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Brief Report

Deontic and epistemic reasoning in children revisited: Comment on Dack and Astington

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ABSTRACT

Dack and Astington (*Journal of Experimental Child Psychology* 110 2011 94–114) attempted to replicate the deontic reasoning advantage among preschoolers reported by Cummins (*Memory & Cognition* 24 1996 823–829) and by Harris and Nuñez (*Child Development*. 67 1996 572–1591). Dack and Astington argued that the apparent deontic advantage reported by these studies was in fact an artifact due to a methodological confound, namely, inclusion of an authority in the deontic condition only. Removing this confound attenuated the effect in young children but had no effect on the reasoning of 7-year-olds and adults. Thus, removing reference to authority "explains away" young children's apparent precocity at this type of reasoning. But this explanation rests on (a) a misunderstanding of norms as targets of deontic reasoning and (b) conclusions based on a sample size that was too small to detect the effect in young children.

Introduction

Cummins (1996a) and Harris and Nuñez (1996) found that children performed significantly better when asked to monitor compliance with social norms than when asked to test the truth of epistemic statements with similar content. The tasks used were variations of the standard Wason card selection task. In this task, people are shown a conditional rule (if ⟨p⟩, then ⟨q⟩) and four cards corresponding to ⟨p⟩, ⟨not-p⟩, ⟨q⟩, and ⟨not-q⟩. The reasoner's task is to decide which to turn over to test the truth of the rule (epistemic or hypothesis-testing task) or to test compliance with the rule (deontic). For example,

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the rule might be "If a customer is drinking beer, the customer is at least 21 years old," and the four cards would represent customers who were "drinking beer," "drinking Coke," "23 years old," and "16 years old." The reasoner's task is to decide which cards to turn over to test the rule (e.g., whether to turn over "drinking beer" to check the drinker's age, or "23 years old" to see what the patron was drinking). Cummins (1996a) used a modified version of this task, called the reduced array selection task, in which only the ⟨q⟩ and ⟨not-q⟩ cases are shown. Children were shown toy mice, some of which squeaked when squeezed. Children were told either "All the squeaky mice are in the house" (epistemic) or "All the squeaky mice must stay in the house" (deontic) and were required to choose whether to test toy mice that were inside or outside of a toy house to test the truth of the rule or compliance with the rule. Harris and Nuñez (1996) used a picture evaluation task in which the four cards illustrated the four possible combinations of ⟨p⟩ and ⟨q⟩. For example, if the rule was "Julie always wears a helmet while drawing pictures," the cards would illustrate Julie drawing with a helmet, Julie drawing without a helmet, Julie riding a bicycle with a helmet, and Julie riding a bicycle without a helmet. Children were required to find the picture that showed either that the sentence was wrong (epistemic) or that Julie was doing something wrong ("being naughty"; deontic). In the deontic versions of these tasks, an authority uttered the rule. Preschool children were found to perform nearly optimally on the deontic versions of the task but frequently made errors on the epistemic versions of the task.

This "deontic advantage" over hypothesis testing is a characteristic of adult reasoning (e.g., Cosmides, 1989; Cummins, 1996b; Manktelow & Over, 1991). When asked to monitor compliance with social norms, adults rarely make mistakes, but when asked to test the truth of a rule via hypothesis testing, they frequently show evidence of seemingly inefficient or inaccurate strategies such as confirmation bias (e.g., Wason, 1960, 1968). Although researchers disagree over what constitutes error in hypothesis testing, everyone agrees that testing compliance with a norm requires seeking out norm violations (Cheng & Holyoak, 1985; Manktelow & Over, 1991; Oaksford & Chater, 1994; Politzer & Nguyen-Xuan, 1992).

Cummins (1996a) and Harris and Nuñez (1996) interpreted their results to mean that a deontic advantage in social norm reasoning emerges early in development. More recently, Tomasello and colleagues reported a series of studies supporting this view. They found robust norm reasoning among children as young as 3 years (Rakoczy, Brosche, Warneken, & Tomasello, 2009; Rakoczy, Warneken, & Tomasello, 2008; Schmidt, Rakoczy, & Tomasello, 2011; Schmidt & Tomasello, 2012).

Dack and Astington (2011) modified the materials used by Cummins (1996a) and Harris and Nuñez (1996) by removing reference to authority and found that the apparent deontic advantage either was substantially reduced or disappeared entirely. On the basis of these results, they argued that the apparent deontic advantage was due to a "confound" in the study designs. But this simply shows a misunderstanding of norms as targets of deontic reasoning.

