

*Research article*

# The Right to Know: A Logical Analysis

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**Abstract:**

We study the right to know within the theory of normative positions. We do so by extending this theory with epistemic and (legal)-alethic modalities. We propose and discuss four plausible but nonequivalent formalizations of the right to know as an epistemic claim-right. We compare these formalizations on how they fare with respect to the so-called Åqvist's paradox and detachment principles. Then, we briefly address the formalization of the right to know as a power. This article thus makes a conceptual rather than technical contribution: it maps the possibilities for understanding the right to know as a claim-right (and a power) and shows, more generally, how the theory of normative positions can make a positive contribution to our understanding of epistemic rights. We do not study the metalogical and computational properties of the underlying logic we use.

**Keywords:**

Epistemic rights, Hohfeldian rights, Deontic logic, Epistemic logic, Dynamic logic

What does it mean to say that expectant parents have a right to know whether their child will be healthy? Or that a patient has a right to know her test results, and, conversely, a right not to know them? What do we refer to when saying that citizens have the right to know if their government does something illegal, or that a detained person has the right to know his rights? These questions have a bearing on a prominent type of so-called epistemic rights, namely, the right to know, which is the main focus of this paper.

We study the right to know as a normative position. The theory of normative positions (Sergot, 2013) goes back to Kanger & Kanger (1966) and Lindahl (1994), and was developed in order to study, using tools from deontic logic, the typology of rights developed by Hohfeld

(1923). The original version of this theory faces a number of important challenges, particularly with respect to its analysis of the Hohfeldian categories of power and immunity (Makinson, 1986; Sergot, 2013). Alternative models have been developed to address these challenges, for instance in Gelati *et al.* (2004, 2002); Governatori and Rotolo (2008); Sartor (2005), as well as recently in Dong and Roy (2017, 2021) and Markovich (2019, 2020).

Although the theory of normative positions has been discussed extensively in deontic logic, and epistemic rights have been studied in neighboring disciplines, e.g., epistemology (Dretske, 2000; Feldman, 1988), looking at the right to know—or epistemic rights in general—through the lens of the Hohfeldian typology is a new development. Logicians have studied the interaction between deontic and epistemic notions, focusing mainly on epistemic duties and their paradoxes, cf. (Hulstijn, 2008; Åqvist, 1967), the theory of knowledge-based obligations (Pacuit *et al.*, 2006), or reasoning about confidentiality (Cuppens and Demolombe, 1996). Aucher *et al.* (2011; 2010), for instance, used combined epistemic-deontic systems to model privacy policies, and studied obligations and permissions to know *vs* obligatory and permitted messages. In legal theory and philosophy of law, on the other hand, epistemic rights have mostly been studied in contrast to the theory of normative positions (Wenar, 2003; Altschul, 2021). Prominent surveys of the philosophy literature on rights, e.g., (Wenar, 2015), even go as far as to express skepticism regarding the usefulness of the Hohfeldian typology for analyzing epistemic rights, because these rights seem to be confined to the category of Hohfeldian privileges.

This view has been challenged in recent years. To our knowledge, Watson (2018; 2021) was the first one to argue that epistemic rights come in a much broader variety and that they can be fruitfully cast in the Hohfeldian framework. As we will see in Section 1, evidence from national legislation appears to support that claim. This evidence needs, however, to be examined thoroughly and formally. The theory of normative positions provides fine-grained and mathematically precise tools to fill this research gap. This has led to the development, and combinations, of different deontic, epistemic, and action logics within a project called Deontic Logic for Epistemic Rights (DELIGHT).<sup>1</sup> In this paper we introduce one of its main pillars: a multimodal approach to the right to know.

We base our analysis on the model of normative positions developed by Markovich (2020; 2019) and Dong and Roy (2017; 2021). We chose these relatively recent contributions because they are based on a combination of tools from deontic and dynamic epistemic logic, i.e., logical models of knowledge, beliefs, and information changes in social settings. As such,

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<sup>1</sup> See <https://icr.uni.lu/research.html> for more detail.

these models provide the most natural first step for studying the epistemic and dynamic aspects of the right to know. Studying the right to know in this particular formalization of the theory of normative positions also provides a benchmark case for the latter, allowing us to assess its extendability and explanatory power.

This paper is organized as follows. Section 1 is a brief introduction to the theory of normative positions. We describe our basic language and semantics in Section 2, and study different formalizations of the right to know in Section 3. Our focus will be mostly on the right to know when it is a so-called claim-right. We propose four formulations of this epistemic claim-right, and study their logical relationships and behaviors, particularly with respect to detachment principles and Åqvist’s paradox. At the end of Section 3, we tentatively explore formalizations of the right to know when it is a Hohfeldian power. We do not address questions pertaining to the metalogical and computational properties of the logic that we use. The contribution of this article is conceptual, and is about *applying* these logics to the special case of the right to know.

## 1. Legal Rights as Normative Positions

The theory of normative positions stems from the work of the American legal theorist Hohfeld (1923) who, finding that the word “right” was overused and referred to various concepts, differentiated between four atomic types of rights and their correlative duties. Since the Hohfeldian typology underpins our formalization of epistemic rights, we start by presenting its main characteristics. More details can be found in Markovich (2020); readers familiar with this theory can move on to Section 2.

### 1.1 The Hohfeldian Typology

The baseline of the Hohfeldian typology consists of the four atomic types of rights (Fig. 1, top line) and their correlative duties (Fig. 1, bottom line) (Markovich, 2020). As far as the logical analysis is concerned, the correlative relation can be seen as an equivalence.

The Hohfeldian positions are inherently relational: they are to be interpreted in terms of a pair of agents. The two atomic rights in the square on the left are *claim-right* and *privilege*. A claim-right of an agent  $x$  towards  $y$  corresponds to a duty of  $y$  towards  $x$ . A seller’s right against a buyer that the latter pay the purchase price is an example of such a claim-right, and it corresponds to the buyer’s duty to pay the purchase price. A privilege, also often called “freedom,” of  $x$  against  $y$  to see to it that  $\phi$  is the case corresponds to the absence of  $y$ ’s claim-

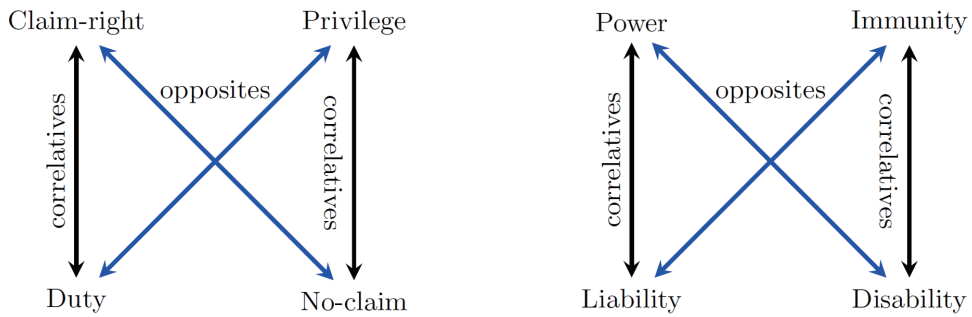


Fig. 1. The Hohfeldian atomic types of rights, and their correlatives.

right against  $x$  to refrain from seeing to it that  $\phi$ . A landowner's right to use her own land can be seen as her privilege, since no one has a claim-right against her that she refrain from this use.<sup>2</sup>

The directed duties involved in the characterization of claim-rights and privileges should be understood as legal duties, that is duties, or lack thereof, from the perspective of the law.<sup>3</sup> The buyer's duty to pay the purchase price, for instance, holds within a specific legal code. It is still agent-relative and directed. It concerns only the buyer and is directed at the seller. Still, it is not meant to capture the buyer's or the seller's subjective understanding of their respective duties and claims. These apply to the buyer and the seller from the perspective of the legal system, whether they, the buyer and the seller, recognize them or not.

*Power* and the related positions, i.e., the atomic rights in the right-hand square in Fig. 1, refer to the capacity, or absence thereof, of executing actions through which one can change existing normative positions. A power, in particular, can be seen as a form of *potential* (Markovich, 2020). A landowner has the right to sell her land, which would result in transferring her existing property rights<sup>4</sup> to the buyer, thereby changing the normative positions of both of them and every other agent who is involved in a normative relation regarding the land. Along similar lines, an employer can assign a task to an employee, thereby creating a duty for him (the employee) towards her (the employer). The employer's power

<sup>2</sup> From a legal point of view, the owner's position is a so-called absolute position. Her property rights, and, in particular, this privilege, are valid against *every* other agent. This particularity had already been observed by Hohfeld, who called this a multital (*vs* paucital) right. In this article, the difference is not important, so we do not go into details, but one can find them in (Simmonds, 2001; Markovich 2021).

<sup>3</sup> We thank one of the anonymous reviewers for pointing out the need to clarify this.

<sup>4</sup> This applies not only to the claim-rights and privileges, but also powers and immunities. For details see Simmonds (2001); Markovich (2020).

against the employee corresponds, in the Hohfeldian terminology, to the employee's liability towards the employer. An *immunity*, on the other hand, corresponds to not being subject to someone else's legal or normative power. Our landowner has an immunity, for instance, to anyone else selling the land: normally, no one but the owner has this power. Others are legally unable to do so (or disabled, in Hohfeldian terminology).

The Hohfeldian categories are useful for disambiguating legal and everyday use of the word "right," with the right to know being a salient example. In Hungary, citizens have the right to know the declarations of property given by their Members of Parliament (MPs) and by their local representatives, but these two rights to know are different normative positions. MPs have a statutory duty to publish their declarations, while local representatives must publish them only if a citizen requests it.<sup>5</sup> Hence, the first right to know is a claim-right, whereas the second is a power.

There are different types of rights to know also in healthcare,<sup>6</sup> and we will provide such cases as our running examples below. Suppose that a medical test is carried out to determine whether the child of expectant parents suffers from a particular disease.<sup>7</sup> The parents have a right to know the result, i.e., whether the fetus has the disease or not. This right has been naturally interpreted as a claim-right, i.e., as the doctor's correlative duty to let the parents know. The following two—strictly related—components of such a case will be important for us.

1. The parents have a (claim-)right to know *whether* their child would be healthy, i.e., know that the fetus has a disease, or know that the fetus does not have a disease.
2. The doctor has a correlative duty to *inform* the parents, i.e., to *perform an epistemic action* that results in the parents knowing whether the fetus has a disease.

Interestingly, the right to *not* know is usually also routinely listed among parents' rights. If, however, we take a patient's right to know as the default position, and the right to not know means the patient's ability to *change* the doctor's duty to let him know the results, then it is a

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<sup>5</sup> Act XXXVI of 2012 on the Parliament vs Act CLXXXIX of 2011 on local government representatives in Hungary.

