processual roles. Nonetheless, it would be reasonable to link some relational roles with processual ones, insofar as they figure prominently in the social world because socially relevant relational roles typically involve corresponding processual ones. For example, Mary’s relational role of being a student at school could not exist unless she can play a processual role of taking classes at school. In this direction of inquiry, we will consider socially relevant processual roles (Section 3.2), socially relevant relational roles (Section 3.3), and social roles (Section 3.4) in order. Through this exploration, it is expected that contexts for social roles will be elucidated by contexts (which are relation instances) for socially relevant relational roles and these contexts will be in turn further elucidated by contexts (which are processes) for socially relevant processual roles.

3. A Dispositional Approach for an Aggregate View of Social Roles

3.1. Preliminaries

In the text, we will write terms for type-level entities (universals, classes) in italics and terms for token-level entities (particulars, instances) in bold for expository purposes. In first-order formalization, variables stand only for tokens and free variables are universally quantified. Predicates stand for types (unary predicates) and relations. Figure 1 provides an *is-a* hierarchy of ontological categories with their corresponding unary predicates, where a type *A* being a subtype of a type *B* (which is expressed by the indentation) amounts to the thesis that all instances of *A* are instances of *B*, and is represented by an indentation (for example, the class *Material object* is a subtype of the class *Material entity*).

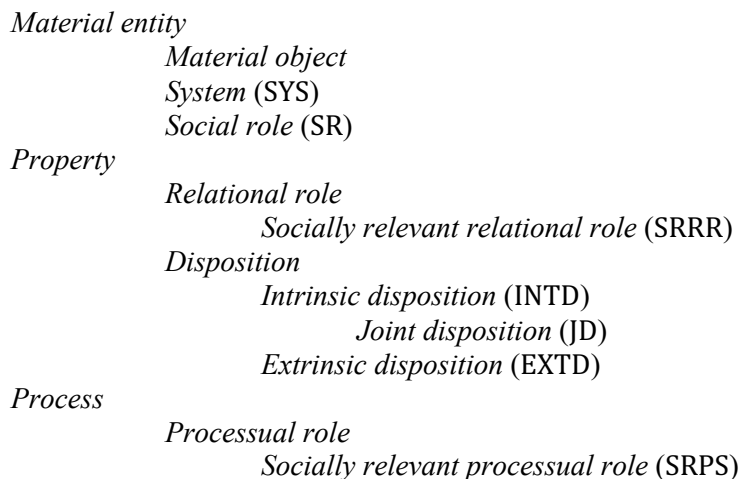


Figure 1: A hierarchy of ontological categories and their associated unary predicates

Table 2 lists relational predicates with their informal explanation.

Table 2
Relational predicates and their informal explanation

Predicate	Informal explanation
BEA(x,y)	x (material entity instance) is a bearer of y (property instance)
GRD(x,y)	x (disposition instance) fully grounds y (disposition instance)
P(x,y)	x (material entity instance) is part (proper or not) of y (material entity instance)
PLAY(x,y)	x (object instance) plays y (role instance)
REL(x,y)	x (disposition instance) is realized in y (process instance)
REON(x,y)	x (extrinsic disposition) relies existentially on y (intrinsic disposition)

To examine Loebe’s aggregate account of social roles, we will deploy an ontology of dispositions which is theoretically underpinned by McKittrick’s [15] pragmatically motivated and causal approach to dispositions (which she calls “disposition pluralism”). As a matter of fact, this approach is useful for representing multifarious entities dispositionally (see Toyoshima et al.’s [16] detailed examination of her theory). In particular, we will avail of the following characterization of dispositions [9][10]. A disposition is a causal property that is connected with a *realization*, namely a specific possible behavior of the bearer (paradigmatically a material object) of the disposition. To be realized in a process, a disposition typically needs to be triggered by some other process (*trigger*). Classical examples include fragility (the disposition to break when pressed with a force) and solubility (the disposition to dissolve when put in a solvent). Dispositions may exist even if they are not realized or even triggered: for example, a glass is fragile even if it never breaks or even if it never undergoes any shocks.

