A Theory of Social Agentivity and its Integration into the Descriptive Ontology for Linguistic and Cognitive Engineering

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ABSTRACT

The agentivity of social entities has posed problems for ontologies of social phenomena, especially in the Descriptive Ontology for Linguistic and Cognitive Engineering (DOLCE) designed for use in the semantic web. This article elucidates a theory by which physical and social objects can take action, but that also recognizes the different ways in which they act. It introduces the “carry” relationship, through which social actions can occur when a physical action is taken in the correct circumstances. For example, the physical action of a wave of a hand may carry the social action of saying hello when entering a room. This article shows how a system can simultaneously and in a noncontradictory manner handle statements and queries in which both nonphysical social agents and physical agents take action by the carry relationship and the use of representatives. A revision of DOLCE’s taxonomic structure of perdurants is also proposed. This revision divides perdurants into physical and nonphysical varieties at the same ontological level at which endurants are so divided.

Keywords: Agentivity, Descriptive Ontology for Linguistic and Cognitive Engineering (DOLCE), Ontology, Social Action, Social Agent

INTRODUCTION

The Descriptive Ontology for Linguistic and Cognitive Engineering (DOLCE) is an ontology for “comparing and elucidating the relationships with other future modules in the [WonderWeb ontology] library, and also for clarifying the hidden assumptions underlying existing ontologies or linguistic resources such as WordNet” (Masolo, Borgo, Gangemi, Guarino & Oltramari, 2003, p. 13). It was developed as part of an effort to create basic infrastructure for the semantic web, and has been used as a foundational ontology for creating domain-level ontologies, such as Bottazzi and Ferrario’s (2009) preliminary ontology of organizations. When DOLCE is extended and used to examine
domains in more detail (as with Bottazzi and Ferrario, 2009, and the considerations of the geopolitical domain in Robinson, 2010), some issues arise that were not immediately apparent when the foundational ontology was examined in isolation.

The purpose of this article is to resolve issues uncovered in Bottazzi and Ferrario (2009) and Robinson (2010) regarding the agentivity of social objects. “Since ontologies are seen as the semantic web’s ‘basic infrastructure’, it is becoming increasingly important to ensure that ontologies can reflect the social reality that we live in” (Wood & Galton, 2009, p. 268). Thus, the goal of this article is to expand DOLCE with the ability to far more accurately describe social agentivity. How can an ontology simultaneously and in a noncontradictory manner explain the agentivity of both physical and social objects, especially since many nonphysical social objects depend upon the actions of physical agents to perform actions? In order to address this, a theory of social agentivity is proposed that is consistent with DOLCE’s basic assumptions. It is then shown how this theory can be encoded into DOLCE with some revision of its basic taxonomic structure of perdurants.

The goal of this effort is to capture the natural language notion that some physical and social objects have the capacity to be agentive while recognizing the commonsense notion that they act in different ways. For example, both human beings and corporations can be agents, but corporations, being nonphysical entities, can only act indirectly though human beings authorized to act on their behalf. DOLCE has been chosen as the foundational ontology for this research because it already includes an agentive/non-agentive distinction. This in contrast with other ontologies, such as OCHRE, the Object-Centered High-level Reference Ontology, which “does not distinguish agentive vs. non-agentive entities” (Masolo et al., 2003, p. 79) and BFO, Basic Formal Ontology, which notes that its category substantial entity is taken to include “organizations and other agents” (p. 58) but does not further elaborate on agentivity.

This effort is undertaken with the assumption of social realism: that is, that “social reality exists, that entities such as claims, prices, financial transactions, elections, trials, and weddings are not mere fictions and that our talk of such entities is not a mere collection of roundabout ways of talking about other things” (Smith, 2008, p. 42). Taking a philosophically informed approach to information systems can lead to better information systems research (Lee, 2004). This is especially true in the area of ontology design for the semantic web, because, even though the technical aspects of ontology design may be derived from earlier research on databases, ontology design includes “methods similar to those employed in philosophy, including the methods used by logicians when developing formal semantic theories” (Smith, 2003, p. 161).

The structure of this article is as follows: (1) the meaning of the term “social” as it is used in this article is discussed, (2) a summary of the current problems in DOLCE that this research proposes to solve is provided, (3) the theory of social agentivity is elucidated and informally introduced into DOLCE, and finally (4) some preliminary formal axioms are supplied.

THE MEANING OF “SOCIAL” AND THE EXISTENCE OF SOCIAL OBJECTS

“Social action occurs when thought processes intervene between a stimulus, an actor, and their subsequent response. In other words, it is a process whereby an individual attaches a subjective meaning to his or her action” (Ryan, 2005, p. 714). Trypuz (2008), with reference to Kemke (2001), writes that social actions are actions undertaken by an agent “which have an effect on another agent and are caused and determined by certain social rules and behaviors (shaking hands or kissing someone)” (p. 216, parenthetical in original). Masolo, Vieu, Bottazzi, and Ferrario (2004) distinguish between two senses of sociality: a weak sense and a strong sense. An object is social in the weak
sense if it is immaterial and the product of a community. Objects are social in the strong sense if, in addition to the above criteria, “its very conventional constitution involves a network of relations among social agents” interpreted in terms of collective intentionality, actions, and deontic constraints (p. 267).

Weber (1978) writes,

“No every type of contact of human beings has a social character; this is rather confined to cases where the actor’s behavior is meaningfully oriented to that of others. For example, a mere collision of two cyclists may be compared to a natural event. On the other hand, their attempt to avoid hitting each other, or whatever insults, blows, or friendly discussion might follow the collision, would constitute “social action.”” (p. 23)

In this article, the physical motions the cyclists make to avoid hitting one another would not be considered social actions, and neither would any blows exchanged between the two following the collision. Those are regarded as physical actions. The term “social” does not necessarily refer to nonphysical entities created by two or more individuals, but rather the subjective meaning given to a physical action by one or more intentional minds. Therefore, it is possible for a human being to perform a social action completely alone. A lone individual might be physically shifting cards from one stack to another, but these physical actions may carry the social action of playing solitaire. Likewise, a hermit can develop certain physical motions that to him or her constitute the performance of a religious ceremony, a social action.

In some research, social actions are actions taken by a group, whether the entire group acts in unison, or the groups are represented in some way. Ware (1988) writes on the subject of “secondary actions of collectives” where a group is attributed action through “the action of a representative or leader” which constitutes action on behalf of the whole (p. 53). Here, a social action can take place even if the action is not ascribed to a group, but to a single socially constructed individual. The existence of these singular social entities is similar to the distinction explained in Stoutland (2008) between “plural” and “collective” social agents. This distinction is based on whether or not the social entity in question is referred to in the plural (such as using the word “they” with a group of people), or in the singular (such as using the word “it” with a corporation). If a corporation takes an action, it is not considered that the action was taken by the entire group of people affiliated with the corporation, but rather by the single corporate entity itself.

The existence of such social entities is, however, debated. Karl Popper (1945) argued that explanations of the activities of social entities should be given only in terms of individual actions. Even theories that do recognize social entities may not regard them as “genuine” objects in the world (Ware, 1988), and further debate can be held regarding whether such social entities are “non-entities, useful fictions, hypothetical, theoretical, or reduced” (p. 49). In contrast, scholars such as Stoutland (2008) claim that “there are irreducible social agents that intentionally perform social action” (p. 533). Johansson (2004) discusses leveled ontologies in which higher level entities (such as social entities) depend on the levels below them (such as biological entities) but higher level entities cannot be reduced to lower level entities.

