Deductive Reasoning Without Rule-following

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1 Introduction

Becca reads about Yayoi Kusama's work and comes to believe that

(1) All of Kusama's work is psychedelic.

Though she knows that *Pumpkin* is one of Kusama's works, she has neither seen it nor any description of it. Purely on the basis of (1), she comes to believe that

(2) Kusama's work, *Pumpkin*, is psychedelic.

When Becca transitions from (1) to (2), she engages in the kind of deductive reasoning that interests us here. As a first pass, such reasoning may be characterized as a transition in thought that is active, in that it is something that Becca does rather than something that merely happens to her; and which is accessible to consciousness and self-report, in that Becca can recall her premises and conclusion or cite them when asked.

Though this first pass suffices to fix ideas, it does not amount to an account of what deductive reasoning consists in, since some transitions in thought, though active and accessible, clearly do not amount to reasoning. For example, suppose that when Becca sees *Pumpkin* for the first time, she starts thinking about making pumpkin ravioli. Even if this transition in thought is active and consciously accessible, it is merely associative, and not a case of reasoning.

What, then, does deductive reasoning consist in? According to the orthodox view, the answer is *rule-following*:

> **The Rule-following View of Deductive Reasoning (RULE):** Necessarily, if *S* reasons deductively from a particular set of premises P to a particular conclusion Q, *S* follows a rule that licenses reasoning from P to Q.

According to RULE, if Becca reasons from (1) to (2), she must be following a suitable rule. Given that she reasons in accordance with Universal Instantiation,

UI: $\forall x\, Fx \vDash Fa$,

she might be taken to follow a rule such as:

> **UI-Rule**: From the thought that everything is *F*, you ought to infer that this thing is *F*.[1]

[1] Since UI is not a rule but a statement of entailment, it cannot be 'followed' (Harman 1986). Thus, if RULE is true, an agent who reasons in accordance with UI must follow an associated rule. These rules might be formulated in many ways: as imperatives, permissions, or obligations. Nothing in the present paper hangs on the formulation of UI-Rule. Indeed, there may be no uniformly attractive way to formulate rules of logic.

RULE is so popular that it is impossible to give an exhaustive list of its proponents. It is suggested by Gentzen's (1964) characterization of natural deduction, in which logical consequence is determined by a set of basic rules. Conventionalists (Ayer 1946; Carnap 1937; Warren 2020b) endorse the stronger view that logic itself is constituted by conventionally adopted rules, while many inferentialists and conceptual role semanticists hold that the meanings of logical terms in natural language, such as 'and', 'not', 'or', 'all' and 'some', or the concepts with which these are associated, are constituted by rules governing their use in reasoning (Block 1998; Boghossian 2008; 2014; Harman 1982; Miller 2015; Peacocke 1992; Warren 2020b; Wedgwood 1999). Wittgenstein (1953) and his followers (Brandom 1994; Wright 2007; 2018) likewise hold that to reason deductively is to follow a rule, though they offer a deflationary account of rule-following in terms of participation in a practice. (See also Boghossian 2014; Broome 2013; 2014; Hlobil 2014; Quilty-Dunn and Mandelbaum 2018; Winters 1983.)

RULE's popularity is understandable. It is attractive both as an account of the psychological process of reasoning, and of its epistemology. Psychologically speaking, RULE offers a compelling explanation of what differentiates reasoning from mere transitions in thought: when Becca reasons, she follows UI-rule, and when she freely associates, she does not. Epistemologically speaking, it figures in a satisfying account of how deductive reasoning is justified: assuming that UI is valid, Becca is justified in following UI-Rule in her reasoning.

In this paper, we throw orthodoxy to the winds, and take issue with RULE.[2] In Section 2, we develop our main objection to it, which is inspired by the 'adoption problem' put forward by Saul Kripke in 'The Question of Logic' (2024).[3] As it strikes us, the adoption problem shows that it must be possible to reason deductively without rule-following, and hence that RULE is false. In Section 3, we propose an alternative to RULE: the *Particular-First* view of deductive reasoning, according to which the capacity to reason in particular cases is prior to the adoption of any general rule. In Section 4, we develop an account of *Intuitive Reasoning* without rule following in particular cases, which builds on influential work in empirical psychology on deductive reasoning and the acquisition of concepts (Carey 2004; 2009). We then demonstrate how our account can explain what it is to learn and follow rules. In Section 5, we argue that our account is superior to RULE, not only in solving the adoption problem, but many of the well-known problems associated with RULE, such as Lewis Carroll's (1895) regress. In section 6, we sketch how our account is apt to explain how deductive reasoning may be justified.

[2] The present paper builds on Besson (2019) and Hattiangadi (2023). Valaris (2017) has also challenged RULE, albeit on different grounds than those provided here.