Additionally, we will employ the distinction between intrinsic and extrinsic dispositions, as it is acknowledged by McKittrick’s dispositional pluralism. Roughly speaking, a property (instance) is *intrinsic* if it inheres in its bearer purely in virtue of the way the bearer is and it is *extrinsic* otherwise, *scilicet* if it inheres in its bearer (at least partly) in virtue of the way the world that is external to the bearer is. For instance, the fragility of this glass is intrinsic because the glass is fragile under any external circumstances (even when packed in a bubble wrap). While dispositions are traditionally taken to be intrinsic, extrinsic dispositions are highly useful for characterizing a wide range of entities. Canonical examples include the disposition of this key to open this particular lock because this disposition is borne in virtue of the existence of the lock (which is external to the disposition bearer, namely the key).

Toyoshima et al. [16] propose two ways of characterizing extrinsic dispositions. First, following Williams [17], we can hold that every realization of an extrinsic disposition is a realization of some intrinsic disposition (“intrinsic dependee”) on which the extrinsic disposition *relies (existentially)*. For instance, the extrinsic disposition of this key to open this particular lock relies on the intrinsic disposition of the key to open any instance (including this lock) of a certain lock type. Second, following Vetter [18], we can provide a “systemic account” of extrinsic dispositions. Its cardinal tenet is that the possession of an extrinsic disposition (“extrinsic potentiality” in her terms) by an object is both necessary and sufficient for the possession of a *joint disposition* (“joint potentiality” in her terms) by a system composed of this object and others. (More details will be given in Section 3.3.) To illustrate this systemic theory, the extrinsic disposition of this key to open this particular lock exists in virtue of a joint disposition to be realized in an unlocking process that is borne by the “key & lock system” composed of the key and the lock.

3.2. Socially Relevant Processual Role

Taking a cue from Loebe [7], we will take a driving example of Alice playing the social role (say sr_A) of being a doctor with the simplifying assumption that treating a person is a minimal element of being a doctor. To make it simpler, we will also consider that Alice has (and will have) only one patient in her career, named Bob. Since we are primarily concerned with first steps towards clarification of the

notion of social context, we will strive for a minimal characterization of a context (which is a social individual in Loebe’s terms) in which Alice counts as an object such that, unlike Alice, this object has some “doctoriness-related properties”. The aggregate view of social roles consists in considering that sr_A aggregates some socially relevant relational roles and socially relevant processual roles of Alice. We will focus on the latter in this section and on the former in Section 3.3, based on the priority of processual roles over relational roles in the social world (see Section 2). More specifically, we will clarify the connection between socially relevant relational and processual roles using dispositions, which will provide a solid foundation for an analysis of social roles.

During her career, Alice will treat Bob several times. Accordingly, she plays each time a processual role; when Alice plays one of those processual roles, she participates in it (but Bob does not, cf. the remark above on the “miming-like” nature of processual roles), and this processual role is part of a full process of Alice treating Bob (which has not only Alice, but also Bob as a participant). We will name PR_A the class of such processual roles played by Alice.

Let us now consider why Alice can participate in a process of treating Bob at all. One plausible hypothesis is that Alice has various intrinsic properties (such as her ability to observe people or her medical abilities) that would (collectively) enable her to treat a person. From an ontological point of view, we can think of Alice’s intrinsic disposition (say d_A) to treat a person. We can then find the following linkage between PR_A and d_A : any instance of PR_A is part of a realization of d_A .

