

# Declarative Power, Representation, and Mandate. A Formal Analysis

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**Abstract.** This paper provides a formal framework for developing the idea of normative co-ordination. This idea is based on the assumption that agents can achieve flexible co-ordination by conferring normative positions to other agents. These positions include duties, permissions, and powers. In particular, we introduce the idea of declarative power, i.e. the capacity of the power-holder of creating normative positions by simply “proclaiming” such positions. We account also for the concepts of representation – the representative’s capacity of acting in the name of his principal –, and mandate – the mandatee’s duty to act as the mandator has requested.

## 1 Introduction

The idea of normative co-ordination is based on the assumption that agents can achieve flexible co-ordination by conferring normative positions to other agents. Those positions include not only duties and permissions, but also powers, as for instance powers of creating further normative positions on the head of other agents. In particular we will characterize three ideas. First, the idea of declarative power, i.e., the capacity of the power-holder of creating normative positions, involving other agents, simply by “proclaiming” such positions. Second, the idea of representation, which consists in the representative’s capacity of acting in the name of his principal. Third, the notion of mandate, which corresponds to the mandatee’s duty to act as the mandator has requested. These notions do not exhaust the domain of normative co-ordination. However, they indeed belong to the basic building blocks for specifying the relations and interactions between a user and its agents, and between autonomous agents.

The notions of power, representation and mandate originate from a legal background: we can find them in every legal system, though they may be differently regulated. We focus on their most general aspects, which are common to most legal systems.

## 2 Contractual Liberty: Declarative Power, Representation and Mandate

The declarative power provides a general facility through which autonomous agents can shape their own normative environment. Indeed, autonomous agents (in the legal sense of “private autonomy”) must go beyond activating institutional connections between pre-determined actions and results: they must be empowered to state what normative relations they want to hold among them, and to achieve those effects by doing so. This is performed by a “declaration of will”: the interested agents state the results to achieve, in the appropriate form, and the institution within which they are operating makes so that those results are achieved.

Such an empowerment of autonomous agents also corresponds to the needs of a self-organising society, where it is not possible to establish in advance all normative relations between agents: it is left to agents themselves to decide what normative relations are required for the fulfillment of their tasks. In the law, this normative self-organization typically happens through contracts (a contract is a declarative act jointly performed also by all parties whose status is going to be changed by the declaration they are performing). For example, the Italian civil code art.1321 establishes that “the contract is the agreement between two or more parties to create, regulate, or extinguish any legal relationship between them”. This means that the parties create legal positions (duties, powers or rights), extinguish them, and transfer them (e.g., property rights) from one party to another. Note that the law does not establish what changes a contract will make to the legal positions of the parties: it is up to the latter to establish those changes, and the law will in principle recognise their will, i.e. producing those results that the parties state in the contractual terms (the law can integrate and modify some of those results though). This explains why contracts usually cannot be exhaustively classified as of the types of acts which theories of institutional acts usually distinguish (commissive, commands, etc.): a single contract usually, at once, establishes new normative positions. In fact contracts put into focus a new dimension of autonomy: private or contractual autonomy, by which one means the possibility of realizing the legal effects the parties wish, just by stating those effects.

An agent empowered to make the type of statements we have just described, may not be in condition of directly exercising this power. However, there is no need to impose a regulation from above: an autonomous agent must rather be able to delegate to agents the exercise of his own powers. So autonomy is further enhanced by instrument of representation, which basically concerns the situation “where a principal is held to declarations, especially contracts, made on his behalf” [37]. The essential aspect of representation is the grant of an authority or of a power: the representative’s declarations can directly bind the principal, since they count as if they were the principal’s declarations. In most cases, one subject confers representation to another, by accompanying it with a mandate, i.e. the obligation of exercising (and in a certain way) the power of representation. So, the idea of mandate concerns instead the situation where one agent (the mandator) commands another agent (the mandatee) to do something on his account. Usually a mandate presupposes that the mandator has authority over the mandatee, or that a contract has been signed between them for the execution of a specific business. Therefore, the mandator’s requests generate the mandatee’s duty to act in such a way as the mandator has requested, in order to achieve the goals of the mandator.