[3] There are two seminal presentations of the adoption problem. First, Kripke's (2024), which is based on a lecture delivered in Pittsburgh in 1974, where he argues against the anti-exceptionalism of Putnam and Quine on the grounds that one cannot adopt a logical principle in the way that one adopts a scientific hypothesis, since one needs logic to determine what follows from any general principle. The second is due to Birman (2015; 2024) (née Padró) who elaborates on Kripke's argument, arguing that it is not possible to adopt a basic logical principle without having a prior practice of reasoning in conformity to it. While we take our cues from Kripke, we do not attempt an exegesis of his paper. Unfortunately, we don't have the have the space to review either Birman's take on the adoption problem, or the many formulations, interpretations and solutions put forward in the growing literature on it (Besson 2019; Finn 2019; Devitt and Roberts 2024; Boghossian and Wright 2024; Susanszky 2023).

2 The Adoption Problem

The adoption problem gets its purchase on RULE in conjunction with the following plausible view of rule-following:

> **The Representational View of Rule-following (REP):** Necessarily, if *S* follows *R*, then *S* first accepts *R* in a way that involves explicitly representing its content, and is subsequently guided by this content in conforming to *R*.

Given REP, if Becca followed UI-rule in her reasoning, she must have previously accepted it in a way that involved explicitly representing its content, and she must have been guided by this content in conforming to it in her reasoning. We assume the familiar notion of guidance according to which a content guides an agent only if it both causes and subjectively rationalizes her behaviour, in that it makes her behaviour intelligible or sensible from her own perspective (Anscombe 1963; Boghossian 2014; Davidson 1970). One's moving from P to Q can be intelligible in this subjective sense even if P does not in fact entail Q.

Now, RULE implies that if *S* reasons, *S* follows some rule, *R*, while REP implies that if *S* follows *R*, *S* must first explicitly accept *R*, and then be guided by it in subsequently conforming to it. Thus, RULE & REP imply the view that the adoption problem targets:

> **Reasoning and Adoption (RAD)**: If *S* reasons deductively, there must be some rule *R* such that *S* first explicitly accepts the content of *R*, and then conforms to *R* because *S* is guided by its content.

Kripke (2024) makes a powerful case against RAD. He argues that UI-Rule and the like cannot be adopted, because one cannot first explicitly accept such a rule, and then come to be guided by it in one's reasoning.[4] He implicitly assumes that if it is possible to adopt UI-Rule, then it is possible to adopt it without having the prior ability to see a universal statement as implying its instances. This is suggested by RULE itself: if one could *see* a universal statement as implying an instance of it, prior to adopting any rule, one could plausibly reason from universal statements to their instances without rule-following, which is incompatible with RULE. So, Kripke asks us to consider a person, whom we can call 'Charlie', who 'somehow *just doesn't see* that from a universal statement each instance follows' (Kripke 2024, 15, emphasis ours). Though Charlie believes that

(3) All ravens are black,

he does not see that (3) implies, of a raven he cannot see, that

(4) *This* raven is black.[5]

[4] Kripke primarily discusses UI, without distinguishing between UI and UI-Rule. The question of *which* logical principles the adoption problem primarily targets has been widely discussed (see Besson 2019; Birman 2015; 2024; Hattiangadi 2023; Finn 2019; Susanszky 2023). We do not engage with this issue here.

[5] A conceptual role semanticist might respond to the adoption problem by arguing that Charlie could not believe that all ravens are black in advance of having accepted UI-Rule, since that rule is constitutive of the meaning of 'all' (Boghossian and Wright 2024). However, as Hattiangadi (2023) argues, this exacerbates the adoption problem, since now Charlie must *both* adopt UI-Rule *and* learn the meaning of 'all', neither of which seems doable given Charlie's inability to see any universal statement as implying any instance of it.

Now suppose that we attempt to enlighten Charlie by teaching him UI-Rule. Surely, we are doomed to failure. After all, UI-Rule is a universal statement, so if Charlie is incapable of seeing any universal statement as implying its instances, he is incapable of seeing that UI-Rule implies its instances too. So, presenting Charlie with UI-Rule will not put him in a position to see what follows from it. Kripke writes:

> This is the problem. If he did not already reason in accordance with the pattern of inference we call 'Universal Instantiation', telling him that it was true would do him no good: he couldn't 'adopt' it as a hypothesis, he couldn't use it as an auxiliary to derive further statements. If he was not able to make the simple inference, 'All ravens are black, therefore, this raven is black', then giving him some 'super premise' like 'Every universal statement implies each instance' as another premise won't help him either. (Kripke 2024, 15)

As it strikes us, the adoption problem may be summed up as follows. By RAD, if one is to reason deductively in a particular case, one must first adopt a general rule, and subsequently be guided by it. But if one cannot antecedently see that any universal statement implies an instance of it, then one will not be able to see what any general rule implies. And if one cannot see what a general rule implies, one cannot be guided by it, and thus cannot adopt it. We take this to show that RAD must be false. Though it is obvious that we very often *do* reason deductively from universal statements to their instances, it is not possible to do so by adopting a general rule. Since RULE and REP imply RAD, if RAD is false, then we must reject either REP or RULE. We will argue that RULE must go.