John Searle is well known for his work on the ontological construction of social reality. His formulation “X counts as Y in context C,” such that a physical act (X) “counts as” a social act (Y) in context C, might be thought to provide a starting point for codifying social action. Unfortunately, Searle’s account can only provide limited assistance in answering the questions set forth in this article. This is because, despite being centrally concerned with “how there can be a social and institutional reality in a world consisting of physical particles” (Searle, 2008, p. 20), he is emphatically “not interested in the category of social objects” (Smith & Searle, 2003, p. 305).

Searle writes that “Social objects are always ... constituted by social acts; and, in a sense, the
object is just the continuous possibility of the activity. A twenty dollar bill, for example, is a standing possibility of paying for something” (Searle, 1995, p. 36, original emphasis), and that “What we think of as social objects, such as governments, money, and universities, are in fact just placeholders for patterns of activities” (p. 57, original emphasis). Smith points out that this “seems to come threateningly close to a skeptical theory of social objects, according to which there are not social objects (like California drivers licenses) after all, but only (somewhat vaguely) ‘patterns of activities’” (Smith & Searle, 2003, p. 288, original emphasis).

Searle also writes, “The notion of a social object seems to me at best misleading, because it suggests that there is a class of social objects as distinct from a class of non-social objects” (p. 302). DOLCE operates with exactly that assumption. Searle claims that this situation gives rise to contradictions such as there being one object that is both a physical piece of paper and a social dollar bill. His position is that, “when I am alone in my room, that room contains at least the following ‘social objects.’ A citizen of the United States, an employee of the state of California, a licensed driver, and a tax payer. So how many objects are in the room? There is exactly one: me” (p. 302). Differently, DOLCE employs the notion of qua-individual, hinted at in the WonderWeb Deliverable D18 (henceforth D18), which describes and provides the foundational axiomatization of DOLCE, and described in Masolo et al. (2004) and Masolo, Guizzardi, Vieu, Bottazzi, and Ferrario (2005). When a role classifies a particular endurant, a third entity emerges, called a qua-individual.

A semiskeptical approach to social objects would be difficult to reconcile or integrate with DOLCE, given that it includes the category Social Object. Eliminating social objects by integrating a Searleian approach into DOLCE would likely require so much disruption to DOLCE’s taxonomic structure that it might become unrecognizable. This DOLCE-based theory of social agents and actions is not based on Searle’s formulation. Instead, a theory of social action is presented that begins with the acceptance of the existence of social objects. This is not because DOLCE’s assumptions and structures should be accepted for their own sake (they should be reviewed and revised as necessary), but rather to investigate the topic from within the framework of social realism and thus the acceptance of social objects. This effort could be compared and contrasted with a theory of social agentivity based on a Searle’s approach in future research.

PROBLEMS WITH AGENTIVITY IN DOLCE

“Depending upon how we define agency it may be possible to argue that anything can have agency” (Wight, 2004, p. 271). A brick may be said to be the agent that caused the window to break, but according to a narrower understanding of agency, “an action (or event) is caused by an exertion of power by some agent endowed with will and understanding” (Rowe, 1999, p. 15, parenthetical in original). In this sense, agents are capable of what Kemke (2001) calls “real” actions. “Real actions” are “generally volitional, intentional and thus done consciously and under our control,” and “the effect associated with the action corresponds to the motive or intention of the actor as reason for performing the action” (p. 8). Similarly, for Boella and van der Torre (2004), agents are those entities that are able to make autonomous decisions based on their own beliefs, desires, and goals. DOLCE takes this narrow view of agentivity and recognizes two different categories of agents: Agentive Physical Object and Agentive Social Object. Agentive Physical Objects are ascribed intentions, beliefs, and desires. D18 provides “human person” as an example of an Agentive Physical Object. This is specifically contrasted with “legal person,” which is provided as an example of an Agentive Social Object (and, more specifically, a Social Agent). DOLCE does not have a category for agents that are neither physical nor social.
Bottazzi and Ferrario (2009) and Robinson (2010) leave issues surrounding the agentivity of social entities unresolved. With regard to organizations, Bottazzi and Ferrario (2009) write that in legal and moral philosophy, “organisations are considered as having a personality and identity of their own and thus as being agentive entities” (p. 228), but they challenge this position based on the “peculiar” way in which organizations act, “namely through the actions of some agents who, in virtue of the roles they play, are delegated to act on their behalf” (p. 228), and thus “it is not very obvious that they can really be classified as agentive entities” (p. 228). They do not take an ultimate stand on the agentivity of organizations in that article, but they do tentatively place Organization under the category of Non-agentive Social Object because of the manner in which organizations act.

This approach can be difficult to reconcile with the existing DOLCE structure as described in D18. Robinson (2010) encountered such difficulty when he argued that states (in the geopolitical sense of the term) were not organizations, but rather legal persons. This places states in the category Social Agent and would make them agentive. This sets up the odd situation that if organizations are denied agentivity on the basis of the peculiar way in which they act (that is, through certain institutionalized actions of physical agents playing certain roles), then it would seem strange to grant agentivity to legal persons, as they are even more “abstract” entities than organizations and seem no more capable of taking direct action than are organizations. Perhaps the agentivity of the organization should not be denied when it is granted to the legal person.

The following theory should not be taken as an attempt to make a conclusive metaphysical argument concerning the agentivity of social entities, but rather to elucidate a solution to the problem of social agents in the context of DOLCE. DOLCE is a descriptive ontology, and thus “aims at capturing the ontological stands that shape natural language and human cognition. It is based on the assumption that the surface structure of natural language and the so-called commonsense have ontological relevance” (Masolo et al., 2003 p. 7, original emphasis). Thus, it would seem that regardless of whether or not organizations and legal persons are agents in an ultimate philosophical or metaphysical sense, these entities should, by virtue of the surface structure of natural language, be granted agentivity for the purposes of DOLCE. Nevertheless, it does seem intuitive that social entities (such as Fiat, Apple, and the Bank of Italy) are agentive in a different way than are physical entities, such as human beings, cats, or rhinoceroses. Further, as noted in Trypuz (2008), DOLCE contains no concept of action itself.

A THEORY OF SOCIAL ACTIONS AND SOCIAL AGENTIVITY

In everyday conversation, people often attribute agentivity to nonphysical social entities. The United States may declare war, IBM may sell ten thousand computers, General Motors may bring a lawsuit against another company, New York City may enact regulations about smoking in public places, NATO may hold military exercises, or the 9/11 Commission may investigate what happened on certain days. In these cases, natural language suggests that there is an entity (nonphysical and social though it is) that takes action in the world. However, even after cursory consideration, it seems that these actions are of a different character than physical actions taken by physical entities, such as a human being stabbing another with a sword, pushing a table or throwing a rock, a cat bumping its food bowl, or a bear striking another with its paw. In all of the social cases given above, some physical agent performs some action on behalf of the social entity. Thus, one might conclude that social objects are not agentive after all. In some ontologies, it might be possible or desirable to reduce the agentivity of social agents to the agentivity of physical agents, but this seems undesirable and incorrect within the framework of a descriptive ontology where
the surface structure of language is intended to have ontological relevance. In order to explain how the agentivity of social entities can exist in harmony with physical agents in an ontology, this section will present a theory of how physical objects can take social actions. Then it will extend that theory into how social objects can take social actions.

