Mentalizing Objects

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"[Our] beautiful fancies…illustrate the same kind of psychological processes and attempts to form a harmonious view of the seen and unseen…." (Lyman, 1904, p. 247)

We have a full-blown mentalistic view of objects. It is the result of the interdependence of folk psychology (i.e., our capacity for understanding mental events and processes) and folk physics (i.e., our capacity for understanding non-mental events and processes). Specifically: when considering events that don't involve agents, we naturally default to tracking intentions, goal-directed processes, or teleological causation, despite the fact that agents aren't involved. One tie that binds folk psychology and folk physics is *Teleological Commingling*.

It is hard for us to view events in non-intentional, mechanical terms. We have a deep-seated intentionality bias—defaulting to viewing the actions of agents as intentional and extending this even to events that don't involve agents—that emerges in childhood and extends into adulthood. This kind of teleological view of causation is extended beyond the realm of human action because we pervasively detect agency cues. The most basic agency cue—and the one that we are most sensitive to—is viewing events or sequences of events as ordered or non-random.

This all gives rise to the *Agentive Worldview*. The *Agentive Worldview* is a teleological worldview: we view nature as a whole as being infused with agency and purpose. We view only agents as being capable of bringing about non-random events. And we infer agency from the impression of non-random events. Since most events are viewed as non-random—indeed the world is viewed as displaying intricate design—we view nature as a whole as being infused with agency and purpose. *Teleological Commingling* and the *Agentive Worldview* it gives rise to are at the core of our conception of objects.

These facts about object cognition press methodological problems for the metaphysician who maintains that metaphysical theories of objects—where two of the leading issues concern when composition occurs and how objects persist—are beholden to common sense (e.g., Baker, 1997; Burke, 1997; Hirsch, 2002; Lewis; 1986; Lowe, 1983, 1995; Korman, 2009, 2015; Korman & Carmichael, 2017; Kriegel, 2011; Markosian, 2014; Paul, 2012; Thomson, 1983; Wiggins, 1980). These philosophers aim to defend the view that our ordinary, natural view about the "highly visible objects right before our eyes" is more or less correct (e.g., Korman, 2015 p. 1), to show "how, reflectively, we can make sense of our unreflective common sense worldview" (Thomasson, 2007, p. 3) and struggle "to keep a polite straight face" when "deep ontologists" tell them that there are "apple trees but no apples" (Hirsch, 2002, p. 67).

Some representative examples. Universalism—the view that composition occurs under any circumstances whatsoever and is completely unrestricted—is typically charged with and rejected on the basis of conflicting with common sense.[1] Hirsch (2002) tells us that, "I understand perfectly well what it means to talk (in plain English) about such things as cars, bees, human beings, books, and the Eiffel Tower, or even to talk about such marginal things as noses and car-hoods. But it's crazy to say (in plain English) that there exists something composed of my nose and the Eiffel Tower" (p. 60). And Kriegel (2011): "Commonsense shuns [arbitrary] fusions, but some philosophers—mereological universalists

[1] Universalism is just one representative example of a view of composition that is typically charged with conflicting with common sense. But there are many others (see e.g., Rose & Schaffer, 2017a and 2017b for further documentation).

(e.g. Van Cleve, 1986, 2007; Lewis, 1991)—embrace them. The folk's intuitive verdicts will be against 'there is a fusion of this table and the moon'…" (p. 198). Universalism— or more generally any theory of composition that conflicts with folk intuitions—is thus met with a "fatal objection", charged with generating "wildly counterintuitive consequences" and succumbing to "mereological madness" (Markosian, 2014).

Mereological Essentialism—the view that objects cannot persist through part alteration, that to gain or lose a part is to destroy an object (Chisholm, 1979)—is one representative view of persistence that is typically charged with and rejected on the basis of conflict with common sense.[2] As Sider (2008) notes, if we accept Mereological Essentialism, then "most of our ordinary beliefs about tracing objects are badly mistaken" (p. 10). Such is one of the leading reasons for rejecting Mereological Essentialism.

My plan isn't to defend any particular theory of composition or persistence. Instead, my plan is to problematize a central methodological assumption underwriting opposition to theories of object composition and persistence. The assumption: common sense deserves to be taken seriously and if a theory conflicts with common sense then it is the theory that suffers a serious disadvantage. Decisive—or at least, heavy—epistemic weight is placed on common sense. It's an epistemic difference-maker (Sider, 2013).

The pox I aim to cast isn't targeted more generally at the role of common sense in debates in metaphysics. Nor is it aimed more generally at any metaphysical debate arising in connection with material objects that emphasizes common sense as a serious constraint on a theory. My focus is selective. In particular, my focus is on two central issues—composition and persistence—about the nature of material objects. If common sense deserves to be dismissed in connection with these two central issues, then that suffices to press a serious problem for a major approach to metaphysical theorizing about the nature of material objects. I'll argue that people's intuitions about composition and persistence are derived from a false view, the *Agentive Worldview*. The ordinary view of material objects—rooted as it is in an implicit, false theory—should be given no weight in metaphysical debates about the nature of material objects. Common sense doesn't deserve to be taken seriously on these matters. That problematizes a prominent methodological assumption underwriting opposition to many theories of object composition and persistence. But there are further consequences. My view—that we have a deep-seated tendency to mentalize objects—has important psychological consequences. Specifically: psychologists need to rethink the standard view that folk psychology and folk physics are entirely independent. Folk psychology and folk physics are partly interdependent.

The Plan: I'll begin, in Section 1, by documenting some main findings—and leading explanations—on folk teleology in object cognition. The explanation I develop is that we mentalize objects. Section 2 presents evidence in favor of this, first by discussing the standard psychological view that folk psychology and folk physics are independent and then providing evidence indicating that they are instead interdependent. More specifically, I argue that the dependence is such that the operation on folk physics partly depends on folk psychology. From these general facts about the functional dependence of folk physics on folk psychology, in Section 3, I narrow in on the specific aspects of folk psychology and folk physics featured in *Teleological Commingling* and connect *Teleological Commingling* to the *Agentive Worldview*. Section 4 argues that no weight should be placed on folk material object intuitions since they are tied into a false theory, concluding that metaphysicians need to seriously rethink a major approach to theorizing about the nature of objects.