<sup>6</sup> In Hungary, Act CLIV of 1997 on Healthcare lists patients' rights, and most countries have similar regulations.

<sup>7</sup> The reason for investigating this specific example is the case of Texas Bill 25 from 2017, as mentioned in (Watson, 2019), where the parents' right to know whether their child would be ill or not was legally threatened. We investigated the case's logical relevance for the theory of normative positions in (Markovich and Roy, 2021a).

power.<sup>8</sup> In Section 3.5, we briefly consider the formalization of the right to (not) know as a power.

## 1.2 Formalization in Deontic Logic

The formalization of the Hohfeldian typology using tools from deontic logic goes back to Kanger & Kanger (1966), and subsequently Lindahl (1994). Its modern form is the theory of normative positions; see (Sergot, 2013) for an overview of the original contributions. Here we follow the presentation of that theory in (Markovich, 2020, 2019), which is among the most recent contributions to explicitly represent the relational aspects of the Hohfeldian typology.

The main insight of Kanger & Kanger (1966) is that the Hohfeldian typology can be fruitfully analyzed by combining deontic with agential modalities. According to this analysis, an agent  $y$ 's claim-right to  $\varphi$  against  $x$  boils down to  $x$ 's duty towards  $y$  to see to it that  $\varphi$  holds. Following Markovich (2020, 2019), we capture the deontic modality in such statements using a standard deontic obligation operator, indexed by directed pairs of agents. Our atomic duty operator will thus be of the form  $\mathbf{O}_{y \rightarrow x}$ , to be read as “ $y$  has a duty towards  $x$  that...”<sup>9</sup> The agency modality, on the other hand, will be captured using standard tools from logics of agency, i.e., operators of the form  $E_y$ , should be read as “agent  $y$  sees to it that...” An agent  $y$ 's claim-right to  $\varphi$  against  $x$ , using the notation from (Markovich, 2020), is then analyzed as follows:

$$\mathbf{CR}_{y \rightarrow x} \varphi \Leftrightarrow \mathbf{O}_{x \rightarrow y} E_x \varphi$$

Agents' privileges, in the theory of normative positions, are in turn analyzed as directed weak permissions in standard deontic logic, i.e., the lack of the correlative obligation to the contrary. Agent  $x$ 's privilege against  $y$  thus boils down to  $y$ 's lack of a claim-right against  $x$  that she does not see to it that  $\varphi$ .

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<sup>8</sup> Of course, one could argue that the right to not know the test results is just a specification of the doctor's correlative duty of the patient's right to know, i.e., a claim-right to make the results accessible to the patient, letting him decide whether he wants to know them or not. We thank David Streit for pointing out this interpretation. For our present purpose, however, this alternative reading only gives additional support to the observation that legal and lay uses of the term 'right' are often ambiguous, and that the Hohfeldian categories can help resolve this ambiguity.

<sup>9</sup> Echoing the remarks made in Section 1.1, the most natural interpretation of these deontic operators is as duties that hold from the perspective of a given legal system. We expand on this point again in Section 2, where we present the semantics for the  $\mathbf{O}_{x \rightarrow y}$  operators.

$$\mathbf{PR}_{x \rightarrow y} \varphi \Leftrightarrow \neg \mathbf{CR}_{y \rightarrow x} \neg \varphi \Leftrightarrow \neg \mathbf{O}_{x \rightarrow y} E_x \neg \varphi$$

There is less consensus on how to formalize power and immunity. Kanger & Kanger (1966) and Lindahl (1977) formalize them as the legal permissibility of seeing to it that a certain normative position holds. An agent  $x$ 's power to create a claim-right against  $y$  regarding  $\varphi$ , for instance, would be formalized as  $\neg \mathbf{O}_{x \rightarrow y} \neg E_x \mathbf{O}_{y \rightarrow x} E_y \varphi$ . This type of analysis has benefits and drawbacks, see (Dong and Roy, 2017). Some drawbacks are that it neglects both the truly dynamic aspects of norm-changing actions as intended by Hohfeld (hence falling short of the original theory; see (Sergot, 2013)) and the prominent role that speech acts play in the exercise of legal powers (Markovich, 2020). As such, in Section 3.5 we pursue a two-pronged strategy of providing both a “static” analysis of legal powers using the agency and (legal) alethic operators (staying closer to the Hohfeldian concept than the Kanger-Lindahl form does) and a “dynamic” analysis using a model-changing operation.

## 2 Language and Semantics

### 2.1 Language

We work with a propositional language extended with four modalities, which we interpret using standard possible-world and neighborhood semantics.

**Definition 1 (Language).** *Let  $x, y$  be elements of a finite set of agents  $A$ , and  $\Phi$  a given set of propositional letters. The language  $\mathcal{L}$  is defined as follows.<sup>10</sup>*

$$p \in \Phi \mid (\varphi \wedge \psi) \mid \neg(\varphi) \mid \mathbf{K}_x(\varphi) \mid \mathbf{O}_{x \rightarrow y}(\varphi / \psi) \mid E_x(\varphi) \mid \Box(\varphi)$$

As we saw above, the standard theory of normative positions is developed in a fragment of this language containing only the obligation operator  $\mathbf{O}_{x \rightarrow y}(\varphi / \psi)$ , to be read as “given  $\psi$ ,  $x$  has a duty towards  $y$  that  $\varphi$ ,” and the static agency operator  $E_x \varphi$ , to be read as “agent  $x$  sees to it that  $\varphi$ .” Unconditional obligations are definable as  $\mathbf{O}_{x \rightarrow y} \varphi \equiv \mathbf{O}_{x \rightarrow y}(\varphi / \top)$ , with  $\top$  being any propositional tautology. To study the right to know, we extend this language with two modalities.  $\mathbf{K}_x \varphi$  is the standard knowledge modality from epistemic logic, to be read as “agent

<sup>10</sup> We will be somewhat liberal with the use of brackets. We typically omit outermost brackets around conjunctions, as well as those around the formula in the scope of the modal operators, when that scope is unambiguous.

$x$  knows that  $\varphi$ .” In order to study detachment principles, the legal necessity operator  $\Box\varphi$ , read as “it is legally settled that  $\varphi$ ,” will be useful as well. We shall comment later on the interpretation of that modality.

## 2.2 Frames and Models

The deontic, epistemic, and (legal) alethic modalities in this language are normal modalities<sup>11</sup> interpreted in Kripke models. We are fully upfront about the limitations that come with this modeling choice, especially regarding the deontic and epistemic operators. The deontic fragment we use is (conditional) standard deontic logic (SDL) (Hilpinen and McNamara, 2013) interpreted using preferential semantics (Hansson, 1970; Parent, 2021). It is well known that SDL licenses several counter-intuitive inferences, involving, for instance, disjunctive or contrary-to-duty obligations (see again Hilpinen and McNamara (2013) for an overview). The conditional version that we use here handles contrary-to-duty obligations somewhat better, although it is not immune from criticism either, e.g. (Hilpinen and McNamara, 2013). Some of its limitations will also become apparent in this paper as well. The same can be said about the epistemic fragment. Logical omniscience and introspection principles are by now common topics for critics of standard epistemic logic (van Ditmarsch *et al.*, 2015).

Nevertheless, we use these models of obligations and knowledge here for three reasons. First, most of the inadequacies of SDL are said to be not prominent or even relevant when we model normative positions with it (Sergot, 2013) so, in this paper, we use a combination that follows the original formalism in being built on SDL. Second, and along the same lines, our analysis of the right to know builds upon recent models of the Hohfeldian categories using tools developed in dynamic epistemic logic (Markovich, 2020, 2019; Dong and Roy, 2017, 2021). These models are, again, based on standard Kripke semantics for the deontic and dynamic modalities. Since we want to assess how these models fare in analyzing the right to know, we try to deviate as little as possible from their standard version. Finally, and perhaps more positively, working with standard models of deontic and epistemic modalities allows us to see not only their limitations but also the points in which they actually deliver valuable insights. We will see, for instance, that this basic model sheds light on the logical relationship

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<sup>11</sup> By “normal modalities” we mean that the logic of these three modalities is a normal modal logic (Blackburn *et al.*, 2001). It validates the respective versions of the  $K$  axiom and the necessitation rule. For  $\Box$ , for instance, this means that  $\Box(\varphi \rightarrow \psi) \rightarrow (\Box\varphi \rightarrow \Box\psi)$  is valid on the class of all frames (Definition 2), as well as the rule that allows to infer  $\Box\varphi$  whenever  $\varphi$  is valid. For the conditional obligation operator, this corresponds to  $\mathbf{O}_{x \rightarrow y}((\varphi \rightarrow \psi)/\chi) \rightarrow (\mathbf{O}_{x \rightarrow y}(\varphi/\chi) \rightarrow \mathbf{O}_{x \rightarrow y}(\psi/\chi))$ .



between different formalizations of the right to know as a claim-right, how these handle detachment principles and Åqvist’s paradox, and how they relate to formalizations of the right to know as a power. In other words, even with simplistic underlying models of obligations and knowledge, there is a lot to learn from analyzing epistemic rights with the theory of normative positions.

The only non-normal modality that we use is the agency operator  $E_x$ , which we interpret using a neighborhood function  $f_x$  (Pacuit, 2017). Here we follow, again, the original approach of normative positions. The agency operator used in Kanger & Kanger (1966) was not normal, and many variations of modern logics of agency, prominently in so-called the “see to it that” (STIT) theory, invalidate principles like necessitation or closure under logical consequences (Belnap *et al.*, 2001).

**Definition 2 (Frames and Models).** *A frame  $\mathfrak{F}$  for a given finite set  $A$  of agents is a tuple,*

$$\mathfrak{F} = \langle W, \{R_x, \leq_{x \rightarrow y}, f_x\}_{x, y \in A}, R_\square \rangle$$

where  $W$  is a finite set of possible worlds,  $R_x$  is an equivalence relation on  $W$ ,  $\leq_{x \rightarrow y}$  is a pre-order (reflexive and transitive) relation on  $W$ ,  $R_\square$  is an equivalence relation, and  $f_x : W \rightarrow \wp\wp(W)$  is a neighborhood function such that

– (Success) For all  $w$  and  $X \in f_x(w)$ ,  $w \in X$ .

We say that a frame  $\mathfrak{F}$  is monotone whenever for all  $w, x$  and  $X \subseteq Y \subseteq W$ , if  $X \in f_x(w)$ , then  $Y \in f_x(w)$ . A model  $\mathcal{M}$  is a frame together with a valuation function  $V : \Phi \rightarrow \wp(W)$ . We write  $w <_{x \rightarrow y} v$  whenever  $w \leq_{x \rightarrow y} v$  but not  $v \leq_{x \rightarrow y} w$ , and we write  $w \equiv_{x \rightarrow y} v$  whenever  $w \leq_{x \rightarrow y} v$  and  $v \leq_{x \rightarrow y} w$ .