### **3 Connections among Declarative Power, Representation and Mandate**

The notion of declarative power is the basic one. Representation is usually created by an exercise of such a power, and so is a mandate. Additionally, it is not uncommon that representation and mandate go together with each other: whenever a principal confers an agent the power to represent her, usually the principal also binds the agent so that he acts in certain ways, or there is a legal relation providing the background for the exercise of the representation.

It is possible to have representation without mandate (the agent has the power to act in the name of the principal, without the obligation to do so). As the American Restatement of the law of torts affirms: “It is not essential to the existence of authority, that there be a contract between the principal and the agent and that the agent promise or otherwise undertake to act as an agent”. Consider the situation when one person confers to a relative the power of representing her in the sale of her house. The relative may not be obliged towards his principal to exercise this power (assume that he tells her: “If I have time enough I will go to the notary

and sell the house in your name, but I undertake no obligation to doing that”). He may just be permitted to do that (she relies on his goodwill for accomplishing this task). What usually accompanies representation, besides the power of the representative, is his duty to exercise this power (if he decides to do so) to satisfy the interest of his principal (see e.g. the Italian Civil code art. 1388).

Representation still exists when the representative acts against the interest of the principal. Though there is an “abuse of representation”, the contract concluded by the representative binds the principal (the contract is only voidable if the counterparty knew, or should have known, that the representative was acting against the duty assigned by the principal). However, the representative may be obliged to compensate the principal for the losses incurred because of his abuse. The situation where the representative acts against any duties he may have towards the principal, but does an act which is within his power, must be distinguished from the situation where the representative lacks the power of representation or acts beyond such power. In this case the contract will generally not be effective in regard to the person in the name of which the representative affirmed he was acting.

One important aspect of representation is that representative does not limit his contribution to the transmission of a declaration which was prepared by the principal in advance. Usually, on the contrary, the principal elects a representative because she does not know how she should best handle the business she has entrusted to the representative, in the circumstance where this business will take place. When the representative decides to perform a transaction in the name of his principal, this is the representative’s own decision, so that his contractual declaration expresses his own intention, as determined by his goals and beliefs. In other words, beyond those specific conditions that were predetermined by the principal, the transaction is willed and decided upon by the representative.

#### 4 Logic of Actions and Obligations

Our approach falls within the Kanger-Lindahl-Pörn [21, 26, 24] theory of organised interaction. Despite some limitations [12, 34, 29], such an approach seems well suited for our purposes because actions are viewed at a very abstract level and are taken to be relationships between agents and states of affairs. In addition, it is permitted to easily combine action concepts with other (normative) modalities.

Here, it suffices to use the well-known action operator  $E_i$ , employed in expressions like “ $E_j A$ ” to mean that “agent  $j$  brings it about that  $A$ ”. In addition to this classical reading, we extend the formalism to cover also collective actions<sup>1</sup>. As suggested in [24], for the purpose of this paper it is sufficient to index  $E$  by sets of agents [10]. So,  $E_{\{i,j,k\}} A$  means that  $i, j, k$  collectively bring it about that  $A$ . Investigating the nature of collective agency is outside the scope of this paper. Thus we refer to the basic properties of  $E$  as described in [31, 32] but simply extended to the case of sets of agents. For example, the axiom stating that  $E$  is a successful operator is reformulated as  $E_X A \rightarrow A$ , for any set of agents  $X$ <sup>2</sup>.

What about obligations? It is well-known that Standard Deontic Logic (SDL) is not adequate for combining deontic and action operators. For example, in SDL  $O E_X A$  implies that  $O A$ , which is unacceptable: that  $X$  is obliged to bring it about that  $A$  should not entail that

<sup>1</sup>The issue of collective action and cooperation is greatly discussed in the recent literature. For a recent extension of the  $E$  logic to cover collective agency, see [10].

<sup>2</sup>When the set of agents is a singleton, the logical meaning of  $E_{\{j\}}$  collapses into that of the usual expression  $E_j$ . For cases with more than one agent, such as  $E_{\{i,j,k\}} A$ , we assume that neither  $E_{\{i,j,k\}} A$  implies that each agent in  $\{i, j, k\}$  brings it about that  $A$ , nor the converse: a collective action to achieve a goal is qualitatively different from a sum of actions performed to achieve the same goal by the single agents belonging to the group. See, e.g., [11, 4, 30].