[2] There are a number of other views of persistence that are typically charged with conflicting with common sense. For some documentation see e.g., Rose, 2015.

1. Folk Teleology: Findings and Explanations

1.1. The Findings

The empirical findings on folk intuitions of composition and persistence indicate that the folk operate with a teleological view (Rose, 2015; Rose & Schaffer, 2017a; Rose & Schaffer, 2017b; Rose, Schaffer & Tobia, 2017; Rose & Nichols, 2019; Rose & Nichols, 2020; Rose, 2020). First, composition.

Rose and Schaffer (2017a) found that when an agent superglues some mice together with the intention of creating a bomb detector, participants were significantly more inclined to think that the arrangement of mice composed a larger object in comparison to a case where the agent had no such intention in supergluing the mice together. This pattern isn't restricted to biological organisms. It extends to everything.

Participants were given a case featuring an unfamiliar artifact, a Gollywag. In one case, Jones fuses some Gollywags together via supergluing and thinks that the arrangement of Gollywags compose an object. In another, Jones superglues the Gollywags together, has a sore back and so sits on them for the rest of the day. At the end of the day, his back was no longer sore. Participants were significantly more inclined to think that the arrangement of Gollywags composed an object in the latter case.

Handshakes are also viewed similarly. So are rocks. Rose and Schaffer (2017a) gave participants a version of van Inwagen's "Handshake Case" (1990). Two leaders of rival political factions decided to set aside their differences and commemorate the event with a historic handshake. In one case, they simply shook hands; in the other, their handshake served as a model for a sculptor. In the former case, people didn't think that the handshake composed a larger object, with the leaders as parts. In the latter case, they did. In a different study, participants were told about John, who lived on the side of a mountain. One evening an avalanche occurred and rocks were strewn across his lawn. In contrast to a case where John didn't think the arrangement of rocks had a purpose, when John did think they had a purpose, participants thought that "Rather than being a bunch of scattered objects that do not in any way compose some one thing, the arrangement of rocks actually compose something."

A teleological view of composition is also displayed in counting (Rose & Schaffer, 2017a). People were told that Jones had an old water heater in his backyard. He tied a rope around it, tried to move it, but it wouldn't budge. Thinking the rope was too short he tied another piece to it. In one case, the water heater still didn't budge; in the other, it easily moved. When asked whether Jones "created a single, unified object" or whether "When Jones tied the pieces of rope together, he did not create a single, unified object out of the rope. Rather, he simply had two, distinct pieces of rope." participants were significantly more inclined to think that Jones had two pieces of rope when the water heater didn't budge. When it did move, Jones had "a single unified object".

Across these various studies, there was no effect of whether the plurality was in contact or fused together, of familiarity, of labeling the candidate larger object or of quantifier variance. Instead, teleology was the only factor relevant to whether people thought composition occurred. And teleological considerations played a large role.

Intuitions about persistence display a similar pattern. Rose (2015) gave participants a case modeled on the Ship of Theseus case (see also Rose et. al., 2019). John—who was a woodworker and sailor—built a ship and over the years all of the original parts were replaced. The original parts were kept and when he had accumulated enough he built a ship using his original plans. He thus has two ships. When given this case, participants were divided. But when given a counterpart case, where the ship that had its parts replaced worked perfectly and the ship made from the original parts did not, people thought the original ship was the one with its parts replaced. This pattern was reversed when the ship made from the original parts worked perfectly and the ship with its parts replaced did not. And this pattern continues to obtain even when organisms are used in place of a ship.

Rocks, clouds and proteins also persist through part alterations provided they preserve their purpose. For rocks, Rose (2015) gave participants a case where an individual, John, found a rock alongside a trail. The rock was glowing and John noticed that it housed microorganisms which fed off minerals in the rock's interior. But the microorganisms began to die because they couldn't access the minerals deeper in the rock's interior. The rock was beginning to fade. So John tries an experiment: he smashes the rock into three pieces with a hammer. In one case, the microorganisms continue to die and the thing fades to black; in the other, the microorganisms can now access the minerals and the thing resumes glowing. In the former case, participants thought that the rock was destroyed while in the latter case, participants thought the rock survived being smashed by the hammer. The same pattern obtains in similar cases where the rock—instead of being smashed into three pieces—is either pulverized into dust or merely dented with a hammer. And for clouds, Rose, Schaffer and Tobia (2017) found that participants were significantly more inclined to think that a cloud forest that contained large amounts of H_2O and provided a habitat for maintaining the local ecosystem survived part replacement—large amounts of H_2O being displaced by sulfur dioxide—when the cloud forest preserved its purpose of maintaining the local habitat than when it did not. A similar pattern of findings obtains in cases involving a cave that hosts bats, undergoes minor or severe part alterations as the result of an earthquake, and either preserves or loses its purpose. It also occurs when considering a protein that either loses a small or large number of molecules and either preserves or loses its purpose (for further findings see Rose and Nichols, 2020).

The results on persistence aren't due to salience effects, the type of object considered or the extent of alterations the object underwent. Just as with composition, teleology was the only factor relevant to whether people thought an object persisted through part alterations. And the magnitude of the effect of teleological considerations on persistence intuitions was consistently large.

These are some of the main findings. Teleology plays a central role in ordinary judgments of composition and persistence when:

> (1) An agent is present and intentionally organizes some parts to either generate or preserve a whole and (2) an agent is not present and so does not intentionally organize some parts to either generate or preserve a whole.

And there are three leading explanations of this pattern of findings.

1.2. Creative Intentions

One option is the "Creative Intentions Account" on which folk teleology is centered on an assessment of the creative intentions of actual agents (Korman & Carmichael, 2017). This assumes two things (see Rose, forthcoming). The first is that there should be an agent involved in organizing some parts and that this agent should either have or lack an intention to create some further thing. The second is that in every case where participants are considering whether an agent has an intention to create something, they are treating the would-be object as an artifact. For metaphysicians who maintain that theories of composition and persistence are beholden to folk intuitions, the creative intentions account offers a novel view. It might even offer respectable answers to the questions of when composition occurs or how objects persist.[3]

[3] This Creative Intentions Account is specific to Korman and Carmichael (2017) and is the version I am opposing throughout. Their proposal requires that there be an agent present. This is an important ingredient in their defense of the respectability of folk intuitions about composition against Rose and Schaffer's charge that these intuitions result from a "benighted superstition". My proposal—that we mentalize objects—is compatible with a kind of creative intentions account, though one that would be very different from Korman and Carmichael's account. This version would be one on which actual agents are not required for this kind of intentional, goal directed, teleological view of causation to feature in composition and persistence judgments.