The concept of authority is central to social norms

Norms (social rules) are socially constructed objects that are created by agents to direct the behavior of other agents over whom they have authority (Hilpinen, 1981; von Wright, 1963). They prescribe constraints on social behavior that dictate what is permitted and obligated. An agent succeeds in creating a norm depending on whether the agent has the authority to do so. Arguing that the presence of an authority in a problem description (or the adoption of an authority perspective) somehow "explains away" the deontic effect belies a misunderstanding of the concept of "norm." It is a little like saying that if you remove the long-wave components of a light display, people no longer see red.

Philosophers also distinguish between a *norm* and a *normative proposition* (e.g., von Wright, 1963). Authorities can create norms (e.g., a Queen Mouse uttering the sentence "Squeaky mice must stay in the house"), but others may make reference to them (e.g., an observer uttering the sentence "The Queen Mouse said squeaky mice must stay in the house"). Importantly, norms cannot be true or false; they can only be complied with or violated. Normative propositions, on the other hand, can be true or false. For this reason, it is imperative that the experimental task make clear what the participants are supposed to do—test the truth of a normative proposition or monitor compliance with a social norm.

Indeed, removing reference to authority can introduce ambiguity into norm reasoning tasks even for adults. Stanovich and West (1998, Experiment 1) found that adult performance on the standard Wason card selection task plummeted from approximately 80% to 30% when reference to authority was removed from the deontic problem description. Rather than being instructed to imagine that they were bartenders enforcing a drinking age rule, participants in this study were simply told the following: "If a person is drinking beer, then the person must be over 21 years of age. Your task is to decide which boxes you would need to turn over in order to find out whether or not the rule is being violated" (p. 199).

The term *violated* can apply to both deontic and epistemic formulations. In the case of the former, it means engaging in proscribed behavior. The rule is not falsified by discovery of a violation. Instead, a miscreant is identified. In the case of the latter, *violation* means discovering a counterexample that falsifies the rule. This is the heart of Popperian hypothesis testing (Popper, 1959), and it is what people rarely do when required to test the truth of an assertion. To understand which type of task is being described, it is necessary that the drinking rule be understood as a legitimate norm and that the task requires monitoring compliance with it. Reference to an authority or requiring the reasoner to adopt the role of an enforcer usually removes the ambiguity in favor of a norm compliance interpretation. The most reasonable interpretation of the performance decrement reported by Stanovich and West (1998) is that removal of authority made the problem interpretation ambiguous; participants were less likely to understand that their job was to evaluate compliance with a prescriptive social rule rather than to test the truth of a normative proposition.

Dack and Astington (2011) referred to these results but argued that because performance was higher on the deontic task (~30%) than the epistemic task (~10%), adults showed a "deontic advantage" even when reference to authority was removed. It difficult to see how 30% performance can be construed as an advantage. A more likely explanation is that a small percentage of adults correctly interpreted the task as a request to monitor compliance given their familiarity with drinking age laws, whereas the others were trying to test the truth of a normative proposition.

Now what about 3- and 4-year olds? To avoid this ambiguity, Cummins (1996a) included an authority (Queen Mouse) in the deontic task who was simply described as Minnie Mouse (no authority) in the epistemic task. Dack and Astington (2011) argued that children who displayed deontic reasoning under these conditions were simply responding to a "contextual cue" that adults do not need to understand the nature of the task. But given the centrality of authority in norm creation, removing the authority from the deontic formulation of the mouse task just made it less likely that children understood their task was to monitor compliance with a norm.

Dack and Astington (2011) themselves appealed to this explanation when they stated, "However, we believe that the differences between the deontic and epistemic tasks in Experiment 2 (without the contextual differences) were too subtle for this violation detection to be activated in preschoolers." In other words, this study showed what it takes for children to understand that they are being asked to monitor compliance with a social norm—*reference to authority*. They understand that authorities make norms, they understand what a norm violation is, and they understand that compliance with norms must be monitored. Adults and older children understand that authority is implicit in the norm task; younger children do not. This is a difference in their understanding of the pragmatics of utterances, not a difference in their capacity to reason about norms.