$A$  is in general obligatory. For similar reasons,  $OE_X E_Y A \rightarrow OE_Y A$ , which is a theorem of SDL, cannot be accepted because the obligation on  $X$  should not imply an obligation on  $Y$  [29]. We will not enter here into a discussion about which axiomatisation is suitable for modeling deontic concepts. The only thing we need is to make provision for directed deontic operators for obligation and permission. We simply write  $O_j E_{\{k\}} A$  to mean that  $k$  has, towards agent  $j$ , the obligation of realising  $A$  (on directed obligations, see [17, 22], though they provide a different formalisation). We assume that obligations satisfy Agglomeration and Consistency, and are closed under classical logical equivalence [19, 15]. We also accept the usual interdefinability between obligation and permission.

## 5 The ‘Counts as’ Link

We need also a way of expressing connections holding in the context of an institution. Jones and Sergot (JS) [20] have developed a formal approach to the notion of institutionalised power by introducing a conditional connective ‘ $\Rightarrow_s$ ’ to express the ‘counts as’ connection holding in the context of an institution  $s$  as described, e.g., by [33]. This idea occurs in the law mainly in two contexts: when the law specifies that a certain brute fact counts as a certain type of legal act and when a certain legal act has the same legal effects of another legal act [15].

JS characterise the logic for  $\Rightarrow_s$  as a classical conditional logic plus the axioms  $((A \Rightarrow_s B) \wedge (A \Rightarrow_s C)) \rightarrow (A \Rightarrow_s (B \wedge C))$  and  $((A \Rightarrow_s B) \wedge (C \Rightarrow_s B)) \rightarrow ((A \vee C) \Rightarrow_s B)$ . In addition, JS’s analysis is integrated by introducing the normal **KD** modality  $D_s$  such that  $D_s A$  means that  $A$  is “recognised by the institution  $s$ ” [32]. Accordingly, it is adopted the schema  $(A \Rightarrow_s B) \rightarrow D_s(A \rightarrow B)$ , which in combination with  $(A \Rightarrow_s B) \rightarrow (A \rightarrow D_s A)$  allows for a restricted version of detachment of the consequent of  $\Rightarrow_s$  (modalised by  $D_s$ ).

As argued elsewhere, although this approach provides an interesting account of the counts-as link, it suffers of one limitation. In fact, the consequences of counts-as connections follow non-defeasibly (via the closure of the logic for modality  $D_s$  under logical implication), whereas defeasibility seems a key feature of such connections [15]. Our characterisation of the counts-as adopts a different perspective. Rather than introducing a logic for the counts-as connection, and then linking it with a  $D_s$  logic, we use one conditional operator  $\Rightarrow$  to express any defeasible normative connections or constants, in any institutions. We argued that the type of non-monotonic reasoning involved in the institutional and the normative domains is essentially the same [15]. Accordingly, we use the same  $D_s$  operator as in [20] but we apply it to the components of normative links, to relativise them to a particular institution. We stress that any institution can only state what normative situation holds for itself, given certain conditions, but according to a general type of conditionality. In particular, on the basis of  $\Rightarrow$  we can define a relativised operator  $\Rightarrow_s$  operator, which behaves similarly to  $\Rightarrow_s$  of JS. For this purpose we combine a link  $A \Rightarrow D_s B$  from a brute fact to an institutional fact, and a link  $D_s A \Rightarrow D_s B$  from an institutional fact to another institutional fact:

$$(A \Rightarrow_s B) =_{def} (A \Rightarrow D_s B) \wedge (D_s A \Rightarrow D_s B) \quad (1)$$

As shown elsewhere [15], the connective  $\Rightarrow$  is characterised by the normal conditional logic **CU** [3] corresponding to cumulative reasoning. In addition, the account of counts-as link requires the axiom schema **Or**, i.e.,  $(A \Rightarrow C) \wedge (B \Rightarrow C) \rightarrow (A \vee B) \Rightarrow C$  [20]<sup>3</sup>. The system is completed by introducing a restricted version of the detachment of the consequent based

<sup>3</sup>Notice that this property is accepted in its deontic version, e.g., in the Hansson-Lewis account of conditional obligations [23, 28]. The reader who does not like to add it to **CU** can adopt its variant for  $\Rightarrow_s$

on specificity [15]<sup>4</sup>. Finally, let us remark, that though  $\Rightarrow_s$  is relative to a certain institution  $s$ , we do not need to specify this since we are considering just one institution (the legal system).

