Open Reading without Free Choice

Albert J.J. Anglberger[1], Huimin Dong[2], and Olivier Roy[2]

[1] Munich Center for Mathematical Philosophy, LMU Munich, Germany
[2] Philosophy and Economics, University of Bayreuth, Germany

Abstract. The open reading of permission (OR) states that an action α is permitted iff every execution of α is normatively OK. Free Choice Permission (FCP) is the notorious principle turning permission of disjunction into conjunction of permissions $P(\varphi \vee \psi) \to P\varphi \wedge P\psi$. We start by giving a first-order logic version of OR that defines permission of action types in terms of the legality of action tokens. We prove that implies FCP. Given that FCP has been heavily criticized, this seems like bad news for OR. We disagree. We observe that this implication relies on a debatable principle involving disjunctive actions. We proceed to present alternative views of disjunctive actions which violate this principle, and which so block the undesired implication. So one can have the open reading without free choice and, as we argue towards the end of the paper, there are philosophical reasons why one should.

This paper is about two related principles pertaining to permissions. On the one hand we have *Open Reading* of permissions.[1]

[1] To our knowledge the term was coined by [6]. In what follows, we give a brief history about the development of the terms "Strong Permissions" and "Open Specification [9] (or Open Interpretation [6])". Strong Permission is first mentioned in [27], and an action is permitted in this sense if "the authority has considered its normative status and decided to permit it". But his later work [28] defines strong permissions satisfying a property that $P(A \vee B) = PA \wedge PB$, and names it as Free Choice Permission. Our FCP in this paper is the one direction of his. The open interpretation of an action expression is first mentioned in [9]. Roughly speaking, an action expression in an open sense is that "if an action expression is used it means informally that the action denoted by that action expression occurs, possibly in combination with other actions" [8]. Under such an "open" specification for actions, a strong permission here adopts the definition that an action is permitted if every way to perform this action never leads to a violation state. Formally, $P\alpha := [\alpha]\neg Violation$. Thus, the idea of strong permissions can return to [28]'s sense, namely the FCP property. Thus, strong permissions is equal to saying FCP in [28], and it is defined under an open specification of actions and it implies FCP in [9,8]. Open interpretation in [6] expands the idea of open specification into the openness with respect to the concrete description of the effects of actions. Our basic idea of Open Reading is rooted in [28, pp. 34-35], but not in its Strong Permission sense; also, the openness of OR is different from the one in [9,6], because we reject the Additivity while they accept it. Our OR focuses on the interaction between action tokens and action types, and then interprets permissions according to their relations. These are never explicitly expressed in the literature. More details will be presented in section 1.

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(OR). An action type α is permitted iff every token of α is normatively OK.

On the other hand, we have *Free Choice Permission*. This principle states that a permission to perform a disjunctive action is a permission to choose freely between the disjuncts.

(FCP). $P(A \vee B) \rightarrow P(A) \wedge P(B)$

FCP is "probably the most discussed issue in the logic of permission", and most of this discussion is heavily critical [12, p.207] We do not try to defend this principle here. In Section 1 we show, however, that it follows for OR. Is one then forced to reject OR? No. What one should do is change the underlying theory of action. This is the main point of this paper. Indeed, a quick look at the derivation of FCP from OR reveals that the culprit is what we call the principle of additivity:

(Add). If t is an action token of type φ then it is also of type $(\varphi \vee \psi)$.

The bulk of this paper is devoted to explaining why and when Add should be abandoned. In Section 2 we present three general reasons why Add fails. In Section 3 we show two concrete examples of the failure of Add. So it is possible to keep OR while rejecting FCP. But is this also a plausible view? Yes. We argue for that in Section 4.

1 A First-Order Derivation of FCP from OR

Deontic logic has primarily dealt with normative notions as applied to *generic actions* or *action types*, rather than *individual acts* or *act tokens*. The relation between generic actions and individual acts has not attracted much attention in deontic logic, although there are notions of normative concepts that can be interpreted as relating individual acts to generic actions. As we will see later, OR can be interpreted as being one of them. Here is its original formulation.

(Original OR). An action α is permitted iff every execution of α results in a state that is normatively OK.