Physical Agents and Social Actions

To account for how a physical agent (such as a human being) can perform social actions, the notion of a physical action carrying a social action is introduced. When a physical agent performs a physical action, that action may carry a social action. As a simple example, a human being can raise his or her hand. Sometimes raising the hand has no social meaning, but in certain situations, the raising of the hand carries the social action of expressing a greeting to another human being. Here, the physical action is the raising of the hand and the social action is an expression of greeting. If a woman raises her hand in greeting, then both the statements “The woman raised her hand” (a statement concerning the physical action) and “The woman expressed greeting” (a statement concerning the social action) are true. This is similar to the way in which Smith (2008) notes that moving an arm can mean different things in different contexts. Sometimes it may express greeting, but it might also signal an infantry unit to halt, or indicate the refusal of an offer. In still other contexts, raising the arm may be an expression of farewell.

As a more complex example, in the Colosseum of ancient Rome, a victorious gladiator looks to his emperor to decide whether or not the life of his defeated foe should be spared. The emperor will perform one of two social actions: either condemn the defeated gladiator to death or spare his life. Either social action the emperor decides to perform will be carried by a physical action. In order to condemn the man, the emperor will make the “thumbs down” sign. The spectators may give either sign in order to cheer for their preferred choice, but merely performing the physical action of pointing the thumb up or down does not condemn or spare the defeated gladiator. Only the thumbs up or thumbs down sign from the human being playing the role of the emperor of Rome carries the social action of sparing or condemning the man. The emperor is not feeling generous, and points his thumb downward, condemning the gladiator. Note that, here again, the statements “The emperor gave a thumbs down” (concerning the physical action) and “The emperor condemned the gladiator” (concerning the social action) are both true. One might argue that signaling thumbs up or thumbs down merely communicated the decision to the victorious gladiator, but this can be rejected. Even if the emperor decided and intended to spare the gladiator’s life, but in a moment of confusion gave the thumbs down sign instead, the emperor would have actually condemned the gladiator by the physical act of pointing his thumb downward, which carried the social act of condemnation.

Performing a social action may or may not depend upon the intention of the person who makes the action. For example, a tourist may make a physical hand gesture that carries no offensive social action in his or her own culture, but happens to carry a highly offensive social action in the culture he or she is currently visiting. The tourist was totally ignorant of this fact when the gesture was made. Did the physical hand gesture carry the offensive social action? In the context where the gesture was made, it would appear that it does, although ignorance of what the tourist was doing might absolve him or her of the responsibility for the action to some people. Alternatively, consider a hermit who developed the physical actions that carry a religious ceremony, but never communicated that information to anyone. Completely accidentally, another person performs the exact physical motions the hermit specified as carrying the religious ceremony. Has the second person performed the religious ceremony? Probably not, since part of the required context
for performing the religious ceremony may be intending to perform it. In another instance, one might perform the physical actions, but only intend to practice them for later performance. In this case, the ceremony would not have been performed during the practice.

Certain situations may prevent the social act from being carried. For example, making certain markings on a sheet of paper with certain other markings already on it may ordinarily carry the social action of agreeing to a contract, but being under duress may cause the social action not to be carried. Also, a single physical act may carry different social actions in different situations. Making certain marks with a pen on a sheet of paper is a physical act that can carry different social actions depending on the situation. Besides agreeing to a contract, making certain marks on a sheet of paper might carry the social action of signing an autograph or granting permission for other actions to happen. The physical act of homicide may carry the social act of murder in some situations; in others it may be the social act of manslaughter, the severe social act of treason, or (in self-defense or another situation of justifiable homicide) not carry a crime at all.

It is possible to assign new social actions to existing physical actions. For instance, a club could have a particular physical action performed by two people that carried the social action of the club’s secret handshake. If a third party compromised the secret handshake, the club might adjust its norms so that a new physical action carried the social action of performing the secret handshake. In addition to physical actions being able to carry different social actions in different contexts, a single physical action may carry multiple social actions. For instance, perhaps the secret club finds itself on the wrong side of the government and its secret handshake is outlawed. Now, whenever the members performed the specific physical action, those actions would carry not only the social action of the secret handshake, but also the commission of a crime.

In this example, it is important to consider whether the government bans the physical action or the social action. If the government bans the social action, then even if the secret club reassigned the secret handshake to a new physical action, performing that new physical action would still carry the secret handshake, and thus, the social act of the commission of a crime. If the government bans the physical action, then the club could be free to reassign the secret handshake to a new physical action, but the original physical actions would still carry the commission of a crime. Banning the physical act might occur when the physical action and the social action it carried became intertwined in the mind of the public and significant emotional weight was attached to the action. Of course, it is certainly possible that the government might ban both.

Not only can a single physical action carry multiple social actions, but also the same social action can be carried by different physical actions. Consider the social action of expressing greeting. It might be carried by raising the hand, by shaking hands, or by making certain utterances. This can especially be seen cross-culturally when different cultures have the same social actions (such as getting married, getting divorced, adopting a child, or crowning a monarch) but very different physical actions that carry those social actions. A speech act is also a physical action that can carry social actions. Speech acts of certain kinds and under the right circumstances can carry social actions or bring about certain social conditions. Searle (1995) wrote on the subject of “declarations” in which “the state of affairs represented by the propositional content of the speech act is brought into existence by the successful performance of that very speech act” (p. 34).

In order for one social act to be performed, another social action might be required to precede it, and another social action required to precede that one, and so on and so forth. The requirements for each of these social acts can leave the physical acts necessary to carry them unspecified. For example, perhaps before some other social action can happen, the social action of a greeting is required, but the physical action that carries the greeting is not specified. It could be a handshake, raising the arm, or even
a head nod. Figure 1 provides a diagrammatic overview of the various ways in which physical and social actions can carry social actions as they have been described in this section.

When do Certain Actions Carry Other Actions?

It is important to be able to determine when one action carries another. As mentioned above, there may be certain situations (such as being under duress) that might prevent the carry relation from holding between two actions. But more generally, it is important to understand that this relation may hold between two actions only in certain circumstances or when certain conditions are met. An appropriate context for the carry relation to hold may be created by multiple criteria, none of which may alone be sufficient for the physical action to carry the social action. Both temporal and spatial location may be important parameters for defining an appropriate context, but may neither be sufficient nor necessary alone.

For example, certain social actions may only be carried at certain times, such as only during the fourteenth century, or only during the hour before sunset. Others may only be carried when performed in the correct spatial location, such as in Europe, or the territory of Venezuela. Temporal Location and Spatial Location are neither Endurants nor Perdurants in DOLCE, but rather members of the class Quality. Thus, temporal and spatial parameters might be reduced to saying the entity performing the action must have the correct qualities. Other parameters might include the relations of belonging to a certain group or being classified by a certain role. It might be required that an individual be in the presence of other certain individuals, or the event be happening before, after, or during the occurrence of another event. For example, the spatiotemporal qualities of a hand wave alone are insufficient to determine what social action (if any) has been carried. If the hand wave is preceded by one’s arrival, then “hello” may be carried; if the hand wave is followed by the individual departing, then “goodbye” may be carried.

Combinations are certainly possible and even likely. Certain social actions may only be carried in certain spatial locations at certain times, such as within the bounds of Venezuela in the hour before sunset, or only in Europe during the fourteenth century. But, beyond physical and temporal location, other factors may come into play to define a context. For instance, a social action may only be carried if someone of a particular social class performs the action, or by someone playing a certain role. These can be combined with spatial or temporal location parameters. Perhaps a certain social action is only carried if a certain physical action is performed by a member of the landed gentry in fourteenth century Europe, or by a person playing the role of priest in the hour before sundown within the territory of Venezuela.