The obvious problem with the Creative Intentions Account is that it doesn't explain the fact that the folk operate with a teleological view even in cases where there is no agent and so no intentions are actually present. There are other problems with the account (see Rose, forthcoming). But the fact that it can't explain the range of findings is reason to look elsewhere.

1.3. Normative View

Another option: De Freitas et al., (2017) suggest that valence—or valuing certain features as good or bad—plays a key role in our conception of an object (see also Tobia, 2015; Newman & Knobe, forthcoming). For instance, participants were given a case where a university in Nazi-era Germany was divided between focusing on academics or propaganda. It then either underwent changes which resulted in the university focusing solely on either academics or propaganda. Participants where significantly more likely to say that the university persisted through improvement—focusing on academics—than through deterioration—focusing on propaganda. On the normative view, what is at the core of our conception of an object is normative considerations.

I doubt that metaphysicians who think that theories of composition and persistence are beholden to folk intuitions should take a normative view of objects to provide a respectable account of when composition occurs or how objects persist. Whether some candidate thing has or continues to have some normatively good feature is no more relevant to the question of whether there is an object or continues to be an object than is whether someone is blameworthy to the question of whether they caused some outcome. But a more basic problem with the normative view is that experimental results show that normative effects don't play any direct role in our conception of an object: causal modeling results indicate that normativity is screened off by teleology (Rose, Schaffer & Tobia, forthcoming). In other words: the effect of normativity on persistence intuitions is largely explained by teleology. Teleology is at the core of our conception of an object.

1.4. Mentalizing Objects

What explains the kind of teleological view that infuses the folk conception of an object is that the folk operate with a mentalistic view of teleology. This teleological view is an intentional, goal-directed view of causation.

Causal intuitions are affected by whether the event involved in bringing about an outcome is construed intentionally or accidentally (Rose, 2017; see also Lombrozo, 2010). People are substantially more likely to view an event as bringing about an outcome when the event is viewed intentionally. For instance, participants were told that a plant emits a toxin that coats its leaves and prevents insects from eating it. The release of toxin is regulated by a mechanism. Participants who read that the mechanism released excess amounts of toxin that killed the plant were significantly more likely to think that the mechanism caused the death of the plant when it was described as intentionally, as opposed to accidentally, releasing excess amounts of the toxin. This pattern is explained by the fact that the folk tend to view reality as a whole as being infused with agency and purpose. That is, implicit beliefs that nature is a living, powerful, goal-directed being (e.g., Kelemen, 2012) explain why an intentional construal of events plays such a substantial role in causal intuitions (Rose, 2017).

This kind of intentional, goal-directed, teleological causation at the core of our conception of material objects plays a guiding role in our intuitions about composition and persistence when agents are present: we track intentions, goal-directed processes, in intuiting whether composition or persistence has occurred. But this kind of teleological causation also plays a role in our intuitions about composition and persistence when considering events that don't involve agents: we naturally default to tracking intentions, goal-directed processes, despite the fact that agents aren't involved. The intentional, goal-directed, teleological causation at the core of our conception of material objects serves dual roles in our view of

material objects. It plays a *generating* role in cases of composition and a *sustaining* role in cases of persistence. And it serves these dual roles whether agents are present or not.

This is all due to a deeper fact about our psychological makeup; namely, that folk psychology and folk physics are partly interdependent. The tendency to mentalize objects is woven into our cognitive architecture. And these deeper facts can't be explained by the competing accounts of folk teleology and its role in object cognition.

2. Folk Psychology and Folk Physics: Interdependent

2.1. The Standard View

Folk psychology, broadly speaking, involves predicting and explaining the behavior of agents; folk physics, broadly speaking, involves predicting and explaining events involving non-agents. Psychologists tend to assume that folk psychology and folk physics reflect two different kinds of causal cognition: folk psychology tracks "social causation"—which involves tracking the intentions of an agent for the purpose of prediction and explanation—and folk physics tracks "physical causation"—which involves tracking non-intentional mechanical processes and forces for the purpose of prediction and explanation (see e.g., Baron-Cohen, 1994; Baron-Cohen et al, 2001; Kamps et al., 2017; Leslie, 1995; Premack, 1990). As Baron-Cohen et al (2001) put it: "folk psychology involves searching for the mental or intentional causes behind agentive events, whilst folk physics involves searching for the physical causes of non-agentive events" (p. 8).

Folk psychology and folk physics are standardly viewed as independent because they both deal with domain specific information and represent core domains of human cognition (e.g., Carey, 1985; Gelman & Hirshfield, 1994; Spelke, 2000; Sperber et al., 1995; Wellman & Inagaki, 1997). In short: "These systems are distinguished…by the kinds of information they must represent" (Kamps et al., 2017, p. 146). The assumption of independence is also reflected in the fact that folk psychology and folk physics are empirically studied in isolation

Most empirical work has focused solely on folk psychology. This work has uncovered that from infancy we display signs that we track the mental states of agents (e.g., Baillergeon, Scott & Bian, 2016). For instance, we expect that agents will undertake the most rational means to satisfy a goal (e.g., Gergely, Nadasdy, Csibra, & Biro, 1995), expect that agents act on the basis of their beliefs—including false beliefs— (e.g., Onishi & Balillargeon, 2005; Surian et al., 2007), and expect agents to know about seen but not unseen objects (Luo & Baillargeon, 2007; Kim & Song, 2015).