Although mainly used in dynamic deontic logic (DDL), the idea behind the open reading of permission goes back (at least) to G. H. von Wright [28, p. 34-35]. In DDL, early formalizations of Original OR can already be found in J.-J. Ch. Meyer's seminal paper [20]. He associates permission with the dynamic logic box operator $[\ ]$ and its dual $\langle\ \rangle$, and defines a concept of *free choice permission* P_F as:

(PDL P_F). $P_F\alpha =_{df} P\alpha \wedge [\alpha]OK$, where OK expresses, that a state is normatively OK, and the "usual" concept of permission $P\alpha$ is defined as $\langle\alpha\rangle OK$ (Meyer used the negation of a violation constant instead of OK. For our purpose, though, this difference is irrelevant.)

J. Broersen [6] implements a version of Original OR without the additional requirement $\langle\alpha\rangle OK$, which makes it even closer to its natural language version.

(PDL OR). $P\alpha =_{df} [\alpha]OK$, where OK expresses, that a state is normatively OK (Broersen also used the negation of a violation constant instead of OK.)

As both authors observe (cf. [20, p. 121] and [6, p. 166]), this very association makes the so-defined permission predicate one that obeys free-choice:[2]

(PDL FCP). $P(\alpha \cup \beta) \rightarrow P\alpha \wedge P\beta$

In dynamic deontic logics α, β, ... usually are singular terms representing action types and permission therefore a defined predicate [20], [6]. Interestingly, in dynamic logic the theorem responsible for the derivability of PDL FCP from PDL OR is a special form of additivity, expressed in the formula:

(Add PDL). $< \alpha > \varphi \ \rightarrow < \alpha \cup \beta > \varphi$

As we will see later, this is not a coincidence. We will argue in a slightly more abstract setting, that every deontic logic that contains the Open Reading and an additivity principle (or rule) of a special form (expressible by a certain first-order proposition), leads to free-choice permission.

In our framework, we require generic actions to be describable by a proposition (a common assumption found in many deontic logics), and interpret "every execution of α" as "every individual act instantiating α". This gives a natural reinterpretation of Original OR, one that links generic actions to individual acts:

(OR). An action type φ is permitted iff every individual act instantiating φ is normatively OK.

Contrary to DDL, this results in a logic where permission once again can be treated as a sentential operator, and OK becomes a property applicable to individual acts rather than a propositional constant being true at certain states. Furthermore, OR *explicitly reduces* the permission of a generic action to the claim of certain individual acts being normatively OK or legal.[3] We believe this to be a very natural approach connecting singular and generic actions.

In a first step we now formalize OR. We extend a first-order language with individual constants $c_1, c_2, \ldots$ and two additional types of formulas:

(Inst) Formulas $Inst(t, \varphi)$, where t is a singular term and φ is an arbitrary formula not containing occurrences of $Inst$. $Inst(t, \varphi)$ is read as 't instantiates φ'.

[2] Although only stated implicitly, R. Trypuz and P. Kulicki make a similar observation in their algebraic account of actions [26].

[3] So this approach also reduces permissions and obligations to another property of act tokens, namely being "normatively OK" or legal. We leave it has a primitive notion here. One could explicate this notion in terms of being liable, or not, to blame or sanctions, as done in DDL.

(OK) Formulas $OK(t)$, where t is a singular term. $OK(t)$ is read as 't is normatively OK'.

OR can now be easily expressed using these notions:

(OR*) $P\varphi =_{df} \forall x(Inst(x, \varphi) \rightarrow OK(x))$

Note that we do not make any restrictions on $Inst$ and OK, we merely assume that individual actions can be the range of quantification, and that generic actions can be represented by formulas. Recall that OK is a predicate applicable to individual actions (action tokens) and not to states as in DDL.

What exactly the resulting deontic logic will look like depends on the theory of individual acts, the instantiating operator, and the OK predicate (as applied to individual acts). How well this approach performs certainly is a matter for more detailed investigations concerning the logic of $Inst$ and OK. At this stage, we leave this for further research. In what follows, we just want to discuss one principle for $Inst$, and take a look at some of its consequences. The three frameworks presented in next section might serve as a blueprint for developing a logic of $Inst$.

At this point it seems natural to strengthen this theory by postulating additional rules for more complex generic actions. At least at first sight, for disjunctive generic actions $\varphi \vee \psi$ we have two obvious and equally reasonable candidates.