The conditions necessary for one action to carry another must be given in a description (a Non-agentive Social Object). Following Bottazzi and Ferrario (2009), descriptions “are always encoded in at least one physical support” (p. 227). For example, the description could be written in a book or memorized in the brain of a human being. The physical actions that occurred and the circumstances in which they occurred can be compared with the criteria enumerated in the description in order to determine whether or not a social action was carried.

Social Agents and Action Through Representation

How social objects come into being is not at issue in this article. Their existence is presupposed. The explanation for how social agents take action is partially based on the comments in Bottazzi and Ferrario (2009) on organizations, but is broadened to incorporate the action of any agentive social object. Here, however, rather than denying certain social objects agentivity because of the indirect way they act in the world, it is put forward that such entities should be granted agentivity because of it.
In this article, representation is the key to the ability of nonphysical social objects being able to take action. Bottazzi and Ferrario (2009) describe two relations, delegation and its specification, the representation relation. They write, “Generally speaking, the representation relation is a delegation relation that holds between agents that are classified by two roles: the representative and the represented role. Differently from the delegation relation, if the representation relation holds, the delegator cannot perform him/herself the action that (s)he wants or needs the delegate to do. Sometimes it is the case that there is a contingent impediment, other times the delegator is intrinsically unable to perform what (s)he is delegating. The case of organisations is clearly one of these. Organisations, as immaterial entities, cannot act without a physical agent who acts for them.” (p. 234)

Agentive Social Object is a broader class than Organization, so the above can be generalized. The representation relation can hold between an Agentive Social Object and an Agentive Physical Object that are classified by the appropriate roles. Agentive Social Objects cannot act unless there are physical agents that act for them. The representation relation can
form a transitive chain in which one Agentive Social Object is represented by other Agentive Social Objects. At the end of this chain is either a physical agentive object or a qua-individual. For instance, the transitive chain of representation might terminate with an entity such as “the Duke of Edinburgh,” regardless of what physical agent may be playing that role at the time.

If an Agentive Physical Object represents an Agentive Social Object (either directly or through a chain of other Agentive Social Objects) and that Agentive Physical Object performs a physical action on behalf of the Agentive Social Object that carries a particular social action, then the Agentive Social Object has performed the social action. An Agentive Social Object need not be represented by the same Agentive Physical Object for all purposes. Further, there may be only a very limited set of actions that an individual is authorized to take on behalf of the Agentive Social Object. For example, Bottazzi and Ferrario (2009) write that the action that an agent may perform on behalf of an organization must be institutionalized within the organization. Specifically, “The president does not hit a piece of wood with a stick on behalf of the organization he is president of (unless this is a symbolic gesture with some further meaning), but he can very easily sign a contract on behalf of it” (p. 228, parentheses in original).

A single Agentive Social Object may be represented by several other entities, with each entity representing it for different purposes. For example, the government of Latvia (an Organization, and an Agentive Social Object) may represent the state of Latvia (another Agentive Social Object). A particular suborganization within the Latvian government, the Latvian Ministry of Foreign Affairs, may represent the state of Latvia for the purposes of its foreign relations. For the purposes of its relations with the state of Estonia, the state of Latvia may specifically be represented by an Agentive Social Object (and qua-individual), the “Latvian Ambassador to Estonia” (created when an Agentive Physical Object plays a certain role). When the Agentive Physical Object playing the role of Latvian Ambassador to Estonia performs the physical action of making some markings on a sheet of paper, and those markings are of a certain type, and other markings on the paper are of a certain type, this may carry the social action of agreeing to a treaty with Estonia. Thus, Latvia has agreed to a treaty with Estonia. See Figure 2 for a diagrammatic overview of a social agent performing a social action by way of representation, and Figure 3 for an overview of a social agent performing a social action by way of a representation chain.

Bottazzi and Ferrario (2009) write, “it seems fair to say that every organisation not only has at least an affiliate, but also at least a representative, i.e., someone who can act on its behalf” (p. 235). This may or may not be the case for organizations, but even if it is, it is not something that can be generalized to Agentive Social Objects as a whole. For example, ordinarily, a state’s government represents the state, but in the case where the government is destroyed, disbanded, or overthrown, there may well be no representative of the state. Destruction of a government is not identical with destruction of a state, and the state may continue despite having no government to represent it. A human being in a coma serves as another example. The legal person, the Social Agentive Object, still exists, but the Physical Agentive Object, the human being, is unable to act on the legal person’s behalf. Many times, a spouse or other family member is authorized to represent the legal person in the coma. But, if the person has no family, spouse, or other human being to act on his or her behalf, there may be no way for that legal person to act.

It was explained above that an agent can be restricted to representing an entity for only certain purposes (although there is nothing preventing one agent from representing a Social Agentive Object for all purposes). Therefore, it is possible that a Social Agentive Object might lose its representative for a particular purpose. For instance, the representative might be assassinated. Until a new representative is reappointed, the Social Agentive Object may be unable to take action with regard to that purpose. This might be especially significant if
that representative cannot be replaced. Perhaps the representative of a Social Agentive Object for purpose $p$ might be required to be a male of a particular familial line, but if the person assassinated happened to be the last male of that line, then the Social Agentive Object might no longer be able to perform actions with regard to purpose $p$.

In other situations, there may be no procedure for replacing a representative for purpose $p$. This might be especially relevant in the cases of terrorist or insurgent organizations. An opposing force may go out of its way not to kill enemy leadership so that there will be someone to negotiate with. If its leadership is dead, an insurgent force may have no one to represent it for the purposes of political negotiations, and they might have no process to reappoint a representative for that purpose. Such a conflict might drag on, rather than being concluded by those authorized to represent the force for that purpose. The insurgent force may still have representatives for other purposes, such as violence (conducting ambushes or planting explosive devices) or religious proclamations. This could have implications as to what responsibility for the actions of certain individuals might or might not fall upon the organization as a whole.

Thought must be given to the kind of entity a purpose is, in order to place it within the DOLCE hierarchy. One could suppose that a purpose is something that inheres in an entity, and thus be a Quality. However, according to D18, an entity’s qualities must exist as long as the entity exists. DOLCE explicitly does not consider that a quality might only intermittently inhere in an entity. This means that an entity could not have no purpose, acquired one later, and then at further future time lose its purpose again. Perhaps the existence of intermittently inhering qualities should be reevaluated, even though the larger issue of whether an entity’s

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**Figure 2. Diagram of a social agent performing a social action by way of representation**

In the diagram:

- $SAG_1$ represents the Social Agentive Object.
- $APO_1$ represents the Action Object.
- $PA_1$ represents the Performed Action.
- $SA_1$ represents the Social Action.

The diagram illustrates how $SAG_1$ performs an action $PA_1$ that is represented by $APO_1$. The legend explains the symbols:

- $x \xrightarrow{\text{represented-by}_{\text{purpose } p}} y$ means “$x$ is represented by $y$ for purpose $p$.”
- $x \xrightarrow{\text{performs}_{y, \text{purpose } p}} z$ means “$x$ performs $z$ on behalf of $y$ and consistent with purpose $p$.”
purpose inheres in it at all is also open debate (i.e., does the purpose of a person’s life inhere in the life or in the person, either permanently or intermittently?).

At least for the reason of the prohibition on the intermittent inherence of a quality in an entity, this article will understand a purpose as a Non-agentive Social Object. Purposes has no direct spatial qualities (and thus is a Non-physical Object), and also are Social Objects, at least in the sense that they depend on intentional minds (and thus contrast with the merely private experiences which fall under the category Mental Object).

