UvA-DARE (Digital Academic Repository)

Towards a Representational Model of Social Affordances from an Institutional Perspective

Sileno, G.; Boer, A.; van Engers, T.

[Link to publication](#)

Towards a Representational Model of Social Affordances from an Institutional Perspective

Giovanni Sileno, Alexander Boer, and Tom van Engers

Leibniz Center for Law,
University of Amsterdam, the Netherlands
{g.sileno,a.w.f.boer,t.m.vanengers}@uva.nl

Abstract. The paper investigates the connection of the concept of *affordance* with the concept of *institution*, fundamental in social sciences and in legal theory, with the purpose of delineating a working definition of *social affordance*. This hybrid concept enriches the representation tools to be used with agent-roles, knowledge components we use as basis in explaining and interpreting socio-legal scenarios. The paper shows how social affordances are of critical importance to model the agent-role *embodiment* mechanism.

Keywords: Social affordance, Institutions, Distributed cognition, Complex Systems, Agent-based modelling

1 Introduction

The dichotomy between *internal* and *external* perspectives to law — i.e. the participant perspective of the legal scholar (cf. Kelsen's "Pure Theory of Law") and the observer perspective of the sociologist — has been advocated not only by legal scholars (Hart [15]), but also by sociologists (Luhmann [19]). Still, the world of norms and the world of facts touch each other at a certain point. An emblematic case is given by public administrations, as they are collective agencies whose behaviour is defined by the legal system, and act as components of the social system. With the purpose of improving the mutual interactions between the different spheres of activities of public administrations, our current research aims to a partial realignment of *representations of law* (traditional domain of legal theory) with *representations of power* (domain of sociology) [4]. We are performing two approaching steps, one for each pole of this imaginary path.

The first step proposes a change to the traditional focus on (legal) institutional concepts, moving the attention from *obligations* to *powers*. As observed in [2], the power component is often neglected in normative research, more focused on *deontic* aspects of norms. Nevertheless, as Hohfeld explained analyzing the fundamental jural relations [17], power conditions underpin all obligations.

The second step deals with moving from an *external* to an *internal* perspective on agency. A pure behavioristic perspective would imply to use only empirical observations as basis to create models for agents. However, *intent* is an important factor in the interpretation of people's behaviour according to the

law, and intent is also what drives one's own behaviour. The intentional stance links the observer and participant roles that humans have in the social system, and works as basis for *explanatory theories* that are also *generative theories* [9].

In previous works [3, 28], we have identified as key concept for our research the *agent-role* model, a *self-other representational* model which integrates the abstraction of roles, the cognitive and motivational aspects of intentional agents, and the jural positions related to institutional roles. What the law and more in general institutions do, is to normatively characterize agent-roles as correct/good and faulty/bad ones.[1] The aim of the present work is to propose a model for the agent-role *embodiment* mechanism. Our intuition is that an agent selects a certain agent-role in certain social circumstances with a mechanism similar to the one described by the theory of *affordance*, introduced in *ecological psychology* in order to explain the situatedness of behaviour in animals.

The paper proceeds as follows. In section 2 we report some of the current theories of affordance, relevant to our work. Then, in section 3 we circumscribe the concept of institution, working specifically on institutional affordance, failure and enforcement. In section 4 we integrate such concepts in the agent-role model and informally apply them for an evolutionary analysis of institutions. Discussion ends the paper.

2   Affordances

According to Gibson, *"the affordances of the environment are what it offers the animal, what it provides or furnishes"* [13]. The concept of affordance explicitly binds two entities: the *environment* and the *animal*. Some examples: a chair *affords* that we sit on it, because our body can bend at the level of the knees; a glass affords that we drink from it, because we can carry it in our hands and our mouth can lean on it, etc. At a first glance, affordances can be seen as qualities of objects, in dual relation with the shape of the agent's body and with his ability in performing certain actions. Their true nature is however more complex, and manifold interpretations have been presented about its ontological and epistemological status.[2]

Reed sees affordances as **resources** [22], providing a link between affordances and natural selection: "affordances and only the relative availability (or non-availability) of affordances create selection pressure on animals; hence behavior is regulated with respect to the affordances of the environment for a given animal". In contrast, Turvey interprets affordances as **dispositions** [29]. A certain object is characterized by a dispositional property or tendency, if, under certain circumstances, it manifests additional properties. An example of disposition is

---

[1] This characterization is often given at a more abstract level. For instance a sale is usually defined without specifying the reason why someone wants to buy, or to sell. Then, some individual cases raise exceptions to such general dispositions (e.g. a sale obtained by extortion), completing the normative characterization of "generic" agent-roles with more contextualized factors.

[2] cf. [6] for an outline of the theoretical debate around the concept of affordance.

being fragile. In opposition to Reed, Turvey's account on affordances is non-selectionist. Dispositions depend on the possibility of existence of *actualizing circumstances*; for example, nothing is soluble if there are no solvents. If affordances are dispositions, they depend first of all on the possible presence of animals that can actualize them. In addition, affordances must be complemented by fit properties of animals.