For every singular term t:

$$(\vee Int1)\ \frac{Inst(t, \varphi)}{Inst(t, \varphi \vee \psi)} \qquad\qquad (\vee Int2)\ \frac{Inst(t, \varphi)}{Inst(t, \psi \vee \varphi)}$$

Although the resulting logic of action is still very weak, it is strong enough to prove FCP. Suppose $P(\varphi \vee \psi)$, which by OR* means $\forall x(Inst(x, \varphi \vee \psi) \rightarrow OK(x))$. Using $\forall x(Inst(x, \varphi) \rightarrow Inst(x, \varphi \vee \psi))$ (follows from $\vee Int1$) and transitivity of material implication we arrive at $\forall x(Inst(x, \varphi) \rightarrow OK(x))$, which (according to OR*) is equivalent to $P\varphi$. Analogously for $P\psi$ via $\vee Int2$.[4]

So if we want to avoid FCP we have to drop either OR* or both $\vee Int1$ and $\vee Int2$.[5] Dropping only one of $\vee Int1$ and $\vee Int2$ is not an option in our view. We think the following is a plausible principle for disjunctive actions.

($\vee Sym$) $\forall x(Inst(x, \varphi \vee \psi) \leftrightarrow Inst(x, \psi \vee \varphi))$

Under that principle $\vee Int1$ and $\vee Int2$ turn out to be deductively equivalent. Another argument for dropping both $\vee Int1$ and $\vee Int2$ is that otherwise one still gets either $P(\varphi \vee \psi) \rightarrow P\varphi$ or $P(\varphi \vee \psi) \rightarrow P\psi$. For someone dissatisfied with FCP this is equally undesirable.

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[4] This derivation seems to have been already observed, at least implicitly, for instance in Makinson's account of disjunctive permissions as "checklist conditionals" [16]. The contribution here is to make it explicit.

[5] Of course, one could also give up certain principles of first-order logic. We do not consider this option here though.

So if we want to avoid FCP we are left with a choice between dropping OR* or both $\vee Int1$ and $\vee Int2$, or both. Given what we have just said, we will lump $\vee Int1$ and $\vee Int2$ together and talk generally of a choice between OR and additivity Add, as presented in the introduction.[6]

If we drop Add, we cannot derive FCP from OR* anymore. This can be shown by a simple first order model, in which one utilizes the fact that $Inst(a, \varphi)$ is independent from $Inst(a, \varphi \vee \psi)$.[7]

The next two sections can be seen as a conceptual exploration into ways to keep OR while resisting FCP. We argue that there are plausible notions of disjunctive generic actions which allow that, i.e. for which Add does not hold. Of course, one could agree with us on Add but also insist on rejecting OR. So no problem with free choice, that person would say. In Section 4 we address this potential objector. In our view OR does express a plausible notion of permission, and so there are good reasons to look for ways to accept it without being committed to FCP.

2 Rejecting Additivity: General Reasons

In this section we answer two questions:

1. Why reject Add?
2. And if we do so, which algebraic properties do action types retain?

We do so by explaining how normality, resource sensitivity and relevance, once applied to action types, warrant a rejection of additivity. Of course dropping additivity is a well-known solution to avoid classical deontic paradoxes. The novelty of our approach is to provide additional reasons, beyond avoiding paradoxes, to reject additivity.

Normality, resource sensitivity and relevance are behind very well-known logical calculi. So rejecting Add does not force us into a logical no-man's land. The algebraic properties of these systems are known, and can be used to develop a full-fledged calculus of action types that does not include Add.

2.1 Normality

Statements about action types can be seen as referring to the normal instances of that type. Normality statements are made against a set of conventional assumptions, shared views or beliefs. This idea is by now widely accepted in AI [18], non-monotonic logic [17] and linguistics (see below). Applied to action types this blocks Add. A normal instance of "walking back home" might not be a normal instance of "walking back home or robbing a bank." Why? One could argue that normal instances of disjunctive action types are those where both disjuncts are or were live options. In that view then there might just not be any normal

[6] The reason for calling it additivity is the connection with linear logic. See Section 2.2.