## 6 Proclaiming

The notion of proclaiming is used to cover all those acts by which a subject makes a statement expressing a certain proposition, and this statement has the function of making this proposition true. Such a notion is formalised by the modal operator  $proc$ . As for  $E$ ,  $proc$  will be indexed by sets of agents. In this way,  $proc_X A$  means that the members of  $X$  jointly proclaim  $A$ <sup>5</sup>. Of course,  $proc$  is not necessarily successful:  $proc_X A$  is just an attempt to achieve  $A$ . Whether it is successful or not, within a certain institution  $s$ , depends on whether  $s$  makes it effective. For example, in legal systems children cannot validly undertake obligations. If  $j$  is a child and she proclaims that she assumes an obligation, no obligation for  $j$  will be created according to the law.

A proclamation has some intuitive logical properties. It seems that by proclaiming a conjunction one also proclaims each conjunct, and vice versa:

$$proc_{\{j\}}(A \wedge B) \equiv (proc_{\{j\}}(A) \wedge proc_{\{j\}}(B)) \quad (2)$$

In addition, when a set of agents  $X$  makes a joint proclamation that  $A$ , then each agent  $j \in X$  makes such a proclamation<sup>6</sup>:

$$\forall j \in X, proc_X(A) \rightarrow proc_{\{j\}}(A) \quad (3)$$

The converse is not generally valid, since it may be argued that a joint declaration is more than a couple of parallel declarations having the same content. This type of speech act has some interesting peculiarities.

First, it is neutral in regard to intention-based [16] and non intention-based theories of speech acts [18]. By saying that  $j$ 's statement has the function to achieve  $A$  we do not specify how the notion of function is to be characterized: it may be determined by the intention of the speaker, by the intention attributed to the speaker by its interlocutor, by a shared convention, etc. What is sufficient, here, is that the act has a word to world direction of fit ([36]), i.e. it has the function of changing the normative world to make it fit the content of the act.

Second, the idea of proclaiming is neutral in regard to what is proclaimed. So  $proc$  can play the function vested by different speech acts:

$$(a) proc_{\{j\}}(O_k E_{\{j\}} A) \quad (b) proc_{\{j\}}(O_j E_{\{k\}} A) \quad (c) proc_{\{j\}}(\neg O_k E_{\{j\}} A) \quad (4)$$

Here (4a) is  $j$ 's attempt to commit itself towards  $k$ , (4b) is  $j$ 's attempt to command  $k$ , and (4c) is  $j$ 's attempt to free itself from an obligation towards  $k$ .

## 7 Declarative Power

Proclamations are not necessarily effective. When an agent  $j$  proclaims  $A$ ,  $j$  brings it about that  $A$  only if the concerned institution  $s$  provides for this result. This means that within  $s$  a

<sup>4</sup>This is an important property since we want to detach the consequent modalised by  $D_s$  when the antecedent (a brute or another institutional fact) occurs.

<sup>5</sup>Also in this case, when  $X$  has only one element  $i$ ,  $proc_X A$  means that  $A$  is proclaimed personally by  $i$ .

<sup>6</sup>We are aware that this a debatable assumption. It might be argued that such an implication holds only if the proclamation of a set of agents consists of a set of parallel utterances performed in the presence and with the awareness of the others.

rule must hold having the following content:

$$proc_{\{j\}}(A) \Rightarrow E_{\{j\}}A \quad (5)$$

In other words, for the institution,  $j$ 's proclamation that  $A$  counts as  $j$ 's action producing  $A$ . Note that according to the action logic above presented,  $E_{\{j\}}A$  implies  $A$ . Therefore when  $proc_{\{j\}}(A)$  is effective,  $A$  follows in the domain of the institution. Rules stating that a proclamation is effective can be seen as a type of power-conferring rules. By a power-conferring rule, we mean any rule stating that the action  $A$  counts as (in the concerned institution) the performance of an action  $B$  [20], i.e. any rule having the form  $E_{\{j\}}A \Rightarrow E_{\{j\}}B$ .

Not every power is exercised through a proclamation. It may also be the case in which an institution links a specific outcome to a specific action: consider for example the connection between raising one's hand in an auction and making an offer. The peculiarity of  $proc$  consists in its generality: it may produce any state of affairs which is the object of the proclamation.