Developmental psychologist have provided a range of evidence concerning the age by which children begin to use mental state vocabulary—speaking for instance of "beliefs" and "desires"— in making genuine mental state attributions (e.g., Bartch & Wellman, 1995; Shatz et al., 1983; Tardiff & Wellman, 2000 see Rose, 2015b for discussion). They have charted out the emergence of our ability to distinguish knowledge from ignorance as well as our ability to understand false beliefs, desires and pretense. The emergence of these capacities has been sequenced (e.g., Wellman & Liu, 2004; Wellman, Fang & Peterson, 2001), studied cross-culturally (see e.g., Stich, 2013 for an overview) and studied across a wide range of age groups—from infants to older children and adults—and populations—from people who are deaf to people who have Down's Syndrome, Autism and Asperger Syndrome (e.g., Baron-Cohen, Leslie & Frith, 1985; Baron-Cohen, 1995).

Other empirical work has focused solely on folk physics. Research with infants suggests that we expect that larger objects cannot fit into smaller ones, that objects cannot be unsupported and that one object cannot pass through another object (e.g., Baillargeon, Kotovsky & Needham, 1995; Leslie & Keeble, 1987; Spelke, Phillips & Woodward, 1995). But some of the earliest work on folk physics comes from McCloskey et al (1980) who showed experimental participants—adults in this case—a C-shaped tube and asked them to predict the trajectory of the ball as it exited the tube. Most people predicted that it would

continue on a curved trajectory. This "curvilinear impetus" also appears in our interactions with objects (McCloskey & Kohl, 1983). In a similar vein, people also make systematic mistakes in predicting how an object will fall. If asked to predict the trajectory of an object dropped from a moving aircraft carrier, most people will predict that it will fall straight down (McCloskey, Washburn & Flech, 1983).

Other aspects of folk physics that have been investigated include: falling rate—we think that objects fall at a constant velocity proportional to their mass (Shannon, 1976)—acceleration—we think that the speed of a thrown object is greatest some distance after it is released (Hecht & Bertamini, 2000)—and the dynamics of rotation—we think that size makes no difference to the time it takes a wheel to roll down a ramp (Proffitt et al., 1990). Further work on folk physics has revealed that we make erroneous predictions about the orientation of liquid in a tilted but stable glass (McAfee & Proffitt, 1991), display a range of mistaken intuitions about magnetism and electricity (Maloney et al., 2000), think that a thermostat controls the rate of heat flow in the same way that a gas pedal controls the rate of gas flow into a car engine (Kempton, 1987) and think electrical switches work like the trigger of a gun: flipping a switch sends an impulse to a battery which triggers current flow from the battery to the light bulb (Collins & Stevens, 1984).

2.2. Evidence of Interdependence

If the standard psychological view that folk psychology and folk physics are independent is right, then disruption of the capacity for folk psychology should not affect the capacity for folk physics. But a range of evidence indicates that disruption of the capacity for folk psychology does affect the capacity for folk physics. They are, at least in part, interdependent. Specifically: folk psychology and folk physics are partly functionally dependent. And this functional dependence has a direction. The operation of folk physics depends in part on the operation of folk psychology. Folk psychology is sometimes given functional priority.

Baron-Cohen et al (2001) gave neuro-typical children and children with Asperger Syndrome—who display deficits in their capacity for folk psychology—the Folk Physics and the Folk Psychology Test. The finding: those with Asperger Syndrome significantly outperformed their neuro-typical counterparts on the Folk Physics Test. In fact, among the children with Asperger's Syndrome, performance on the Folk Physics and Folk Psychology Test was inversely correlated.

Picture sequencing tasks display a similar pattern (Baron-Cohen, Leslie & Frith, 1986). In one condition, the mechanical condition, there were four pictures showing: (1) a rock atop a hill (2) the rock toppling (3) the rock rolling down the hill and (4) the rock knocking a tree over. In another condition, the intentional condition, there were four pictures showing: (1) a girl setting a teddy bear down, (2) the girl turning to pick some flowers (3) a boy taking the teddy bear and (4) the girl seeing the teddy bear gone. Children in both conditions were asked to order the events that appeared in the pictures. Compared to neuro-typical children, children with Autism—who, like those with Asperger Syndrome, display deficits in folk psychology—performed significantly better, indeed near perfect, in the picture sequencing task for the mechanical condition. This pattern was reversed in the picture sequencing task for the intentional condition: neuro-typical children performed significantly better, near perfect. Overall: better performance in the intentional condition resulted in worse performance in the mechanical condition while better performance in the mechanical condition resulted in worse performance in the intentional condition.

This basic pattern is also found in the "False Photograph Task" (Zaitchick, 1990) and "False Belief Task". The False Photograph Task mirrors the standard False Belief Task. In a standard False Belief Task a child watches Actor A place an object in location x and then leave. Then Actor B moves the object to location y and finally the child is asked "Where does A think the object is?". In the False Photograph Task a child watches Actor A place an object in location x and take a photo of it. Then Actor B moves the object to location y and finally the child is asked "In the picture, where is the object?". Leslie and Thaiss (1992) found that while children with Autism performed significantly worse than neuro-typical

children on the False Belief Task, they significantly outperformed neuro-typical children on the False Photograph Tasks. This basic pattern extends to cases where, instead of making judgments about whether a photograph accurately represents the location of objects, children use a diagrammatic map to make their judgments.

These findings aren't peculiar to children. The same pattern of findings has also been found with adults. Baron-Cohen et al (1999) found that three high-functioning individuals with Asperger Syndrome—a math professor, an engineering student and computer science student—performed significantly worse on the Folk Psychology Test and significantly better on the Folk Physics Test than age matched counterparts with university degrees in the physical sciences.

The standard psychological view should predict that disruption of the capacity for folk psychology should not affect the capacity for folk physics. But this range of findings—from children to adults and across a range of different task types—conflict with this: those with a neuro-typical capacity for folk psychologizing display deficits in folk physics; those with deficits in folk psychologizing—e.g. people with Asperger Syndrome or Autism—display superior performance in folk physics. Changes in the capacity for folk psychology are related to changes in the capacity for folk physics. That suggests that folk psychology and folk physics are partly interdependent. Specifically, it suggests that they are functionally dependent—the operation of one depends in part on the operation of the other.