[7] We explore this in more detail in section 5.

instances of "walking back home or robbing a bank". I might not be the kind of person who is normally in a state of mind where I can rob a bank. Less dramatically, the normal cases of walking home might be completely disjoint from those where robbing a bank is a live alternative. All the latter might be abnormal instances of the former. So if generic action types are taken to refer to normal tokens, additivity fails.

There is an extensive literature in formal semantics showing how to handle this phenomena when it comes to action sentences. [3], for instance, treats action types as generic. Generics do not express unrestricted quantifications over all instances. Constraints such as interests, our beliefs or shared knowledge constrain this quantification [3,29,25].

2.2 Resource Sensitivity

Resource sensitivity is the general idea that resources, be they linguistic or informational, cannot be reused or discarded at will. Just like normality, it is by now a fairly accepted idea that language and information are resource sensitive [4,13]. Linear logic [7] has been developed precisely to deal with this phenomena. There are two kinds of disjunctions in linear logic: additive and multiplicative. These are expressed by the following rules, in natural deduction systems:

$$(\mathbf{par})\ \frac{\Gamma, A, B}{\Gamma, A \parr B}$$

$$(\mathbf{plus_L})\ \frac{\Gamma, A}{\Gamma, A \oplus B} \qquad (\mathbf{plus_R})\ \frac{\Gamma, B}{\Gamma, A \oplus B}$$

The rule **par** is for the multiplicative disjunctive connective $\parr$, and the rule **plus** for the additive one $\oplus$. [8] Notice that the information contexts of premises in the multiplicative disjunction need all information of both alternatives. This is not the case for the additive one [10,11]. This reflects the fact of resource sensitivity. The same information inputs must be used in both alternatives for the additive disjunction. In the multiplicative case each input is used exactly once in producing the output [1].

This general idea applies to action as well. Additive disjunction expresses the choice of one action token between two possible token alternatives, where multiplicative disjunction expresses a dependency between two alternative tokens [10,11]. For instance, in a Chinese restaurant, an action token consisting of

[8] We also have a Sequent Calculus version of the rules **par** for the multiplicative disjunctive connective $\parr$, and the rules **plus** for the additive one $\oplus$ as follows:

$$(\mathbf{par_L})\ \frac{\Gamma_1, A \vdash \Delta_1 \qquad \Gamma_2, B \vdash \Delta_2}{\Gamma_1, \Gamma_2, A \parr B \vdash \Delta_1, \Delta_2} \qquad (\mathbf{par_R})\ \frac{\Gamma \vdash A, B, \Delta}{\Gamma \vdash A \parr B, \Delta}$$

$$(\mathbf{plus_L})\ \frac{\Gamma, A \vdash \Delta \qquad \Gamma, B \vdash \Delta}{\Gamma, A \oplus B \vdash \Delta} \qquad (\mathbf{plus_R}, i = 1, 2)\ \frac{\Gamma \vdash B_i, \Delta}{\Gamma \vdash B_1 \oplus B_2, \Delta}$$

All of these still reflect the fact of resource sensitivity in our topic.

an offer of baked oysters is not a token of an offer of a choice between baked oysters or pizza. The cook knows nothing about Italian pizza, or the restaurant lacks the ingredients for Italian dishes. So this is a case of a multiplicative, non-additive disjunction.

2.3 Relevance

Additivity can also be rejected by invoking relevance. This idea has been explored in [24], [23]. According to these authors the root of (some) classical paradoxes is the rules governing (classical) disjunction introduction. In deontic logic the paradigmatic example is Ross's paradox. Instead of using non-normal modalities, the authors in [24], [23] suggest that inference steps using rules like Add are problematic because they introduce a certain kind of *irrelevance*:

> "[...] one should distinguish between *validity* in the sense of mathematical logic and *appropriateness* with respect to *applied arguments*. The paradoxes rest on certain *irrelevant* deductions, which are, although mathematically valid, nonsensical and often enough harmful in applied arguments." [23, p. 399]

Generally speaking, an inference rule "From φ infer ψ" is prone to introducing irrelevance iff ψ contains a subformula which can be replaced by an arbitrary formula *salva validitate*. In the case of classical deontic logic, blocking inference rules prone to introducing irrelevance excludes Add and as a consequence also Ross's Paradox. If this criteria is applied to the logic of our $Inst$ operator (Section 1), $\vee Int1$ and $\vee Int2$ have to be given up.