We often write  $R_x[w]$  for  $\{v : wR_x v\}$  and, similarly,  $R_\square[w]$  for  $\{v : wR_\square v\}$ . In general, we do not assume that the neighborhood functions are monotone. We will, however, study the consequences of making this additional assumption, since it is often made when modeling agency, e.g., for effectivity functions in coalition logic (Pauly, 2002). To simplify the exposition, we assume here that the set of states is finite. This assumption could, of course, be lifted when studying the metatheory (axiomatization, decidability) of the underlying logic.

Before explaining the interpretation of the preorders in more detail, a few words are in order concerning the relation  $R_\square$  that will be used to interpret the (legal) alethic modality  $\square$ . Recall that a formula of the form  $\square\varphi$  should be read as “it is legally settled that  $\varphi$ .” This is, in turn, interpreted using the partition corresponding to the equivalence relation  $R_\square$ . This

partition encodes what, at each state, is settled *in the eyes of the law*. Typically, legislations impose stringent conditions, e.g., in terms of admissible evidence, for recognizing that certain states of affairs hold or that certain events took place. Not everything true in a given state is legally settled. In other words, what Markovich (2020) calls “legal metaphysics” might not coincide with actual metaphysics.

We can illustrate this with our running example of the parents’ right to know whether their child is healthy. As we saw in Section 1.1 this corresponds to a correlative duty of the doctor to inform the parent of the state of the child. In many contexts, however, this duty is conditional on the doctor herself being informed of the state of the child. The corresponding unconditional duty takes effect or, in technical terms, “detaches” when it is legally settled that the doctor is informed.<sup>12</sup> We discuss this question further in Section 3.3. For now, it is sufficient to observe that the doctor could be informed of the state of the child without this fact—that the doctor is informed—being legally settled. The doctor might observe certain symptoms outside the professional context, and draw the (correct) conclusions about the child from what she saw there, or from testimony from a reliable source and, in virtue of those facts, might come to know whether the child is healthy. This might not be sufficient, however, for this fact to be settled in the eyes of the law. The latter might require additional steps, for instance, that the doctor makes an official diagnosis following a pre-established protocol.

The  $R_{\square}$  equivalence relation is meant to capture this difference between certain facts being “simply” true, what we call above “actual metaphysics,” and those facts being settled in the eyes of the law, what we call the “legal metaphysics.” On the one hand, since in most cases there will be more than one state related with one another by  $R_{\square}$ , only a strict subset of the facts that are true at a state will be settled in the eyes of the law. On the other hand, the assumption that  $R_{\square}$  is an equivalence relation entails that what is settled in the eyes of the law at a state is always a subset of what is true at that state. Under that interpretation the law cannot be mistaken, so to speak. A false proposition cannot be legally settled. Note, furthermore, that what is legally settled doesn’t need to coincide with what the agents know or enforce in a particular state. Agents can, in particular, be uncertain about what is currently settled legally. So we do not impose restrictions on the relation between epistemic indistinguishability ( $R_x$ ) and legal necessity ( $R_{\square}$ ). Similarly, agents can see to it that certain propositions can hold without them being settled, and also the other way around. Of course,  $R_x$  is reflexive, and  $f_x$  satisfies *Success*. What the agents know is therefore consistent with what is legally settled, and the same holds for what they do.

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<sup>12</sup> Several professional questions can become legally settled in themselves, without requiring further confirmation by a third party or the judiciary. Medical diagnoses are relevant examples.

The interpretation of the preorders  $\leq_{x \rightarrow y}$  is best understood in relation to the semantics of SDL. In SDL the obligation operator is interpreted using a serial, binary relation  $R$ . A formula of the form  $\mathbf{O}\phi$  is then true, in SDL, at the state  $w$  whenever  $\phi$  is true in all the states  $w'$  accessible by  $R$  from  $w$ . Those states are usually thought of as being morally or, in the theory of normative positions, legally ideal from the perspective of  $w$ .

The preorders  $\leq_{x \rightarrow y}$  generalize this standard semantics in two ways. On the one hand the set of ideal states  $w'$ , from the perspective of a state  $w$ , can be recovered by considering the set of states accessible from  $w$  that are *most* ideal in the sense that no other state in the model is strictly more ideal to them. As we will see below, this is essentially how the unconditional obligations are defined: an unconditional obligation to  $\phi$  will hold if  $\phi$  holds in all the most ideal states.<sup>13</sup>

The preorders, however, allow not only to consider the most ideal states overall, but also those that are ideal *relative to a given subset of the model*. It is this additional flexibility that allows us to define conditional obligations by considering subsets that are definable by formulas of  $\mathcal{L}$ . The preorders  $\leq_{x \rightarrow y}$  indeed allow us to define, for each state  $w$ , not just one, as in SDL, but many sets of states that are ideal from the perspective of  $w$ , i.e., one for each subset of  $W$ . Sometimes these states that are ideal relative to a given subset will also be ideal overall, but often they will be in some ways non-ideal, i.e., further down in the ordering. The relations  $\leq_{x \rightarrow y}$  thus also generalize conceptually the standard semantics for SDL. The preferential semantics moves to form a binary division between ideal and non-ideal states to a ranking of increasing levels of ideality.

## 2.3 Truth Conditions

We are now ready to present the truth conditions for formulas in  $\mathcal{L}$ . We present the mathematical definition first and then motivate them conceptually.

**Definition 3 (Truth Conditions).** *Let  $\mathfrak{M}$  be a model and take any  $w \in W$ . Write  $\|\phi\|$  for  $\{w : M, w \models \phi\}$  and, for any  $X \subseteq W$ ,  $\max_{\leq_{x \rightarrow y}}(X) = \{w \in X : \neg \exists v \in X \text{ such that } w <_{x \rightarrow y} v\}$ . The truth conditions for formulas in  $\mathcal{L}$  are defined as follows.*

- $\mathfrak{M}, w \models p \Leftrightarrow w \in V(p)$
- $\mathfrak{M}, w \models \neg\phi \Leftrightarrow \mathfrak{M}, w \not\models \phi$

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<sup>13</sup> This is correct, modulo a further relativization to what is legally settled at the current state. We come back to this below.

- $\mathfrak{M}, w \models \varphi \wedge \psi \Leftrightarrow \mathfrak{M}, w \models \varphi$  and  $\mathfrak{M}, w \models \psi$
- $\mathfrak{M}, w \models E_x \varphi \Leftrightarrow \|\varphi\| \in f_x(w)$
- $\mathfrak{M}, w \models \Box \varphi \Leftrightarrow \forall v$  such that  $wR_\Box v, \mathfrak{M}, v \models \varphi$
- $\mathfrak{M}, w \models \mathbf{K}_x \varphi \Leftrightarrow \forall v$  such that  $wR_x v, \mathfrak{M}, v \models \varphi$
- $\mathfrak{M}, w \models \mathbf{O}_{x \rightarrow y}(\varphi / \psi) \Leftrightarrow \forall v \in \max_{\leq_{x \rightarrow y}}(\|\psi\| \cap R_\Box[w]), \mathfrak{M}, v \models \varphi$

The clauses for propositional variables and the Boolean connectives are standard. As announced, we interpret both the legal necessity operator  $\Box$  and the epistemic operators  $K_x$  as in standard Kripke semantics for modal logic. The agency operators  $E_x$  are also defined as announced using the neighborhood function  $f_x$ . We use here the so-called exact neighborhood semantics (Pacuit, 2017) because we do not want to assume properties like closure under conjunction or logical consequence for the agency operator.

We use the so-called preferential semantic clause (Hansson, 1970; Parent, 2021) for conditional obligations, but with an important caveat: this condition is relativized to the set of states accessible by  $R_\Box$  from  $w$  and hence to what is legally settled at that state. We do this both for conceptual and technical reasons. As we argued in Section 1.1, legal duties are duties from the perspective of a given legal system, and therefore conditional on facts that are also recognized as such in that system. To use our running example, the parent might not have an unconditional claim-right against the doctor to know whether their child is healthy as long as it is not legally settled, i.e., part of the legal metaphysics that the doctor herself knows, even if she, in fact, knows whether the child is healthy. Legal duties live in the legal realm, and are therefore constrained by its legal metaphysics.

Another way to see this is by considering unconditional obligations and having a first peek at detachment principles. As mentioned in Section 2.1, in dyadic deontic logic, unconditional obligations of the form  $\mathbf{O}_{x \rightarrow y} \varphi$  are standardly defined as  $\mathbf{O}_{x \rightarrow y}(\varphi / \top)$ , c.f. again (Parent, 2021). It is straightforward to check that such an unconditional obligation regarding  $\varphi$  will be true in all the most ideal states in  $R_\Box$ , from the perspective of  $w$ , satisfying  $\varphi$ . This, in turn, validates what has been called the necessary detachment principle:

$$\Box \psi \wedge \mathbf{O}_{x \rightarrow y}(\varphi / \psi) \rightarrow \mathbf{O}_{x \rightarrow y} \varphi$$

We, in fact, obtain something stronger:  $\Box \psi \rightarrow (\mathbf{O}_{x \rightarrow y}(\varphi / \psi) \leftrightarrow \mathbf{O}_{x \rightarrow y} \varphi)$ . We come back to this in Section 3.3, where we study detachment principles in the specific case of the right to know as a claim-right.

Relativizing the truth conditions of conditional obligations to  $R_{\square}$  also has the technical advantage that it allows the expression of a constrained version of the “ought implies can” principle, which would otherwise not be expressive. Indeed, it is again straightforward to check that the semantics validate the following.

$$\diamond\psi \wedge \mathbf{O}_{x \rightarrow y}(\varphi / \psi) \rightarrow \diamond\varphi$$

Observe, however, that this principle fails if it is not constrained by  $\diamond\psi$ . It could be, at a given state, that  $\psi$  is legally settled to be false. In such a case we get  $\mathbf{O}_{x \rightarrow y}(\perp / \psi)$ , an obligation that is impossible to fulfill. If, on the other hand, the semantic of  $\mathbf{O}_{x \rightarrow y}$  was not relativized to the equivalence relation  $R_{\square}$ , “ought implies can” would still only hold in a constrained form, which would only be expressible in a richer language, for instance, the one used in (Dong and Roy, 2021) including a so-called universal modality (Blackburn *et al.*, 2001).