3 Resisting the Adoption Problem

Rejecting RULE might strike many as a radical move. Given its popularity, it might be thought better to sidestep the adoption problem by replacing REP with an account of tacit rule-following, involving implicit acceptance of a rule, or non-representational know-how. For instance, some hold that what it is to follow a rule is to have certain dispositions or patterns of dispositions (Broome 2013; 2014; Warren 2020b; 2020a), possibly realized in sub-personal processes (Quilty-Dunn and Mandelbaum 2018); that rule-following consists in a non-representational know-how that can be acquired through training (Devitt and Roberts 2024; Ryle 1949); or that rule-following consists in participating in a social practice (Birman 2015; 2024; Wittgenstein 1953; Wright 1980; 2018).

However, none of these accounts of rule-following resolves the adoption problem. They all face a dilemma, which turns on whether or not it is assumed that Charlie acquires the capacity to see particular universal statements as implying their instances as a result of learning to follow UI-Rule implicitly. Consider the first horn. Suppose that through training or participation in a practice, Charlie acquires the disposition to go from accepting universal statements to accepting their instances *without* being able to see any particular universal statement as implying any particular instance of it. When Charlie goes from accepting (3) to accepting (4), he does not do so because he regards the former as implying the latter. Perhaps (4) simply pops into his mind on the heels of thinking (3). If this is so, then even though he *happens* to conform to UI-rule, it does not guide him, since his transition in thought is purely causal, and fails to rationalize his reaching the conclusion that he does. Indeed, he is not reasoning deductively at all, let alone implicitly following UI-Rule. Thus, the proponent of RULE who rejects REP undermines one of the features of RULE that made it seem initially

attractive: that it is able to supply a distinction between deductive reasoning and mere transitions in thought.

The foregoing considerations are closely related to the familiar idea that when one reasons from a set of premises to a conclusion, one *takes* one's premises to be reasons to reach one's conclusion. Paul Boghossian (2014, 5) puts this forward as a constraint on accounts of reasoning:

> **Taking Condition:** Reasoning necessarily involves the thinker *taking* her premises as *supporting* her conclusion and drawing her conclusion because of that fact.

Though Taking Condition strikes us as virtually platitudinous, it is not without its detractors. Assuming RULE and REP, some object that Taking Condition over-intellectualizes reasoning. If taking P to support Q requires that one has the *belief* that P logically entails Q, Taking Condition implies that if one lacks sophisticated concepts of support or entailment, one is incapable of reasoning deductively, which is implausible (Broome 2014).

Another objection to Taking Condition is that any account of reasoning as rule-following that satisfies it seems to give rise to Lewis Carroll's (1895) regress. Suppose that one reasons from P to Q. By Taking Condition, one must take P to support Q and conclude Q because of that fact. Suppose that one's taking P to support Q amounts to one's being guided by a belief, B, whose content is that P supports Q. The regress is triggered by Carroll's assumption that B can only guide one in concluding Q if it figures as a premise in one's reasoning. So, in order to reason from P to Q, one must first reason from P *and* B to Q. And by Taking Condition, if one reasons from P and B to Q, one must *take* P and B to support Q, for instance, by being guided by a belief, B´, whose content is that P and B support Q. But if Carroll's assumption holds generally, B′ can only rationalize one's concluding Q if it figures as a premise in one's reasoning. So, in order to reason from P and B to Q, one must first reason from P, B *and* B′ to Q. And so on.

In the next section, we develop an account of reasoning that satisfies Taking Condition, and preserves REP, while avoiding both of these difficulties. For now, we merely wish to note that accounts of reasoning that reject REP fail to satisfy Taking Condition, and are to that extent implausible**.**

Let's now turn to the second horn of the dilemma. Suppose that as a result of his training or participation in a practice, Charlie acquires the ability to see universal statements as implying their instances in particular cases—albeit without at any point explicitly representing UI-Rule. Once again, even if Charlie's behaviour conforms to UI-Rule, it plays no role in guiding him in drawing his conclusions. First, Charlie's being disposed to represent *particular* universal statements as implying their instances does not amount to following UI-Rule. For, in the absence of any explicit representation of a rule, it is radically underdetermined which of infinitely many rules Charlie is following, or indeed, whether he is following any rule at all. Since UI-rule applies to universal statements too long and complex for Charlie to processes, Charlie's dispositions do not determine whether he is following UI-rule or another rule that diverges from it for statements Charlie cannot process. This point is familiar from Kripke's (1982) discussion of Wittgenstein's rule-following considerations.[6] Second, even if Charlie represents (3) as implying (4), he might take this implication to hold only in this particular case, without even implicitly accepting a logical

[6] Though there have been many responses to this objection to dispositionalism, most recently offered by Warren (2020a), we do not think any of these responses are satisfactory (Guardo 2021; Hattiangadi 2007; 2023).

rule.[7] Though his transition in thought in this case conforms to UI-Rule, he need not be following it, even tacitly. [8]

Since these attempts to shore up RULE by rejecting REP are unsatisfactory, we propose to jettison RULE and retain REP. Thus, we take the adoption problem to show not only that UI-Rule cannot be adopted, but that the ability to reason in particular cases must be prior to the ability to follow any general rule.[9] In a nutshell*:*

> **Particular-First**: It is possible for *S* to reason deductively from a particular set of premises P to a particular conclusion Q prior to accepting any general rule that licenses reasoning from P to Q.