Then again blind people have a deficit in their capacity for visual perception but display superiority in their capacity for audition. That doesn't suggest that vision and audition are interdependent. And it certainly doesn't suggest that they are functionally dependent. Audition obviously doesn't depend on vision. So why think folk psychology and folk physics are any different?

Two reasons. First, concerning folk psychology and folk physics, the neuro-typical case is one where people are better at folk psychology, worse at folk physics. But with sense modalities—such as vision and audition—the neuro-typical case is not one where people are, for instance, better at seeing and worse at hearing. Second, the functional dependence between folk psychology and folk physics has a direction: the operation of folk physics depends on the operation of folk psychology. Kamps et al (2017) gave neuro-typical adults and adults with Williams Syndrome—who suffer from, among other things, deficits in their capacity for folk physics—tasks assessing folk psychology and folk physics. The main finding was that adults with Williams Syndrome performed significantly worse than neuro-typical adults on folk physics tasks but both groups performed similarly on folk psychology tasks. This difference in the capacity for folk physics didn't lead to differences in the capacity for folk psychology. The evidence above indicates that differences in the capacity for folk psychology lead to differences in the capacity for folk physics. So the operation of folk physics depends in part on the operation of folk psychology. This contrasts with sense modalities like vision and audition: being blind can lead to auditory enhancements and being deaf can lead to visual enhancements (see e.g., Lomber et al., 2010)

Interdependence is radical. Less radical is that an agentive interpretation of events that don't involve agents over a non-agentive interpretation is simply the result of a performance error. The contrast: interdependence assumes that the functional priority given to the operation of folk psychology arises in part because of architectural constraints, reflecting our basic understanding of material objects; the performance error interpretation denies this and assumes that the tendency to mentalize objects isn't a result of architectural constraints and doesn't reflect anything about our basic understanding of material objects. Put differently: interdependence is the view that mentalizing objects is a feature of our competence, explained by the interdependence of folk psychology and folk physics; the performance error interpretation is that this instead arises due to features or circumstances extrinsic to our basic competence for understanding material objects.

The fact that interdependence is radical might cast some doubt on the view. And it might incline some toward the less radical performance error explanation. But there is at least some reason for favoring

interdependence. If the tendency to mentalize objects is the result of some kind of performance error then it is a kind of performance error unlike any of the familiar kinds of performance errors that are due to being inattentive or cognitively overwhelmed. And it would be a very different kind of performance error from those that are perhaps most well understood and documented such as those occurring in language production. Unlike the differences between neuro-typical individuals and individuals with Autism, Asperger's and William's Syndrome on tasks assessing folk psychology and folk physics, I am aware of no evidence of language production errors displaying a similar pattern. And if we did find a case of language production error which displays the same striking pattern of disruption and dependence that we see in the case of folk psychology and folk physics then it seems that we wouldn't explain the occurrence in terms of extra-architectural considerations of the kind the performance error theorist trades in. Instead, it would seem that we would explain the pattern in terms of interesting and important architectural constraints of the kind that centrally feature in a competence-based proposal.

Admittedly, these considerations aren't decisive. It is notoriously difficult to decide between a performance- and competence-based explanation of psychological phenomena. But this fact works in favor of the more radical, interdependence view: it is on at least as good of footing as a performance error proposal.

3. Teleological Commingling and The Agentive Worldview

It's an interesting question exactly what aspects of folk psychology and folk physics are functionally interdependent. But concerning the tendency to mentalize objects, the evidence indicates that when considering events that don't involve agents, we naturally default to tracking intentions, goal-directed processes, or teleological causation, despite the fact that agents aren't involved. At least one tie that binds folk psychology and folk physics is *Teleological Commingling*. Some of the main findings supporting this suggest that we have a deep-seated intentionality bias, defaulting to viewing the actions of agents as intentional and extending this even to events that don't involve agents.

3.1. The Intentionality Bias

Start with the intentionality bias as exhibited with respect to agents. Rosset (2008) gave experimental participants—all adults—a range of sentences involving intentional or accidental actions. Some sentences were clearly accidental such as "He sneezed from allergies" while others were clearly intentional "She proofread her paper". These were the control sentences. The test sentences included both prototypically accidental events such as "She burnt the meal" and prototypically intentional events such as "She drove over the speed limit". Participants were in either speeded or unspeeded conditions and asked to judge whether the events in the target sentences were intentional or accidental. The main finding was that participants in the speeded condition were significantly more inclined to judge prototypical accidental events as intentional in comparison to the unspeeded group. More surprisingly, this pattern even extended to unambiguous accidental events such as "He sneezed from allergies". This suggest that we have a deep-seated intentionality bias: we initially judge all acts as intentional, even acts that are almost always accidental such as sneezing or tripping on a curb. Due to this, it is more cognitively demanding to view events in accidental terms. We have to override the intentionality bias and engage in further processing to arrive at a judgment that the event in question is accidental.

This is confirmed by a further study conducted by Rosset (2008). The rationale: it has been shown that increased cognitive processing leads to better recall (e.g., Shiffrin & Atkinson, 1969; Lockhart & Craik, 1990). If we initially judge an act to be intentional—even when considering unambiguous accidental events—and have to override this intentional inference to arrive at the judgment that the event is accidental, then judging events to be accidental requires more cognitive processing than judging events to be intentional. So we should have better recall for accidental events compared to intentional events. And

this is just what Rosset finds. Moreover, this intentionality bias isn't merely an artifact of being put under time pressure. It arises spontaneously and naturally in the absence of time constraints. People continue to default to viewing actions as intentional, even for prototypical accidental actions such as tripping on a curb, when asked to describe the image that first comes to mind. They only revert to a description of such events as being an accident when explicitly reminded by the experimenter that the events do sometimes occur on accident.

The intentionality bias also surfaces in childhood. Piaget (1932) claimed that children operate with a strong default assumption where they view all behavior as intentional. And Smith (1978) provides compelling evidence for this.