## 2.4 Dynamic Modalities, Power and Immunity

While in the standard theory of normative positions, agency is captured using static modal operators like those mentioned above, a number of recent contributions (Markovich, 2020; Dong and Roy, 2017; Dong, 2017; Dong and Roy, 2021) have shown the benefits of also modeling deontic actions using dynamic operators such as those originally developed in dynamic epistemic logic (Baltag and Moss, 2004; van Benthem, 2011). We follow this two-pronged approach here, comparing the result of modeling the right to know as a claim-right using either static or dynamic modalities.

We will be mostly interested in duties that have a bearing on so-called epistemic actions, for instance, informing someone, and for that reason, we will focus first on epistemic action models and their corresponding dynamic modalities. In Section 3.5, we also briefly explore formalizations of the right to know as a power. This involves deontic rather than epistemic actions, i.e., actions that change the underlying legal relations. We define them at the end of this section. Let us start with the definition of epistemic action models.

**Definition 4.** *Let  $A$  be a given finite set of agents. An epistemic action model  $\mathcal{A}$  is a tuple*

$$\langle Act, \{R_x\}_{x \in A}, Pre \rangle$$

*Each  $R_i$  is an equivalence relation on  $Act$ , and  $Pre : Act \rightarrow \mathcal{L}$  is a precondition function.*

An action model represents different actions that change the agents' information, for instance, various types of public or private announcements, learning, observations, etc. (Baltag and Moss, 2004; van Benthem, 2011). These changes are captured using a general update procedure, namely, product updates.

**Definition 5.** Let  $\mathfrak{M}$  be a model and let  $\mathcal{A}$  be an epistemic action model. The product update model, also called the updated model  $\mathfrak{M} \otimes \mathcal{A} = (W', \{R'_x, \le'_{x \rightarrow y}, f'_x\}_{x,y \in A}, R'_\square)$ , is defined as follows.

1.  $W' = \{(w, a) : \mathfrak{M}, w \models \text{Pre}(a), \text{ where } a \in \text{Act}\}$ .
2.  $(w, a)R'_x(w', a')$  iff both  $wR_x w'$  and  $aR_x a'$ .
3.  $(w, a) \le'_{x \rightarrow y} (w', a')$  iff  $w \le_{x \rightarrow y} w'$ .
4.  $(w, a)R'_\square(w', a')$  iff  $wR_\square w'$ .
5. Let  $X \in f_x(w)$ , and define  $X' = \{(w', a') : w' \in X \text{ and } (w', a') \in W'\}$ .  
Then  $f'_x(w, a) = \{X' : X \in f_x(w)\}$ .
6.  $V'(p) = \{(w, a) \in W' : \mathfrak{M}, w \models p\}$ .

The idea behind this definition is to specify how epistemic actions change the information of the agents by updating the underlying model. Condition (1) captures the idea that epistemic actions can only be executed in states where their preconditions hold. Hence, after the update, the state space consists of pairs of states in the original models together with actions that have been successfully executed in those states. Conversely, pairs  $(w, a)$  where an action  $a$  was not executable in  $w$  because the preconditions of  $a$  did not hold, are “removed” from the model after the update. Condition (2) is the main condition when it comes to capturing actions that change the agents' information. It states that two states in the updated model are indistinguishable for agent  $x$  if and only if they were indistinguishable before the update and also that the same agent could not differentiate the actions that had been executed in each state. In other words, if an agent already could not distinguish between two states before the update, and two actions are executed in these states that, as far as the agent is concerned, are also indistinguishable, then the resulting states after the update are still indistinguishable for that agent. Clauses 3, 4, and 5 state that epistemic actions only change the agent's information. The normative positions, legal necessity, agency operators, and “basic facts,” i.e., the truth value of the atomic propositions, are transposed, *mutatis mutandis*, into the updated model.

Language  $\mathcal{L}$  is then extended with dynamic modalities of the form  $[\mathcal{A}, a]$ , where  $\mathcal{A}$  is a given epistemic action model and  $a$  is an action in that model. Formulas of the form  $[\mathcal{A}, a]\varphi$  should be read “if  $a$  is executable, then  $\varphi$  holds after updating with  $a$ .” Formulas containing dynamic modalities thus express what would result, or the *potential* of certain epistemic or doxastic actions, as opposed to the fact that such an action is performed. This observation is important for our analysis of the right to know. Dynamic modalities also have duals, written as  $\langle \mathcal{A}, a \rangle$ , with formulas of the form  $\langle \mathcal{A}, a \rangle \varphi$ , to be read as “ $a$  is executable, and after updating with it,  $\varphi$  holds.” Again, this formula expresses the potential for changes that would be brought about by executing a given action. The main difference between the “box” modality  $[\mathcal{A}, a]$  and its dual  $\langle \mathcal{A}, a \rangle$  is that the latter also implies that  $a$  is executable, while the former does not.

These readings are embedded in the truth values for the dynamic modalities. A formula  $\varphi$  holds after executing action  $a$  at state  $w$  whenever, to the extent that  $a$  is executable in  $w$  in the first place,  $\varphi$  holds at  $(w, a)$  in the updated model:

$$\mathfrak{M}, w \models [\mathcal{A}, a]\varphi \text{ iff if } \mathfrak{M}, w \models \text{Pre}(a) \text{ then } \mathfrak{M} \otimes \mathcal{A}, (w, a) \models \varphi$$

Applying the standard duality  $\langle \mathcal{A}, a \rangle \varphi \Leftrightarrow \neg[\mathcal{A}, a]\neg\varphi$  thus gives us the following:

$$\mathfrak{M}, w \models \langle \mathcal{A}, a \rangle \varphi \text{ iff } \mathfrak{M}, w \models \text{Pre}(a) \text{ and } \mathfrak{M} \otimes \mathcal{A}, (w, a) \models \varphi$$

Action models and dynamic modalities have also been used to model the agents’ potential to change normative positions (Dong and Roy, 2017, 2021). They will be useful here to capture the right to know as a power (Section 3.5). That discussion will be, however, comparatively short. For that reason, we only sketch the relevant definitions here, and use them to introduce the general notions of Hohfeldian powers and immunity.

In *deontic* action models, the equivalence relations  $R_x$  on  $Act$  are replaced by a set of pre-orders  $\leq_{x \rightarrow y}$ , one for each pair of agent  $x, y$ . The update procedure for deontic actions is modified accordingly: clause 3 in Definition 5 is replaced by an analogous clause for the pre-order, encoding the deontic relation  $\leq'$  after the update as follows:  $(w, a) \leq' (w', a')$  iff both  $w \leq_{x \rightarrow y} w'$  and  $a \leq_{x \rightarrow y} a'$ . Similarly, clause 2 in Definition 5 is replaced by a clause analogous to clause 3 stating that the agents’ information, encoded by the equivalence relations  $R_x$ , only changes to the extent that it is affected by the changes in normative positions:  $(w, a)R'(w', a')$  iff  $wR_x w'$ . The truth conditions for the corresponding deontic dynamic modalities are then exactly as above, using deontic action models instead of epistemic ones.

These deontic dynamic modalities then provide natural definitions of the Hohfeldian categories of power and immunity. Here, we follow Dong and Roy (2021) and assume that the legal powers of agent  $x$  are encoded in a given deontic action model  $\mathcal{A}_x$ .<sup>14</sup> Agent  $x$ 's legal power towards  $y$  to change the normative position described by the formula  $\varphi$  can then be analyzed as follows:

$$\mathbf{Pw}_{x \rightarrow y} \varphi \Leftrightarrow \bigvee_{a \in \text{Act}_x} \langle \mathcal{A}_x, a \rangle \varphi$$

Agent  $x$ 's power against  $y$  is thus analyzed as  $x$  having at least one executable action that would result in the normative position described by  $\varphi$ . The Hohfeldian category of immunity is defined analogously:

$$\mathbf{Im}_{x \rightarrow y} \varphi \Leftrightarrow \neg \mathbf{Pw}_{y \rightarrow x} \varphi \Leftrightarrow \bigwedge_{b \in \text{Act}_y} [\mathcal{A}_y, b] \neg \varphi$$

Immunity is thus analyzed, in this framework, as the situation where no action available to  $y$  results in the normative position described by  $\varphi$ .

### 3. The Right to Know as a Normative Position

Our main goal in this paper is to assess the potential of the theory of normative positions we have just outlined for analyzing epistemic rights by formalizing one of the most paradigmatic types of epistemic rights: the right to know. As the first step towards this goal, we will now focus on the right to know understood as a Hohfeldian claim-right. Even for this comparatively simple case, the theory and the language we use allow for at least four possible ways to capture the right to know which, as we will see, have different logical strengths. We will also see that these different formalizations fare differently with respect to two standard benchmarks for combinations of deontic and epistemic logics, namely the so-called Åqvist's paradox, a potential problem that arose in early formalizations of epistemic duties, and detachment principles. In this section, we look at these in turn, starting with the static and dynamic versions of the unconditional right to know. Our discussion of these two versions is comparatively long because we cover a number of issues that are relevant to all other cases. We then turn to a formalization of the conditional claim-right interpretation of the right to

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<sup>14</sup> In such cases, the action model is indexed with  $x$  simply to mark syntactically that the model encodes  $x$ 's legal powers, and not someone else's. The definition of such an action model  $\mathcal{A}_x$  remains as above.



know, and towards the end of the section, we outline how it could also be formalized as a Hohfeldian power.

### 3.1 The Right to Know as a (Conditional) Claim-Right

Our running example is the expectant parents' right to know the results of their child's medical tests. In Section 1, we highlighted that one of its salient features is the fact that this claim-right is naturally analyzed as the right to know whether the fetus is healthy. "Knowing whether" is standardly captured using a disjunction of knowledge statements like in (Hulstijn, 2008), in this case,  $\mathbf{K}_p(h) \vee \mathbf{K}_p(\neg h)$ , with  $\mathbf{K}_p$  referring to what the parents know and  $h$  being the proposition that the fetus is healthy.

This claim-right of the parents against the doctor corresponds, furthermore, to a correlative duty of the latter towards the former, and the object of this duty is that the doctor sees to it that the parents know whether the fetus is healthy, which can be considered as an epistemic action. The theory of normative positions outlined in the previous section allows multiple ways to analyze each of these two components—as long as the correlative nature is preserved between the right and the duty. The duty can be unconditional or conditional. In turn, the object of the duty, i.e., the (epistemic) action of the doctor, can be analyzed using either static or dynamic action modalities. The next subsections present and compare them conceptually, after which we will look at their relative logical strengths and how they fare with respect to the above-mentioned benchmarks.