More generally, every socially relevant processual role is part of a realization of an intrinsic disposition of the player. For one thing, it will help to analyze some paradigmatic examples of processual roles. Consider a processual role of being a breather, taken from Loebe [7]: it can be plausibly taken as a part of a realization of an intrinsic disposition to breathe. (Other similar examples include eaters and walkers.) At the same time, one may wonder whether some examples of socially relevant processual roles can be understood in this dispositional manner. Consider this piece of paper (say p_1) playing a social role of being money and suppose for the sake of argument that an associated socially relevant processual role (say pr_{p_1}) is part of a process of exchange between Mary and John (that is, pr_{p_1} is the process of p_1 being given by Mary to John in exchange of some goods, that has as participant p_1 , but neither Mary nor John, since it is a “miming-like” processual role). One could wonder whether there is any intrinsic disposition of p_1 to be realized in a process having pr_{p_1} as part.

There are at least two ways to handle this concern. First, Loebe’s [7] conception of social roles is based on Searle’s [3][4] view that social objects are made (in some sense) out of material objects. However, Smith [19] counters that there are social objects (which he calls “free-standing Y terms”) which do not coincide ontologically with physical reality. He provides the illustrative example of money recorded in the bank’s computers. In this respect, the difficulty of a dispositional approach to socially relevant processual roles may be due to the limitation of Searle’s framework for social ontology. A discussion of this question lies outside the purview of our current investigation.

Second, such apparently problematic cases as money might be possibly accommodated. A process of exchange (having pr_{p_1} as part) in which p_1 participates amounts to a process of p_1 being used as a medium of exchange by some particular person (say Pat). Now, we can think of a disposition of p_1 to be realized in a process of p_1 being used as a medium of exchange by Pat. This disposition would be extrinsic because it exists in virtue of Pat’s existence, which is external from p_1 . Therefore, pr_{p_1} is part of a realization of this extrinsic disposition of p_1 . From the existence of intrinsic dependees of extrinsic dispositions (see Section 3.1), we can deduce that pr_{p_1} is also part of the realization of some intrinsic disposition of p_1 .

There are some worries as to this tentative proposal. For instance, it can be extremely difficult to identify explicitly what is the intrinsic disposition on which this extrinsic disposition of p_1 depends. However, we could think that these issues can arise for some kinds of social roles (e.g., money), but not for other kinds of social roles, especially agentive ones such as students and presidents. We thus propose the following axiom as a substantive thesis about socially relevant processual roles:

$$\mathbf{a1} \quad SRPS(x) \wedge PLAY(y,x) \rightarrow \exists z,w (INTD(z) \wedge BEA(y,z) \wedge REL(z,w) \wedge P(x,w))$$

A socially relevant processual role is part of a realization of an intrinsic disposition of its player. (If x is a socially relevant processual role and y plays x , then there is an intrinsic disposition z borne by y and realized by a process w such that w has x as part.)

3.3. Socially Relevant Relational Role

We move onto Alice’s socially relevant relational role. Let us consider as before the simple case where Alice will only have one patient during her career, named Bob. We name \mathbf{rr}_A Alice’s relational role of being Bob’s treater (where the meaning of the term “treater” will be discussed below). As Loebe [7] says, one distinguishing characteristic of relational roles is that they depend (existentially) on “complementary” relational roles. In the present example, \mathbf{rr}_A depends on Bob’s relational role (say \mathbf{rr}_B) of being Alice’s “treatee”. Note that \mathbf{rr}_A and \mathbf{rr}_B depend also on their respective players, namely Alice and Bob.

There are several ways of characterizing \mathbf{rr}_A from the viewpoint of processual roles, depending on the understanding of the term “treater” (and also “treatee”). One idea is to construe a treater as a person who is actually treating somebody else. However, we can also think of a treater more broadly as a person who *can* treat somebody else (where the term “can” means circumstantial, but not normative, possibility). In this view, Alice may be Bob’s treater even before she actually began to treat him, or even when she never treated him for some reason. We will adopt this second interpretation of relational role terms because it will be more useful for analyzing social roles that are often described with the term “status” (see Section 1).