Chemero proposes an alternative account in [6]. Considering a certain behaviour ϕ, he starts by defining the logical structure of affordance as:

$$Affords\_\phi(environment,\ organism) \tag{1}$$

In continuity with Gibson, the affordance of a specific behaviour (or a single action) is expressed by a relation between an environment and an organism (including animals, agents, etc.). Then, Chemero investigates the *relata* of (1).

First, he observes that the environmental parameter consists of *features* of contextual situations, rather than generic *properties* of things. Such difference is quite critical. Already at conceptual level, features and situations are higher-level abstractions than properties and objects. But there is something more. Dismissing all theories of direct perception (affirming that the environment contains meaning in itself), we necessarily take an inferential position (i.e. the environment transports meaning, as it is interpreted by an observer). In general, in Kantian terms, inferences may involve *analytic* statements (whose truth is determined by *definition* or *deduction*) or *synthetic* statements (matter of *facts*). In our case, the analytical position would be expressed in two steps: (i) the recognition of objects via certain defining conditions, (ii) the inference of their relative properties from first principles. However, as Clark observes in [7], features are cognitively directly related to perception and correspond to the direct attribution of a state to the context. They are a good example of synthetic statements: they are progressively acquired and usually grow out of experience (for the individual) or evolution (as a species).

Second, the organism parameter describes the possibility of the animal of effectively performing a certain action, not considering the environmental contingency (e.g. I can drink, even if I don't have a glass of water now). For this reason, they are called also *effectivities*, as in [29], who associates them to dispositions. Chemero, however, argues that they are rather *abilities*. The definition of disposition contains a degree of necessity: in the right conditions, the conditional property associated to the disposition has to become manifest; on the other hand, "having the ability to walk does not mean that one will not fall down even in the ideal conditions for walking". This is an important point, which underlines the connotation of *subjective* or *agentic perspective* intrinsic to the whole concept of affordance, to be opposed to the *objective perspective* given by dispositions.

In consideration of the above, the definition of affordance becomes:

$$Affords'\_\phi(features,\ ability) \tag{2}$$

3   Institutions

The focus of social investigation is on the relations found to exist among human beings in their groupings. In general, a *social system* is defined by social components (individual or groups) and relations between them; within the relations, a *social structure* corresponds to a series of patterns related to the composition and the behaviour of social entities. A *social institution* is considered as a mature, specialized, and comparatively rigid part of the social structure. The first characterization of institutions is epistemic; however, as they are embodied by individual social members, they manifest an ontological nature as well.[3] As epistemic entities, institutions exists only in the agents' mental domains. The collective flavour is given by a comparatively similar representation in each individual of the community.

The generation of institutions may be related to different factors. Traditionally four main classes of institutions are considered, depending on whether they "have arisen from, or have been moulded by: (a) animal instinct, (b) religious emotion, (c) certain abstract principles as to right behaviour, we may term humanistic; and (d) deliberate planning, whether empirical or scientific, being particular forms of social organisation devised in order to attain specific ends, for which class we use the term *technical*" [31].

A complementary perspective on institutions has been introduced by Searle in [24, 26], and more recently in [25], as an outgrowth of his study of language. As *speech acts* are always embedded in social settings, *illocutionary forces* as promise, assertion, command, inquiry, etc. express key concepts in the processes of constitution, operation and maintenance of social institutions, which include, in those terms, *games*, *social customs* and *legal norms*.

Example 1. Suppose an agent A promises to perform a certain action, and an observer/agent B *expects* A will do that. Stated equivalently, B associates to A's promise the creation of an *obligation* about the promised performance. This inference underpins that A has, in regards to B, the (institutional) *power*, i.e. his speech act does change the institutional domain of reference. B's expectation may not hold if B knows that A is an unreliable person: A won't have the power of promising, and, despite his promise, no obligation will be created, nor expectations about his actions.

The example above shows the strong connection between obligation and power with *expectation*. These two concepts rewrite respectively "necessity" and "possibility" in institutional terms.

A powerful semiotic instrument to describe all *jural relations* has been introduced in legal theory by Hohfeld [17, 23] (Fig. 1). The first square — concerning

---

[3] "It is often said that the Pilgrims in the Mayflower brought over to these shores their English institutions. They did, but where did they bring them? Were they packed in a cedar chest? Were they stowed in the hold of the Mayflower? No, they were in the minds of the pilgrims." [16]
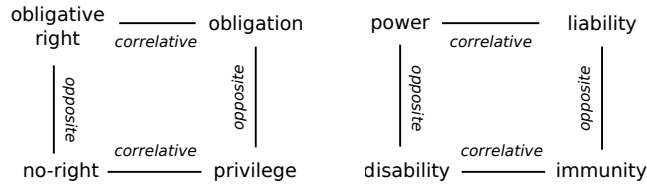
Fig. 1. The two Hohfeldian semiotic squares: obligations and power concepts.

directed obligations — can be read as: an *obligative-right* is a person's (enforceable) claim against another person, which in turn has an *obligation* (or *duty*) concerning this claim towards the first person; *privilege* is one's freedom from the claim of another person, which in turn has no-right on this claim with the first. The second square — related to *power* (called also *ability* in Hohfeld's terms) — can be read similarly.