Consideration also needs to be given to whether or not any social object can be represented. The answer appears to be no, since it seems Agentive Social Objects can be distinguished from Non-agentive Social Objects because they can be represented. Just as the purpose of this article is not to analyze how Social Agentive Objects come into being, it is not its purpose to investigate the ontological distinctions between agentive and non-agentive social objects. For present purposes it is enough to understand that some social objects are of such a character that they can be represented and others are not. How that determination can be made could be the subject of deeper investigation. It is not the case that a non-agentive social object can become agentive simply by someone claiming to represent it (i.e., an economic system, a Non-

---

**Figure 3. Diagram of a social agent performing a social action by way of a representation chain.**

Note that in this case $SAG_2$ does not perform $SA_1$. Consider a law firm representing a client by filing a lawsuit. The represented client files suit by way of representation through the law firm.
agentive Social Object, cannot become agentive simply because someone claims to represent it). In spite of both being socially created, there appears to be something intrinsic to the nature of Agentive Social Objects that allows them to have representatives (or in other words, to be able to be classified by the represented role) that Non-agentive Social Objects do not share.

The status of an Agentive Social Object that has no representatives should be contrasted with that of a Non-agentive Social Object. While it seems that an Agentive Social Object without a representative is not agentive, it is still potentially agentive (and will be fully agentive again when it reacquires a representative). Whatever intrinsic characteristic of the Agentive Social Object that allows it to have representatives is still present even at the times when there are no representatives, and this characteristic seems to be enough to distinguish agentive from non-agentive social objects. At this time, DOLCE does not recognize a category of “potentially agentive objects,” social or otherwise.

Introduction of Physical and Nonphysical Perdurants into DOLCE

According to DOLCE’s taxonomic structure endurants are “wholly present (i.e., all their proper parts are present) at any time they are present” (Masolo et al., 2003, p. 15, parentheses in original). It also recognizes a distinction between the physical and the nonphysical, and hence the social. This distinction is based on whether or not the entity has direct spatial qualities, such as spatial location. Physical endurants have direct spatial qualities, nonphysical entities cannot. DOLCE’s taxonomy of perdurants, entities that “extend in time by accumulating different temporal parts, so that, at any time they are present, they are only partially present, in the sense that some of their proper temporal parts (e.g., their previous or future phases) may be not present” (p. 15, parentheses in original), does not include such a distinction. For reference, see Figure 4 for a diagram of the original DOLCE structure for endurants and perdurants. An ontological distinction between physical and nonphysical endurants is proposed at the same level at which the distinction between physical and nonphysical perdurants is recognized. The taxonomy proposed is diagrammed in Figure 5, and examples of physical and social states, processes, achievements, and accomplishments are provided in Table 1.

The nature of the physical/nonphysical distinction in the taxonomy of perdurants is still open to question. As mentioned above, only physical endurants are allowed to have direct spatial qualities. Perdurants are only allowed direct temporal qualities. “The temporal regions of endurants and the spatial regions of perdurants are inherited by means of the participation relation” (p. 74). Since all perdurants are only allowed to have spatial qualities indirectly (by virtue of the spatial qualities of endurants that are participating in them), using the direct/direct spatial qualities distinction to divide perdurants into physical and nonphysical categories is not possible.9 More to the point of this article is the distinction between the physical and the social. The critical distinction between the physical and social perdurants put forward in this article is that social processes are dependent upon society (or at least a single intentional mind) that is able to provide subjective meaning to physical actions. Photosynthesis and combustion are physical processes that are not dependent upon intentional minds. Agreeing to a contract or receiving a university degree are dependent upon intentional minds.

Following the distinction between the physical and nonphysical, the distinctions that DOLCE makes between kinds of perdurants are maintained. These include Event and Stative being distinguished based on cumulativity, the distinction between Achievement and Accomplishment being atomicity, and State and Process being distinguished by homeomericity. But, as shown in Figure 5, the perdurant side of the taxonomy switches from distinguishing “physical” and “nonphysical” to distinguishing “physical” and “social” at the same ontological level at which the endurants are so divided. This
immediately prompts the question of whether there are nonphysical nonsocial perdurants. Insofar as DOLCE recognizes nonphysical, nonsocial endurants (Mental Object) and the perdurant side of the ontology potentially mirrors the endurant side, their possible existence should be considered.

Mental Process might be the obvious perdurant complement to Mental Object. The existence of mental objects and processes can be argued for or against, depending upon the theory of mind to which one subscribes. For instance, it is possible that mental objects and processes are only the physical objects and processes of the brain. Insofar as DOLCE subscribes to no particular theory of mind, the question is left open here, although the inclusion of Mental Object would seem to suggest the inclusion of Mental Process as well.

Other potential candidates for nonsocial nonphysical statives might be emotional or spiritual statives. Changes in emotional state (such as being happy or becoming sad) may also be actual physical changes in the brain and thus physical perdurants. Medication for chronic depression creates a chemical (physical) change in the brain, and thus going from depression to happiness may be a physical process. With regard to spiritual statives, a great deal will depend on the realism to which the ontology subscribes. If “being saved” is an actual state of a nonphysical soul, then it might be a candidate for a nonsocial, nonphysical stative. Nonsocial, nonphysical perdurants have not been included.
Figure 5. Proposed DOLCE taxonomic structure for endurants and perdurants. Also shown are the categories concept, description, role, and norm from Bottazzi and Ferrario (2009). The categories amount of matter, feature, and arbitrary sum are not shown due to space limitations.

Table 1. Examples of proposed new categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Achievement</td>
<td>Reaching the summit of K2, a departure, a death</td>
</tr>
<tr>
<td>Physical Accomplishment</td>
<td>An ascent, the demolition of a building, attacking an individual</td>
</tr>
<tr>
<td>Physical State</td>
<td>Being solid, being red, being sitting, being pregnant, being hungry, being translucent, being cold, being liquid</td>
</tr>
<tr>
<td>Physical Process</td>
<td>Photosynthesis, combustion, bioluminescence, coagulation, evaporation, sublimation, freezing, melting, running, making marks on a sheet of paper</td>
</tr>
<tr>
<td>Social Achievement</td>
<td>The moment a boxing match is won, the moment abill becomes law</td>
</tr>
<tr>
<td>Social Accomplishment</td>
<td>A theatrical performance, a conference, a war, a family get-together, a cocktail party</td>
</tr>
<tr>
<td>Social State</td>
<td>Being excommunicated, being at war, being at peace, being under judicial review</td>
</tr>
<tr>
<td>Social Process</td>
<td>Educating, declaring war, making peace, writing</td>
</tr>
</tbody>
</table>
in the proposed ontology in this article, but it remains open to their inclusion in future revisions if warranted.

**Participation vs. Performance**

Participation is a relation of central importance in DOLCE. According to Masolo et al. (2003),

> “In DOLCE, the main relation between endurants and perdurants is that of participation: an endurant “lives” in time by participating in some perdurant(s). For example, a person, which is an endurant, may participate in a discussion, which is a perdurant. A person’s life is also a perdurant, in which a person participates throughout its all [sic] duration.” (p. 16)

To explain action, one needs a stronger relation than mere participation. This stronger relation will be called performance. Performance is a kind of participation. Endurants that perform social perdurants also participate in them, but not all participants are performers.