To clarify the relationship between the relational role particular \mathbf{rr}_A and the processual role class PR_A , we will appeal to an ontology of dispositions, especially of extrinsic dispositions. We said in Section 3.2 that Alice’s class of processual roles PR_A is closely related to her intrinsic disposition \mathbf{d}_A to treat a person in the sense that every instance of PR_A is part of a realization of \mathbf{d}_A . In a parallel way, we can think that Alice’s relational role \mathbf{rr}_A of being Bob’s treater is intimately connected with her disposition (say \mathbf{d}_A^B) to treat *Bob*; and note that \mathbf{d}_A^B is an extrinsic disposition because Alice bears \mathbf{d}_A^B in virtue of Bob’s existence. Moreover, \mathbf{d}_A^B relies on \mathbf{d}_A : for example, if \mathbf{d}_A^B is realized in a process of Alice’s treating Bob, then \mathbf{d}_A is also realized in this process [16].

It will be helpful here to refer to the systemic account of extrinsic dispositions (introduced in Section 3.1). In more details, whenever an object bears an extrinsic disposition, this disposition is “fully grounded” (in her terms) in a joint disposition which is borne by a system composed of this object and others; and whenever a system composed of a number of objects bears a joint disposition, each of the objects thereby bear an extrinsic disposition which is fully grounded in that joint disposition. Close scrutiny of the full grounding relation between a joint disposition and an extrinsic disposition is set aside for future work, but we can at least say that one disposition fully grounds another disposition only if the latter depends on the former (see Toyoshima et al.’s [16] work for further thoughts). As for systems and joint dispositions, it will suffice to assume that being an aggregate of objects is a necessary condition for being a system and being an intrinsic disposition of a system is a necessary condition for being a joint disposition.³ For instance, Alice bears \mathbf{d}_A^B and Bob also has an extrinsic disposition (say \mathbf{d}_B^A) to be treated by Alice in virtue of the fact that there is a joint disposition (say $\mathbf{d}^{\text{joint}}_{AB}$) of the “Alice & Bob system” (say \mathbf{system}_{AB}) composed of Alice and Bob such that $\mathbf{d}^{\text{joint}}_{AB}$ fully grounds \mathbf{d}_A^B and \mathbf{d}_B^A . $\mathbf{d}^{\text{joint}}_{AB}$ would be realized in a process of Alice treating Bob, namely in an instance of PR_A .

Now we formulate a hypothesis about the connection among \mathbf{rr}_A and PR_A or more generally between relational roles and processual roles in the social world. The basic idea is that playing a socially relevant relational role is a sufficient condition for the player bearing an extrinsic disposition that whose realizations have as part a socially relevant processual role. Moreover, this extrinsic disposition is fully grounded in a joint disposition of a system that has the player. This line of thoughts leads to the following axiom:

³ One potentially interesting idea is that a system may be *defined* as an aggregate of objects that has a joint disposition. A system is typically conceived as an aggregate of objects which “work together”, or in more detail, which displays a specific behavior in virtue of behaviors of its components. This simple conception of systems seems to mesh well with the view that a specific behavior of a system is the realization of a joint disposition or even is *identical* with its joint disposition, the latter construal implying a one-to-one correspondence between a system and a joint disposition. We mention this as a possible dispositional inquiry into the notion of system.

$$\begin{aligned} \text{a2 } \text{SRRR}(x) \wedge \text{PLAY}(y,x) \rightarrow \exists z,s,t,u \text{EXTD}(z) \wedge \text{BEA}(y,z) \wedge \text{SYS}(s) \wedge \text{P}(y,s) \wedge \text{JD}(t) \wedge \text{BEA}(s,t) \wedge \\ \text{GRD}(t,z) \wedge \text{INTD}(u) \wedge \text{BEA}(y,u) \wedge \text{REON}(z,u) \wedge \\ \forall v [\text{REL}(u,v) \rightarrow \exists w \text{SRPR}(w) \wedge \text{PLAY}(y,w) \wedge \text{P}(w,v)] \end{aligned}$$

For any socially relevant relational role and its player, the player has an extrinsic disposition which is fully grounded by a joint disposition of a system having as part the player and which relies on an intrinsic disposition of the player whose realizations have as part a socially relevant processual role played by the player of the socially relevant relational role.⁴

(If x is a socially relevant relational role played by y , then there is some z , s , t and u , such that z is an extrinsic disposition borne by y , s is a system that has y as part, t is a joint disposition borne by s , t fully grounds z , u is an intrinsic disposition borne by y on which z relies, and every realization v of u has as part a socially relevant processual role w played by y .)