Why should we accept this relevance criterion? Here are three arguments from [23]. First this solves a whole variety of paradoxes from very different areas, e.g. deontic logic, philosophy of science, epistemology. In particular, if we are interested in applying logic, this criteria seems to do a pretty good job. Second, there even seems to be empirical evidence that subjects reason in line with this criteria. Schurz reports conducting a small experiment with students untrained in logic (see [23, p. 429–430]). As it turns out, these students regard (logically) valid inferences *with* irrelevant parts occurring in their conclusion as intuitively invalid. On the other hand, valid arguments *without* irrelevant parts appearing in their conclusion are considered to be intuitively valid. This gives us at least partial evidence for believing that everyday reasoning is closer to logical reasoning including this criteria than to logical reasoning without it. Finally, we conjecture that this also holds for reasoning about actions, and that Add can be rejected on these grounds. The following is a revealing instance:

$$\frac{Inst(a,p)}{Inst(a,p\vee\bot)} \quad ,$$

where p stands for some generic and possible action (e.g. smoking), and a for an instance of p (e.g. John's smoking of his first cigarette after lunch). Taking into account Schurz's empirical results, we think it is very unlikely that logically untrained subjects would regard a derivation from

"John's smoking of his first cigarette after lunch is an instance of smoking"
to
"John's smoking of his first cigarette after lunch is an instance of smoking *or* walking and not-walking"

to be intuitively valid. Whether or not this is so remains to be seen. If this turns out to be true, there is a notion of disjunctive actions (e.g. the one presumably used in everyday reasoning) that does not validate Add. But Schurz's results already show that relevance does play a role in reasoning in general, and that Add could be rejected on that ground.

3 Rejecting Additivity: Two Concrete Cases

In this section we exemplify our claim that additivity should be rejected. We observe that the agency operator "deliberative stit" is not additive. Additivity also fails when one sees disjunctive actions as non-trivial mixings. So having the Open Reading without Free Choice Permission does not commit to an outlandish theory of action. The principle fails in well-known cases.

There is another reason why it is important to show concrete cases of non-additive disjunctive action types. It is not clear what constitutes a disjunctive action type in the first place. PDL gives a simple answer to that. These are non-deterministic choices. An action of type $\alpha \cup \beta$ is a non-deterministic choice between an action of type α and an action of type β. If one can become rich by "going to college or robbing a bank", then one can do so by either "going to college" or "robbing a bank." And also the other way around.

So in PDL the vague notion of disjunctive action types is made precise by reducing it to a disjunction of types. This reduction is reflected by the following PDL validity:

(ND-Choice PDL). $(< \alpha > \varphi \vee < \beta > \varphi) \leftrightarrow < \alpha \cup \beta > \varphi$

If all disjunctive action types were analyzable this way, additivity would hold. The examples below show that this is not the case. There are natural readings of disjunctive action types for which additivity, and thus the interpretation as non-deterministic choice, fail.

3.1 Deliberative Stit

According to the so-called deliberative *stit*, or *dstit*, agent i sees to it that φ in history h and moment m whenever "φ is guaranteed by a present choice of i", while i could have done otherwise [5, p.37]. Choices at a given moment m are represented by a partition of the set of histories compatible with m. Figure 1 shows a small example. Four histories are compatible with m_1. Agent i has two possible choices or options: c_1 and c_2. In c_1 she forces that the future will lie in histories h_1 or h_2. In c_2 she rules out these two histories and forces h_3 or h_4. Write $Choice_i^m(h)$ the cell of i's choice partition at m that contains h. A formula

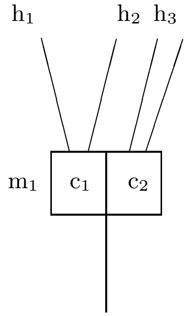

Fig. 1. Branching time with choices

[i *dstit* : φ] is true at moment-history pair m, h whenever φ is true at all pairs m, h' with $h' \in Choice_i^m(h)$, and there is a pair m, h'' in which φ is false.

Stit theory is about consequences of actions, not directly action types. A formula of the form [i *dstit* : φ] doesn't mean that i performs a φ action. Rather, it says there is a concrete choice available to i through which she can achieve φ.