Consider the ceremony of conferring knighthood upon a squire. There are several participants in the ceremony. The squire participates in his own knighting. The lord dubbing the squire participates. A priest may bless the arms and armor of the squire the night before and administer religious rites to the squire, and thus participate in the ceremony. There might be many spectators to witness the dubbing, who also participate in that regard. Both the lord and the squire seem to be necessary participants in the ceremony since it could have taken place on the battlefield and therefore be conducted without the priest and the religious rites, or the ceremony could have been conducted privately so there were no spectators. Other participants even include the squire’s shoulder, since the squire’s shoulder is being touched with the sword during the dubbing, and the sword itself, since it is used to do the dubbing. Intuition suggests that the lord is unlike the others in a very specific way, in that it is the lord who actually performs the knighting.

Smith and Grenon (2004) discuss a number of formal ontological relations related to the ones being put forward here, but different in important respects. For instance, when discussing participation, they list a number of ways in which participation can vary. These variations included an active/passive distinction and a
direct/mediated distinction. The active/passive distinction is based on whether or not the participating entity is agentive. Agentive participation is called perpetration, whereas non-agentive participation is called patiency. Perpetration is “direct and agentive participation in a process” (p. 290), whereas with patiency “a substance is being acted on by a process” (p. 291). Smith and Grenon’s perpetration is different from the performance relationship described here in at least the sense that performing entities can be acting indirectly in a process.

Their article also includes “mediation,” which considers indirect participation, but not in the sense of representation discussed here. Rather, they consider mediation to occur when a “substance plays an indirect role in the unfolding of a process relating other participants” (p. 291). The given examples are “the Norwegians mediate the discussions between the warring parties” and “the mailman brings Mary’s letter to John” (p. 291). Their article also includes a brief mention of a performance relation, but as a specific variant of the realization relation.

Parallels can be drawn between the performance relation given here and the is-agent-of relation given in Trypuz (2008). Trypuz (2008) uses is-agent-of as “the main relation between an agent and an action” and indicates that “for any action there is always an agent which is an agent of action” (p. 19). Later, when integrated with DOLCE, is-agent-of is interpreted as participation and dependency. While participation and dependency are necessary for performance, it is the intention for performance to have a stronger meaning than merely those two relationships. This is because even though knightng a squire does depend upon the participation of the squire as well as the lord, the lord is still further distinguished as being the performer of the knighting, since it is his actions that carry the social action of bestowing the accolade of knighthood.

Possible Restrictions on the Performance of Social Actions

Physical agents can perform physical actions, and they can do so directly without the need of representation. Physical agents can perform social actions and can do so directly. Social agents can indirectly perform social actions by virtue of representatives. A more difficult question is whether social agents can perform physical actions. Clearly they cannot do so directly, due to their immaterial nature, but can an Agentive Social Object, through the use of a representative, perform a physical action?

In the context of DOLCE, the answer would seem to be “yes.” The Roman Empire may destroy the city of Jerusalem, al Qaeda may detonate a bomb, and the U.S. Air Force may attack a Taliban troop position. All of these are social entities taking physical action. As a descriptive ontology, DOLCE would seem to need to be able to account for such situations. It may also be that social acts can cause physical acts. The cause of a person’s death (a physical act) may have been a war (a social act) or even the declaration of the war (another social act) as well as the sword stroke of the enemy soldier (a physical act), but the purpose of this article is not to analyze causation or responsibility from either a legal or moral perspective. Further, D18 does not describe mechanisms by which DOLCE might handle causation. Developing such mechanisms is left for future research.

PRELIMINARY FORMALIZATION OF THE PROPOSED ONTOLOGY

In this section, some preliminary axioms for the proposed revision to DOLCE’s structure and theory of social action are provided.

Introduction of Basic Predicates

Following the notation given in D18, x, y, and z will be used as variables that range over par-
ticulars. DOLCE’s notation for the predicates of endurant, perdurant, agentive physical object, agentive social object, participation, parthood, proper parthood, specific constant dependence, one-sided constant dependence, being present, and time interval are all adopted here. Further, the category description (DS(x) is a description) and the definition relation (DF(x, y) x defines y) is adopted from Bottazzi and Ferrario (2009). The basic predicates introduced in this article are as follows:

- **PPD(x)** standing for “x is a physical perdurant.”
- **NPPD(x)** standing for “x is a nonphysical perdurant.”
- **PEV(x)** standing for “x is a physical event.”
- **NPEV(x)** standing for “x is a nonphysical event.”
- **SACH(x)** standing for “x is a social achievement.”
- **SACC(x)** standing for “x is a social accomplishment.”
- **PACC(x)** standing for “x is a physical accomplishment.”

**Construction of the Revised DOLCE is-a Tree**

The division of perdurants into physical and nonphysical varieties occurs at the same ontological level as the endurants are so divided. Figure 4 shows the original DOLCE is-a tree and Figure 5 shows the suggested revision. As has been noted previously, DOLCE’s original distinctions regarding cumulativity, homeomericity, and atomism are preserved, despite the introduction of the physical and nonphysical divide. See definition Dd57 for the definition of cumulatively, Dd59 for the definition of homeomerous, and Dd61 for the definition of atomic in Wonderweb Deliverable D18.

**Introduction of Formal Axioms Regarding “Carrying”**

The carry relationship is used to describe how through one action (either a physical action or another social action), a social action can take place. The predicate CARRY(x, y, t) standing for “perdurant x carries the perdurant y at time t” is now introduced formally.

One action can only carry another when it is performed in the correct context. This context must be defined in a description. The circumstances under which an event occurred can be compared with the description to determine whether or not the action a further action was carried. This makes it important to understand how the context fits within the underlying ontology. The context of an action is the collection of all the facts or conditions related to that action. This means the context surrounding an event is a kind of collective, and unfortunately “there is little support for them in DOLCE” (Wood & Galton, 2009, p. 269). While DOLCE can classify the members of collectives, “one searches in vain for any category to place the collectives themselves” (p. 269). This means that the underlying ontology is not expressive enough with regard to its ability to describe collectives. DOLCE requires further development in this area, but for present purposes, the variable c will be used to indicate a context, a collective which with currently no place in the DOLCE is-a hierarchy.

However, using this context variable c, one can define what it means for one action to carry another. One action carries another at a certain time, if and only if there exists a description that defines the context under which that action is carried and that context is present at that time (1D).

\[
\text{CARRY}(x, y, t) := \exists z (DS(z)) \land DF(z, c) \land \text{PRE}(c, t) \quad (1D)
\]

Only Social Achievements, Social Accomplishments, and Social Processes can be carried (1A). Social States may be the result of other social activities, but they do not need other actions to carry them. For example, the process of declaring war is carried by physical action, but the result of the process, a country being in a state of war, requires no other perdurant to carry it.
CARRY(x, y, t) → (PPD(x) ∨ NPPD(x)) ∧ (SACH(y) ∨ SACC(y) ∨ SPRO(y)) ∧ T(t)

(1A)

CARRY is transitive (2A). It is also asymmetric (3A) and antireflexive (4A).

CARRY(x, y, t) ∧ CARRY(y, z, t) → CARRY(x, z, t)

(2A)

CARRY(x, y, t) → ¬ CARRY(y, x, t)

(3A)

CARRY(x, y, t) → ¬ CARRY(x, x, t)

(4A)

When one action carries another at time t, and t' is a part of t and both the carrying and carried perdurants are nonatomic events (i.e., Physical Achievements or Social Achievements), then part of the carrying event carries part of the carried event during that part of the time interval (5A).