When an institution provides for the effectiveness of a proclamation that  $A$ , we say that the subject  $j$  of the proclamation has a declarative power  $DeclPow_{\{j\}}A$ , which corresponds to accepting (5) as true. Therefore, that an agent  $j$  has the declarative power of producing  $A$  means that if  $j$  proclaims that  $A$  then  $j$  produces  $A$ .

## 8 Empowering Autonomous Agents

A fundamental aspect of a norm-governed society consists in the allotments of permissions and obligations to its members. However, in an autonomous society the agents themselves must be able of creating those permissions and obligations. The decisive aspect of an autonomous social organization consists in the empowerment of its agents, that is in establishing how agents may create what normative relations. In our model agents are empowered by attributing them declarative powers. This enables agents to create the normative relations and to co-ordinate their behaviours. The failure to provide a viable allocation of such powers may threaten the survival of society. For example, if each self interested agents were given an unlimited power to unilaterally create obligation on the head of other agents, society will soon collapse, since everybody would soon be covered with an unsustainable workload, obligations will no longer be fulfilled, conflicts will explode, and trust will fade away. In the following we will sketch some features of a viable allocation of powers, which gives each agent the maximum of power consistent with the attribution of the same power to other agents.

**Multi-lateral Proclaims (Contracts)** A declarative power may be jointly exercised by more than one party. If so, the proclamation will be an action performed by a set of agents. In very general terms, we may call such an action a contract. For example the making of a contract through which  $j$  takes the obligation towards  $k$  to provide a piece of music  $m$  and  $k$  undertakes the obligation toward  $j$  to pay the price  $p$ , can be represented by the following proclamation<sup>7</sup>:

$$proc_{\{j,k\}}(O_k E_{\{j\}}(\text{deliver}(m)) \wedge O_j E_{\{k\}}(\text{pay}(p))) \quad (6)$$

Such joint proclaims are usually performed by two acts, the first of which is called offer, and the second acceptance. This combination is considered as a joint declaration (even when there

<sup>7</sup>Notice that our reading is different from that proposed, e.g., by Herrestad and Krogh [17]. They view a contract relation as follows:  $O^i E_i B \wedge O_j E_i B$ . The first conjunct is an ought-to-do statement expressing that  $i$  has the obligation to do  $B$ ; the second corresponds to an ought-to-be statement saying that  $j$  requires  $i$  to perform  $B$ . We think this approach is intuitively unsatisfactory since it lacks to make explicit a strong logical relation between the two conjuncts. We solve this problem by saying that the conjunction of directed obligations is proclaimed jointly by both parties.

is a delay between offer and acceptance). So we may want to say that the combination of an offer and an acceptance counts as making a contract:

$$offer_{\{j\},\{k\}}(A, B) \wedge accept_{\{j\},\{k\}}(A, B) \Rightarrow proc_{\{j,k\}}(O_k E_{\{j\}} A \wedge O_j E_{\{k\}} A) \quad (7)$$

if  $j$  offers to  $k$  to make a contract with content  $A$  and  $B$ , and  $k$  accepts, this counts as making the contract. If the parties have the power to make an effective contract, the joint declaration generates the obligations for the parties involved in the contract:

$$proc_{\{j,k\}}(O_k E_{\{j\}} A \wedge O_j E_{\{k\}} A) \Rightarrow O_k E_{\{j\}} A \wedge O_j E_{\{k\}} A \quad (8)$$

The operators *offer* and *accept* are two committing declarative acts, that can be defined using the non committing declarative acts *proposal* and *agree*.

$$proposal_{\{j\},\{k\}}(A, B) = proc_{\{j\}}(O_k E_{\{j\}} A \wedge O_j E_{\{k\}} B) \quad (9)$$

$proposal_{\{j\},\{k\}}$  is a declaration of  $j$  where she proposes to ascribe to herself the obligation towards  $k$  to do  $A$ , and to  $k$  the obligation towards herself to do  $B$ . Similarly

$$agree_{\{j\},\{k\}}(A, B) = proposal_{\{j\},\{k\}}(A, B) \wedge proc_{\{k\}}(O_j E_{\{k\}} B) \quad (10)$$

means that  $k$  recognises  $j$ 's proposal and agrees to bind herself to the obligation towards  $j$  to do  $B$ .