Example 2. In modern legal systems, a sale is usually structured as unilateral or bilateral sale contract. In general, a *bilateral contract* arises from the exchange of mutual, reciprocal promises (the *offer* and the *acceptance*) between two persons (the *offeror* and the *offeree*) that require the performance or non-performance of some act by both parties. In a sale contract, the two parties are the buyer and the seller, and, once the acceptance is declared, the buyer has the obligation to proceed to the payment and the seller to the delivery.
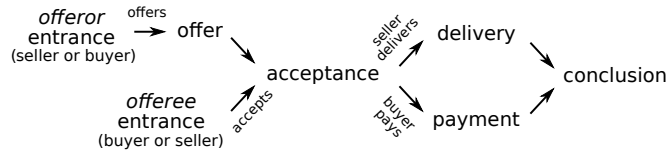
Fig. 2. The sale transaction, as a bilateral contract

The process is summarized in Fig. 2, including an entrance condition for each party. Intuitively, the buyer should own the required amount of money (in the moment of payment) and the seller should own the good to deliver (in the moment of delivery). In a second analysis, these conditions represent only what is necessary to fulfil the *obligation* derived from the promise. More in general, however, entrance conditions reify the *power* ascribed to people, and they are synthetic statements.

3.1 Institutional roles

Terms like buyer and seller denote agents acting within the sale institution. However, there is an intrinsic difference between the actual participants and the *role* they play. An institution concerns persons, but not "whole" persons: each one enters into it via an adequately trained and specialized part of himself. These "parts" are embodying specific *institutional roles*.

Institutional roles are defined with certain abilities (equivalently, powers), obligations and expectations about the other roles. Following the description given by the sale contract, a buyer may accept a previous offer, and if he does that, he has to pay, expecting to receive the delivery. All these steps are synthesized in one word: a buyer may *buy*. Therefore, institutional roles are defined in a first place by actions that may be taken, in an adequate institutional setting, in order to achieve certain outcomes. Going further, we observe that the possibility of buying exists because there is a seller who has offered, who will receive acceptance and payment, and finally will deliver the object. Both roles are strictly necessary: there cannot be a buyer without a seller.

In this line of thought, it is evident that in general a sale does not concern only one buyer and one seller: sales occur in a whole market, composed by several competing economic actors. Although it is not explicitly present in the formal description of the sale institution, the presence of an *alternative seller* (we synthesize in just one role all the competitors), and an *alternative buyer* is obviously not negligible for the social institutional dynamics.[4] These relations are involved in the *evaluation* of the offer, action meant to judge the acceptability of the offer. Evaluation, however, was not made explicit in the definition of the sale process. Institutional roles defined by law *circumscribe* social institutional roles. In principle, the resulting looseness characterizes the degrees of freedom of the behaviour of social components, i.e. the domain for competition, coalition construction, moral and religious prescriptions, trends, free will.[5]

A complete scheme about the process can be drawn unifying procedural and institutional descriptions. In this spirit, we map in Fig. 3 the jural relations holding in a sale in which the seller acts as offeror. The gray circle means that the performance of the action is not sufficient to proceed, but it has to return a positive result.

3.2   Institutional affordance

As any other institutional action, buying is successful only if performed in a *social environment* that responds accordingly. Following this line, we can extend the expression (1) quite intuitively:

$$Affords\_\phi(social\ environment,\ social\ agent) \tag{3}$$

The existence of the institution guarantees the underlying link between the *institutional action ϕ* — performed by the agent playing the institutional role related

---

[4] This perspective, first presented by Commons in [8], is considered fundamental in institutional economics.

[5] Mingers [20] gives a clarifying example considering the game of chess. The rules governing the moves are strictly defined and cannot be modified during the game. However, habitual players may apply many additional rules, associated to tactics and strategies used in previous games or exchanged with other players. This informal knowledge is constructively created by the history of games of the individual player, and of the community of players.
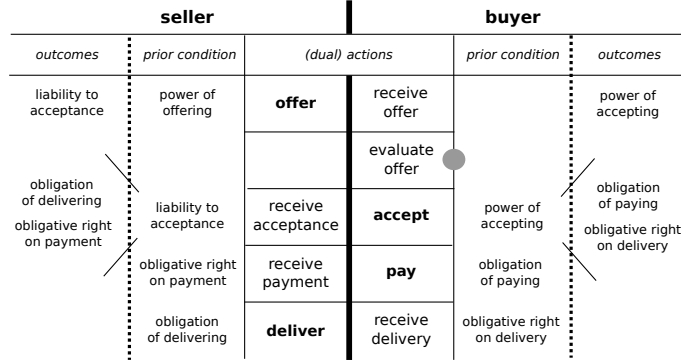
seller			buyer		
outcomes	*prior condition*	*(dual) actions*		*prior condition*	*outcomes*
liability to acceptance	power of offering	**offer**	receive offer		power of accepting
			evaluate offer		
obligation of delivering	liability to acceptance	receive acceptance	**accept**	power of accepting	obligation of paying
obligative right on payment					obligative right on delivery
	obligative right on payment	receive payment	**pay**	obligation of paying	
	obligation of delivering	**deliver**	receive delivery	obligative right on delivery	