Though the Particular-First view treats deductive reasoning in particular cases as prior to adopting a general rule, it neither implies that *all* reasoning proceeds without rule-following, nor that rule-following is impossible. What we maintain, and what we take the adoption problem to show, is that our capacity to reason in the absence of rules is fundamental: one must first be capable of reasoning in particular cases without following rules, in order to eventually learn to follow rules.

4 How Can We Reason Deductively Without Following Rules?

In answering this question, we once again take our cue from Kripke (2024, 20), who somewhat enigmatically suggests that the adoption problem does not arise for what he calls 'intuitive reasoning', without spelling out what he takes this to be. So, we sketch our own picture of intuitive deductive reasoning without rule-following.

This picture makes use of the distinction between *iconic* representations—in perception, maps, diagrams, rough estimates, and the like—and *symbolic* representations, in language and thought (Block 2023). Crucially, for present purposes, iconic representations encode information holistically; their contents are concrete tropes, such as the redness of a particular apple; they relate to behaviour causally, through heuristics; they have accuracy conditions, but not truth conditions; and they contain no logical operators. Thoughts, in contrast, are composed of discrete concepts that represent individuals in abstraction from

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[7] This point is in line with Kripke's (2024, 5) suggestion that in objecting to Putnam's Quantum Logic, he does not assume *any* general rules, even implicitly, as well as Williamson's (2007, chap. 2) claim that we ordinarily reason with premises we take at 'face-value', that is, without assuming any logical system or general logical principles.

[8] Boghossian and Wright (2024) propose to solve the adoption problem without rejecting REP or RULE. They argue that it is possible for Charlie's explicit acceptance of UI-rule to give rise to a disposition to conform to it, though when he manifests this disposition in reasoning, he does not explicitly think of UI-rule. This approach does not avoid the dilemma presented here. If Charlie's acceptance of UI-rule gives rise to a disposition to reason in accordance with it, but not the ability to see a universal statement as implying its instances, his acceptance of UI-rule neither rationalizes nor guides his behaviour. If Charlie's explicit acceptance of UI-rule gives rise to a disposition to *see* that universal statements imply their instances, the proposal simply fails to engage with the adoption problem. See Hattiangadi (2023) for further critical discussion.

[9] Though Kripke (2024, 20) leaves it unclear whether he intends to reject RULE, he suggests that it must be possible to reason deductively not just without following any *special* set of rules called 'logic', but without following any general rules at all.

their properties, and properties in abstraction from their instances; have truth-conditions that are determined by their conceptual constituents and their mode of combination; are truth-evaluable, and—most importantly for present purposes—contain logical operators which operate on the truth-conditions of the constituents they embed.

Our picture additionally builds on empirical work in developmental psychology on the emergence of deductive reasoning in children and non-human animals. We focus on Disjunctive Syllogism (DS: $A \vee B$; $\neg A \vDash B$), since it has been widely investigated (Carey 2004; 2009; Mody and Carey 2016a). Early studies involved the *cups task*, in which an experimenter hides a reward in one of two cups, A and B, which are obscured by a screen, so that the subject does not know which cup contains the reward. The experimenter then removes the screen and shows the subject the empty cup—say it is A—and invites the subject to find the reward (Mody and Carey 2016a). Across numerous studies, it was found that many subjects—including non-human animals and pre-linguistic infants—tend to pick the target cup, B. These subjects were then interpreted as reasoning deductively from (5) and (6) to (7):

(5) Either the reward is in A or the reward is in B.
(6) The reward is not in A.
(7) Therefore, the reward must be in B.

This interpretation ascribes a symbolic representation system to subjects, including grasp of the abstract, logical concepts 'or' and 'not,' and recognition that, given (5) and (6), (7) follows. These results have led many to suppose that both non-human animals and pre-linguistic infants are implicitly following a rule that licences reasoning in accordance with DS (Quilty-Dunn and Mandelbaum 2018; Quilty-Dunn, Porot, and Mandelbaum 2023).