We are now able to introduce *offer* and *accept* formally.

$$offer_{\{j\},\{k\}}(A, B) = (agree_{\{j\},\{k\}}(A, B) \Rightarrow proc_{\{j,k\}}(O_k E_{\{j\}} A \wedge O_j E_{\{k\}} A)) \quad (11)$$

$j$  proposes the content of the contract to  $k$  and she is aware that the acceptance of it by  $k$  will create the respective obligations.

$$accept_{\{j\},\{k\}}(A, B) = offer_{\{j\},\{k\}}(A, B) \wedge agree_{\{j\},\{k\}}(A, B) \quad (12)$$

In the same way *accept* indicates that  $k$  accepts committingly the legally binding offer of  $j$ .

**Empowerment to Commit Oneself** First we may consider giving every agent the power of creating obligations for itself, i.e. the power of making effective promises, or of committing itself. If our agents are autonomous, this power should be equally given to each of them. However, this may seem too liberal:  $j$ 's obligation, towards  $k$  to perform  $A$  implies the permission toward  $k$  to perform that action. So,  $k$ 's consent seems to be required. We can propose a general rule attributing all agents the power of committing themselves to other agents through a contract:

$$\forall j, k (DeclPow_{\{j,k\}}(O_k E_{\{j\}} A)) \quad (13)$$

which means that every couple of agents has the power of establishing any obligation between them, simply by proclaiming it. In other words, we empower all our agents to make effective promises (with the consent of the promisee).

**Empowerment to Remit Obligations and Give Permissions** It is reasonable to assign every agent  $j$  the power of freeing any other agent  $k$  from obligations toward  $j$ , even without  $k$ 's consent. For example, if  $j$  is no longer interested in  $k$ 's performance,  $j$  should be allowed to free  $k$  from that performance. In fact, if  $j$  is able to look after itself and an obligation on  $k$  was originally created to promote  $j$ 's interest, then  $j$  should be empowered to choose whether to cancel that obligation or not:

$$\forall j, k (DeclPow_{\{j\}}(\neg O_j E_{\{k\}} A) \wedge DeclPow_{\{j\}}(\neg O_j \neg E_{\{k\}} A)) \quad (14)$$

Accordingly, this formula also enables an agent to give any permission towards itself.

$$\forall j, k (DeclPow_{\{j\}}(P_j E_{\{k\}} A)) \quad (15)$$

So, for example, if agent  $j$  has the obligation towards  $k$  not to access a certain piece of information,  $k$  has the power of permitting that  $j$  accesses the information, according to 15. This is a very libertarian approach, but is appropriate for autonomous agents in the commercial domain.

**Empowerment to Command** It would be unreasonable to give all agents the power of commanding whatever action to any other agent. The power of commanding needs to be restricted only to specific cases, such as when one agent is hierarchically superior to another. A power of commanding held by superiors over inferiors would be conferred by the following rule<sup>8</sup>:

$$\forall j, k ((superior(j, k) \Rightarrow DeclPow_{\{j\}}(O_j E_{\{k\}} A))) \quad (16)$$

Note that in many types of societies, further restriction would be opportune, if the boss is not be a total dictator over its subordinates. A total power of commanding may be, however, the right empowerment for a human user over its agents.

**Empowerment to Renounce to Power** It may seem reasonable to give agents also the power to renounce to their powers. In general terms this would be expressed by the following general empowerment:

$$\forall j (DeclPow_{\{j\}}(\neg DeclPow_{\{j\}} A)) \quad (17)$$

**Empowerment to Empower** We give our agents a further chance to develop their societal relationships if we give them the power of conferring a power. For example, the formula below expresses the idea that  $j$  has the power of creating  $l$ 's power of creating the obligation that  $k$  realizes  $A$ .

$$\forall x (DeclPow_{\{j\}}(DeclPow_{\{l\}}(O_x E_{\{k\}} A))) \quad (18)$$

What kinds of empowerment to empower can be allocated to our agents, according to a general rule? A very liberal choice would consist in stating that each agent has the power of giving other agents the powers he has for itself.

$$\forall j, k (DeclPow_{\{j\}} A \Rightarrow DeclPow_{\{j\}}(DeclPow_{\{k\}} A)) \quad (19)$$