Fig. 3. A sale transaction (without enforcement) illustrated in terms of actions, with jural positions as pre and post conditions (neglecting their terminations).

to that action — and the *response* to ϕ given by the social environment — i.e. agents playing the network of institutional roles dual to ϕ.

As any generic action, an agent can perform it, if he has the *ability* of doing it. In this case, however, the concept of ability encapsulates both its practical meaning — e.g. being able of performing the associated speech act — and the institutional ability, of transforming that action in an socially meaningful act.

Leaving aside the practical layer, the first feature demanded to the social environment to be successful in the performance of ϕ, is therefore *compliance*. This is quite intuitive: before acting, the agent expects that the environment generates the (supposedly) correct response to his act. Consequently, (2) becomes:

$$Affords'\_\phi(\{compliance\}, ability) \tag{4}$$

However, this is not sufficient to be successful in completing an action in an actual social settings. Contextual *market features*, as the average market price, may suggest for instance that there would be no offeree sensitive to that offer. The complete figure is expressed as:

$$Affords'\_\phi(\{compliance, market\ features\}, ability) \tag{5}$$

3.3   Institutional failures and enforcement

The social world is not a world of necessity, at least, not in the same sense as the physical world. If I throw a stone against a mirror in order to break it, I'm almost certain that the mirror will break. The relation between my ability (e.g. of throwing a stone) and relevant features of the environment (e.g. fragility) is expressed by the affordance, but it relies on essential characteristics of the physical world (including my body). If I pay for an object purchased on the internet, I may not receive the object, not only because there may have been a problem with the shipping, but also because the seller may have never intended to deliver it. Cognitive and motivational factors play a fundamental role in social

systems. In general, scenarios of non-compliance cause a *failure* of the institutional system. If I lived in a country in which all promises are systematically not maintained, I would evaluate the affordance of any behaviour relying on others' promises (e.g. buying) as not holding. The "promise" institution would become irrelevant, because any person would avoid to perform actions related to it. And the same fate would occur to all institutions based on promises (e.g. sale).
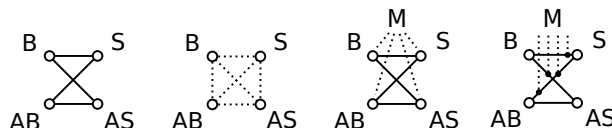

Fig. 4. The topology of a sale: main transactional channels (a), communication channels for reputation construction (b), sensing channels for *ex-post* (c) and *ex-ante* (d) failure monitoring.

Systemic maintenance reasons could therefore explain the existence of the **enforcer**, an institutional role present in some form in any institution.[6] Enforcement actions are expected to provide an institutional remedy to failures and to strengthen the general compliance, using rewards and sanctions.[7] In order to perceive a failure, the enforcer must have some sensing ability on the institutional actions of the agents. For this reason, the first enforcer is usually the same agent who believes to be victim of a social failure. However, in modern systems, the enforcement role is not played solely by the victim, but normally refers to collective entities liable to provide a legal repair, remedy or punishment, if the failure is confirmed. Bringing the case to the court and providing proofs is equivalent to creating an *ex-post*, asynchronous monitoring handled by a collective enforcement agency (Fig. 4c). In certain (and hopefully limited) contexts, however, the monitoring may also be applied *ex-ante*, in real-time (Fig. 4d).

Vatiero [30], amongst others, notices that the enforcement related to obligations is naturally *exogenous* to the institution, as enforcement actions are different from the institutional actions of reference. Conversely, the enforcement related to power relations is *endogenous*. The successful participation to the institution counts in itself as a reward, in many senses: (a) the agent has been able to achieve its objectives; (b) if this success is publicly observable, other agents can see that he is able to conduct the transaction.[8] The concept of *reputation*

---

[6] There are interesting situations, like regulations of right-hand/left-hand traffic, where there is a kind of "natural" enforcement. Not being compliant with the correct driving direction would have direct and possibly terrible consequences.

[7] cf. Dari-Mattiacci and Geest [10] for an institutional/economic investigation on the mechanism of *carrots* and *sticks*.