Children were shown videos of three different types of event sequences. The intentional condition showed a woman walk across a room, sit in a chair, do arm exercises and chew something; the unintentional condition showed a woman sneeze, yawn, cry "ow" when poked in the ribs with a stick and laugh when tickled with a dust mop; in the object-like condition, the woman was pushed around by a moving filing cabinet, her arm was hooked and pulled up by the handle of an umbrella, she stumbled over a box, and she slipped on a rug and fell into a chair. Four-year old children viewed sequences in every condition—intentional, unintentional and object-like—as being intentional. This basic pattern—viewing even non-intentional events as intentional—has been extended by Colle et al (2007), who find that even three-year old children over-ascribe intentionality, viewing accidental and unintentional events as intentional.

We have a deep-seated intentionality bias that emerges in childhood and extends into adulthood. But it could be that this intentionality bias is restricted only to situations that involve agents. We might default to viewing events involving agents as intentional, and it may be difficult to override this tendency, but perhaps this doesn't arise when considering events that don't involve agents. Thus, the main question is whether teleological causation—viewing events in intentional, goal-directed terms— also extends to understanding events that don't involve agents. It does. And that's because we pervasively detect agency cues.

3.2. The Agency-Non-Randomness Link

Self-propulsion is one agency cue that gives rise to viewing events in intentional terms. For instance, Luo and Baillargeon (2005) had five-month old infants view a box move back and forth across an apparatus floor. Two objects, A and B, were then placed on each side of the apparatus wall. The children observed the box repeatedly approach and stop against object A. Then the positions of objects A and B were switched and when the box approached object B, the infants looked reliably longer. This suggest that the infants attributed an intention to the box and formed expectations about its goals on the basis of this (see also e.g., Csibra, 2008). This suggests that self-propulsion is an important agency cue involved in the intentionality bias. But self-propulsion isn't the only agency cue, or even the most basic agency cue, that prompts the intentionality bias.

I maintain that the most basic, general agency cue—and the one that we are most sensitive to—is viewing events or sequences of events as ordered or non-random. Self-propulsion is a special instance of this more general agency cue. That's because self-propulsion is viewed as the result of a non-random process. Non-randomness is the more basic, general agency cue. We view agents as being capable of bringing about non-random events. And we infer agency from the presence of non-random events.

It begins in childhood. Friedman (2001) gave children cases where sequences change from either ordered to disordered or from disordered to ordered. For instance, participants viewed either a disordered set of colored marbles that was then ordered by being arranged into colored columns or an ordered set of colored marbles that was then disordered. When asked whether a natural force, such as the wind, or a human could have brought about the change, four-year old children (and older children) judged that the

human could arrange the marbles from either being disordered to ordered or from ordered to disordered but natural forces, such as the wind, could only create arrangements that went from ordered to disordered. This suggests that we associate agents with order.

Even infants associate agents with order. For instance, 7- and 12-month-olds were first shown either a self-propelled face-like ball with eyes—which served as the agent—or a ball—which served as a non-agent. They were then shown ordering and disordering events. In the ordering event, infants saw a disordered pile of blocks; then an opaque barrier was placed to occlude the blocks; the agent or the non-agent then moved behind the barrier; and finally, the barrier was removed and infants saw the blocks in an ordered arrangement (aligned into two columns by color). In the disordering event, the beginning and the end states of the blocks reversed. In another study, 12-month-olds were first familiarized with either an agent (i.e., a human hand) or an inanimate object (i.e., a claw-like stick) creating order or disorder using the same ordering and disordering events as in the previous experiment. The results from both of these studies showed that infants expected that agents were associated with state changes from disorder to order whereas inanimate objects were not (Newman, Keil, Kuhlmeir & Wynn, 2010).

These results indicate that we view agents—but not natural forces—as bringing about ordered or non-random events. Natural forces can only remove order, transforming ordered events to disordered events. Other work shows that we infer an agent from ordered or non-random events.

Ma and Xu (2013) presented 9-month-old infants with a transparent jar containing colored ping pong balls. A human hand or claw-like stick drew balls from the jar, the ball was dropped down a slide and then displayed in view for the infants. Two occluders were then introduced, one that blocked only the display where the balls had been dropped and the other that blocked the jar as well as the area above the jar so that the infants could not see if a claw or hand was drawing balls from the jar. The occluder blocking the display was then removed and the infants watched more balls drop onto the display. In the regularity condition, the sample of balls dropping onto the display was non-random, in a yellow-red-yellow-red-yellow-red and so on sequence. In the random condition, the balls that dropped onto the display were in a random sequence, for instance, a yellow-red-red-yellow-yellow-yellow-red-yellow-yellow sequence. Sampling was repeated three times in both the random and non-random conditions. Finally, the second occluder was removed revealing either that the hand or claw was drawing the balls.

The main findings: in the regularity condition, infants looked reliably longer when they saw the claw compared to when they saw the hand; in the random condition, infants showed no difference in looking times when they saw either the hand or claw. The results suggest that infants inferred an agent as the cause of a non-random sequence of events and were thus surprised when a non-agent was revealed to have caused the non-random sequence. We infer an agent from ordered or non-random events.

This pattern isn't confined to infants. It is also exhibited in adults. Meng, Griffiths and Xu (2017) present findings with adults suggesting that agency detection is tightly related to the subjective impression of non-randomness. Participants viewed 256 binary sequences of length 8. One group of participants was asked to classify the source of each sequence into agentive or non-agentive entities while another group was asked to classify the source of each as either a non-random or random process.

The main question is whether there is a strong correlation between judgments of non-randomness and judgments of agency. There is. Indeed, as Meng et al (2017) note: "A hidden Markov model fit human data in both tasks reasonably well and produced highly overlapping predictions for subjective non-agency and subjective randomness, which suggests that people are solving highly similar problems when detecting agents and violation of randomness" (p. 2702).

In another experiment, separate groups of participants generated sequences that others would either view as agentive or non-random. "Sequences in these two conditions had a substantial overlap, indicating common guiding principles of agency and non-randomness generation" (p. 2703). This suggest an

important "agency-non-randomness link" and thus, taken together, and as Keil and Newman (2015) note, we "associate only agents but not non-agents with many kinds of ordered and non-random sequences" (p.132). Due to the pervasive detection of agency cues—order or non-randomness—the intentionality bias extends even to events involving non-agents.