So, for example, since each agent  $j$  has the power of committing itself according to 13, according to 19,  $j$  also has the power of submitting itself to another agent  $k$ , giving  $k$  the power to commanding  $j$ . This will be done via the following proclamation:

$$proc_{\{j\}}((DeclPow_{\{k\}} O_k E_{\{j\}} A)) \quad (20)$$

Note that according to the definition above, when  $j$  gives to  $k$  a power which was previously possessed by  $j$ ,  $j$  does not lose its power: both  $j$  and  $k$  can now exercise it. Obviously, empowerment may lead to cycles. Agent  $j_1$  empowers  $j_2$  to  $A$ , ..., agent  $j_n$  empowers  $j_1$  to  $A$ . However, this is no problem, the latter empowerment simply is redundant, since  $j$  already possessed that power (unless it has renounced its power when conferring that power to another agent).

**Recursive Empowerment** We may confer our agents a further kind of power, which includes both the power of conferring a power to create a normative position and also the power of transferring to others a similar power. We define it as a recursive declarative power:

$$RecDeclPow_{\{j\}}(O_j E_{\{k\}} A) \equiv DeclPow_{\{j\}}(O_j E_{\{k\}} A) \wedge DeclPow_{\{j\}}(RecDeclPow_{\{l\}}(O_j E_{\{k\}} A)) \quad (21)$$

<sup>8</sup>For a formal treatment of hierarchies among agents in the current setting, see [15].

This formula means that the holder  $j$  of the recursive declarative power is enabled to exercise his power in two ways. The first capacity,  $DeclPow_{\{j\}}(O_j E_{\{k\}} A)$ , enables  $j$  to make so that  $k$  is obliged to realise  $A$ . The second,  $DeclPow_{\{j\}}(RecDeclPow_{\{l\}}(O_j E_{\{k\}} A))$ , enables  $j$  to transfer to another agent  $l$  the same recursive declarative power which  $j$  possesses. The latter is useful in those cases where an organization is developed in multiple levels, and the top level wants to delegate not only the performance of the action, but also the command to perform it. The exercise of this power may lead to cycles, but again, this is no problem (the agent who started the cycle may consider having another try), or better it is a problem that it is up to the concerned agents to solve, according to their view of their own interest.

**Specific Limitations to Empowerment** We have sketched the constitution of a liberal, or better a libertarian society, where every agent is able to look after its interest, and where any normative relation can be created via the consent of the interested parties. In legal institutions various limitations to individual freedom are provided, for a number of reasons: preventing frauds, protecting the weaker party, preventing the parties from making mistakes. Unfortunately, there is not much that we may say in general in regard to such limitations. It depends on the particular institutions what exceptions are made to the libertarian framework we sketched.

## 9 Representation and Mandate

On the basis of the notions previously introduced, we will now provide a formalisation of representation and mandate.

**Representation** Representation enables an agent to act in the name of its user or in the name of other agents. In the following, we always use the index  $j$  to refer to the principal and  $k$  to refer to the  $j$ 's representative. First we may characterise representation itself as consisting in the possession of a declarative power. The representative has the declarative power of proclaiming that the represented person performs a certain proclamation:

$$proc_{\{k\}}(proc_{\{j\}} A) \Rightarrow E_{\{k\}}(proc_{\{j\}} A) \quad (22)$$

that is, when  $k$  proclaims that  $j$  proclaims that  $A$ , this counts as  $k$  making so that  $j$  proclaims that  $A$ . Using the  $DeclPow$  abbreviation, this can be expressed as  $DeclPow_{\{k\}}(proc_{\{j\}} A)$  that is,  $k$  has the declarative power of making so that  $j$  proclaims that  $A$ . Let us now consider what allocation of representative powers will be appropriate to the type of libertarian society we have been so far defining. The most appropriate choice seems to be to give any agent the power of conferring on any other agent  $k$  the power of representing itself, in regard to any type of act:

$$\forall j, k (DeclPow_{\{j\}}((DeclPow_{\{k\}}(proc_{\{j\}} A)))) \quad (23)$$

Every  $j$  and every  $k$  are such that  $j$  has the power of conferring to  $k$  the power of representing  $j$ , in regard to any proclamation. Representation does not need to be conferred in relation to a specific proclamation. It may concern any proclamation of concerning a certain type of proposition. We have so far considered representation as the situation where  $k$ 's proclamation counts as  $j$ 's proclamation. Another type of representation is also possible:  $k$ 's proclaiming that  $A$  counts as  $j$  making so that  $A$ :