More important, *how* the authority is introduced into the problem situation is less important than *whether* one is introduced. Using simple novel game rules, Rakoczy, Tomasello, and colleagues (Rakoczy et al., 2009; Schmidt & Tomasello, 2012) have found that beginning around 3 years of age, young children do not just follow social norms, they actively enforce them on others. So strongly do they feel compelled to enforce norms that they will even do so from a third-party position, that is, situations in which they are not directly involved. They do not need to be explicitly instructed about the rules by an authority, but they do need to see that an adult expects such behavior. For example, 3-year-olds will actively correct and admonish a puppet who interacts with an object in a way that is different from the way that an adult previously interacted with it; moreover, they will use deontic/normative language to do so (e.g., "You have to do it this way") (Schmidt et al., 2011).

Social norms and reciprocal exchanges

Dack and Astington (2011) argued that contextual cues other than authority may elicit deontic reasoning, and this is to be expected. There are many types of situations that require deontic reasoning, and what constitutes a violation depends on the type of deontic structure that is in play. For example, our actions may be conditionally obligated, permitted, forbidden, or omissible. An action may be taken if it is permitted, must be taken if it is obligated, must not be taken if is forbidden, and may be omitted if it is omissible. Complex structures combine one or more of these and make different demands on the parties involved, depending on their social roles. For example, promises impose an obligation on the promisor once the promisee satisfies a condition while simultaneously imposing a permission on the promisee to pursue satisfying the condition (Politzer & Nguyen-Xuan, 1992).

Dack and Astington (2011) argued, "It is also important to note that there may be contextual cues other than the presence of an authority figure that, if present in the deontic condition, would lead to precocious deontic reasoning in children. One possible cue is the context of reciprocal obligation" (p. 109). Authority is a defining difference between norms and exchanges. Social norms differ from reciprocal exchanges in much the same way as laws differ from contracts; norms (like laws) are prescriptive rules established by authority that dictate what is permitted or obligated under specified conditions, whereas exchanges (like contracts) are entered into freely by agents who promise a conditionalized exchange of benefits. Engaging in proscribed behavior constitutes a violation of a norm, and there need not be any direct or immediate benefit to the agents controlled by the norm (other than avoiding punishment). In fact, many systems of social norms are enacted and enforced precisely to benefit some members of society over others. A violation of a reciprocal exchange is simply failure to reciprocate a benefit received that was given conditionally on reciprocation (Cosmides, 1989; Politzer & Nguyen-Xuan, 1992). These are distinct deontic situations, yet young children's performance on Cummins's (1996a) mouse task and Harris, Núñez, and Brett's (2001) "Let's swap" task clearly show their precocity at both.

The apparent "ease" of deontic reasoning

Dack and Astington (2011) stated that deontic reasoning may simply be easier for children and pointed to the fact that deontic reference appears earlier in young children's speech than epistemic reference as evidence to support this view (p. 97). This begs the question as to *why* such formulations are easier for children to understand. Some researchers have argued that epistemic reference is more demanding of metarepresentational cognitive resources and pointed to the simultaneous emergence of adult-like theory of mind reasoning and epistemic reference in children's language as evidence to support this claim (e.g., Papafragou, 1998; Pérez-LeRoux, 1998).

There are four problems with this claim. First, epistemic sentences do not require more complex operators than deontic sentences to capture their logical forms. Deontic logics usually include operators for *permit* and *obligate*. Epistemic sentences can be represented either through the use of *necessity* and *possibility* operators or as simple indicative sentences. Indicative sentences do not require the use of modal operators and, hence, are formally simpler than deontic sentences. Hence, norms require the use of modals; epistemic formulations do not. Deontic verb systems (e.g., "You can go now," "You must do this") therefore are not necessarily less syntactically complex than epistemic ones (e.g., "It is true," "It might be true").

Second, the claim is circular; it argues that deontic reference must be easier because it emerges earlier in development, and it emerges earlier because it is easier. Third, adults continue to perform poorly on the epistemic version of the Wason task after having obviously mastered both theory of mind and epistemic auxiliary verb formulations. Fourth, greater metarepresentational demands are attributed to epistemic utterances because they purportedly require children to detect discrepancies between an individual's mental representation and the actual world (e.g., comparing "It must be raining" and "It is not raining"). But social norm reasoning makes the same demands; that is, one must detect discrepancies between what ought to be true (e.g., "Squeaky mice must stay in the house") and what is true (e.g., "Squeaky mice are not in the house"). Furthermore, recent studies demonstrate

the opposite; deontic reasoning is intrinsically connected to theory of mind both in adults (Cosmides, Barrett, & Tooby, 2010) and in young children (Nuñez, 2011; Nuñez & Harris, 1998).