3.3. The Agentive Worldview

This all gives rise to the *Agentive Worldview*: we view nature as a whole as being infused with agency and purpose. As Meng, Griffiths and Xu (2017) remark: "When we look at something as delicate and orderly as the eye, it is only natural to believe that such a work of art must be designed by someone, an intentional agent with a purpose in mind" (p. 2699). In contrast, it takes "a very large leap of the imagination to think the other way around" (Dawkins, 1996, p.7). We have a deep-seated cognitive compulsion to infer agents from the perception or order or design (Bloom, 2007). Since most events are viewed as non-random—the world is viewed as displaying intricate design—we view nature as a whole as being infused with agency and purpose. The *Agentive Worldview* is a teleological worldview where the perception of order and design is viewed as being the product of intentions, goal-directed processes, that emanate from agency.

Decades of research in scientific education support this (see Kelemen, 2012 for an overview). We tend to think that a "personified "Mother Nature" responded to animal's functional needs by generating or conferring the functional part with a view to preserving the animal's survival" (Kelemen, 2012, p. 4; see also Kampourakis & Zogza, 2008; Moore et al., 2002; Gregory, 2009; Clough & Wood-Robinson, 1985; Demastes, Settlage, & Good, 1995; Evans et al., 2010; Jensen & Finley,1995). That's because our teleological views are "embedded within a framework of intuitions characterizing Nature as a designing agent" (Kelemen, 2012, p. 6). This begins early in childhood (e.g., Kelemen, 1999a, 1990, 2004; Kelemen & DiYanni, 2005), extends throughout adulthood (e.g., Casler & Kelemen, 2008; Kelemen & Rosset, 2009) and even persists despite professional scientific training (e.g., Kelemen, Rottman & Seston, 2013). We can't help but see order and design everywhere. And we have a deep-seated cognitive impulse to associate order or design with agency.

Mentalizing objects appears to be a feature of our competence, due, at least in part, to architectural constraints evidenced by differences between neuro-typical individuals and individuals with Autism, Asperger's and William's Syndrome on tasks assessing folk psychology and folk physics (Section 2.2). It emerges early (Sections 2.2-3.2), extends throughout adulthood (Sections 2.2-3.3) and leads to substantial and pervasive effects on judgments about objects even into adulthood (see Section 1.1.; also see e.g., Rose, 2015; Rose & Schaffer, 2017; Rose, Schaffer & Tobia, 2018; Rose & Nichols, 2019; Rose a& Nichols, 2020 for evidence favoring the pervasive and substantial role this plays in judgments of composition and persistence in adulthood). Our tendency to mentalize objects reflects a basic way we understand the world.

Teleological Commingling and the *Agentive Worldview* it gives rise to are at the core of our conception of material objects. The kind of intentional, goal-directed, teleological causation at the core of our conception of material objects serves dual roles in our view of material objects. It plays a *generating role* and a *sustaining role*. On the ordinary view, cases of composition—when a whole fuses some parts—are cases of teleological causation where the kind of intentional, goal-directed process, plays a generating role, namely, in generating a material object; moreover, on the ordinary view, cases of persistence—when some whole survives part alterations—are cases of teleological causation where the kind of intentional, goal-directed process, plays a sustaining role, namely in sustaining a material object—a whole—through part alternations.

Teleological causation plays dual roles in ordinary object cognition. This is rooted in *the Agentive Worldview* which is given birth by *Teleological Commingling*.

4. Debunking the Folk View of Objects

These psychological facts about object cognition press methodological problems for metaphysicians who maintain that metaphysical theories of objects are beholden to common sense. That's because at least one constraint on a metaphysical theory is that it shouldn't conflict with what our best science says about the world (see e.g., Paul, 2012; Schaffer, 2016; Rose, 2019).

There is an obvious respect in which the teleological view at the core of the folk conception of material objects conflicts with what our best science says about the world. The rejection of a teleological perspective on all of the natural world traces at least as far back to the emergence of modern science from medieval Aristotelianism. Moreover, the rejection of an agentive, teleological perspective on the natural world is also one main reason that modern day intelligent design "science" is widely rejected. A teleological perspective where all of nature—every rock and cloud—is infused with agency and purpose is part of a "superseded, pre-scientific muddle about how the world works" (Hawthorne & Nolan, 2006; see also e.g., Mayr, 1998; Allen & Bekoff, 1994). Our best science indicates that our view of material objects is based on false assumptions about reality. They are built into our conception of material objects. The fact that people's intuitions about composition and persistence are derived from a false view—the *Agentive Worldview*—problematizes the central methodological assumption that metaphysical theories of material objects should be beholden to common sense. The ordinary view of material objects—rooted as it is in an implicit, false theory—should be given no weight in metaphysical debates about the nature of material objects.

The proposal that ordinary intuitions about composition and persistence be dismissed because they arise from an implicit, false theory marks a different route to undermining the evidential credentials of ordinary intuitions in metaphysical theorizing about the nature of material objects. Familiar debunking arguments of ordinary intuitions of composition and persistence have proceeded by arguing that teleologically infused intuitions help supply an undermining defeater (Rose, 2015; Rose & Schaffer, 2017; see also Kovacs, forthcoming) or that they are based in epistemically defective processes (Rose, 2017; see Nichols, 2014) and as such should be dismissed. That ordinary material object intuitions are rooted in a false view of reality offers an alternative to these familiar proposals.

It might seem that the kind of psychological facts about material object cognition documented throughout only indicate that some people explicitly endorse the *Agentive Worldview*. And for those who explicitly reject the *Agentive Worldview*, their material object intuitions don't derive from false assumptions about reality. The empirical evidence discussed, far from undermining a central methodological assumption that metaphysical theories of material objects be beholden to common sense, has instead helped to reveal which intuitions should be taken seriously and which should not. Only those intuitions about material objects from those who explicitly reject the *Agentive Worldview* should be trusted. There is no reason to think that those intuitions are similarly based on false assumptions about reality.