CARRY(x, y, t) ∧ ∃t'(P(t', t) ∧ (PACC(x) ∨ SACC(x)) ∧ (PACC(y) ∨ SACC(y)) → ∃x'(P(x', x)) ∧ ∃y'(P(y', y)) ∧ CARRY(x', y', t'))

(5A)

Because CARRY is transitive, there are two different ways that a social action can be carried: directly (DCARRY) or indirectly (ICARRY). An action is directly carried when there is no intermediate action between the starting action and the carried action. The definition of DCARRY is as follows:

DCARRY(x, y, t):= CARRY(x, y, t) ∧ ¬∃z(CARRY(x, z, t) ∧ CARRY(z, y, t))

(2D)

Similarly, the definition of ICARRY is as follows:

ICARRY(x, y, t):= CARRY(x, y, t) ∧ ∃z(CARRY(x, z, t) ∧ CARRY(z, y, t))

(3D)

If an action is directly carried, it is not indirectly carried, and vice versa (6A).

ICARRY(x, y, t) ↔ ¬DCARRY(x, y, t)

(6A)

From 1D and 2D, it can be determined that if an action is carried, then it is either directly or indirectly carried (1T).

CARRY(x, y, t) → (DCARRY(x, y, t) ∨ ICARRY(x, y, t))

(1T)

If x carries y at t, and y' is part of y at t, then there exists an x' such that x' is part of x at t and x' carries y' at t (7A). By using the parthood relation, rather than the stronger proper parthood relation, the possibility that y' may equal y and x' may equal x is preserved. Thus, this axiom holds even in the case of atomic achievements, since atomicity is defined through proper parthood and not simple parthood (see A5 in D18).

CARRY(x, y, t) ∧ P(y', y, t) → ∃x'(P(x', x, t) ∧ CARRY(x', y', t))

(7A)

However, 7A could be strengthened by the use of proper parthood instead of mere parthood (8A). For instance, in the case where a woman takes the physical action of waving her hand, which carries the social action of saying hello, the first part of her saying hello is carried by the first part of the wave of the hand. The inclusion of this axiom makes it impossible for a y that has proper parts to be carried by an x that has no proper parts.

CARRY(x, y, t) ∧ PP(y', y, t) → ∃x'(PP(x', x, t) ∧ CARRY(x', y', t))

(8A)

If x carries y at time t, then x is present at t and y is present at t (9A).

CARRY(x, y, t) → (PRE(x, t) ∧ PRE(y, t))

(9A)
CARRY is not parthood. If \( x \) carries \( y \) at time \( t \), then \( x \) is not a part of \( y \) at time \( t \) (10A). This means the physical action of the emperor pointing his thumb downward is not part of the condemnation of the gladiator.

\[
\text{CARRY}(x, y, t) \rightarrow \neg\text{P}(x, y) \quad (10A)
\]

Following I A and DOLCE’s axiom Ad33 in D18, CARRY is not participation (2T). CARRY is a relation between perdurants (1A), whereas participation is a relation between an endurant and a perdurant (DOLCE axiom Ad33).

\[
\text{CARRY}(x, y, t) \rightarrow \neg\text{PC}(x, y, t) \quad (2T)
\]

**Specific Constant Dependence** (SD) is a relation that can hold between particulars or properties. “A particular \( x \) is specifically constantly dependent on another particular \( y \) iff, at any time \( t \), \( x \) can’t be present at \( t \) unless \( y \) is also present at \( t \)” (Masolo et al., 2003, p. 21). Furthermore, “This notion is naturally extended to properties by defining that a property \( \phi \) is specifically constantly dependent on a property \( \psi \) iff every \( \phi er \) is specifically constantly dependent on a \( \psi er \)” (p. 21). If \( x \) carries \( y \) at time \( t \), then \( y \) is one-sidedly specifically constantly dependent (OSD) on \( x \) (11A). In the action of waving hello, communicating hello is the social action and it is dependent upon the waving of the hand.

\[
\text{CARRY}(x, y, t) \rightarrow \text{OSD}(y, x) \quad (11A)
\]

See DOLCE definition Dd69 for the definition of *specific constant dependence* and Dd74 for the definition of *one-sided specific constant dependence*.

DOLCE includes the constitution relation \( \text{K}(x, y, t) \), and it can hold between perdurants (DOLCE axiom Ad20), if and only if both its \( x \) and \( y \) terms are perdurants (DOLCE axiom Ad23). If perdurant \( x \) is carried by perdurant \( y \), is \( y \) constituted by \( x \)? D18 does not use perdurants to illustrate the constitution relation, but rather endurants (the lump of clay LUMPL, and the statue GOLIATH). While recognizing that additional study on perdurant constitution may be required in the future, for now, if \( x \) carries \( y \), then \( x \) is considered to constitute \( y \) (12A).

\[
\text{CARRY}(x, y, t) \rightarrow \text{K}(x, y, t) \quad (12A)
\]

### Formalization of Performance

The predicate \( \text{PER}(x, y, t) \) standing for “the endurant \( x \) performs the perdurant \( y \) at time \( t \)” is now introduced. If an entity performs a perdurant, then it participates in it (13A) and the perdurant is dependent upon the performing entity.

\[
\text{PER}(x, y, t) \rightarrow \text{PC}(x, y, t) \land \text{OSD}(y, x) \land T(t) \quad (13A)
\]

Of course, the reverse is not true. An entity can participate in an event without performing it. In order to perform an action, the entity in question must be agentive (either a member of the class *Agentive Social Object* or *Agentive Physical Object*), and the action it is performing must be a perdurant, specifically, either a *Physical Event* or a *Non-Physical Event* (14A).

\[
\text{PER}(x, y, t) \rightarrow (\text{APO}(x) \lor \text{ASO}(x)) \land (\text{PEV}(y) \lor \text{NPEV}(y)) \land T(t) \quad (14A)
\]

\( \text{DPER}(x, y, t) \) will stand for “the endurant \( x \) directly performs the perdurant \( y \) at time \( t \).” \( \text{IPER}(x, y, t) \) will stand for “the endurant \( x \) indirectly performs the perdurant \( y \) at time \( t \).” If an agent directly or indirectly performs an action, it has performed that action (15A and 16A). Direct and indirect performance are different relations (17A), and all performances are either direct or indirect (18A).

\[
\text{DPER}(x, y, t) \rightarrow \text{PER}(x, y, t) \quad (15A)
\]

\[
\text{IPER}(x, y, t) \rightarrow \text{PER}(x, y, t) \quad (16A)
\]

\[
\text{DPER}(x, y, t) \rightarrow \neg \text{IPER}(x, y, t) \quad (17A)
\]

\[
\text{PER}(x, y, t) \rightarrow \text{DPER}(x, y, t) \lor \text{IPER}(x, y, t) \quad (18A)
\]
Agentive Social Objects can only perform actions indirectly (19A).

\[ \text{PER}(x, y, t) \land \text{ASO}(x) \rightarrow \text{IPER}(x, y, t) \]  
\hspace{1in} (19A)

It can also be noted that entities can indirectly participate in activities that they do not perform. For example, the state of Latvia might send a representative to a state funeral being held by the state of Estonia. The Latvian representative and thus the state of Latvia participate in the funeral (as observers), but do not perform it. \( \text{DPC}(x, y, t) \) will stand for “endurant x directly participates in a perdurant y at time t.” \( \text{IPC}(x, y, t) \) will stand for “endurant x indirectly participates in a perdurant y at time t.”