To exemplify (a2) with our driving example, $\text{SRRR}(\mathbf{rr}_A)$ and $\text{PLAY}(\text{Alice}, \mathbf{rr}_A)$ hold: informally, \mathbf{rr}_A is a socially relevant relational role and Alice plays \mathbf{rr}_A . (a2) enables the derivation of the existence of \mathbf{d}_A^B , \mathbf{system}_{AB} , $\mathbf{d}_{AB}^{\text{joint}}$, and \mathbf{d}_A . Note first that $\text{EXTD}(\mathbf{d}_A^B)$ and $\text{BEA}(\text{Alice}, \mathbf{d}_A^B)$ hold: \mathbf{d}_A^B is an extrinsic disposition and Alice bears \mathbf{d}_A^B . All the following facts are also true: $\text{SYS}(\mathbf{system}_{AB})$, $\text{P}(\text{Alice}, \mathbf{system}_{AB})$, $\text{JD}(\mathbf{d}_{AB}^{\text{joint}})$, $\text{BEA}(\mathbf{system}_{AB}, \mathbf{d}_{AB}^{\text{joint}})$, and $\text{GRD}(\mathbf{d}_{AB}, \mathbf{d}_A^B)$. That is: \mathbf{system}_{AB} is a system, Alice is part of \mathbf{system}_{AB} , $\mathbf{d}_{AB}^{\text{joint}}$ is a joint disposition, \mathbf{system}_{AB} bears $\mathbf{d}_{AB}^{\text{joint}}$, and $\mathbf{d}_{AB}^{\text{joint}}$ fully grounds \mathbf{d}_A^B . We also have: $\text{INTD}(\mathbf{d}_A)$, $\text{BEA}(\text{Alice}, \mathbf{d}_A)$, and $\text{REON}(\mathbf{d}_A^B, \mathbf{d}_A)$. That is to say, \mathbf{d}_A is an intrinsic disposition, Alice bears \mathbf{d}_A , and \mathbf{d}_A^B relies on \mathbf{d}_A . Finally, if $\text{REL}(\mathbf{d}_A, \mathbf{p})$ (that is, \mathbf{d}_A is realized in some \mathbf{p}), then there exists some \mathbf{pr} such that $\text{SRPR}(\mathbf{pr})$, $\text{PLAY}(\text{Alice}, \mathbf{pr})$, and $\text{P}(\mathbf{pr}, \mathbf{p})$ (\mathbf{pr} is a socially relevant processual role played by Alice that is a part of \mathbf{p}).

3.4. Social Role

We finally consider Alice's social role \mathbf{sr}_A of being a doctor so as to provide a minimal restriction on its context (social individual). In Section 3.3, we articulated the relationship between the socially relevant relational role \mathbf{rr}_A and the class of socially relevant processual roles PR_A by way of an extrinsic disposition whose realizations have as part instances of PR_A . Before turning to \mathbf{sr}_A , we remark that one can find a broad spectrum of social roles in the relevant literature. For example, Masolo et al. [1] and Guizzardi et al. [20] cite, as examples of social roles, catalysts (substances that make chemical reactions happen faster without being changed themselves) and pedestrians (people walking in the street and not travelling in a vehicle), respectively. Presumably, the sociality of such social roles is so weak that they may be mostly explicated in terms of socially relevant processual and relational roles, as is illustrated by Toyoshima et al.'s [16] dispositional analysis of catalyst roles.