However, as Mody and Carey (2016a) point out, this behaviour is better explained by appeal to iconic representations. To show this, they devised the *four cups task*, in which the subject is presented with four cups, grouped into two pairs: A&B and C&D. The experimenter first obscures A&B with a screen while hiding a reward in either A or B, and then repeats this process, hiding a second reward in either C or D. Once both screens have been removed, the experimenter shows the subject the empty cup from just *one* of the two pairs. Once again, suppose that it is A. The symbolic interpretation predicts that the subject will search for the reward in the target cup, B, since the information that A is empty makes it certain that B contains a reward, but leaves it uncertain which of C or D contains a reward. The results of this study are striking: both chimpanzees and children under the age of about two-and-a-half choose the target cup first only about 50% of the time, while children above the age of about three reliably choose the target cup every time (Carey 2023; Leahy et al. 2022). A better explanation for the behaviour of these subjects on *both* tasks is that they keep track of the cups in perception, and conform to what Mody and Carey call the 'avoid empty' heuristic, which can be understood as a conditioned response to stimuli, of obvious evolutionary benefit to foraging animals. This explanation does not attribute grasp of concepts of disjunction or negation, nor any recognition that (5) and (6) imply (7). It is merely because B is the only other place to look in the cups task that non-human animals and pre-linguistic infants pick B.

What explains the emergence of deductive reasoning conforming to DS in three-year-olds? It is implausible that they learn DS or an associated rule, since no such rule is explicitly taught to them, and since their behaviour in these and similar tasks is insufficient to determine which general rule, if any, they are following (Kripke 1982). A far more plausible hypothesis, suggested by Mody and Carey, is that the emergence of deductive reasoning in

accordance with DS arises as a result of progressive competence with logical concepts of negation and disjunction. This is supported by evidence that though toddlers use negations earlier, they only start using the word 'or' around the age of three, suggesting that they begin to acquire the concept of disjunction around that time (Mody and Carey 2016b).

What is it to have the concept 'or' in a particular case? On our picture, it is to have a particular thought with a constituent concept that plays the role characteristic of disjunction in determining the truth-conditions of the thought. For instance, what it is to have the concept 'or' as it figures in (5), is for one's thought to have a constituent that combines with the other constituents to determine that (5) is true if and only if the reward is in A or the reward is in B. Crucially, we maintain, one may have particular thoughts with disjunctive content such as (5), without having previously adopted a general rule, nor acquired a disposition to conform to one. In thinking (5), one must be aware of *its* disjunctive content, which requires neither explicit nor implicit rule-following.

Of course, competence with 'or' is cumulative: once one has formed one thought with disjunctive content, one may form another, then another, eventually acquiring a disposition to form disjunctive thoughts across a range of particular cases.[10] Nonetheless, this progression starts with a particular disjunctive thought. Thus, our view stands in stark contrast to the familiar view that conceptual competence in a particular case is grounded in dispositions. The crucial difference has to do with order of priority. The familiar view implies that dispositions are temporally and metaphysically prior to competence: one must *first* have the disposition to think thoughts with disjunctive content in order to subsequently think a particular thought with disjunctive content, such as (5). In contrast, on our view, the ability to think a particular thought with disjunctive content is both temporally and metaphysically prior to a general disposition to think disjunctive thoughts. Once again, the particular comes first.

Now suppose that young Elsa believes (5), and that when she learns (6), she comes to believe (7). What makes this a case of reasoning, rather than a mere transition in thought? Our hypothesis is that Elsa has an *intuition* that (5) and (6) imply (7). In accordance with its everyday meaning, we take an intuition to be a mental representation that arises spontaneously, not on the basis of any reasoning. Beyond that, we take intuitions to be heterogenous in their content, attitude type, and phenomenology (Williamson 2007, chaps 6 & 7). For instance, logical intuitions may be realized by beliefs, quasi-perceptual states, or non-cognitive attitudes.

Indeed, we maintain that the logical intuitions of young children such as Elsa are *iconic*, in that they holistically encode the relations between the truth-conditions of (5), (6) and (7). Iconic intuitions can nonetheless be *logical* in virtue of being causally sensitive to truth-preservation in particular cases. That is, when Elsa reasons from (5) and (6) to (7), she is consciously aware of the disjunctive content of (5) and the negative content of (6). This gives rise to an iconic representation of certainty in (7) given (5) and (6) that is sensitive to the relations between the truth-conditions of (5)-(7): not only does Elsa in fact move from (5) and (6) to (7), but if the logical determinants of the truth-conditions of (5) and (6) had been relevantly different, *ceteris paribus*, she would have taken (5) and (6) to have different

[10] While competence with 'or' starts with a particular disjunctive thought, given that thought is compositional, we take something along the lines of Evans' Generality Constraint to be true. That is, if a one is able to think different but structurally identical thoughts, then one is able to recombine the constituent concepts to form new thoughts with the same structure. For instance, if one can think 'A or B', and 'C or D', then one is able to think 'A or D'.

truth-conditions, and would not have concluded (7).[11] Crucially, this iconic intuition does not represent the relation between the contents of (5)-(7) in abstraction from their instances, so they contain no sophisticated concepts of logical entailment or validity as constituents. Iconic representations of certainty are familiar from Bayesian frameworks, in which one can be certain of some conclusion *Q* given some premises *P,* without having the belief that *P* implies *Q*, or that *Q* has probability 1, given *P*. Similarly, if Elsa's intuition is iconic, it will not take the form of structured thought, but will holistically encode the relations between the truth-conditional contents of (5), (6), and (7) in a way that is causally sensitive to truth-preservation in this particular case.