**The static, unconditional version:** The first and perhaps most natural rendering of this claim-right is as a doctor's unconditional duty, and we use our epistemic action operator  $E_d$  to capture the object of this duty. This gives us the following, with  $d$  being the agentive label of the doctor:

$$\mathbf{O}_{d \rightarrow p} E_d(\mathbf{K}_p(h) \vee \mathbf{K}_p(\neg h)) \quad (1)$$

This formula will be true in all the most ideal states, legally speaking, whenever the doctor sees to it that the parents know whether or not their child is healthy. This is the standard reading of such an unconditional deontic operator in preferential semantics (Hansson, 1970; Parent, 2021).

However, the truth condition for the agency operator  $E_d$  provides a somewhat more subtle reading of the object of this duty than what its surface interpretation suggests. By “surface interpretation,” we simply refer to the notion that the doctor has a duty *to see to it that* the parents know whether or not the fetus is healthy. The agentive component of this duty is then captured by the operator  $E_d$ . Recall, however, that—to align with classical models of the theory of normative positions—we go with a very weak, non-normal agency operator, and, thus, we interpret this operator using neighborhood semantics. A statement of the form  $E_d\varphi$  is true at state  $w$  whenever the set of states where  $\varphi$  is true is part of the neighborhood  $f_d(w)$ . In other words,  $E_d\varphi$  is true at a state where there is a set in the neighborhood of  $w$  that is exactly the truth set of  $\varphi$ , see again (Pacuit, 2017). Although somewhat artificial, this formulation uses an existential quantifier to highlight that agents will typically see to it that different, nonequivalent propositions, i.e., sets of states, hold at any given state. The success condition (Definition 2, page 8) guarantees that these propositions are all mutually consistent in that they overlap with at least the current state. There is, however, no other constraint on the logical relationship between the propositions that an agent enforces at a given state, at least in nonmonotone frames.

Coming back to the right to know, the subformula  $E_d(\mathbf{K}_p(h) \vee \mathbf{K}_p(\neg h))$  can thus be read existentially: one of the propositions that the doctor enforces at a given state is that the parents know whether or not the fetus is healthy. Since this subformula is within the scope of the deontic operator, we obtain, on the one hand, that the parents know whether or not the fetus is healthy in each ideal state and that everything the doctor enforces in those states is at least consistent with the parents having this knowledge, both because of the success condition. On the other hand, since the doctor will typically enforce multiple propositions at any state, it could be that some of them are also consistent with the parents not having that knowledge.

The surface reading of (1), i.e., that the doctor has a duty “to see to it that” the parents know whether or not the child is healthy, thus hides an important subtlety that is a consequence of using a non-normal agency modality in the standard theory of normative positions. A more accurate reading is perhaps that the parents knowing whether the fetus is healthy or not should be among the propositions that the doctor enforces. Models of agency that are logically stronger, e.g., deliberative STIT (Belnap *et al.*, 2001) or coalition logic (Pauly, 2002), would allow us to bypass this subtlety, because in those models, there is always a logically strongest proposition that the agent enforces at a given state. This is not the case with our agency operator  $E_d$ .

**The dynamic, unconditional version:** The doctor’s duty can be intuitively understood as performing an *epistemic* action, e.g., informing the parents. The agency operator  $E_d$ , however,

does not commit to this interpretation. The dynamic modalities introduced above provide a more direct modeling of the epistemic actions of the doctor.

Simply replacing the static modality  $E_d$  in (1) with a given dynamic  $[\mathcal{A}, a]$  does not, however, give an intuitively plausible reading. To see this, recall first that dynamic modalities describe the *potential* of certain epistemic actions and, second, that a given modality  $[\mathcal{A}, a]$  describes the epistemic potential of a *specific* action  $a$ . So the formula  $\mathbf{O}_{d \rightarrow p}[\mathcal{A}, a](\mathbf{K}_p(h) \vee \mathbf{K}_p(\neg h))$  intuitively reads as “the doctor has a duty towards the parents that her action  $a$  results, if executable, in the parents knowing...” One could, of course, strengthen this formula using the dual operator  $\langle \mathcal{A}, a \rangle$ , thereby requiring the doctor to make  $a$  executable in all ideal states. This would not, however, circumvent the deeper problem that this formula refers to a specific action  $a$  by the doctor while both the static version and the informal reading (Section 1) are more indefinite. They require that the doctor “sees to it that” the parents know whether or not the fetus is healthy, while leaving open how she (the doctor) does that.

Two options — disjunctions and conjunctions — naturally present themselves as ways to address this limitation, with reference to some or all the doctor’s epistemic actions. Let us illustrate the first with the “conjunction-box” combination on which we will ultimately settle.<sup>15</sup>

$$\mathbf{O}_{d \rightarrow p} \bigwedge_{a \in \text{Act}_d} [\mathcal{A}_d, a](\mathbf{K}_p(h) \vee \mathbf{K}_p(\neg h)) \quad (1\text{-Dyn})$$

The formula states that the doctor has a duty towards the parents to the effect that, *whatever* epistemic action she takes, if executable at all, this action results in the parents knowing whether or not the fetus is healthy. Just as before, one could, of course, use the respective dual modalities  $\langle \mathcal{A}, a \rangle$  instead. This, however, has the intuitively implausible consequence of entailing a duty on the doctor to ensure that all her epistemic actions are executable. Still, one might worry that the use of the conjunction  $\bigwedge_{a \in \mathcal{A}_d} [\mathcal{A}_d, a]$  of “box” modalities is compatible with *no* actions of the doctor being executable, which is indeed the case for that type of dynamic modality. To alleviate this concern, one could add the conjunct  $\bigvee_{a \in \mathcal{A}_d} \langle \mathcal{A}, a \rangle \top$  in the scope of the deontic operator. We leave that option aside to keep the discussion focused on the doctor’s duty to inform the parents, but it should be explored in more detail in future work.

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<sup>15</sup> In all the dynamic versions, we use the same type of indexed action models as we used for our analysis of Hohfeldian powers at the end of the previous section. The index serves merely as “syntactic sugar,” added to focus our attention on the doctor’s actions. It is mathematically inconsequential.

Besides the choice between the “box” and the “diamond” dynamic modalities, the strength of this dynamic rendering of the parents’ right to know also depends on whether one uses a disjunction or, as above, a conjunction over the doctor’s epistemic actions. The discussion regarding the interpretation of the static agency modality  $E_d$  in the previous subsection might suggest the use of a disjunction. Recall, indeed, that the static modality implicitly makes an existential quantification on the set of propositions that the doctor enforces. The corresponding quantification, captured through the disjunction  $\bigvee_{a \in \mathcal{A}_d} [\mathcal{A}_d, a]$ , does not, however, give a plausible reading. On the one hand, it will be true at a state as soon as the doctor has one action that cannot be executed at that state.<sup>16</sup> That problem could be, of course, addressed along the lines suggested in the previous paragraph. This would, however, not take away the fact that the “disjunction-box” combination really expresses an ability, i.e., that the doctor can inform the patient, but doesn’t *have* to.<sup>17</sup> One should be careful here to read this “can” as an agential possibility, not as a deontic (weak) permission. Having the formula  $\bigvee_{a \in \mathcal{A}_d} [\mathcal{A}_d, a] (\mathbf{K}_p(h) \vee \mathbf{K}_p(\neg h))$  in the scope of the deontic operator  $\mathbf{O}_{d \rightarrow p}$  means that in *all* ideal states, the doctor has *at least one* epistemic action that would result in the parents knowing whether or not the fetus is healthy. This agential possibility is substantially weaker than that expressed by the static modality  $E_d$ . As we argued above, because of the success condition, the static rendering ensures that everything the doctor “sees to it that” (in each ideal state) is at least consistent with the parents knowing whether or not the fetus is healthy. This is not the case when we take a disjunction over dynamic modalities, as the doctor could also have epistemic actions available to her resulting in the parents not having that knowledge. The “conjunction-box” combination avoids that problem and, for that reason, we adopt it for the dynamic version of the right to know.<sup>18</sup>

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<sup>16</sup> This is one way in which disjunctions of the form from conjunctions  $\bigvee_{a \in \mathcal{A}_{ct,d}} [\mathcal{A}_d, a] \dots$  behave differently from conjunctions  $\bigwedge_{a \in \mathcal{A}_{ct,d}} [\mathcal{A}_d, a] \dots$ . In the latter case the conjuncts where  $a$  is not executable at a state are still trivially true at that state. The difference with the disjunctive form is that the conjunction also requires the truth of the conjuncts where  $a$  is executable.

<sup>17</sup> The same would hold for the “disjunction-diamond” combination, thus we leave it aside here.

<sup>18</sup> It is worth mentioning that the dynamic version also allows us to apply the standard reduction axioms from dynamic epistemic logic (van Ditmarsch *et al.*, 2007; van Benthem, 2011) and obtain equivalent formulas that contain only epistemic and deontic operators and references to the preconditions of the epistemic actions. We omit them here for space reasons, but see (Markovich and Roy, 2021b) for details. This reduction is interesting in that it references the preconditions for actions, which allows us to study possible dependencies between what the doctor knows and her duties towards the parents, which in turn allows for an interesting connection with the theory of knowledge-based obligations, for instance (Pacuit *et al.*, 2006).

Another important difference between (1) and (1-Dyn) is that the latter does not entail that, in all ideal states, the parents know whether or not the fetus is healthy. The reason for this is that the dynamic modalities describe the epistemic potential of the doctor’s action, i.e., what *would* result from these actions, in each ideal state, were they executed. By using the “conjunction-box” combination, we do ensure that each such action would result in the parents having the required knowledge, but the dynamic modalities do not describe the doctor’s actual action. Prefiguring our discussion of Åqvist’s paradox below, this can be expressed formally by observing that (1) implies  $\mathbf{O}_{d \rightarrow p}(\mathbf{K}_p(h) \vee \mathbf{K}_p(\neg h))$ , because of the success condition, but that (1-Dyn) does not.

The upshot of this discussion is that, although syntactically similar, the static and the dynamic formalizations yield conceptually different understandings of the parents’ (claim-) right to know whether or not the fetus is healthy. The static version provides a more straightforward rendering of the object of the doctor’s duty, namely to *do* something that results in the parents knowing the state of the fetus. The downside of the static version is that it leaves implicit the fact that what the doctor ought to perform is an epistemic action, and that it allows for the doctor to enforce also propositions that do not rule out the parents not having that knowledge. The dynamic version avoids these problems; it explicitly captures the fact that the doctor’s duty is to perform an epistemic action, and ensures that all these actions would rule out the parents not knowing. That version, on the other hand, does not explicitly refer to what the doctor actually does in all ideal states, or what she ought to do in the current state, but rather what would result from performing certain actions in those states. This difference is particularly salient because the static version entails that the parents actually know the state of the fetus in all most ideal states, while the dynamic version does not.