"Innateness" of deontic reasoning

The term *development* is typically used to distinguish changes in children's motor and cognitive skills that arise from maturation from those that depend on explicit learning. The term *innate* is frequently used by psychologists to mean "present at birth," but this is not the sense in which it is meant by either Cummins (1996b) or Cosmides (1989). Secondary sexual characteristics are innate in that they are coded in the human genome, yet they do not emerge until puberty. Binocular columns in visual cortex are innate in that they are coded in the genome, but they require exposure to visual stimuli during the first year of life to develop (which is why exotropy can preclude the development of binocular depth perception if it is not surgically corrected within the first 1 or 2 years of life).

Many innate behaviors and cognitive functions are not present at birth but emerge early in development and/or are easily acquired during development (Spelke, 1994). Cummins (2000, 2004) argued that specific forms of social reasoning fall into this category, namely, the acquisition of social rules (norms) that constrain behavior in one's social group and detecting violations of such norms. Cummins and Cummins (1999, 2003, (see also Cummins, Cummins & Poirer, 2003) analyzed early emergence in terms of learning bias and canalization. *Learning bias* refers to attentional biases (e.g., the infant's preference to look at faces as opposed to equally complex stimuli). *Canalization* refers to the degree to which the development of a trait is robust across normal environmental variations (Ariew, 1996; Waddington, 1975). All children are "primed" to rapidly acquire social rules due to their attentional bias toward social stimuli (learning bias), but which rules are acquired depends on the rules in their particular environments (canalization).

Dack and Astington (2011) argued that their null results are inconsistent with views that attribute early emergence of deontic reasoning to "innateness" or other adaptationist explanations. As Cummins (1996a) pointed out, the alternative offered by those critical of such views is that deontic schemas are readily induced due to the frequency and urgency with which deontic reasoning situations present themselves during early childhood. In other words, there is ample opportunity to induce a schema for reasoning about deontic situations given their ubiquity. Yet we surely are exposed to instances of lying (epistemic violations) as frequently as instances of misbehavior (prescriptive violations). Despite this, we induce no efficient schemas for testing truth. Children and adults agree on what constitutes a violation of a social rule, and both adults and children are clueless as to how to effectively test the truth of a statement (hypothesis testing), frequently showing confirmation bias and other deficient strategies for establishing the truth value of one's beliefs (e.g., Cheng & Holyoak, 1985; Cummins, 1996a; Schmidt et al., 2011; Wason, 1960, 1968). In contrast, adults are clear about what constitutes lying as opposed to honest mistakes, but young children are not (e.g., Strichartz & Burton, 1990), and very young children can successfully engage in sabotage but not deception (e.g., Sodian & Frith, 1992). Do these performance profiles reflect differences in the cognitive demands of these tasks, or do they reflect differences in the structure of mind and its development? A growing body of evidence suggests the latter.

Failure to replicate the deontic advantage among 3-year-olds

Dack and Astington (2011) reported that they were unable to replicate the deontic advantage with 3-year-olds. They also noted that Cummins (1996a, Experiment 2) used a larger sample size for 3-year-olds than for 4-year-olds but pointed out that no explanation was offered as to why. This is a legitimate question, and here is the answer: Given that the mouse (norm) task is mentally taxing (even for adults), greater variability was expected among the younger children whose attentional capacities are not as well developed as their older counterparts. For this reason, it was considered more important to use a larger sample of 3-year-olds than to hold sample size constant. Given Dack and Astington's (2011) results, it turns out that this was the right thing to do. As they themselves noted, "It is possible that there would have been evidence of the deontic advantage with the

3-year-olds in the current study if the sample size had been larger. This is supported by the fact that the performance means for the 3-year-olds in the current study were in the predicted direction (0.64 in the deontic condition and 0.57 in the epistemic condition)" (p. 101).

To further test this assertion of insufficient power, the data from Cummins (1996a, Experiment 2) were reanalyzed, dividing 3-year-olds into a younger group (up to 3 years 6 months) and an older group (3 years 7 months to 3 years 11 months). The data are shown in Table 1.