It might be objected that an iconic representation cannot rationalize Elsa's reasoning from (5) to (7), because only structured thoughts such as beliefs and desires can satisfy the coherence constraints on rationalizing explanations of behaviour (Davidson 1970; Dennett 1971). However, this objection presupposes a form of rationalizing explanation far more demanding than ours, which merely requires making sense of an agent's behaviour from the agent's point of view—and that, iconic representations can undoubtedly do. For instance, many animals—from pigeons to humans—are equipped with an *analogue magnitude* system for roughly comparing the sizes of sets of objects without counting their members (Carey 2009). Analogue magnitude representations are iconic, since they are holistic, have concrete contents, and are non-compositional , and since even pigeons can often tell whether one heap of seeds is bigger than another, without being competent with abstract concepts such as 'greater than' (Beck 2012). Yet, despite being iconic, these representations can rationalize behaviour in the weak sense of making it intelligible from the agent's point of view. For instance, the pigeon's iconic representation of heap A as bigger than B makes sense of the pigeon's choosing heap A, from its point of view. Similarly, despite being iconic, since Elsa's intuition is sensitive to the contents of (5) and (6), it makes sense of her certainty in (7), which in turn makes sense of her reaching for cup B.

Perhaps it will be objected that intuitions are passive and inaccessible to consciousness, and thus cannot guide us in the kind of deductive reasoning at issue here. However, this objection is unfounded. Though we have said that intuitions are spontaneous, it does not follow that they are passive. Indeed, whether they take the form of structured thoughts or non-conceptual representations, it is plausible that logical intuitions arise only when we actively set out to work out what follows from what. After all, Elsa can store (5) in memory, without believing any of its entailments, and only engage in intuitive reasoning when the question of what (5) entails becomes salient to her. And though an iconic representation is unstructured, it is nonetheless accessible to consciousness. Though Elsa may be unable to express her logical intuition in words, she must be consciously aware of her certainty in (7), given (5) and (6), since she manifests this by making a beeline to cup B.

Of course, as one's conceptual resources become more sophisticated, so too do one's intuitions. For instance, Becca's logical intuition might be realized by a structured belief that she can express with the sentence, 'if (1) is true, then (2) must be true,' while the logical intuitions of experts may take the form of structured thoughts containing such concepts as 'entails' or 'is logically valid'. Though these expert intuitions are the product of

[11] We can distinguish intuitive deductive reasoning from intuitive reasoning that is merely truth preserving, such as from 'this apple is red' to 'this apple is coloured'. In deductive reasoning, one's intuition is sensitive to the contents of the logical constituents of the premises and the conclusion, whereas in the case of non-logical reasoning, one's intuition is also sensitive to the contents of the non-logical constituents of one's thoughts. We are grateful to Gil Sagi for pressing on this point.

extensive training, involving a good deal of inference, an expert's belief about the entailment relation in a particular case can be spontaneous, and to that extent intuitive.

We propose to characterise intuitive reasoning as follows:

> **Intuitive Reasoning:** What it is to reason intuitively from a particular set of premises P to a particular conclusion Q is to perform an active and consciously accessible transition in thought from P to Q because one has a spontaneous (possibly iconic) representation of P as implying Q (not necessarily conceptualised as such).

5 Over-Intellectualization, Carroll's Regress, and the Adoption Problem

We have advertised that the Particular-First view, coupled with our characterisation of Intuitive Reasoning, allow us to satisfy Taking Condition and vindicate REP, while avoiding pitfalls, such as over-intellectualization, Carroll's regress, and the adoption problem. How so? First, Taking Condition is satisfied because, on our picture, what it is to take a particular set of premises P to support a particular conclusion Q is to have the *intuition* that P implies Q. Moreover, as we have argued, even when it is realized by an iconic representation, one's intuition that P implies Q can both cause and rationalize one's drawing the conclusion Q. Thus, if one reasons intuitively from P to Q, one takes P to support Q, and draws the conclusion that Q because of that fact. Nonetheless, our picture avoids over-intellectualizing reasoning, since the intuition that P implies Q may be realized by an iconic representation, making it possible for young children to have logical intuitions, and thus reason deductively, without grasping any general rules, or having sophisticated concepts of logical validity or entailment.[12]

Furthermore, our view preserves REP as an account of rule-following. Suppose that Becca decides to follow UI-Rule. Given REP, Becca must first accept UI-Rule in a way that involves explicitly representing its content, and she must subsequently be guided by that content when she reasons from universal statements to their instances. This is unproblematic. If Becca can grasp abstract, logical concepts such as 'all' in particular cases, she can equally grasp an explicit representation of UI-Rule. And since Becca is already capable of reasoning intuitively from universal statements to their instances, she can simply assume UI-Rule as a premise, and then reason intuitively to *its* instances. Rule-following turns out to be no more than a special case of intuitive reasoning.