**The conditional versions:** We now turn to the two remaining formulations of the right to know that we will study in this paper. They are different to the first two presented in the previous section in that the doctor’s correlative duty is *conditional on the fetus being healthy or not healthy*. The points made earlier regarding the interpretation of the static agency operator ( $E_d$ ) and the dynamic formulations ( $\bigwedge_{a \in A_a} [\mathcal{A}, a]$ ) remain valid for those conditional versions.

The first observation that motivates the study of conditional versions of the right to know is that in its unconditional variant, the doctor’s duty is logically independent of the actual condition of the child. To see this, recall first that both the knowledge and the agency operators are factive in the models we use. They both validate the “T” axiom, i.e.,  $\mathbf{K}_x \varphi \rightarrow \varphi$  and  $E_x \varphi \rightarrow \varphi$ . This means that the doctor cannot see to it that the parents know whether or not the child is healthy without that epistemic state “actually” happening, and that the parents cannot know

that the child is healthy or unhealthy unless it “actually” is. We put “actually” in scare quotes to emphasize that this is actuality in the deontically most ideal states, which will be typically different from the state of evaluation. The combination of agency and epistemic operators is indeed in the scope of the deontic operator  $\mathbf{O}_{d \rightarrow p}$ . This means that simple examples can be constructed of models where the child is not healthy in the actual state  $w$  but is healthy in all the most ideal states  $w'$ , with the doctor seeing to it that the parents know that. In other words, these are examples where the child is not healthy but the doctor not only ought to see to it that the parents know whether the child is healthy, she ought to see to it that the parents know *that* the child is healthy.

A natural first attempt at addressing this issue is to use a pair of conditional duties. As in the previous section, we start with the case where the object of this duty is captured by the static agency operator  $E_d$ :

$$\mathbf{O}_{d \rightarrow p}(E_d \mathbf{K}_p(h) / h) \wedge \mathbf{O}_{d \rightarrow p}(E_d \mathbf{K}_p(\neg h) / \neg h) \quad (2)$$

The standard preferential semantics that underlies this formalization does not, however, rule out the disconnect between the fetus’s actual state and the doctor’s duty. The two conditions, i.e.,  $h$  and  $\neg h$ , constrain the set of most ideal states that, respectively, make  $h$  and  $\neg h$  true, that are considered when evaluating the deontic statement. In the first conjunct, these are the most ideal states among those settled in the eyes of the law<sup>19</sup> where the child is healthy ( $h$ ), and in the second conjunct, the most ideal states where the child is not. As with unconditional versions of the right to know, one can easily construct models where the child is not healthy at a nonideal state while the conditional obligation  $\mathbf{O}_{d \rightarrow p}(E_d \mathbf{K}_p(h)/h)$  still holds at that state.

This consequence of standard preferential semantics is, however, less counter-intuitive than for the unconditional variant of the right to know. In the example just described, the doctor does not have an unconditional duty to inform the parents that the child is healthy despite the fact that it (the child) is not healthy at the actual state. This duty is conditional and, in such cases, should be read in indicative mode: ideally, if the child is healthy, then the doctor ought to see to it that the parents know that fact. This can intuitively hold even though the child is actually not healthy, and such conditional obligations have arguably been developed to handle such cases. On the other hand, as we will see in our discussion of detachment in Section 3.3, the fact that the child is actually not healthy does not entail that the doctor has an unconditional obligation to inform the parents of that fact. Simple examples can even be

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<sup>19</sup> Recall indeed that our semantics of  $\mathbf{O}_{x \rightarrow y}$  is relativized to the set  $R_{\square}[w]$ .

constructed where the doctor has an unconditional duty to inform the parents that the fetus *is* healthy—perhaps because the fetus ought to be healthy in the first place—while in the actual state, the fetus is in fact *not* healthy, and the doctor also has a conditional duty to inform the parents of that fact. The problem with such cases, however, is with the unconditional obligation rather than the conditional obligation.

Just like the unconditional form, the conditional version of the right to know can be formulated by using the dynamic action operator to capture the doctor’s duty. This gives us the following:

$$\mathbf{O}_{d \rightarrow p} \left( \bigwedge_{a \in Act_d} [\mathcal{A}_d, a] \mathbf{K}_p(h)/h \right) \wedge \mathbf{O}_{d \rightarrow p} \left( \bigwedge_{a \in Act_d} [\mathcal{A}_d, a] \mathbf{K}_p(\neg h)/\neg h \right) \quad (2\text{-Dyn})$$

This version does not raise any conceptual questions beyond those just discussed with respect to (2) and the interpretation of the dynamic modalities in their “conjunction-box” form  $\bigwedge_{a \in Act_d} [\mathcal{A}_d, a]$ . We thus leave it now and come back to it in Sections 3.2–3.4 below.

Other formalizations of the right to know as a claim-right are also possible, but we leave them out of this article. For instance, Markovich and Roy (2021b) considers a version that uses “wide-scope” obligations (Broome, 2007). This version has interesting logical relationships with the unconditional and conditional versions we have just presented. It does, however, suffer from an analogous problem to that identified with regard to the unconditional version, mainly due to the fact that wide-scope obligations handle contrary-to-duty cases poorly. See again (Markovich and Roy, 2021b) for details. Another intuitively plausible variant would be to combine a narrow-scope reading with our “legally settled” operator to form a type of strict implication:  $\Box(h \rightarrow \mathbf{O}_{d \rightarrow p}(E_d \mathbf{K}_p h))$ , and similarly for the case where the child is not healthy. While plausible at first sight, this reading yields a consequence that appears counterintuitive. Such a pair of strict implications will hold at a given state only if it is either settled in the eyes of the law that the fetus is healthy or it is settled in the eyes of the law that the fetus is not healthy.<sup>20</sup>

<sup>20</sup> The argument for this is as follows: Take any model  $M$  and state  $w$  such that  $M, w \models \Box(h \rightarrow \mathbf{O}_{d \rightarrow p}(E_d \mathbf{K}_p h)) \wedge \Box(\neg h \rightarrow \mathbf{O}_{d \rightarrow p}(E_d \mathbf{K}_p \neg h))$ . Suppose, without loss of generality, that  $h$  is true at  $w$ . Since  $R_\Box$  is reflexive, we obtain that  $\mathbf{O}_{d \rightarrow p}(E_d \mathbf{K}_p h)$  is also true at  $w$ . This implies that the most ideal states in  $R_\Box[w]$  all make  $h$  true. Now, suppose there is another state  $w' \in R_\Box[w]$  where  $\neg h$  holds. By the same reasoning, we obtain that  $\neg h$  must hold, and hence  $h$  is false in all the most ideal states in  $R_\Box[w]$ , a contradiction. This means that  $h$  holds in all the states in  $R_\Box$ , and therefore  $M, w \models \Box h$ .

### 3.2 Logical Relationships Between the Different Formalizations

We start by analyzing the logical relationships between our four formalizations of the claim-right to know. Since there is no set relationship between the static agency operators and the epistemic actions, the static and dynamic versions are mutually independent. Thus we look first at the logical relations between the static versions and then those of the dynamic versions.

**Observation 1** (1) and (2) are logically independent in the class of arbitrary frames. (2) implies (1) in the class of monotone frames, but not vice versa.

**Proof.** To show that (1) does not entail (2), take  $W = \{w_1, w_2\}$  with  $R_\square = W \times W$ ,  $f_d(w_i) = \{W\}$  and  $R_p(w_i) = \{w_i\}$ ; where  $i \in \{1, 2\}$ ,  $w_1 <_{d \rightarrow p} w_2$  and  $V(h) = \{w_2\}$ . We get  $w_2 \models E_d(\mathbf{K}_p(h) \vee \mathbf{K}_p(\neg h))$ , and hence  $w_1 \models \mathbf{O}_{d \rightarrow p}(E_d(\mathbf{K}_p(h) \vee \mathbf{K}_p(\neg h)))$ . Observe, however, that at  $w_1$  we have  $\neg E_d(\mathbf{K}_p(\neg h))$ , and hence also  $w_1 \models \neg \mathbf{O}_{d \rightarrow p}(E_d \mathbf{K}_p \neg h / \neg h)$ . By modifying that frame and setting  $f_d(w_i) = \{w_i\}$  for both states, we also obtain a counterexample of the implication from (2) to (1).

For monotone models, take any model based on a monotone frame and a world  $w$  where  $w \models \mathbf{O}_{d \rightarrow p}(E_d \mathbf{K}_p(h)/h) \wedge \mathbf{O}_{d \rightarrow p}(E_d \mathbf{K}_p(\neg h)/\neg h)$ . Now, take any world  $v \in \max_{\leq_{d \rightarrow p}}(R_\square[w])$ . The world  $v$  either makes  $h$  true or it does not. In the first case, since  $v$  is maximal in  $R_\square[w]$ , we know that  $v \models E_d \mathbf{K}_p(h)$ , and since the frame is monotone, we know that  $v \models E_d(\mathbf{K}_p(h) \vee \mathbf{K}_p(\neg h))$ . The case in which  $v$  makes  $h$  false is entirely similar.

The conditional, static version of the right to know as a claim-right thus turns out to be logically stronger than the unconditional one in the class of monotone frames. The intuitive reason for this is that the latter only describes what holds in the most ideal states, while the former, by design, also constrains the epistemic states of the parent in nonideal states. The independence of (2) and (1) for nonmonotone frames essentially rests on the fact that even though  $\mathbf{K}_p(h)$  implies  $\mathbf{K}_p(h) \vee \mathbf{K}_p(\neg h)$ , the truth set of the latter need not be among the propositions that  $d$  sees to, even when the truth set of the former is among those propositions.

The relationship between the dynamic versions turns out to be slightly different in that the conditional version implies the unconditional version, but not the other way around, not only in the class of monotone frames but for any frames.

**Observation 2** For any model  $\mathcal{M}$  and state  $w$ , it is the case that  $\mathcal{M}, w \models (2\text{-Dyn})$  entails (1-Dyn), but not the other way around.



**Proof.** Take  $w, v$  such that  $w \models (2\text{-Dyn})$  and  $v \in \max_{d \rightarrow p} (R_{\square}[w])$ . Suppose first that  $v \models h$ . Since  $v$  is maximal in  $\leq_{d \rightarrow p}$  and makes  $h$  true, we obtain from  $w \models (2\text{-Dyn})$  that  $v \models \bigwedge_a [\mathcal{A}_d, a] \mathbf{K}_p h$ , and therefore  $v \models \bigwedge_a [\mathcal{A}_d, a] (\mathbf{K}_p h \vee \mathbf{K}_p \neg h)$ , since  $[\mathcal{A}_d, a]$  is a normal modality. The argument in the case of  $v \models \neg h$  is again symmetric.