[8] This publication may occur at the offeror's node, or at offeree's node. The offeree node is evidently more sensible, because a priori it has no interest in the publication, apart sharing information with other offerees about the offeror, so as to create a new line of communication between pairs (Fig. 4b).

turns out to be fundamental at this level: it gives a collectively constructed measure of the reliability of an agent.

4   An integrated approach

So far, we have considered only one institutional frame. In reality, the behaviour of an agent is influenced by several institutions simultaneously. For example, each of us is part of a family, citizen of a country, employed by some private or public company, etc. In case of conflicting institutions, a non-compliant behaviour in one layer could be a consequence of an obligation holding at another layer. On the other hand, conformant behaviours might still hide unfair competition schemes. The pure institutional role is not descriptive enough to cover the full picture of social scenarios.

4.1   The agent-role model

Taking an *internal* perspective toward the social system, we assume this general working principle: when an agent discovers a successful scheme of behaviour (after guidance, via *mimesis* or by chance), and possibly goes through subsequent repeated reinforcements, he acknowledges goal-oriented plans of actions, dual to specific social contexts. A possible representation for this knowledge is given by the *agent-role* model, first introduced in [3] with the purpose of representing scenarios of compliance and non-compliance elicited from legal experts.[9]

Agent-roles are self-other representations, modeling how the agent behaves (generative/prescriptive perspective), and how the other agents behave (explanatory/descriptive), in a certain social setting. Agent-roles are deterministic models: they are basically *scripts* structured on a intentional architecture and provided with institutional logic [3, 28]. More in detail, an agent-role consists in:

- a set of *abilities*, related to the actions he is able to perform in adequate conditions,
- a set of *susceptibilities*, or *sensitivities* towards certain events: when he perceives one of them, he modifies his internal state,
- a set of *goals*, describing what he wants to achieve,
- a set of *plans*, i.e. courses of actions that he believes would bring about certain goals,
- a set of *beliefs*, i.e. propositions about the world that he believes to be true.

The first two are observable as messages, the other are ascribed to the agent which is supposedly embodying that agent-role.

In general, the social abilities of an agent-role rely on institutional roles, or equivalently, an agent-role can be seen as a coordination of institutional roles,

---

[9] For support in psychological studies, see Fonagy and Target [12]. In addition, considering the investigations done on *scripts*, you may refer also to Abelson [1].

provided with a second-order intentional layer. Therefore, agent-roles are characterized by two topologies: an *internal topology*, concerning the internal coordination of institutional roles, and an *external topology*, defined by complementary agent-roles. In the case of the buyer of our example, the internal topology concerns the agent-roles of evaluator, offeree, payer and various monitors. The external topology deals with the seller.

When regulators define legal institutional roles, they consider actual or hypothetical agent-roles, and specify the legal roles in order to scope a restricted relevant set of their characteristics: this explains the mechanism of *circumscription* observed in 3.1.

Groups as agent-roles Agent-roles are not played merely by individuals. A group can be interpreted as an agent-role as well, when it shows social topology, social action and collective intention. In this case, the agent-role will have different identities attached to its communication terminals.

People sharing the same institutional conceptualization constitute a group too, which forms the human ontological expression of the institution. The *reinforcement* of the epistemic expression of the institution within the members of that group is performed through *collective enforcement*. The group influences its members, favouring a certain institutional interpretation over others, and encouraging/discouraging specific agent-roles.

4.2   Social affordances and agent-roles

Social affordance has been defined in respect to a certain action/behaviour. As an agent-role is in practice an intentional characterization of behaviour, by extension, we can associate social affordances to agent-roles as well. The social affordance associated to the situation, coupled with deliberated (ascribed) intent, *selects* the agent-roles the (other) agent may effectively embody. Social affordances correspond to *entrance conditions* as the ones illustrated in Fig. 2.

Social affordances of non-compliant behaviours Intuitively, if I know that people who rob a bank never succeed because they are *always* caught and the money is *always* given back, my evaluation of the affordance of the bank robber agent-role should be negative. This consideration, however, does not apply for instance with killing, because the killing action may still be successful whatever response the social environment may have. Therefore, the affordance is influenced also by *repairing features* of the social environment.

If this is the case, there is another important consequence. If the outcome of a non-compliant behaviour is essentially a social agreement (e.g. property), then the repair, if the failure is recognized, may be complete. Conversely, the strength related to *enforcement features* (related to sanctions, punishments, rewards) do not play any role in the evaluation of the affordance, but *only when the agent has to decide between possible alternative agent-roles*. Although the environment affords a faulty behaviour, the agent may decide not to perform it because it has a too low pay-off.

seller outcomes	seller prior conditions	(dual) actions — seller	(dual) actions — buyer	buyer prior conditions	buyer outcomes
liability to acceptance	power of offering	**offer**	receive offer		power of accepting
obligative right on payment; obligation of delivering			*evaluate offer*		obligation of paying; obligative right on delivery
power to enforce in case of failure of payment; liability to enforcement in case of failure of delivery	liability to acceptance	receive acceptance	**accept**	power of accepting	liability to enforcement in case of failure of payment; power to enforce in case of failure of delivery
	obligative right on payment	receive payment	**pay**	power of paying; obligation of paying	
	obligation of delivering; power of delivering	**deliver**	~~receive delivery~~	obligative right on delivery	
liability to enforcement	liability in case of failure of delivery		*evaluate failure*		power to enforce
	liability to enforcement	receive enforce	**enforce**	power to enforce	
	obligation of providing remedy; power to provide remedy	**provide remedy**	receive remedy	obligative right on remedy	

Fig. 5. A sale transaction with delivery failure illustrated in terms of actions, with jural positions as pre and post conditions (neglecting terminations).