The same contingencies were observed between condition and selections, but the results were only marginally significant for older 3-year-olds, $\chi^2(1) = 2.24$, $p = .13$, and for younger 3-year-olds, $\chi^2(1) = 1.67$, $p = .19$. Given that the differences in both groups were in the predicted direction and were marginal for both, this argues against the interpretation of an age effect. It was not the case that older 3-year-olds showed a deontic advantage, whereas younger 3-year-olds failed to do so. Instead, both groups showed the same response pattern, but the smaller sample sizes yielded inadequate power to detect the effect. Combining the two together, as shown in Table 2, yields a significant effect for 3-year-olds, $\chi^2(1) = 4.18$, $p < .05$.

Subsequent t tests (null = .50) also showed that 4-year-olds were above chance in the deontic condition, $t(20) = 3.27$, $p < .001$, and marginally below chance in the epistemic condition, $t(19) = -1.90$, $p = .07$. This latter effect means that they were showing the same kind of bias adults do on this task, namely, reliably selecting the confirming test case over the disconfirming test case. The 3-year-olds were marginally above chance in the deontic condition, $t(33) = 1.39$, $p = .17$, and marginally below chance in the epistemic condition, $t(34) = -1.55$, $p = .13$. Given that this age group showed a marked deontic advantage on the simpler picture evaluation task developed by Harris and Nuñez (1996), these marginal results probably were due to the mentally taxing nature of the mouse task. The picture evaluation task explicitly displays the compliance and noncompliance, and all children need to do is recognize a norm violation. In the mouse task, these choices are not explicitly displayed because whether the mice are squeaky or silent is not directly perceivable. This makes the mouse task more cognitively demanding. Finally, a logistic regression was conducted as described by Dack and Astington (2011). The interaction term contributed no significant variance and was removed from the analysis. The resulting regression was significant, Wald $\chi^2(2, N = 109) = 13.2$, $p < .001$. Age contributed no significant variance, Wald $\chi^2 = .34$, $p = .56$, whereas task condition did, $\chi^2 = 12.07$, $p = .02$.

Dack and Astington (2011) also objected to analyzing the two age groups separately rather than analyzing the entire sample first. Statistical analyses are based on the nature of the hypotheses the experiment is designed to test. Omnibus statistical tests are legitimately ignored when specific comparisons are planned based on those hypotheses; in fact, this is the recommended procedure for avoiding the inflation of experiment-wise error that can result from testing multiple comparisons (Hays, 1981; Keppel, 1991; Marascuilo & Dagenais, 1982). The hypothesis tested by Cummins (1996a) was that there would be a deontic advantage in each age group. Therefore, separate comparisons were planned and tested for each group.

Table 1
Frequency of correct selections in the norm compliance and epistemic tasks for older 3-year-olds and younger 3-year-olds from Cummins (1996a, Experiment 2).

Age	Norm	n	Epistemic	n
≤3 years 6 months	10	15	5	12
>3 years 6 months	11	19	8	23

Table 2
Frequency of correct selections in the norm compliance and epistemic tasks for 4-year-olds and all 3-year-olds from Cummins (1996a, Experiment 2).

Age	Norm	n	Epistemic	n
3-year-olds	21	34	13	35
4-year-olds	16	20	6	20

Conclusions

Several conclusions can be drawn. First, the concept of authority is central to social norms. If it is not there or not inferred from other contextual cues, no deontic effect *should* be expected.

Second, young children require reference to authority either through the problem description or through observing an authority to accept an utterance as a legitimate norm. This does not mean that they show no norm reasoning advantage. Once they accept the utterance as a norm, they reason about norms as effectively as adults.

Third, social norms must be distinguished from obligations/permissions created by opportunities for reciprocal exchange. The former require authority, whereas the latter do not.

Fourth, even simple deontic sentences are essentially modal, whereas simple epistemic sentences need not contain modal operators. Thus, as a class, simple deontic sentences are both syntactically and semantically more complex than simple epistemic sentences. The earlier emergence of deontic formulations and effective deontic reasoning strategies cannot be attributed to their relative simplicity but rather should be attributed to their greater adaptive importance.

Finally, deontic tasks can be distinguished in terms of what constitutes a violation and in terms of the metacognitive demands they make on the reasoner; those that make heavier metacognitive demands will yield greater variability in performance. This must be considered when choosing sample sizes in designs using young children. Using a smaller sample size, Dack and Astington (2011) found a marginal deontic advantage among 3-year-olds, and a split-sample reanalysis of Cummins (1996a) found the same marginal advantage for very young and older 3-year-olds. Combining the samples yielded sufficient statistical power to detect the effect.

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