To construct a counterexample to the implication from (1-Dyn) to (2-Dyn), one need only observe that the former imposes no constraints in the case—for instance, no maximal  $h$ -world in  $R_{\square}[w]$  is maximal *simpliciter*—while the latter does.

### 3.3 Detachment Principles

In deontic logic, the so-called detachment principles are central to the theory of conditional and contrary-to-duty obligations (Hilpinen and McNamara, 2013).<sup>21</sup> Detachment is especially relevant when using deontic logic for computational law, like in this paper. Whether an obligation *follows* from a conditional norm together with its condition is a central question to what it means to apply the law. Of course, the importance of detachment principles is also well recognized in general. Obligation in general, and deontic systems in particular, should arguably be action-guiding. Systems not allowing for an appropriate form of detachment fall short in an important way (van Eck, 1982). However, what form is appropriate is highly debatable. Hence, it is vital to check how our conditional formalizations perform with respect to detachment.

The deontic logic literature considers three types of detachment.

**Factual Detachment.** A conditional obligation  $\mathbf{O}_{x \rightarrow y}(\varphi/\psi)$  validates factual detachment whenever the truth of  $\mathbf{O}_{x \rightarrow y}(\varphi/\psi)$  and of  $\psi$  entail the truth of  $\mathbf{O}_{x \rightarrow y}(\varphi)$ .

**Necessary Detachment.** A conditional obligation validates necessary detachment whenever the truth of  $\mathbf{O}_{x \rightarrow y}(\varphi/\psi)$  and of  $\square\psi$  entail the truth of  $\mathbf{O}_{x \rightarrow y}(\varphi)$ .

**Deontic Detachment.** A conditional obligation validates deontic detachment whenever  $\mathbf{O}_{x \rightarrow y}(\varphi)$  follows from the conditional obligation together with  $\mathbf{O}_{x \rightarrow y}\psi$ .

While factual detachment seems intuitive at first sight, it turns out in many cases to be too strong. The usual worry about factual detachment in standard deontic logic is that this principle might lead to morally or, in our case, legally bad unconditional obligations. See, for example, the discussion around "gentle murders" in (Hilpinen and McNamara, 2013). In the present, legal context, however, the remarks made in Sections 1.1 and 2 are more directly

<sup>21</sup> We are grateful to one of the anonymous reviewers for pressing us to expand the discussion of detachment principles. The discussion that follows is at places strongly inspired by the reviewer's comments.

relevant. Unrestricted factual detachment would have the counter-intuitive consequence that agents could be held responsible, here meaning that unconditional claim-rights could hold against them, for facts that are otherwise not established in the eyes of the law. Although the legal obligations we discuss in this paper do not come from criminal law, it provides a good illustration of this worry about factual detachment; the principle would predict that an accused is legally guilty of a crime that they (actually) committed even before the relevant evidence has been brought to court and recognized as being beyond reasonable doubt. Licensing such an inference would clearly go against the presumption of innocence—that any accused person is innocent until *proven* guilty which is fundamental to most of the criminal codes.

The fact that none of the variants of the right to know validate factual detachment is thus a welcome feature of the present model. We have indeed mentioned in Section 3.1 that both for (1) and (2), simple models can be constructed where unconditional obligations fail to detach despite the truth of the condition. We have in fact observed that (1) might be seen as *too* independent from what is actually true at a state. This is, however, a somewhat orthogonal shortcoming of (1). Facts that are recognized in the eyes of the law are what matters for the conditional variant, which naturally brings us to necessary detachment.

The validity of necessary detachment is one of the most important features of (2), the conditional version of the right to know. We have indeed argued both in Sections 1.1 and 2 for the plausibility of necessary detachment in the context of modeling the right to know as a Hohfeldian claim-right. It is worth restating that argument here in slightly different terms. While factual detachment has been found too strong, necessary detachment seems too weak depending on how one reads "necessary." If one interprets the  $\square$  modality a classical alethic modality capturing metaphysical necessity, the principle is too weak in the sense that too few unconditional obligations will detach. Recall, however, that we interpret the  $\square$  as settled in the eye of the law, talking hence about a context of legal metaphysics considering those—often called institutional—facts that are established or officially recognized by the law. This latter disjunction is important: it allows not only facts listed in a judicial sentence as proven be settled in the eye of the law, but also some professional issues. Many professional questions are considered to be settled in the eyes of the law once they are settled by the relevant professionals. In Germany, for instance, the issue of students' official grades is legally settled by their professors. Similarly, in our case, it is plausible that the doctor's diagnosis of an illness, or of the absence of such an illness, settles the matter in the eyes of the law. With this interpretation, it is plausible that the doctor's duty to let the parents know whether the fetus is healthy or not is triggered by her diagnosis. Necessary detachment is therefore a welcome property of (2). Formally, we have already observed in Section 2.3 that this principle follows

directly from our decision to relativize the truth of the conditional obligation operators to what is legally settled at a given state. This, of course, also applies to the conditional obligations used in our logical model of the right to know.

**Observation 3** *For any model  $\mathcal{M}$  and state  $w$ , it is the case that  $\mathcal{M}, w \models (2)$  and  $\mathcal{M}, w \models \Box h$  entail  $\mathcal{M}, w \models \mathbf{O}_{d \rightarrow p} E_d \mathbf{K}_p h$ , but there exist models where  $\mathcal{M}, w \models (1)$  and  $\mathcal{M}, w \models \Box h$  but not  $\mathcal{M}, w \models \mathbf{O}_{d \rightarrow p} E_d \mathbf{K}_p h$ .*

**Proof.** Take any model  $\mathcal{M}$  and state  $w$  such that  $\mathcal{M}, w \models (2)$  and  $\mathcal{M}, w \models \Box h$ . By the latter, we know that any maximal  $\leq_{d \rightarrow b}$  state  $v$  makes  $h$  true, and so by the former, we know that that state also makes  $E_d \mathbf{K}_p h$  true, as required. For the second part, take  $W = \{w_1, w_2\}$  and, for  $i = 1, 2$ , it is the case that  $R_{\square}[w_i] = \leq_{d \rightarrow p}[w_i] = R_p[w_i] = \{w_i\}$  and  $f_d(w_i) = \{W\}$  and  $V(h) = \{w_1\}$ .

It is also notable that necessary detachment fails for (1), the unconditional version of the right to know as a claim-right, adding to the worry already voiced regarding that version. The intuitive reason why the principle fails for (1) is, however, related to that worry. What the doctor ought to see to, in our general class of models, is not only independent from what is actually the case, but also of what is legally settled.

Turning now to deontic detachment—the intuitiveness of which is much discussed as well—we obtain similar results: the unconditional variant (1) does not validate this principle, but the conditional version does. It is indeed easy to construct a model where both  $\mathbf{O}_{d \rightarrow p} h$  and  $\mathbf{O}_{d \rightarrow p} E_d (\mathbf{K}_p(h) \vee \mathbf{K}_p(\neg h))$  hold but  $\mathbf{O}_{d \rightarrow p} E_d (\mathbf{K}_p(h))$  fails. The mathematical reason for this is the relative independence of the neighborhood function  $f_d$  and the pre-order  $\leq_{d \rightarrow p}$ . For the conditional version, we have the following.

**Observation 4** *For any model  $\mathcal{M}$  and state  $w$ , if  $\mathcal{M}, w \models \mathbf{O}_{d \rightarrow p} h$  and  $\mathcal{M}, w \models \mathbf{O}_{d \rightarrow p} (E_d \mathbf{K}_p(h)/h)$ , then  $\mathcal{M}, w \models \mathbf{O}_{d \rightarrow p} E_p \mathbf{K}_p h$ .*

**Proof.** Take any model  $\mathcal{M}$  and state  $w$ , and consider any state  $w'$  that is  $\leq_{d \rightarrow p}$ -maximal in  $R_{\square}[w]$ . Since  $\mathcal{M}, w \models \mathbf{O}_{d \rightarrow p} h$  we know that  $w'$  makes  $h$  true, but then  $w'$  must be  $\leq_{d \rightarrow p}$ -maximal in  $\|h\| \cap R_{\square}$  as well. This means that  $\mathcal{M}, w' \models E_d \mathbf{K}_p(h)$ , because  $\mathcal{M}, w \models \mathbf{O}_{d \rightarrow p} (E_d \mathbf{K}_p(h)/h)$ .

Taken at face value, the validity of deontic detachment for the conditional version can be seen as a serious shortcoming of this model of the right to know. Going back to our running example, this would seem to mean that the parents' right to know *whether* the child is healthy

entails, as soon as it ought to be the case that the child is healthy, an unconditional duty of the doctor to inform the parents *that* the child is healthy, irrespective of the actual state of the child, or of whether this fact is legally settled. This inference is highly counter-intuitive.

We, however, do not view the validity of deontic detachment as a significant problem of the present formalization. The counter-intuitive inference just sketched above conflates two different senses of “ought.” The correlative duty constitutive of the claim-right is a legal one. The doctor, in this example, has a legal duty to inform the parents, conditional on the state of the child. The purported obligation of the doctor towards the parents that the child is healthy is, however, arguably *not* a legal duty. Doctors might have legal obligations to *do their best* to restore or maintain the child’s health, but we know no legal system where they have an unconditional, *legal* obligation to succeed in that, i.e., a duty *that* the child is healthy. To be sure, doctors might have a moral or perhaps a vicarious obligation (Glavaničová and Pascucci, 2024) that the child is healthy, but this is not the same type as the legal duties involved in Hohfeldian claim-rights.

We get similar results for the dynamic version of these principles. Neither (1-Dyn) nor (2-Dyn) validates factual detachment. The dynamic version of (1) neither validates necessary nor deontic detachment, but the dynamic version of the conditional (2) validates both. These do not raise any further conceptual questions than those already discussed.

Although (1-Dyn) does not validate factual detachment, it does validate the following principle, which is conceptually close to normative detachment:  $\mathbf{O}_{d \rightarrow p} h$  together with (1-Dyn) implies

$$\mathbf{O}_{d \rightarrow p} \left( \bigwedge_{a \in Act_d} pre(a) \rightarrow \left( \bigwedge_{b \equiv a} \mathbf{K}_p(pre(b) \rightarrow h) \right) \right)$$

The same holds the other way around for  $\mathbf{O}_{d \rightarrow p} \neg h$ .