General model of social affordance In order to express this idea more rigorously, we return to the example of the sale, but increasing the granularity of representation. In Fig. 5, we represent a scenario in which the buyer has not received the good and perform successfully an enforcement action. There are a few differences in respect to the previous diagram.

First, we have integrated enforcement actions, empowered by specific jural relations. We associate each obligation to the liability to enforcement if the performance fails. Then, informed by this specific story, we include the recognition of failure of delivery (e.g. caused by timeout), which triggers the enforcement. Finally we add the "enforce" action and the correspondent response of the seller, with the associated jural relations.

Second, in the prior conditions, we separate the power concepts from the others. The empty spaces in the figure reveals powers given for granted. Let us consider the case of the buyer. We distinguish three families of actions: *direct-action* (e.g. power of accepting, paying), *reception* and *evaluation*. Direct-action powers are the powers in the sense used until now. Reception power can be described differently. Taking for granted his sensing abilities, the agent may receive something only if someone else can emit and the transmission is successful. On the other hand, evaluation abilities depend on cognitive skills/competences, and the *result* of the evaluation is usually obtained processing environmental features (e.g. average market price, average response time for delivery).

Generalizing this picture, we can recognize three areas of actions, related to *features* which influence the social affordance of buying:

1. *easiness to find a good offer* (more in general, to find an adequate reason motivating the trans-action), highly related to the "search frictions" studied in economics, e.g. in [21].
2. *compliance*, i.e. proneness of agents to respect social expectations,

3. *effectiveness of control structures*, i.e. ability of enforcement processes to furnish remedies to infractions.[10]

The figure does not make explicit the nature of the remedy. The buyer has an inherent motive: to acquire a certain good, via a certain payment. If the remedy entails the delivery, then the initial desire is satisfied (in this case, the term *repair* is usually preferred). If not, the buyer's primary intent will be unsuccesful. Intuitively, the social affordance attributed to that behaviour (agent-role) should lose consistence. Therefore, more strictly, we should replace the third item with *effectiveness of control structures in repairing the failure.*[11]

The *abilities* necessary to the buyer for the performance of buying can be easily read by following in vertical the actions reported in Fig. 5: to monitor and to evaluate offers, to accept; to pay, to monitor delivery and to evaluate its failure; to enforce, to monitor the enforcement and evaluate its failure.

The complete social affordance of an agent-role can be therefore expressed as composition of these abilities and features, obtaining a far more rich description of the *entrance condition* of the sale.

Evidently, a similar analysis can be performed for an agent-role intentionally non-compliant; the related feature in this case would be the *absence* of control structures, or their *disability to enforce.*
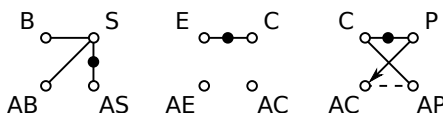

Fig. 6. Three prototypical scenarios of non-compliance: monopoly or cartel, swap-scheme, short-circuit.

4.3   Prototypical patterns of non-compliance

In this section, we will present three prototypical schemes of non-compliance, using the concepts presented so far.

If there is only one seller who offers a certain product, all interested buyers are *subjected* to the price chosen by this seller. The topology of this scenario shows a cut on the connection with the alternative seller (Fig. 6, left). This may happen because of a **monopoly**, or because of a **cartel** coordination (multiple sellers acting as one): the related agent-role directs two supposedly competing institutional roles. The resulting institutional context is not balanced towards the buyers. The more the seller raises his price, the more the potential buyers will lack the power to accept the offer. This process is of no harm to the seller,

---

[10] We use the plural form as we could extend the figure with a hierarchical structure of enforcement processes. If the first enforcer fails, the second one is liable to enforce the first, etc.

[11] The compensation may still interact positively with other agent-roles the agent is embodying, determining a general positive payoff.

because, as long as there will be a buyer accepting his offer, his action will be still successful. However, the general functionality of the institution will be damaged, because many agents are simply cut out from it.