As Loebe [7] says, however, a meticulous analysis of paradigmatic social roles (e.g., students) demands a full-fledged social ontology. This is because social roles are objects with some additional social elements (which will be explained in more detail below) to the properties of the players, and socially relevant relational and processual roles alone would be typically insufficient to account for such social elements. In effect, \mathbf{sr}_A would remain underspecified unless we take into account the fact that Mary has a duty to treat Bob. Thus, \mathbf{sr}_A can be at best only partially characterized with Alice's relational role \mathbf{rr}_A of being Bob's treater. At the same time, our dispositional formulation of an aggregate view of social roles will be helpful in providing a solid basis for social roles and their contexts. For instance, we can hypothesize that the context for \mathbf{sr}_A has as part \mathbf{system}_{AB} because, given our aggregate approach and (a2), contexts for social roles should involve at least systems that are essential to extrinsic dispositions that are intimately connected with socially relevant relational roles.

Nevertheless, a deeper inquiry into social roles and their contexts warrants investigation into social elements that are necessary for a more substantive conception of social roles. We offer a few pointers as to this by borrowing insights from the relevant literature:

⁴ Here we utilize Röhl & Jansen's [9] account of the identity of dispositions, for its representation can be based on the simple usage of the universal restriction ("only") on classes in the Web Ontology Language (OWL) and it therefore helps to give a simple first-order logical treatment of dispositions. See, however, Barton et al.'s [10] criticism that this "ONLY theory" of dispositions would encounter the theoretical problem of "disposition multiplicativism" (by which they mean the arbitrary proliferation of dispositions) and their alternative "PARTHOOD framework" for dispositions, which can avoid disposition multiplicativism.

(1) *Human intentionality*. Human intentionality is a defining characteristic of social roles. For instance, in developing a constructivist (observation-based) approach to objects in general, Bottazzi et al. [21] discuss a way of distinguishing social objects from non-social ones and highlight the human-intentional dimension of social objects. Our driving example of Alice's social role of being a doctor concerns a person Alice (as well as her patients, including Bob), but we did not examine Alice's intention closely. This task will require careful consideration of intentions [22] and intentionality (aboutness) [23].

(2) *Conventionality*. Masolo et al. [1] distinguish two senses (weak and strong) of sociality and explore social roles based on its weak sense. That is to say, an entity is social "if it depends on agents who, by means of some sort of convention, constitute, make use of, communicate about and accept it" (ibid., p. 267) and "social" in this sense is roughly synonymous with "conventional". They argue that social roles are (*social*) *concepts* which are defined by *descriptions*: roughly, a social role classifies objects (in a time-relative way) when they fit descriptions that associated with the role. For example, Alice plays a social role of being a doctor at a hospital because the description of what it is to be a doctor at this hospital applies to her. Descriptions could be seen as a kind of informational entities [24] that emerge from intentional agents' acts.⁵ This would imply that analysis of the conventionality of social roles will need theorizing upon the interaction between informational entities and intention(ality).

(3) *Social and deontic normativity*. In Masolo et al.'s [1] strong sense of sociality, an entity (e.g., money) is social "if, in addition to having a conventional nature, its very conventional constitution involves a network of relations among social agents" such that this network possesses "(collective) intentionality, actions and deontic constraints" (ibid., p. 267). They say that many examples of social roles (e.g., money) are social in this sense. Donohue [25] develops a framework for social and deontic normativity that would be concordant with Searle's [3][4] social ontology. His central thesis is that socio-deontic phenomena (e.g., obligations and permissions) can be accounted for in terms of a *prescriptive representation content* that is backed by collectively held dispositions (which we may call "normativity-conferring dispositions") to monitor for compliance and to sanction in case of non-compliance. A prescriptive representation content is the kind of informational entity that prescribes what something should be done, such as a recipe for cooking (refer to Ethier et al. [26] for some thoughts on prescriptive information entities). In playing a social role of being a doctor at hospital, for instance, Alice should follow a designated guideline for treatment and she would be otherwise sanctioned by the authoritative hospital committee. Therefore, a comprehensive study of social roles will call for a well-developed account of the triad of intention(ality), informational entities (especially prescriptive ones), and normativity-conferring dispositions.