Both are kinds of participation (20A and 21A), but direct and indirect participation are different relations (22A).

\[ \text{DPC}(x, y, t) \rightarrow \text{PC}(x, y, t) \]  
\hspace{1in} (20A)

\[ \text{IPC}(x, y, t) \rightarrow \text{PC}(x, y, t) \]  
\hspace{1in} (21A)

\[ \text{DPC}(x, y, t) \rightarrow \neg \text{IPC}(x, y, t) \]  
\hspace{1in} (22A)

If perdurant x carries action y and an agent performs the action x, then the agent has performed the action y (23A).

\[ \text{CARRY}(x, y, t) \land \text{PER}(z, x, t) \rightarrow \text{PER}(y, z, t) \]  
\hspace{1in} (23A)

The theory in use

The information on the semantic web will be designed for computers to manipulate meaningfully (Berners-Lee, Hendler, & Lassila 2001). Through the theory articulated above, a system could derive knowledge of social entities and social actions that is not explicitly found on the web. It also could understand the potential consistency between statements that might appear contradictory in an initial evaluation. For instance, if it were known that a certain Navy SEAL killed Osama bin Laden, the physical killing carried the social action of bringing bin Laden to justice,\(^\text{12}\) and that this SEAL represented the United States for the purpose of that operation, then the United States must have brought Osama bin Laden to justice.

The system could reason in reverse. If it were known that the United States brought bin Laden to justice, then the system would know that the United States, being a nonphysical geopolitical entity, must have been represented by some physical entity which performed a physical action that carried the social action of bringing bin Laden to justice, given the context in which it occurred. Thus, the statement that United States brought bin Laden to justice would not be incompatible with the statement that a certain Navy SEAL killed bin Laden to justice. Likewise, the statement that the United States killed bin Laden need not be regarded as in contradiction with the statement that a certain Navy SEAL killed bin Laden. Instead, these statements could be understood to be consistent and the system could better understand the social situation, thereby allowing information about social entities and social actions to be more meaningfully manipulated.
CONCLUSION

The purpose of this article has been to solve some of the problems of social agentivity within DOLCE, a descriptive ontology where natural language and “commonsense” are intended to have ontological relevance. It has proposed a system by which both physical and social objects are agentive, but which also recognizes the different ways in which they act. It has elucidated a theory by which physical objects can take social action, and then by which social objects can take action as well. A system based on this theory could simultaneously and in a noncontradictory manner handle statements and queries where both nonphysical social agents and physical agents take action. In order to encode this information into DOLCE, a revision of its taxonomic structure regarding perdurants was proposed, in which a division between physical and social is recognized.

Through this system, some nonphysical social entities can be regarded as agentive, as they are in natural language, while the “behind-the-scenes” activities that must take place in order for a social entity to take an action are still recognized. It also allows the actions of social entities to be coded into the ontology without explicit knowledge of what process was undertaken by physical agents in order to bring about the social act, while still recognizing that there must have been one. For example, one can know that Germany or France declared war at a certain time and encode that information into the ontology without having to know anything about the physical actions that were required in either country for that declaration to have been made. Nevertheless, the ontology still recognizes that some physical actions must have taken place. Likewise, one could encode specific physical actions that physical agents undertook, even though it might not be known at the time what social acts those physical acts might have carried.

This also allows the ontology to handle multiple levels of granularity in a single system. For those individuals who are interested in the social actions undertaken by legal persons, organizations, or social groups, the ontology can encode that information. Those interested in particular physical or social actions underlying higher-level social action will find that information encoded as well.

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REFERENCES


ENDNOTES

1. However, it is possible that the physical blows between the two cyclists might also involve a social component. For instance, the exchange of blows might carry the social action of assault and battery according to a system of laws. The point is that the physical exchange of blows is not regarded as a social action in this article merely because more than one human being is involved.

2. This distinction can result in a different classification for nonvolitional “agents” (such as the brick breaking the window). Instigation of an action can either be volitional or nonvolitional. Volitional instigators are agents, whereas nonvolitional instigators are called effectors (Frawley, 1992; Schalley, 2004).

3. A distinction between a physical and legal person is not always made. Sometimes the distinction is blurred, as with Bickhard (2008), who writes that “Persons are biological beings who participate in social environments” (p. 111).

4. DOLCE’s appeal to commonsense for the structure of its ontology is not new, especially in social ontology. For instance, Ware (1988) made an appeal to commonsense in his investigation of social ontology. He wrote, “Ordinary perceptions and a lot of commonsense can also tell us much about what there is” (p. 49). He wrote that these two sources argue strongly in favor of groups and other social entities.

5. Intentionality from the perspective of individuals and groups is an important part of social reality, but the move from a single person’s intentions to a group’s intentions is not particularly straightforward. In this article, intentionality is not discussed in detail, but for deeper expositions on intentionality as it relates to the construction of social reality, see Searle (1983, 1995, 2010), Hornsby (1997), Tomasello and Rakoczy (2003), Fitzpatrick (2003), Johansson (2004), and Bottazzi, Catenacci, Gangemi, and Lehmann (2006).

6. An element of this theory, which will not be explored here, but may be the focus of additional research, is the power dynamic involved in deciding which context takes precedence. In the case of the secret handshake, the context of the private club is overruled by the context imposed by the government. The ability of an entity to decide in what context a physical event took place, or impose a context, may be a key element of power in some situations. The question remains open as to whether the insurgents in this situation are actually repre-

sentatives of the organization for the purposes of violence, or if they are merely affiliated with the organization. Affiliation is a very broad relation between an agent or a social individual and another social individual. “If an agent or a social individual is affiliated to another social individual at a certain time then at that time (s) he plays a role that is institutionalised for the social individual” (Bottazzi & Ferrario, 2009, p. 232). Thus, representatives of an organization are affiliated with the organization, but all affiliates of the organization may not be able to represent it.

While it would be desirable to refer back to DOLCE’s documentation regarding distinguishing Agentive Social Object from Non-agentive Social Object, D18 provides no axioms to make such a determination. There, and in other literature, the distinction between these two categories seems to be made largely through example, leaving it up the intuition of the user of the ontology to sort other entities into the categories. A law, an economic system, a currency, and an asset are Non-Agentive Social Objects, whereas Fiat, Apple, the Bank of Italy, a (legal) person, and a contractant are Agentive Social Objects. Ultimately, a far more concrete methodology for distinguishing these two categories will be required.

It can also be questioned whether or not having direct spatial qualities or not is the best way to divide endurants into the physical and nonphysical. Perhaps it would be more intuitive for a descriptive ontology to use whether or not the entity is “made of” matter as the distinction between the physical and the nonphysical. Discussion of this subject is left to further research.

Social individuals were informally introduced in Masolo et al. (2004) and used formally in Bottazzi and Ferrario’s (2009) preliminary ontology of organizations.

The related term “undergoer” refers to the participant that is most affected by an action (van Valin & LaPolla, 1997). The proposition that the killing of bin Laden carried the social action of bringing him to justice may or may not be true. The purpose of this article is not to argue conclusively either way, but rather to use it as an example whereby a physical action may carry a social action. This article does provide a framework through which the truth-value of the proposition can be evaluated, namely through the evaluation of 1D. The killing of Osama bin Laden carried the social action of bring him
to justice if and only if there is a description of a context in which a killing results in the social action of bringing Osama bin Laden (or someone in general) to justice and that context was present when the killing occurred. The context under which the CARRY relationship holds between those two actions is certainly complex. It must consider international law, the motivation of the killing, the guilt of the individual regarding the action for which he must be brought to justice, the authority under which the agent doing the killing acted, and so on.

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