The notable feature of this form of deontic detachment is that it remains conditional on the executability of the doctor’s actions, which opens the door to interesting modeling possibilities. Suppose, for instance, that the precondition for the doctor informing the parents is that she knows that the fetus is healthy, i.e.,  $pre(a) = \mathbf{K}_d h$  for some  $a \in Act_d$ , and that the doctor has an epistemic duty to know that, i.e.,  $\mathbf{O}_{d \rightarrow p} \mathbf{K}_d h$ . Now, of course, with such a formulation of the doctor’s epistemic duty to know that the fetus is healthy, Åqvist’s paradox (see below) applies and we obtain  $\mathbf{O}_{d \rightarrow p} h$ . From this, we obtain the strengthened doctor’s duty not only to know that the fetus is healthy, but also to see to it that the parents know that the fetus is healthy, given that certain conditions hold.

$$\mathbf{O}_{d \rightarrow p} \left( \bigvee_{a \in Act_d} pre(a) \wedge \left( \bigwedge_{b \equiv a} \mathbf{K}_p(pre(b) \rightarrow h) \right) \right)$$

The fact that the doctor knows that the fetus is healthy is one of those pre-conditions, but there might be others. This does not entail that the doctor is obliged to see to it that the parents know *simpliciter*.

### 3.4 Åqvist's Paradox Regarding the Right to Know

Åqvist's paradox is a benchmark for theories combining deontic and epistemic modalities (Åqvist, 1967; Hulstijn, 2008). It arises from the basic observation that in standard deontic logic, if someone has an obligation to know that something bad is the case and knowledge is veridical, then it ought to be the case that something bad is happening (Åqvist, 1967). For illustration, we take here this "something bad" as the fetus not being healthy.

The first observation, echoing the findings in (Hulstijn, 2008), is that (1) avoids the paradox. Its truth does not imply  $\mathbf{O}_{d \rightarrow p} \neg h$ , even in monotone frames. The dynamic version (1-Dyn) does not fall prey to the paradox either.

For the right to know formulated as a pair of conditional obligations, i.e., (2), the situation is slightly more subtle. Regardless of whether they express epistemic rights, conditional obligations defined here validate  $\mathbf{O}_{d \rightarrow p}(\neg h / \neg h)$ . This means that  $\mathbf{O}_{d \rightarrow p}(E_d \mathbf{K}_p(\neg h) / \neg h)$  entails  $\mathbf{O}_{d \rightarrow p}(E_d \mathbf{K}_p(\neg h) \wedge \neg h / \neg h)$ , and similarly for  $\mathbf{O}_{d \rightarrow p}(E_d \mathbf{K}_p(\neg \neg h) / \neg \neg h)$ . This observation has nothing specifically to do with the fact that (2) expresses an epistemic right. It is a trivial consequence of the preferential semantics of conditional obligations in the current version of the theory of normative positions (Zvolenszky, 2002; Parent, 2021). Note, however, that this "duty" of the fetus not being healthy does not completely detach in the sense that (2) does *not* imply  $\mathbf{O}_{d \rightarrow p} \neg h$ . The dynamic version (2-Dyn) behaves similarly to the static one, since it uses the same notion of conditional obligation.

Recall that since obligations are relativized to what is legally settled, we automatically get  $\Box \varphi \rightarrow \mathbf{O}_{d \rightarrow p}(\varphi / \psi)$  for whatever  $\psi$ . This means that for legally settled propositions, all three formulations of the right to know as a claim-right validate inferences fitting the pattern of Åqvist's paradox:  $\Box \neg h \wedge (1)$  entails  $\mathbf{O}_{d \rightarrow p}(\neg h)$ , just like  $\Box \neg h \wedge (2)$ . Whether these are really instances of the paradox is, however, debatable. The veracity of knowledge plays no role here, and neither does any other property of knowledge nor our agency operator for that matter. As before, it is a trivial consequence of preferential semantics for conditional obligations.

### 3.5 The Right to Know as a Power

Recall that, in Hungary, citizens have the right to know the declarations of property of their MPs and local representatives, but while the first right is actually a claim-right, the second one is a power. Local representatives have a duty to publish their declarations only upon a citizen's request. They are liable in the Hohfeldian sense, that is, they are exposed to such a duty being established by a citizen's request. One could argue that the parents' right to know the results of the tests is the same: the parents asking the doctor for the results triggers the duty to inform. That is, the action of the request creates their claim-right to know the results, just like the citizen's request created the claim-right that the representative ought to publish her declaration of property. As mentioned earlier, in the test result case, the power interpretation of the right to know also allows for situations in which the doctor wants to tell the parents the result but they can forbid her from doing so (because, for some reason, they do not want to know).

Here we only briefly discuss possible formalizations of the right to know as a power. See Li and Markovich [Forthcoming] for a more detailed logical study of this very epistemic normative position.

As before, the interpretation of the right to know as a power can be captured formally using either the static or dynamic agency operators. Let  $r$  be the local representative,  $c$  a citizen in a given (finite) set of citizens  $C$ , and  $prop$  the proposition that the representative publishes her declaration of property. Since we already have four formulations of the claim-right associated with this power (that is, the claim-right that using the power would result in), it will be useful to use  $\text{CRK}_{c \rightarrow r}(prop)$  as a placeholder for any of these formalizations. Using our static agency operator, the following appears to be a natural formalization of this power:

$$\bigwedge_{c \in C} \Diamond E_c \text{CRK}_{c \rightarrow r}(prop) \quad (4)$$

This states that for every citizen, it is legally possible to see to it that her claim-right against the representative holds. As above, this can of course be formalized instead using the dynamic modalities:

$$\bigwedge_{c \in C} \bigvee_{a \in \mathcal{A}_c} \langle \mathcal{A}_c, a \rangle \text{CRK}_{c \rightarrow r}(prop) \quad (4d)$$

In this formula,  $\mathcal{A}_c$  is a *deontic* action model (Section 2), and  $\langle \mathcal{A}_c, a \rangle$  is the dual of the dynamic modality  $[\mathcal{A}_c, a]$ . Intuitively, the formula thus states that any citizen has at least one deontic action executable in the current state that would result in her having a claim-right against representative  $r$  to publish her declaration of property. This action can be interpreted as an explicit request to the representative to disclose the declaration.

Both the static and the dynamic formulas are compatible with  $\mathbf{CRK}_{c \rightarrow r}(prop)$  being false in the current world. The static version states that the claim-right *can* be created (by the citizen having the power), i.e., in some other legally possible states. The dynamic version rather states that  $\mathbf{CRK}_{c \rightarrow r}(prop)$  holds *after* the execution of one of the citizen's deontic actions. Of course, both formulas could be generalized in such a way that not only  $c$  holds the right created after  $c$  has exercised her power. As for the claim-rights studied above, the static and the dynamic versions here are logically independent. We leave further systematic study of the logical behavior of these two formulations for future work.

Before closing this short section on the right to know as a power, let us briefly return to our running example. The notion of power is also crucial to the parents' right to know in another, more general sense that has implications for the whole theory of normative positions. Texas Senate Bill 25 in the US was designed to prevent parents who had given birth to seriously ill or disabled babies from suing doctors for failing to identify serious health conditions at the fetal stage. The question arose whether this would mean that parents no longer have the (claim-)right to know whether the fetus is healthy or not (Watson, 2019). Answering this question involves considerations about, on the one hand, the legal and logical relationship between a claim-right and the power to initiate legal action against an agent who fails to fulfill his/her correlative duty.<sup>22</sup> On the other hand, it also requires epistemic (logical) considerations about the relationship between (failing) to identify, and informing others about, a given state of affairs. See (Markovich and Roy, 2021a) for a more comprehensive logical analysis of this case in the context of the theory of normative positions.

## 4. Conclusions

Our goal in this paper was to assess the potential of formalizing the right to know within the theory of normative positions by combining some variations of deontic, epistemic, and

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<sup>22</sup> Makinson (1986) did propose an informal definition of claim-right in terms of a power to initiate legal action when a duty is not fulfilled. This definition has been questioned by Sergot (2013) and Markovich (2020) who argue, respectively, that the power to initiate legal action does not entail the existence of a claim-right, and that power should not even be part of the definition of claim-right.

action logics. For the actual variations that we used, we obtained promising results and found some clear limitations.

On the one hand, we view the very fact that one can formulate at least four plausible versions of the claim-right to know as a positive finding showing the potential of logic for computational legal theory—not just for the development of later applications in computational law, but also for legal theory itself to help understand its concepts. Even for this case, where the right to know is an atomic epistemic right,<sup>23</sup> the theory of normative positions helps to disambiguate static and dynamic readings of the epistemic actions that are the object of correlative duties, and we have seen that these are logically independent. We have furthermore seen that distinguishing between the conditional and the unconditional versions of this duty raises important questions about the relationships between what is actually the case, what the claim-right holder ought to be informed of, and what the duty-bearer ought to do. Finally, we have seen the importance of taking into account what is legally settled when studying detachment principles, and this applies to each of these versions.

However, we have also seen that some of the formalizations come with important limitations. On the one hand, the unconditional formulations appear to impose a very, if not too loose connection between the state of the child and what the doctor ought to tell the parents. On the other hand, the conditional versions inherit from the standard semantics the somewhat counter-intuitive property that  $\mathbf{O}_{x \rightarrow y}(\varphi/\varphi)$ , which in the present setting is reminiscent of—although, as we argued in the last section, not equivalent to—Åqvist's paradox.

We, however, by no means take these limitations as fatal blows to the project of analyzing epistemic rights by combining different variants of deontic, epistemic, and action logics. Analyzing epistemic rights within the theory of normative position allows for a detailed formal conceptual analysis, which is already an important contribution. We found, in particular, that both the static and the dynamic versions of the right to know as a claim-right behave comparatively well. We rather take these limitations as challenges that should be addressed in future work. Our basic observations do not rule out formulating a more complex version of the unconditional variant in which the doctor's duty tracks the actual state of the child. Along similar lines, numerous other logical systems have been developed to handle conditional obligations in a more subtle matter than on the basis of preferential semantics, and we view this paper as an invitation to incorporate them in order to extend the current formal theory of epistemic rights.

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<sup>23</sup> See, in contrast, the logical analysis of the molecular freedom of thought in (Markovich and Roy, 2021c).



It should also be noted that, apart from the questions about formalizing power, which is only sketched here, several other conceptual points deserve further attention. Just to mention one example, the relationship between what the holder of the correlative duty ought to do with respect to the claim-right to know and the state of knowledge of the right-holder should be better understood. In this paper, we represented this as the duty-bearer, i.e., the doctor, having a duty to see to it that the parents know whether or not the fetus is healthy. A different content of this claim-right could be that the doctor has a duty to make the information about the health of the fetus available to the parents: whether the parents end up knowing that their future child is healthy or not is, in this view, their private concern and lies beyond the duties of the doctor. Since this idea comes close to a claim-right to knowability, it might be possible to analyze it using tools from the logic of arbitrary announcements (Balbiani *et al.*, 2007).

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