Doesn't this give rise to Carroll's Regress? you ask. After all, the regress was triggered by the assumption that a belief can only rationalize one's drawing a conclusion if it figures as a premise in one's reasoning. Replace 'belief' with 'intuition', and you have an objection to our view. However, this objection can be readily met. First, as we have argued, even an iconic representation can guide one in reasoning, since it can both cause and rationalize one's drawing the conclusion one does. But since iconic representations lack truth conditions, they cannot figure as premises in intuitive reasoning, which requires sensitivity to truth-preservation from premises to conclusion. Second, given that iconic representations can guide one without figuring as premises in one's reasoning, even when one's logical intuition is realized by an explicit belief, it too may guide one without figuring as a premise in one's

[12] Dogramaci (2012) similarly takes reasoning to necessarily involve the intuition that the conclusion one draws follows from one's premises. However, unlike us, he takes intuitions to be phenomenally conscious quasi-perceptual states which have the content that the conclusion of an argument is obvious in light of the premises.

reasoning. Third, one may be unable to state one's logical intuition as a further premise in one's reasoning from P to Q, and it would be decidedly odd to do so even when it is realized by the belief that P entails Q.[13] Thus, Carroll's Regress can be blocked.

What about the adoption problem? you ask. It too can be easily avoided. Suppose that though Becca reasons intuitively with universal statements in particular cases—for instance, in seeing that (1) implies (2)—she has never heard of UI. Now suppose that, just like Charlie, we present her with UI-Rule. Why shouldn't Becca catch on immediately? Unlike Charlie, Becca can already see that universal statements imply their instances in many cases, so there is no obstacle to her seeing that UI implies *its* instances too. Indeed, there is no obstacle to her coming to formulate a general rule herself, upon noting the similarities between cases. Though to do so Becca may need to exercise a capacity for abstraction and generalization, these capacities are necessary for acquiring language and abstract concepts in the first place (Carey 2009). So, given that Becca has logical concepts such as 'all', and can reason intuitively from universal statements to their instances in particular cases, she has what it takes to notice patterns in the logical structures of universal statements and their instances, and to abstract from those patterns to formulate general principles or rules of inference. The crux of the matter is this: given that rule-following is required for neither intuitive reasoning nor possession of logical concepts, it is unproblematic that rule-following requires explicit representation of a rule, and guidance by that rule in reasoning.

6 How Reasoning May be Justified

We now turn to epistemological issues. We need to account for two things: first, how one's intuitive reasoning is justified in particular cases; second, what justifies one in one's acceptance of general logical principles and rules.[14] We address these issues in turn.

First, what justifies our logical intuitions in particular cases? Traditionally, talk of logical intuition has been associated with a faculty of 'rational insight,' which provides a priori justification that is cognitively accessible to the reasoner. For instance, according to Bonjour (1998, 106–7), to have an intuition that P implies Q is to consciously *see* that P logically necessitates Q, thereby acquiring a priori justification for believing that P implies Q. This approach is at odds with our view that logical intuitions come with no distinctive phenomenology, and may be iconic, lacking sophisticated constituents like the concept of logical necessity, making it impossible to read off from them the explicit belief that P logically necessitates Q. However, other forms of internalism may be compatible with our view. For instance, since logical intuitions are accessible to consciousness and sensitive to truth-preservation in sets of conscious thoughts, an internalist might claim that our competence with the logical constituents of particular thoughts justifies our intuitive reasoning in particular cases. While such an internalist approach is compatible with our account of intuitive reasoning, we prefer an externalist approach to the justification of reasoning in

[13] For elaboration of this argument and a positive view of the role of beliefs about entailment in justifying deductive reasoning, see Besson (ms).

[14] We are primarily concerned here with the issue of what it is for one to be justified in deductive reasoning, with or without rules, rather than what it is for logical principles, such as UI, or whole logical systems, to be justified. Nor do we take the account of the epistemology of logical belief to extend straightforwardly to the justification of logical principles or systems, since whatever intuitions we have, and abstractions we make from them, would severely underdetermine the truth of logical principles (e.g. they might not decide between classical and free logic). The justification of logical principles and systems, which is the business of logical experts, may rely on many considerations besides intuition (e.g. strength, completeness/soundness proofs, paradoxes, fit with natural language, applicability to other sciences, etc.).

particular cases, according to which one's justification may not be cognitively accessible to one.

On the externalist view that we favour, a belief is justified insofar as it is *safe*, where one's belief that *p* is safe just in case one could not easily have been mistaken in relevantly similar circumstances (Williamson 2000).[15] For example, suppose that Becca's intuition is realized by the belief that (1) implies (2). Becca's belief is safe since it is true—(1) *does* entail (2)—and she could not easily have had a false belief in relevantly similar circumstances.[16] In nearby possible worlds in which she forms her belief in a similar way as in the actual world, she does not arrive at a false belief about what (1) entails. Why is it that Becca could not easily have gone wrong in a relevantly similar case? This has in large part to do with her competence with the conceptual constituents of her thoughts, such as 'all', and the fact that her intuition is sensitive to truth-preservation. In the actual world, she reasons from (1) to (2) because she has the intuition that (1) implies (2). Since this intuition tracks truth-preservation, in nearby worlds in which she accepts (1), and her reasoning is mediated by a logical intuition that similarly tracks truth-preservation, she will not arrive at a conclusion that is not entailed by (1). Though she is following no general rule, her intuitive sensitivity to truth-preservation in moving from (1) to (2) grounds a locally robust capacity for arriving at beliefs about what follows from (1).