A typical example of **swap** scheme is vote-buying. A candidate promises the performance of a certain action in exchange of the vote of an elector. Stated in this way, this is not different from any political campaign, directed often towards specific communities or groups of interest. Social aggregates use their social influence on their members to support selected politicians. This is not forbidden. What changes in a vote-buying scheme is that the coordination is strict: there is control on individual vote performance.[12] The agent-role involved in a swap-scheme plays two dual institutional roles (e.g. elector and candidate), monitoring and timing the performance of those. When this coordination is set, the connections with competing candidates, and competing electors disappear. The affordance of cartel and swap schemes is determined by two factors: the actual ability of the agent-roles to control the performance, and the lack of adequate reactivity and reparation from the social environment.

The impact of technological innovation is often relevant in respect to institutions as well. The possibility of copying and sharing at almost no cost copyrighted material gives to the consumer the practical ability to easily perform these actions. With the sharing, in particular, any consumer becomes provider too. This results in a **short-circuit** in the market of consumers/providers of contents. The remedy part given by the copyright institution is not relevant in the social affordance formula: there is no physical equivalence to restitution of duplicated digital content. Furthermore, this agent-role does not sell the content, but *shares* it: as a provider he has no expectations of compliance. The environmental parameter of the affordance formula is in this case practically irrelevant.[13]

4.4   An evolutionary perspective

Considering the account on affordance given by [22], people's behaviour would be selectively constructed in relation to the social affordances given by the contextual social environment. Although his account is not prevalent in the affordance community research, this point makes sense in respect to social affordances.

Donald, amongst others, observes in [11] how *mimesis* is at the base of many human abilities. In his definition, mimesis is not simple imitation: it is an "ability to produce conscious self-initiated representational acts that are intentional". In our terms, this definition is equivalent to the ability of acquiring and playing agent-roles. We assume as general working principle that people tend to *reproduce* behaviours—to embody agent-roles—which they believe are affordable, and

---

[12] One of the most recent practice is the use of mobile cameras during the vote, invaliding the secret ballot principle. Another option, valid in case of referendum, is to check whether people do not go to the polling station.

[13] Strengthening enforcement actions may help to reduce the number of agents that will actually share materials, because of negative payoffs, but it does not modify the evaluation of affordance. The impact of technology has been structural.

with better payoffs (not necessarily of economic nature). The perspective of a social agent, however, is internal to a specific social setting. It is in this respect that he associates affordances and payoffs to agent-roles, rather than a strictly legal-institutional perspective. This explains why certain agent-roles are intentionally non-compliant, and others are believed to be compliant, while they are not.[14]

If the number of "faulty" behaviours increases too much, the institution may be compromized. Enforcement actions may partially reduce this, but when the change affects social affordances/dispositions, the problem is on a more structural level. In this case, a more structural reaction is required on the institutional level (changing norms within the institution), or on the super-institutional level.

5   Conclusion and discussion

The motivation behind our research is that the focus on agent-roles can effectively support operational and design processes in legal/administrative systems, bringing the human factor into a central position in contemporary infrastructures. By collecting agent-roles known in the target social setting, policy-makers, regulators and administrators would have a more systemic representation of actual social structures. We are working on concrete applications: (i) a knowledge base of collected agent-roles can be used in operations, in order to support the execution of (positive and negative) enforcement actions; (ii) in an adequate design framework, it can provide a testing ground where to tailor new regulations, in order (a) to calibrate rewards and sanctions, and (b) to create a new institutional layer, introducing new agent-roles in the legal system. In this framework, the concept of affordance, as *subjective component of power*, is of critical importance for the contextualization of agent-roles.

Related literature In the literature the use of the term social affordances is not without ambiguity. A domain-specific interpretation, not relevant to our research, refers to the study of human-computer interfaces for social media. We proceed rather in continuity with [13]: *"[..] economic behavior, political behavior - all depend on the perceiving of what another person or other persons afford, or sometimes on the misperceiving of it"*. Kaufmann and Clément provide in [18] a recent overview of the several interpretations of affordances related to social behaviour. These studies are highly relevant, but focus mostly on components of social behaviour that occur at pre-symbolical level (gestures, expressions), which can be neglected at our level of description. In our terms, the nature of social

---

[14] On the other hand, in certain situations, people may not see other choice than non-compliance to achieve even basic goals. In some of these cases, this choice may actually exist, but they were not able to acquire the relative agent-role, or to evaluate positively the relative affordance. Thanks to an anonymous reviewer, we noticed here an interesting connection between social affordance and the *capability* theory introduced by Sen (e.g. [27]), which remains to be investigated in the future.

affordance is that of a synthetic statement too, but it is more related to the AI qualification/ramification problem, rather than pre-symbolic processing.

Computational implementation A natural extension of this study is to validate the proposed conceptualization via computational simulation. The agent-role model has strong connections with BDI frameworks used in current MAS practices and research. We developed our first prototypes on the platform *Jason*, which implements and extends the *AgentSpeak(L)* language [5]. At the moment, the integration of social affordances in an agent program is still matter of study. Interestingly, the *event-condition-action* (ECA) rule form, characterizing AgentSpeak(L), naturally models the practical reasoning related to affordances. For instance:

event When I want to achieve a certain goal,
condition if I evaluate positively the affordance of a certain action (that I know to bring about that goal),
action I start performing that action.