But this is not to say that no action types can be described using the *dstit* operator. First, atomic propositions in can be interpreted as describing state where an action of a given type is executed. Say p is "Bob is smoking." Then [Bob *dstitp*] is the statement that Bob sees to it that the current history is one where he is smoking. So *stit* formulas can describe action types in this indirect way. Second, some action types can be described by the consequences they bring about. Polluting and breaking are good examples, just like the more positive actions of healing and rescuing. In this case *stit* formulas directly describe a specific action type.

So there are at least two different ways to read off action types out of *stit* formulas. All that remains to observe is that additivity doesn't hold for them. Let p only be true everywhere except at m_1, h_3 in Figure 1, and q be true only at m_1, h_4. Then [i *dstit* : p] is true at m_1, h_1, but not [i *dstit* : $p \vee q$]. There is no moment-history pair that falsifies both p and q. So *dstit* is not a normal modality. This fact is well-known, c.f. [5, p.40], and should not come as a surprise since the operator can be defined as a combination of two normal modalities [15]. The important point for the present argument is that we have a well-known theory of action in which additivity fails.

3.2 Non-trivial Mixing

Given t and t' two actions available to an agent, a mixed action μ is the action of doing t with probability p and t' with probability $1 - p$. Generally, a mixed action over a (measurable) set T is a probability distribution over that set. We call an action *non-trivially* mixed on a set T when it assigns non-zero probability to all the elements of T, i.e. when it has full support over T. Non-trivial mixings require two things. First, each of its components must be a real alternative to the agent. Second, the agent must be able to randomize between them.

Mixed actions are fundamental to game and decision theory. In game theory (non-trivial) mixed strategies are required in proving the existence of Nash equilibria in some games (c.f. [21]). In decision theory dominance reasoning sometimes involves non-trivial mixing. And such actions have recently been put to use to answer purported counter-examples to causal decision theory (see e.g. [14]). One can interpret mixed actions objectively or, in games, as the beliefs of others regarding one's own action. We focus here on the objective interpretation. Here the idea is that playing a mixed action involves real randomizing, eventually using some appropriate device. A typical example is random security searches at airports.

Non-trivial mixing of actions be seen as one kind of disjunctive action, and this is sufficient to invalidate additivity. Take a token t that is an instance of smoking. This token is not necessarily an instance of a non-trivial mixing between smoking and, say, jogging. There might be no token of jogging available to the agent in the first place, and the agent might not be able to randomize. She might just lack the required device to do so. So it is not true that for any token of type φ this token is also an instance of type $\varphi \vee \psi$. In some cases these disjunctive actions will be non-trivial mixings, for which additivity fails.

4 Why Keep the Open Reading

Up to now the paper could been seen as an investigation of the logical space between OR and FCP. We found plenty. This is an important observation in itself. But one could still argue that this investigation is philosophically moot because OR is dubious in the first place. We argue in this section that this is not the case. Not only can one keep OR, one *should* keep it. To be more precise, our claim is the following:

OR reduces permissions of action types to the legality or normative status of action tokens. Under that reading, to say that an action type φ is permitted in a given situation is to say that executing a φ action is sufficient for legality. The companion idea is that obligations give necessary conditions for legality: φ is obligatory iff no non-φ action is legal. This is the Andersonian-Kangerian Reduction of obligation [19]. In our view, combination of the two ideas has intuitive appeal (c.f. [22,2]). Obligations give necessary and sufficient conditions for legality.[9] As an historical aside, it is worth mentioning that von Wright seems to have endorsed a view of permissions close to OR:

> "It seems to me that the most natural way of understanding the phrase is this: "It is permitted that p", no circumstances being specified, means that it is permitted that p, no matter what the circumstances are, i.e. in *all* circumstances." [28, pp. 34-35]

[9] Note that here we lose the usual duality between O and P.

There are two obvious objection to OR. The first one goes as follows. Suppose smoking is permitted outside the building, and that I could smoke outside while robbing my fellow smokers. Surely smoking and robbing my fellow smokers is not permitted, because robbing is forbidden. But any smoking and robbing token is a smoking token. So OR cannot be correct.