The fact that Becca's logical intuitions are safe on some occasions does not preclude her going astray in others. For instance, suppose that as a matter of fact,

(8) Everything is self-identical

entails

(9) Pegasus is self-identical,

but Becca falsely believes this not to be the case, because she finds cases involving non-existents confusing. If so, Becca's belief is false and therefore unsafe, so it lacks justification altogether.[17] Of course, given an account of justification in terms of safety, Becca may not be in a position to know whether she is correct in her beliefs about what follows from what. This is a standard feature of the kind of externalist approach to justification that we have proposed.

Given the Particular-First view, it is possible that Becca is only justified in her belief that (1) entails (2) without being justified in reasoning from universal statements to their instances in any other case. However, as we have noted, Becca might notice a general pattern

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[15] Since statements of entailment are necessary if true, we do not formulate the safety condition on justification traditionally, that is, as the view that one's belief is justified just in case it could not easily have been false. This version of safety implies that if one happens to believe a necessary truth, one is justified in doing so (Williamson 2016, 245ff).

[16] Though it somewhat vague what constitutes a relevantly similar circumstance, we suppose that it is one in which Becca accepts (1), and has an intuition that is similarly sensitive to truth-preservation in the actual case. In some circumstances that are similar to the actual world in these respects, Becca might infer that Kusama's work, *Dots Obsession*, is psychedelic. But since this *is* entailed by (1), her logical intuition is true. If this pattern plays out across all of the relevantly similar circumstances, Becca's belief that (1) entails (2) is safe. We are grateful to Ulf Hlobil and James Shaw for pressing to clarify this point.

[17] Note that Becca need not have adopted a free logic for her to belief to be unsafe in this case. What makes her belief unsafe is the logical fact that (8) entails (9).

in intuitive reasoning from universals to their instances, and through abstraction and generalization, come to believe some more general principles regarding what follows from what. Thus, Becca might come to have some general views about classes of instances of UI, without necessarily conceptualising them as such. Insofar as these processes of abstraction and generalization are apt to confer justification, insofar as they result in generic beliefs that are safe, Becca's beliefs would be justified. These may be safe and therefore justified, provided that her particular beliefs of entailment are safe, and the processes of generalization and abstraction yield generic beliefs that are similarly safe. [18]

Admittedly, this account of justification in terms of safety must be adapted if it is to be applied to iconic representations, such as those that realize the intuitions of young children, since these lack truth-conditions, so they can neither be true nor safe. Nonetheless, iconic representations can be *accurate*. For instance, there is nothing wrong with saying that a pigeon's representation of heap A as being bigger than heap B is accurate just in case A in fact contains more seeds than B. Similarly, let's say that one's non-conceptual representation of certainty in *Q* given *P* is accurate just in case *P* logically entails *Q*, and is safe just in case one could not easily have acquired an inaccurate intuition in a relevantly similar circumstance. By this criterion, Elsa's non-conceptual representation in the four cups task is safe, since her premises do logically entail her conclusion, and she could not easily be mistaken about this. If she found herself in relevantly similar circumstances, she would have the same intuition, and it would be true.

6. Concluding Remarks

This paper elaborated on Kripke's remarks on adopting a logic to mount an objection to RULE, and develop a novel approach to the psychology and epistemology of logic. According to the Particular-First view, the capacity to reason in particular cases is prior to the capacity to follow a general rule. According to our account of Intuitive Reasoning, reasoning from P to Q in some particular case requires not rule-following, but the logical intuition that Q follows from P. Since we have argued that logical intuitions may take the form of iconic representations, even untrained thinkers, who lack sophisticated logical concepts of entailment or validity, can reason intuitively in particular cases without grasping or following any general rules. Furthermore, we have shown that this capacity for intuitive reasoning in particular cases satisfies the virtually platitudinous Taking Condition, and grounds the capacity to learn and follow rules. We also sketched an epistemology of logic that is compatible with our view, and while our sympathies lie with externalism, we take it to be a strength of our view that it is compatible with other epistemological frameworks.

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[18] Note that we do not take Particular-First to imply logical particularism, the view there are no general logical principles that are necessarily true (see, for instance, N. Wyatt and Payette 2018). Though we claim that reasoning in particular cases must be *prior* to rule-following, this does not imply that there are no general logical principles that are necessarily true and that we can follow in reasoning (contrary to what Boghossian (2014, 18) seems to suggest).

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