Relevant research questions concern how to model the computation of features and abilities performed by the agents (e.g. how the last failure in receiving delivery impacts the buyer's perception of the seller's compliance? and of the market overall compliance?). Neglecting psychological factors, and focusing on the computation, the problem of passing from propositions to features has already been investigated in *qualitative reasoning* [14], but insofar we have not found any related implementation in *Jason* or similar platforms.

References

1. Abelson, R.: Psychological status of the script concept. American psychologist, 715–729 (1981)
2. Boella, G., van Der Torre, L.: The ontological properties of social roles in multi-agent systems: Definitional dependence, powers and roles playing roles. Artificial Intelligence and Law 15(3), 201–221 (2007)
3. Boer, A., van Engers, T.: An Agent-based Legal Knowledge Acquisition Methodology for Agile Public Administration. ICAIL 2011: The Thirteenth International Conference on Artificial Intelligence and Law (2011)
4. Boer, A., van Engers, T.: Knowledge about Implementation of the Law: reflections on knowledge representation and the role of the state in making the law work. FCASL 2011: Workshop on Fundamental Concepts and the Systematization of Law (2011)
5. Bordini, R.H., Hübner, J.F., Wooldridge, M.: Programming multi-agent systems in AgentSpeak using Jason. John Wiley & Sons Ltd. (2007)
6. Chemero, A.: An Outline of a Theory of Affordances. Ecological Psychology 15(2), 181–195 (2003)
7. Clark, A.: Feature-placing and proto-objects. Philosophical Psychology 17(4), 443–469 (Dec 2004)
8. Commons, J.R.: Institutional economics. The American economic review 21(4), 648–657 (1931)

 9. Conte, R., Paolucci, M.: On Agent Based Modelling and Computational Social Science, available at SSRN 1876517
10. Dari-Mattiacci, G., Geest, G.D.: The Rise of Carrots and the Decline of Sticks. University of Chicago Law Review 80(1), 341–392 (2013)
11. Donald, M.: Origins of the Modern Mind: Three Stages in the Evolution of Culture and Cognition. Harvard University Press (1991)
12. Fonagy, P., Target, M.: Attachment and reflective function: their role in self-organization. Development and psychopathology 9(4), 679–700 (1997)
13. Gibson, J.: The ecological approach to visual perception. Houghton Mifflin, Boston (1979)
14. Halstead, D.T., Forbus, K.D.: Transforming between propositions and features: Bridging the gap. AAAI2005: 20th National Conference on Artificial Intelligence, 777–782 (2005)
15. Hart, H.L.A.: The Concept of Law. Clarendon Press (1970)
16. Hayes, E.C., Hayes, H.P.: Sociology. D. Appleton (1930)
17. Hohfeld, W.N.: Fundamental legal conceptions as applied in judicial reasoning. The Yale Law Journal 26(8), 710–770 (1917)
18. Kaufmann, L., Clément, F.: How culture comes to mind: From social affordances to Cultural analogies. Intellectica 46 (2007)
19. Luhmann, N., Ziegert, K.A., Kastner, F., Nobles, R.: Law As a Social System. Oxford Socio-Legal Studies, Oxford University Press, Incorporated (2008)
20. Mingers, J.: Can social systems be autopoietic? Assessing Luhmann's social theory. The Sociological Review 50(2), 278–299 (2002)
21. Mortensen, D.: Markets with Search Friction and the DMP Model. American Economic Review 101, 1073–1091 (2011)
22. Reed, E.S.: Encountering the World: Toward an Ecological Psychology. Oxford University Press (1996)
23. Sartor, G.: Fundamental legal concepts: A formal and teleological characterisation. Artificial Intelligence and Law 14(1), 101–142 (2006)
24. Searle, J.R.: Speech acts: An essay in the philosophy of language. Cambridge University Press (1969)
25. Searle, J.R.: Making the Social World: The Structure of Human Civilization. Oxford University Press (2010)
26. Searle, J.R., Vanderveken, D.: Introduction to the Theory of Speech Acts. In: Foundations of Illocutionary Logic, vol. 1. Cambridge University Press (1985)
27. Sen, A.: Development as Capability Expansion. Oxford University Press, New Delhi and New York (2003)
28. Sileno, G., Boer, A., van Engers, T.: From Inter-Agent to Intra-Agent Representations: Mapping Social Scenarios to Agent-Role Descriptions. ICAART 2014: 6th International Conference on Agents and Artificial Intelligence (2014)
29. Turvey, M.: Affordances and prospective control: An outline of the ontology. Ecological psychology 4(3), 173–187 (1992)
30. Vatiero, M.: From W. N. Hohfeld to J. R. Commons, and Beyond? Journal of Economics 69(2) (2010)
31. Webb, S., Webb, B.: Methods of Social Study. Cambridge University Press (1975)