$$proc_{\{k\}}(E_{\{j\}}(A)) \Rightarrow E_{\{k\}}(E_{\{j\}}(A)) \quad (24)$$

This can be simplified in:  $DeclPow_{\{k\}}(E_{\{j\}} A)$ . The second type of representation is necessary when the representative substitutes a principal which would not be able to perform

directly the activity which is delegated to the representative. Consider for example, the situation where only certain agents are empowered of making certain transactions. Agent  $j$ , which has not the power of performing those transactions, can still confer a power of representation to agent  $k$ , but this should not mean that  $k$ 's proclamations count as  $j$ 's proclamation, since  $j$ 's proclamations would be ineffective. It should rather mean that  $k$ 's proclamations count as  $j$  realisation of the proclaimed result. A further aspect normally involved in  $j$ 's representation, but which we cannot approach here, is  $k$ 's duty of acting for the interest of  $j$ , that is of adopting  $j$ 's interests or goals as his own goal in the exercise of representation (see [6]).

**Mandate** We may say that a mandate is a proclamation to create the obligation of exercising a declarative power, or the obligation to exercise this power in a specific way. The author of the proclamation is called the mandator, and the bearer of the obligation is called the mandatee. So, a mandate has the form:

$$proc_{\{j\}}(O_j E_{\{k\}} A) \quad (25)$$

where  $A$  consists in, or is related to, the exercise of a declarative power.

Usually, the conferral of a power of representation is accompanied by a mandate, which obliges the representative to exercise the power of representation in certain ways. For example, besides giving his agent the power of representing him in buying musical recordings, a user may command the agent to buy a specific recording, from a retailer included in a list of agreed retailers, below a certain maximum price, and so on.

In such a case, the representation can be conferred through the following proclamation:

$$proc_{\{j\}}(\forall(l, r, p) DeclPow_{\{k\}} proc_{\{j, l\}}(P_l(E_{\{j\}} DownloadRecord(r) \wedge \wedge O_l E_{\{j\}} PayPrice(p)))) \quad (26)$$

This formula says that  $j$  proclaimed that his representative  $k$  can (in the name of  $j$ ) acquire for  $j$  the permission to download records, and put  $j$  under the obligation to pay to the vendor  $l$  the corresponding price.

Since the mandate puts the mandatee under an obligation, according to the principles here sketched, an effective mandate presupposes that either the mandator has the power of commanding the mandatee (as expressed in 26), or that a contract between the mandatee and the mandator is concluded. The legal notion of mandate includes further refinements: in particular,  $k$  being the mandatee of mandator  $j$  in regard to an action usually also implies that  $k$  should perform that action in the interest of  $j$ . It seems that this may require both the obligation to perform this activity (for instance buying a certain house), and also the obligation to act in such a way that this power satisfies  $j$ 's interests (buy the house at the lowest price, with the best conditions, from a reliable seller, and so forth).

## 10 Conclusions and Related Work

This paper originates from two lines of research. The first concerns the legal positions, and particularly the notion of power. The second concerns how normative positions are generated through speech acts. In the first regard, we are particularly indebted to [20]. The idea of power has been formalized also by [1] along similar lines. In regard to the link between speech acts and normative positions, we refer to [18, 5, 35, 9], and for informal characterization of delegation to [6]. The peculiarity of our work, however, lies in the attempt of substituting a unique speech act (proclaiming) to model all speech acts which are characterised by a world to word direction of fit, that is all speech acts which are intended to modify the institutional world. Of course, a number of works have been put forward to give a formal account of speech acts theory (see, e.g., [8, 36, 7]). More recently, a number of different agent communication languages have been devised [13, 14]. With respect to a great part of works on speech acts, our

approach provides for a simpler framework for institutional performatives since the logic of all institutional performatives is exhausted by the logic of the (modal) operator of proclaiming. In this way, it is also permitted to easily combine speech acts with other formalisms such as those described here.

Further work will address how to deal with conflicting normative positions arising from the exercise of declarative powers (such conflicts are even implicit in certain types of acts, such as when an agent cancels an obligation or renounces a powers). Various approaches are suitable, such as that of making use of defeasible reasoning techniques [27]), or also of Event Calculus as recently done by [2].

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