There are three ways to reply to this first objection. First is to say that all the objection shows is that, with OR, permissions require circumscription. If smoking while robbing is not permitted then it is not smoking that was permitted in the first place. It is smoking and not robbing. Unless a skeptic can show that it is not possible to fully circumscribe permitted action types, the open reading remains in force.

The second reply is that the open reading can be seen as a *prima facie* or default reading. Faced with abnormal or exceptional cases like smoking and robbing one should revise the system of permissions so as to exclude these cases. As before, in the revised system the open reading regains its status as default reading.

Finally, one can avoid the objection by restricting the universal quantification to the set of executions that are not otherwise illegal or not normatively OK. Smoking while robbing is not a legal instance of smoking, because it is an instance of robbing, which is otherwise illegal. The objection points to the danger of unrestricted quantification. Once appropriately restricted the open reading remains. Smoking is permitted if and only if all instances of smoking are legal, which are not deemed illegal through being an instance of a different action type. In other words, in this amended sense, permission provides sufficient conditions for legality, everything else being legal. This reply has the advantage over the first one in that it is less prone to the skeptical rebuttal. The "everything else" clause can remain implicit or be seen as expressing the *prima facie* character of permissions. It doesn't require explicit circumscription. But it is still the open reading.[10]

So OR has intuitive appeal, especially in combination with the Andersonian-Kangerian Reduction for obligation, and the obvious objection less grip than one would think. Is there a positive argument for OR? Yes. One could argue for it in terms of applicability or "decidability"[11] for the assessment of concrete situations. Is token t legal or illegal? E.g. was *that* a legal driving maneuver? Under the classical Andersonian-Kangerian reduction for permission the judge only has a negative test for assessing whether an action is legal or not. Under the open reading the judge has a pair of tests: is t an instance of a forbidden type? If no then it is not illegal. But is it legal then? Some legal systems have

[10] There is another objection looming. It uses conditional permissions. If I have no income, I am permitted not to pay taxes. Otherwise not paying taxes is illegal. So it false that all instances of not paying taxes are OK or legal. And this is neither because some of these instances are otherwise illegal, nor because the permitted action type is not circumscribed enough. Could the open reading be adapted to capture such conditional permissions? We think so, but leave it for future work. We thank an anonymous referee of DEON for raising this point.

[11] In a non-technical sense of "decidable".

closure conditions stating that everything not explicitly forbidden is permitted. But not all systems have that. In that case OR provides the second step needed for assessing legality, namely checking whether the token at hand is an instance of a permitted type. So OR gives additional tools for deciding the legality of specific actions, and this is a reason to accept it.

5 Conclusion

This paper makes three main points:

1 Any deontic system containing the open reading and additivity for action types must validate Free Choice Permission.
2 There are good philosophical reasons to reject additivity, and the property fails in well-known concrete theories of agency. So one can have the open reading without free choice.
3 There are good philosophical reasons to accept OR. So one should accept the open reading, arguably also without free choice.

Of course, there are several issues that deserve further investigation. One point concerns the logic of agency one would get by incorporating each of the philosophical reasons to reject Add that we presented in Section 2. We observed that for each of these we have known logical systems, and that there are different ways of constructing these: one can start with a non-boolean disjunction, for which Add already fails on the level of PC formulas (e.g. relevance), and through that reject Add also on the levels of *Inst* formulas. Here a disjunction has the same meaning in all contexts. The second option is to start with a boolean disjunction, but interpret *Inst* as a non-normal modality in such a way that Add fails (e.g. stit). In this setting, *Inst* contributes significantly to the meaning of disjunctive generic actions, and what we mean by a disjunction depends on whether it occurs inside or outside an *Inst* operator. Prima facie, we regard both options to be worth further research. But how these systems would behave as explicit logic of agency is an interesting open question.

Finally, in answering an obvious objection we mentioned in section Section 4 a possible qualification of OR, namely using an "everything else being legal" clause. The logic of permissions defined this way remains to be investigated. It would be particularly interesting to study the forms of FCP that it would licence in the presence of Add. We leave these questions open for now, content with the observation that one can (and should!) have the open reading without free choice.