But the *Agentive Worldview*, like most intuitive theories, isn't an explicitly represented theory. It is doubtful that people can articulate the intuitive theory of material objects they operate with. The theory is implicit. And the kinds of processes involved in the application of an implicit theory operate below the level of reflection. Though our implicit theory of material objects is not consciously accessible and the underlying principles and processes that play a role in the application of the theory are opaque and beyond the reach of reflection, it is there all the same. And so even if people do not explicitly explain order and design as being the product of intentions, goal-directed processes, that emanate from agency, this doesn't suggest that they have somehow overcome the *Agentive Worldview*. Empirical evidence lends itself: Rottman, Kelemen and Seston (2013) find that those who are less inclined to explicitly endorse statements related to an Agentive Worldview— such as people with PhD's in the humanities and sciences—still displayed a similar pattern in their tendency to accept teleological explanations for events

that don't involve agents to those who do explicitly endorse elements of the *Agentive Worldview*. Explicit rejection of the *Agentive Worldview* doesn't indicate that the theory has been replaced. Implicit theories, even false ones, can continue to operate and feature in judgments, despite explicit disavowal of the theory. Such is the case with the *Agentive Worldview*.

The fact that our implicit theory of material objects is false might be viewed as having little impact on whether we should take it seriously in metaphysical theorizing about the nature of material objects. Though the ordinary view of material objects might be based on wildly inaccurate assumptions about reality, it is perhaps "accurate enough". In one sense, ordinary views that are false might be "accurate enough". Folk physics is an implicit yet false theory that conflicts with our best scientific theories. This poses few problems for ordinary navigation and interaction with the world. But while an implicit yet false theory might be accurate enough for *practical* purposes, it is doubtful that accurate enough for practical purposes confers *theoretical* benefits. Whatever the merits of being accurate enough for practical purposes that, for instance, folk physics offers, there is no reason for thinking this lends to some kind of theoretical benefit when theorizing about physics. If our best physical theories conflict with folk physics—an implicit yet false theory—it is folk physics that shouldn't be taken seriously in theorizing about reality. Accurate enough in the practical domain might amount to nothing more than epistemic futility in the theoretical domain. Once we have discovered that our ordinary view of materials objects is based in an implicit, false theory of reality—the *Agentive Worldview*—then whatever practical merits might accrue in light of operating with a false view of the nature of material objects, it is doubtful that this funds any benefits in metaphysical theorizing about the nature of material objects.

It might instead be suggested that our tendency to mentalize objects isn't at the core of our conception of material objects. Perhaps our tendency to mentalize objects is an incidental feature of object cognition, hanging at the periphery of our core notion of an object. If so, then the psychological facts that have been detailed about object cognition tell us noting about what the core of that view is like. And thus it is an open question as to whether the core of the folk view of objects undermines metaphysical theories of objects that are beholden to common sense.

The psychological facts, however, indicate that the tendency to mentalize objects is built into our cognitive architecture. It begins early and is retained throughout adulthood. This early emergence and retention throughout the lifespan is characteristic of other intuitive views that we hold but which conflict with our best science, such as the our tendency to think that whether something is alive depends on whether it exhibits motion (e.g., Piaget, 1929/1960; Richards & Seigler, 1986; Goldberg & Thompson-Schill, 2009). Like other views we retain despite their conflict with our best science (see e.g., Shtulman, 2017)—even after extended exposure to the relevant science (see e.g., Shtulman & Valcarcel, 2012)—our tendency to mentalize objects is like a roach buried in our mental woodwork. But like these other views, and unlike roaches, our tendency to mentalize objects isn't easily exterminated (see e.g., Shtulman & Lombrozo, 2016). That's because it is at the core of our view of objects.

The tendency to mentalize objects also plays an extensive role in our view of material objects, featuring centrally in many aspects of our thinking about material objects. Teleological considerations don't just exert a powerful influence on intuitions about composition and persistence. They also play a central and substantial role in essentialist intuitions (Rose & Nichols, 2019; Rose & Nichols, 2020). The fact that teleological considerations play such an extensive role in our thinking about material objects—centrally featuring in our thinking about essence, composition and persistence—suggests that this isn't simply some incidental feature of object cognition which hangs at the periphery of our ordinary view of objects. The tendency to mentalize objects is at the core of our view of material objects.

The irony is that metaphysicians who maintain that metaphysical theories of objects are beholden to common sense have betrayed the ordinary view of material objects. At best, what they take to be the common sense view of material objects is at the fringes, the periphery, of common sense. The core of the folk view of objects is mentalistic.

The "shallow ontologists" might struggle "to keep a polite straight face" when "deep ontologists" tell them that there are "apple trees but no apples" (Hirsch, 2002, p. 67). But in light of the psychological facts about ordinary object cognition the deep ontologist should struggle to keep a polite straight face when the shallow ontologist—who is beholden to folk intuitions –proclaims that composition occurs when the result has a purpose and that objects persist provided they preserve their purpose. That's because, in light of the conflict between the scientific worldview and the folk worldview, the folk view deserves to be dismissed. And since many metaphysicians think that theories of composition and persistence should be beholden to folk intuitions, metaphysicians need to seriously rethink a major approach to theorizing about the nature of objects.

5. Conclusion

Folk teleology is at the core of our conception of an object. And this is due to the fact that we mentalize objects. I argued for this by first arguing that the standard psychological view the folk psychology and folk physics are independent (Section 2.1.) is mistaken (Section 2.2.). Changes in the capacity for folk psychology are related to changes in the capacity for folk physics. They are functionally dependent where the dependence is such that the operation of folk physics depends in part on the operation of folk psychology. This fact paved the way for an explanation of the tendency to mentalize objects.

At least one aspect of folk psychology and folk physics that is related involves an intentional, goal-directed kind of teleological causation. *Teleological Commingling* suggests that we have a deep-seated intentionality bias (Section 3.1.), which is prompted by the pervasive detection of agency cues with the impression of order or non-randomness being the most general agency cue (Section 3.2).

Teleological Commingling and the *Agentive Worldview* it gives rise to are at the core of our conception of objects (Section 3.3.). And the kind of teleological causation that plays a role in our view about objects serves dual roles: a *generating* role in cases of composition and a *sustaining* role in cases of persistence. The ordinary view of composition and persistence—infused as it is with a scientifically outmoded view of teleology and agency—deserves to be dismissed (Section 4). But many metaphysicians want theories of composition and persistence to respect folk intuitions. The methodological focus thus needs to be dramatically shifted.[4]

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