4. Related Work

Social roles have long attracted attention in social sciences, but they tend to be considered with a central focus on their social components (e.g., social norms) in these domains [27][28] and their ontological aspects are still largely unexplored. Examples of such aspects include their relationships with other non-social kinds of roles, although we endeavored to address this issue through a Loeb-inspired aggregate view of social roles. More generally, it remains challenging to have a clear overview of various accounts of roles in formal ontology, in spite of Toyoshima's [16] recent examination of theories of roles that are developed in compliance with some prominent upper ontologies, such as GFO (mentioned in Section 2), Basic Formal Ontology (BFO) [29] and the Unified Foundational Ontology (UFO) [30].

It may be interesting to compare our dispositional approach to roles with the UFO relational account of roles that is based on "qua individuals" and "relators" [31]. A qua individual is an individual (e.g., *Mary-qua-student*) that bears all externally dependent moments (where "moment" would be

⁵ Masolo et al. ([1], p. 271) list basic features of descriptions: "Descriptions are created by (communities of) intentional agents at the time of their first encoding in an expression of a 'public' (formal or informal) language." "Different expressions (possibly in different languages) can be associated to the same description, provided they have the same semantic content. I.e., descriptions have a unique semantic content." "Descriptions must be encoded on (possibly multiple) physical supports. [Footnote: Printed or recorded texts obviously count as physical support, but memory or other cognitive processes should probably be considered as well (think of orally transmitted tales, rules and contracts.)]" "Descriptions are usually accepted (adopted) by (communities of) intentional agents, but a description can exist even if no one accepts it, as long as it remains encoded; acceptance can change in time." "Descriptions cease to exist when their last physical support ceases to exist."

synonymous with “property”) of an individual (e.g., Mary) such that those moments share the same external dependencies (e.g., on the XYZ college) and the same “foundation” (e.g., Mary’s enrollment in the XYZ college) which is a process (“event” in UFO’s terms). Roughly, it is an aggregate of externally dependent properties. A relator is then an aggregate of qua individuals that share the same foundation. Assuming that Mary and John enrolled at the XYZ college at the same time, for instance, there is an “enrollment relator” that is composed of *Mary-qua-student* and *John-qua-student* which are founded upon the same process of the enrollment in the XYZ college. A role is a type-level entity (e.g., *Student*) that applies contingently to an individual (e.g., Mary) that bears one or more qua individuals (e.g., *Mary-qua-student*) of a certain type. It will be worthwhile to examine the possibility that some externally dependent moments that constitute qua-individuals and relators that constitute these qua-individuals would correspond to extrinsic dispositions and joint dispositions that are linked by (a2) with socially relevant relational roles.

5. Conclusion

To elucidate social roles and social contexts, we focused on Loebe’s [7] “aggregate view” of social roles based on his tripartition of roles (relational, processual, and social) and investigated dispositionally the connections between socially relevant relational roles and processual roles, which provide a foundation for an analysis of social roles. A key finding is that socially relevant processual and relational roles are closely linked with intrinsic and extrinsic dispositions, respectively, and systems that are connected (via such extrinsic dispositions) with the socially relevant relational roles would serve as a minimal element of contexts for social roles.

In the future we will continue to pursue this aggregate view of social roles. This work will necessitate further development of a formal ontology of extrinsic dispositions [16], especially of their systemic aspects [18]. It will be also interesting to tailor our theory for a specific ontological background. For instance, it is conjectured that extrinsic dispositions would fall outside the category of disposition in BFO and at least some roles in BFO may be extrinsic dispositions [16]. Our proposal may bring about the hypothesis that some roles in BFO (especially the ones with social import) are extrinsic dispositions that are closely related with socially relevant relational roles in the way that is specified by (a2). This direction of research may be also theoretically deepened with recourse to the recent proposal [32][33] that relationships are truthmakers for relations, where relationships can be seen roughly as an aggregate of property particulars (including presumably extrinsic dispositions).

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