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References

1. Abramsky, S.: Computational interpretations of linear logic. Theoretical Computer Science 111(1), 3–57 (1993)
2. Anglberger, A., Gratzl, N., Roy, O.: The logic of obligations as weakest permissions (2013) (manuscript)
3. Asher, N., Pelletier, F.: Generics and defaults. In: van Bentham, J., ter Meulen, A. (eds.) Handbook of Logic and Language. Elsevier (1997)
4. Asudeh, A.: Linear logic, linguistic resource sensitivity and resumption, eSSLLI (2006)
5. Belnap, N., Perloff, M., Xu, M.: Facing the future: Agents and choice in our indeterminist world (2001)
6. Broersen, J.: Action negation and alternative reductions for dynamic deontic logics. Journal of Applied Logic 2, 153–168 (2004)
7. Di Cosmo, R., Miller, D.: Linear logic. In: Zalta, E.N. (ed.) The Stanford Encyclopedia of Philosophy, Fall 2010 edn. (2010)
8. Dignum, F., Meyer, J.J., Wieringa, R.: Free choice and contextually permitted actions. Studia Logica 57(1), 193–220 (1996)
9. Dignum, F., Meyer, J.J.: Negations of transactions and their use in the specification of dynamic and deontic integrity constraints. In: Semantics for Concurrency. Workshops in Computing, pp. 61–80. Springer, London (1990)
10. Girard, J.Y.: Linear logic. Theoretical Computer Science 50(1), 1–102 (1987)
11. Girard, J.Y.: Linear logic: Its syntax and semantics. In: Girard, J.Y., Lafont, Y., Regnier, L. (eds.) Advances in Linear Logic, vol. 222. Cambridge University Press (1995)
12. Hansson, S.: The varieties of permissions. In: Gabbay, D., Horty, J., Parent, X., van der Meyden, R., van der Torre, L. (eds.) Handbook of Deontic Logic and Normative Systems, vol. 1, College Publication (2013)
13. Van Benthem, J.: Language in Action: categories, lambdas and dynamic logic. MIT Press (1995)
14. Joyce, J.M.: Regret and instability in causal decision theory. Synthese 187(1), 123–145 (2012)
15. Kracht, M., Wolter, F.: Normal monomodal logics can simulate all others. Journal Symbolic Logic 64(1), 99–138 (1999)
16. Makinson, D.: Stenius' approach to disjunctive permission. Theoria 50, 138–147 (1984)
17. Makinson, D.: Bridges from classical to nonmonotonic logic. College Publications (2005)
18. McCarthy, J.: Epistemological problems of artificial intelligence. In: IJCAI, vol. 77, pp. 1038–1044 (1977)
19. McNamara, P.: Deontic logic. In: Zalta, E.N. (ed.) The Stanford Encyclopedia of Philosophy, Fall 2010 edn. (2010)
20. Meyer, J.J.C.: A different approach to Deontic Logic: Deontic Logic Viewed as a Variant of Dynamic Logic. Notre Dame Journal of Formal Logic 29, 109–136 (1988)
21. Osborne, M.J., Rubinstein, A.: A course in game theory. MIT Press (1994)
22. Roy, O., Anglberger, A.J.J., Gratzl, N.: The logic of obligation as weakest permission. In: Ågotnes, T., Broersen, J., Elgesem, D. (eds.) DEON 2012. LNCS, vol. 7393, pp. 139–150. Springer, Heidelberg (2012)
23. Schurz, G.: Relevant Deduction: From Solving Paradoxes Towards a General Theory. Erkenntnis 35, 391–437 (1991)

24. Schurz, G., Weingartner, P.: Paradoxes solved by simple relevance criteria. Logique et Analyse 113, 3–40 (1986)
25. Simons, M.: Dividing things up: The semantics of or and the modal/or interaction. Natural Language Semantics 13(3), 271–316 (2005)
26. Trypuz, R., Kulicki, P.: On deontic action logics based on boolean algebra. Journal of Logic and Computation (2013) (forthcoming)
27. von Wright, G.H.: Norm and Action - A Logical Enquiry. Routledge (1963)
28. von Wright, G.H.: An Essay in Deontic Logic and the General Theory of Action. North-Holland Publishing Company (1968)
29. Zimmermann, T.: Free choice disjunction and epistemic possibility. Natural Language Semantics 8(4), 255–290 (2000)